Prices, Taxes and Subsidies in Pakistan Agriculture, 1960-1976

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PRICES, TAXES AND SUBSIDIES IN PAKISTAN AGRICULTURE, 1960-1976

This case study reviews the growth trends in Pakistan agriculture from 1960-76. It identifies the chief factors affecting growth rates, then considers the effects of price policies on these factors. The effect of the interests of various political constituencies on pricing policies are also considered. It concludes that prices have been sufficiently favorable to have maintained a fairly steady growth in overall agricultural output, though at times unfavorable prices have resulted in reduced production of specific crops. Changes in prices and profitability variables have had marked influences on rates of investment in tubewells and tractors. Farm prices of cotton have been consistently maintained well below world market levels as a subsidy to yarn and textile manufacturers, and wheat prices have been maintained below world market levels to keep down urban wages and cost of living, while sugar prices have been maintained above world market levels in order to eliminate imports. Measures to maintain low farm prices have also resulted in large government revenues from cotton and rice exports that have helped subsidize urban ration-shop wheat prices.

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PREFACE

This paper is one of a number of companion papers (see below), which report on the results of a research project -- Country Case Studies of Administered Agricultural Prices, Taxes and Subsidies, RPO 671-42 -- which commenced in the second half of 1976. The research, which included some desk studies besides the eight country case studies (Argentina, Egypt, Kenya, Mexico, Pakistan, Portugal, Thailand and Yugoslavia), was oriented towards eventually providing operational guidelines for country economic, agricultural sector and project planning work. Two of the country case studies involved the use of formal agricultural sector models (Mexico and Portugal), while the other six involved the use of a number of informal methodologies.

An overview and integrated summary of the results of the six country case studies and the complementary desk studies will be given in:


The informal methodologies are described, reviewed and evaluated in:


Three other country case studies, in addition to the present one, are considered of significant individual merit and have also been published. These are:


I. INTRODUCTION

1.01 Despite long-standing theoretical objections, policymakers in most countries continue to find it convenient to distort agricultural prices.1/ In the richer developed countries, this often takes the form of support for agricultural prices and incomes. In developing countries, however, agricultural prices are more frequently held below economic levels in the name of encouraging industrial (urban) development via low-priced food and living costs, and as a source of government revenues. 2/ The rationale for such developing country policies is often rooted in development strategies, e.g., the "infant industries" argument. Without cheap labor and raw materials, it is alleged, domestic producers initiating industrial activities would find it impossible to develop the know-how to compete with established international firms.

1.02 Broader welfare objectives are also frequently invoked. For example, in recent years many countries have distorted domestic cereal prices in favor of consumers in an effort to protect them against the dramatic price increases occurring in international commodity prices. Such actions were taken, in countries with substantial agricultural sectors, at the expense of producers who would otherwise have reaped windfall gains from the effects of several years of worldwide shortages. In the 1960s, with world prices depressed by substantial surpluses, distortions in domestic prices in many industrial countries ran in favor of producers. Most notorious were consumer subsidies of commodities whose production required a substantial investment in plant and facilities, e.g., sugar and dairy products. The ability of a farming system or processing industry to adjust is limited in such cases and the political pressures to maintain the value of fixed assets in the face of fluctuating world prices were persuasive to many policymakers. Even throughout the 1960s, however, developing countries that intervened in market pricing discriminated against agriculture and in favor of industry and urban sectors.

1.03 The theoretical objection to meeting other government objectives by distorting agricultural prices has to do, of course, with the impact of such actions on the allocative and distributive role of prices in an economic system. These issues may arise at the aggregate level with policies that systematically create incentives favoring private investment in the industrial sector when the country actually has a comparative advantage in agriculture. Distortions that significantly affect efficiency of domestic resource use may also occur among crops as the government tries to respond to the economic and political pressures of particular, commodity-specific

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1/ "Distortion" will be used throughout the paper to mean divergence between relative domestic and relative world market prices.

2/ In addition to commodity specific taxes and export duties, exchange rate and trade protection policies have often been designed to impose explicit or implicit taxes on agriculture and to subsidize manufacturing and trade.
constituencies. Lastly, price distortions and subsidies on inputs and outputs may be such that they (1) fail to create a climate that facilitates investment and the development of improved technology and productivity in agriculture, or (2) encourage a pattern of structural change that does not reflect a country's factor endowments.

1.04 There are several reasons that governments, particularly among the LCDs, continue to use commodity prices to accomplish non-agricultural objectives. Among the most important is the limited ability of many countries to collect and dispense the more desirable lump-sum transfers. A substantial bureaucracy, to a reasonable extent free from corruption, is required to administer land and income taxes. In its absence, there is little recourse but to tax goods moving in and out of central depots at various points of the processing and marketing system.

1.05 In addition to administrative simplicity, redistribution through the mechanism of market manipulation also has the political virtue of impersonality. Although many subsidies are readily identifiable, others are embedded in the price structure in ways that make it difficult for those who are being taxed to recognize the transfer element (U.S. farmers, for example, have resisted proposals for specific income guarantees—which would be an identifiable and measurable subsidy—in favor of the much less identifiable subsidy of government-supported "fair" prices in the marketplace.)

1.06 Assuming that price policy will continue to be used to serve distributive as well as production objectives, the problem faced by those in charge of economic policy is then to find a set of prices and subsidies that strikes an appropriate balance between goals of productive efficiency and of income distribution over the relevant time horizon. (In a conflict-resolution model of political economy, time and the objectives that the government chooses to pursue are not, of course, independent; remaining in office may very much depend on the economic policies that are implemented. This accounts for the almost irresistible temptation of policymakers to pursue short-run objectives.)

1.07 Unfortunately, once divergence from relative world market prices is accepted, there is only limited theoretical support for setting the "right" price. One of the more obvious dilemmas in the world of the second best is providing "adequate" incentives for investment and for improvements in technology. Despite a decade of empirical research, there are little more than some rough rules of thumb for guiding policymakers—even in the presence of data that would permit an accurate estimate of the rate of return on the innovation. The size of the threshold that leads to adoption is still rooted in the poorly understood attitudes and perceptions of traditional farmers.

1.08 Moreover, whatever else may be said about these attitudes as they are affected by, say, risk and uncertainty, it is abundantly clear that they are not static. There is nothing inconsistent in the behavior of a farmer who requires a 100 percent rate of return on money invested in fertilizer the
first year, to continue to apply even higher dosages at 25 percent return several years later. He has in the meantime lowered the cost of information dramatically and, in his perception, has discounted the uncertainty in the situation appropriately. 1/ Those in charge of setting fertilizer prices can only guess at the transformation that has taken place.

Organization of the Study

1.09 The discussion begins with a brief overview of the performance of Pakistan's agriculture since 1960. Particular attention is given to the changes in the composition of output at the commodity level as a basis for understanding the relative stagnation that has characterized the sector since 1970. Although there has been a substantial variation in the commodity mix, annual increases in gross domestic product have been more stable. Indeed, were it not for the disastrous cotton crop of the past several years, the growth rate in recent years would have remained close to the long term average of 4 percent per annum. What has disturbed policymakers is the change in the momentum generated during the Third Five Year Plan when the rate of agricultural sector growth averaged 6 percent per annum.

1.10 Both formal and informal methods are used in efforts to establish the relationship between growth and input use. Highly significant positive trends in the use of improved seeds, fertilizer application, water development, tractor purchases, etc. provide solid evidence that the recorded growth was not simply the result of acreage expansion or extremely favorable weather. However, because of collinearity in several of the independent variables, efforts to estimate an aggregate production function that would provide quantitative measures of the contributions by various inputs to growth were not terribly successful and the coefficients presented should be treated with caution.

1.11 In addition to investigating the growth performance at several levels of generality, attention is also given to the pattern of structural change that marked the study period. Pakistan, like many other developing countries, has experienced a large scale migration to the cities. This movement is in part a function of increased opportunities for employment currently available in urban areas. However, there has also been a "push" effect arising out of alterations in farm size and the increase in wage labor. These changes in structure at the micro level are attributable in part to the introduction of substantial numbers of tractors and tubewells.

1.12 Chapter III deals with the relationship between domestic incentives and the pattern of resource use at both the sectoral and commodity levels. A crude estimate of the impact of changes in the net barter terms of trade on changes in the gross national product generated in agriculture fails to produce

1/ This example oversimplifies the matter, for the learning process may be significant across technologies. That is, increased experience generates a (sometimes misplaced) "faith" that new ways of doing things are better.
significant results. More disaggregated attempts to obtain a correlation between relative prices and the demand for purchased inputs are equally unsuccessful. In each case, however, the trend variable included in the equation "explained" most of the year-to-year change. This significance was interpreted as indicating that the profitability of the input was sufficient to insure adoption despite frequent downward adjustments in the benefit-cost ratios over the period being studied.

1.13 Perhaps the only exception to these findings involves the purchase of tractors. Prior to the devaluation in 1972, tractors were being sold at "real" prices that were substantially less than the world market price. The result was a build-up in the number of machines which was only limited by the supplies made available under hard currency loans. Immediately after the devaluation, this demand was sharply curtailed, suggesting that price policies had played an important role in the rate of adoption.

1.14 Chapter III goes on to present the results of attempts to measure the responsiveness of farmers in the Punjab to changes in relative prices between commodities. These calculations produce elasticity coefficients similar to those obtained in previous studies done in Pakistan and India. They show that farmers in these areas have made and would make significant adjustments in their use of domestic resources if the relative profitability of crops were affected by government policies. 1/

1.15 The econometric estimates indicated above, albeit crude, suggest that in the short run the impact of government policy was primarily distributive. Evidence that this involved a substantial taxing of agriculture is suggested by the nominal (NPC) and effective protection coefficients (EPC) calculated for a number of the major crops. 2/ These coefficients are characterized by a number of abrupt changes largely associated with recent fluctuations in world commodity prices. However, there is also a sharp break in 1972 when the rupee was devalued and the official exchange rate used to obtain the border prices in the calculations increased significantly.

1.16 Values of both EPC and effective subsidy coefficients (ESC) follow closely the values obtained for the NPC. Several reasons account for this result, the most prominent being that purchased inputs comprise only a small proportion of the costs of production in Punjabi agriculture. Expenditures on fertilizer, pesticides, and seeds are completely overshadowed by the land, labor and capital committed to the production process. Important also is the

1/ Although the elasticity coefficients are not high (.2 to .5), the implication in terms of absolute shifts in the Indus Basin involves thousands of acres.

2/ In the longer run, it could be expected that the government's distributive policies would have an important effect on agricultural growth. Testing such a hypothesis, of course, would require substantially more sophisticated tools than the simple, single-equation response models used in this paper.
fact that during at least a substantial part of the study period, subsidies on inputs were of approximately the same relative magnitude as the taxes on output, thus preserving the NPC ratio.

1.17 Calculation of the domestic resources cost (DRC) coefficients for various crops indicates that over the period of study, crop rankings have shown a reasonable amount of stability. That is, in the rice areas, rice has generally emerged as the crop making the cost efficient use of domestic resources; similarly, in the cotton areas, cotton has continued to have the lowest DRC coefficient when compared with competing alternatives. The major divergence from this generalization emerges as a result of the dramatic absolute and relative increases in world prices. During the period 1973-1975, these were sufficient to overcome the comparative advantage of the aforementioned crops vis-a-vis sugarcane, even when rice and cotton were combined with wheat to simulate a double-cropping rotation.

1.18 The finding that crops retained their approximate relative positions in the study areas when world commodity prices were moving over rather wide ranges underlines the importance of yields in the comparative advantage calculations. Indeed, in experimental calculations, the rankings of all crops were preserved when only gross revenues at world market prices were compared. This occurs in the Pakistan situation because all of the competing crops are grown with roughly the same cultural practices so that the social costs of labor and capital are approximately equal among crops. The residual accruing to land in the best alternative, which is used to measure its social cost, is therefore primarily a function of yields and world market prices. Since it is this residual that is used to valued land in the DRC calculations, they too are primarily a function of yields and commodity prices.

1.19 Chapter V asks whether the policies that are consistent with comparative advantage are also consistent with government objectives, e.g., obtaining revenue, maintaining politically acceptable producer-consumer relationships, and responding to the demands of powerful, commodity-specific political constituencies. Partly as a result of movements in world prices and partly as a result of deliberate policy decisions, incentive coefficients (with the exception of cotton) are now roughly bunched between 0.7 and 1.0 as compared with roughly 0.2 to 0.6 in 1973/74. However, given the historic willingness of the government to use agricultural prices as instruments of general economic policy, there is no reason to be complacent about this evidence of an increased commitment to long-run efficiency. Indeed, two specific problems are already apparent on the horizon. First, there is the question of what to do about cotton. The DRCs show that, at domestic prices, cotton is not competitive with wheat-rice rotations. Hence, the tendency for farmers to continue the reduction in cotton acreage will continue. Cotton prices could be increased to overcome this tendency, i.e., cotton prices could be brought into line with world market prices, but such a move is likely to be resisted by cotton manufacturers within Pakistan. They argue that cheap raw materials are required to protect their competitive position in world markets.

1.20 A second and perennial problem is the sugar industry. After a period of world prices that made previously questionable investments in sugar mills look good, prices have again descended to the point where protective measures will have to be applied in order to keep the Pakistan sugar refining industry alive.
1.21 A final section in Chapter V deals with the real uncertainties that policymakers face in attempting to reconcile the various competing domestic interests with an overall, long-term interest in promoting an efficient use of the country's total resources. Fluctuations in the world commodity markets have already been mentioned. It is hard to imagine a government that could successfully withstand the changes in domestic prices that would result if agricultural prices had kept pace with the recent variations in international markets. To have relied on professional forecasting services or long-term averages would have been of marginal help because of the severity of the shortages. In such situations policy understandably consists primarily of leaning against the trend, with the substantial costs that lengthy adjustments imply.

1.22 A second source of uncertainty that has inhibited policy adjustments in Pakistan is related to the lack of knowledge on the part of policymakers about the likely behavior of various political constituencies. At the turn of the decade, expert commentators on the agricultural scene were pointing to the deterioration of domestic terms of trade for the agricultural sector. However, there was a reluctance on the part of government officials to make appropriate price adjustments for fear that it would prompt a consumer reaction in the then depressed and already politically restless urban centers. Serious political repercussions were thought to be a possibility if there was any inflammation of urban unrest via higher food prices. It was only with the "revolt" of the farming community in the post-devaluation years (especially 1973) and the escalation of world prices, that significant policy changes were initiated.

1.23 Concluding comments suggest that the dilemmas created by an uncertain planning environment place a high premium on developing a mechanism for more accurate monitoring of what is going on in the countryside and for more flexible policy responses. Currently, there is no systematic effort on the part of government to gather information that would substantiate or refute the claims of various constituencies. Consequently, the uncertainties inherent in the political and social environment are compounded by lack of substantive knowledge about the validity of claims being made by various interest groups.
II. GROWTH AND STRUCTURAL CHANGE IN PAKISTAN AGRICULTURE: 1960-1975

2.01 It is not the purpose of this study to provide a detailed analysis of the recent performance of Pakistan's agricultural sector. Developing relationships between government price and subsidy policies and their impact on producer decisions, however, necessarily requires a good deal of disaggregation. Typically, policy decisions are input and commodity specific; attempts to establish strong links between cause and effect are therefore facilitated by isolating the most immediately affected variables. The sum total of individual measures do add up to a "terms of trade" for agriculture, but its impact is likely to be much more diffuse and spread out over a longer period of time than the effects of a fertilizer subsidy or an export tax on cotton.

2.02 Sector-level data on gross output reveal a startling amount of variation in individual crop yields and acreages. It is apparent, for example, that concerns about agricultural stagnation in recent years are, to a large extent, the result of unusual departures from the long term trend of one or two major crops. While such abrupt shifts are consistent with adverse relative prices, the sharpness of the downturn in the production of, say, cotton in 1974/75 suggests that other immediate factors such as floods, droughts, and pests were also present.

Output Statistics: Trends and Recent Events

2.03 According to official statistics, the gross national product in agriculture at constant factor costs increased approximately 4.0 percent per annum over the 16-year period 1960/61 to 1975/76. Measured over a shorter period, 1960/61 to 1970/71, the annual trend rate is on the order of 6.0 percent. 1/ As the regression lines and scatter diagram in Figure 1 show, the lower rate for the longer period stems from an appreciable decline in the rate of growth for the period 1970/71 to 1975/76. Although several years were not far removed from the long term trend of 4.0 percent, 1974/75 and 1975/76 were both substantially below the trend line. Indeed, a regression fitted to the 1970/71 to 1975/76 period yields an annual rate of increase of 2.0 percent. 2/

2.04 Short-run trend lines can, of course, be seriously misleading as a basis for interpreting sectoral performance. For example, as the scatter diagram shows, at least a portion of the high "growth" rates associated with the Third Plan Period (1965-1970) is more in the nature of a recovery from the drought years of 1965/66 and 1966/67 than a movement from the long term trend established earlier in the decade. Similarly, statements about the "stagnation" of the 1970s are often exaggerated by reference to the very good year of 1969/70.

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1/ If the exceptionally good weather of the year 1969/70 is omitted, the trend rate for the shorter rate is approximately 5 percent.

2/ This latter period is chosen to exclude 1969/70. Including that year in the 1970s regression drops the growth rate from 2.0 percent to 1.6 percent per annum.
Figure 1: Gross National Product of Pakistan Agriculture, at Constant Factor Costs (1959/60 prices)

Annual growth rate (1960/61 - 1975/76) = 4.0  $R^2 = .96$

Annual growth rate (1970/71 - 1975/76) = 2.0  $R^2 = .86$

2.05 Whatever the limitations of looking at short-run growth rates in interpreting economic performance—and the sensitivity of a trend calculation to a few outlying points needs always to be kept in mind—it is clear that the rapid acceleration of agricultural output in the 1960s provided a significant boost to the entire economy. It is equally clear that the same cannot be said for the post-1970 period. Given that population increases of at least 2.7-2.8 percent appear to be inexorable in the short run, it is little wonder that Pakistani planners and politicians have become increasingly alarmed at the possibility—and implications—of stagnation in the agricultural sector.

2.06 **Value added by sub-sector:** National income data are an extremely crude measure of economic development. To a considerable extent, this criticism is based on the failure of national accounts data to deal with important distributional issues. In the Pakistan case, however, it could also be directed at the extent to which a single measure for growth is misleading on its own terms. Figure 2 shows, for example, the indices associated with growth in the major sub-sectors: major crops, minor crops and livestock (Table 1 provides annual growth rates calculated from linear trend estimates). What is immediately apparent is that the overall performance of the economy as measured by the growth rate in GDP is significantly influenced by a low and constant rate of growth in the livestock sector. Because this sector contributed a weight of nearly one third to the value-added estimate, it has been a substantial drag on the agricultural economy—at least so far as official data are concerned.

2.07 Yet there is considerable evidence that livestock has not been the drag that official data suggest. For example, fodder acreage has shown a steady increase during a period when rapid increases in motorized transport and mechanical tillage have been taking place. Also, as comparison of constant and current price indices show, until 1972/73, prices have risen more rapidly in the livestock sector than in the major crops sector. This suggests that a priori expectations about demand pressures generated by increasing incomes are being fulfilled.

2.08 As Timmer and Gotsch pointed out in 1968, there is little or no basis for the estimate of livestock's contribution shown in the National Accounts. According to their calculations for the period 1960-1967, the rate of increase was probably in excess of 4 percent per annum rather than the 2 percent that was officially reported. Because of the weight of livestock sub-sector, such an adjustment would have had a significant impact on the estimate of sector growth, raising it from 4.6 to approximately 5.1 percent.

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1/ A comparison of the 1960 and 1972 Agriculture Census data show that while cattle numbers are down by 13 percent, milk buffalo numbers are up by 20 percent. In short, fodder is being used to produce milk and dairy products rather than being fed to draft animals.
Figure 2: Indices of Gross Domestic Product in Agriculture by Sub-Sector
(Constant Factor Cost: 1959/60 = 100)

- Gross Domestic Product
- Major crops = 57.7%
- Minor crops = 12.7%
- Livestock = 28.8%
- Other = 1.3%

100.0%
Table 1  GROWTH RATE OF DOMESTIC PRODUCT  
IN AGRICULTURE BY SUB-SECTOR

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate (%)</td>
<td>$R^2$</td>
</tr>
<tr>
<td>Agriculture</td>
<td>4.0</td>
<td>.96</td>
</tr>
<tr>
<td>Major Crops</td>
<td>4.9</td>
<td>.93</td>
</tr>
<tr>
<td>Minor Crops</td>
<td>4.4</td>
<td>.92</td>
</tr>
<tr>
<td>Livestock</td>
<td>2.0</td>
<td>.98</td>
</tr>
</tbody>
</table>

2.09 Of the sub-sectors estimated in the National Income Accounts, the most important is that made up of the eleven so-called "Major Crops." In 1975/76 these comprised approximately 60 percent of the value added and hence their performance tends to dominate the index.

2.10 While all eleven crops continue to be important in terms of their absolute contribution to agricultural output, it is clear from Table 2 that a number of significant changes have taken place with respect to their relative importance. For example, while the dominant crops of wheat, rice, and cotton set the pace with respect to increased output for the overall 1960/61 -1975/76 period, much slower growth was recorded by sugarcane, coarse grains, and legumes. 1/

2.11 Figure 3 indicates, however, that any description of the long-run shifts in the cropping pattern misses a great deal of short-term variation. In recent years particularly, there have been drastic changes in the relative importance of the major crops. For example, 1971/72 was indisputably the year for cotton; total output increased by approximately 30 percent. But at the same time, there were substantial declines in the output of other major crops including wheat and rice. In 1972/73, the output of most major crops was still below or equal to the levels achieved in 1969/70. Rice, after declining drastically in 1970/71, showed some increase in 1972/73 but was still below the 1969/70 mark. Sugarcane continued to be well below the 1969/70 figure. However, the 1972/73 cotton crop was only a little bit smaller than the bumper 1971/72 crop and, with some help from wheat, was sufficient to establish a new index record of value-added in agriculture at 188 (1959/60 = 100).

2.12 Perhaps no other years provide as much of a sense of the variation in crop contributions to gross output as do 1974/75 and 1975/76. The former was clearly a bad year. Rice, wheat, sugarcane, and cotton all declined from the relatively good performance of the preceding season. Adverse climatic conditions are a major part of the story along with a lack of fertilizer offtake due largely to institutional difficulties.

1/ The latter development has been of particular concern to nutritionists.
2.13 Nineteen hundred and seventy-five/seventy-six was a year of recovery in which rice and wheat set new records, sugarcane recouped some of its previous position—and cotton plunged drastically to levels already attained in the early 1960s. The explanation for this decline in production is complex and involves a variety of factors. Goldman's recent study suggests, for example, that the instability exhibited during the 1971-76 period is dominated by flooding and unusual pest attacks. Significant, but secondary, have been shifts in relative prices that produced acreage substitution between cotton and competing crops such as sugarcane and rice. In 1974, for example, cotton prices declined drastically. Although a more positive price policy was followed in 1975 and 1976, yields continued to be low, thereby nullifying improvements in comparative advantage. As a result, there was a noticeable shift out of cotton in such major cotton districts as Sahiwal and Multan.

Table 2 ANNUAL GROWTH RATES OF MAJOR CROPS

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rate (%)</th>
<th>$R^2$</th>
<th>Rate (%)</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>All crops</td>
<td>4.5</td>
<td>.94</td>
<td>2.0</td>
<td>.69</td>
</tr>
<tr>
<td>Rice</td>
<td>6.4</td>
<td>.91</td>
<td>2.9</td>
<td>.69</td>
</tr>
<tr>
<td>Wheat</td>
<td>5.4</td>
<td>.87</td>
<td>4.0</td>
<td>.80</td>
</tr>
<tr>
<td>Barley</td>
<td>.9</td>
<td>.07</td>
<td>10.4</td>
<td>.93</td>
</tr>
<tr>
<td>Jawar</td>
<td>2.0</td>
<td>.55</td>
<td>-1.0</td>
<td>.02</td>
</tr>
<tr>
<td>Bajra</td>
<td>-1.1</td>
<td>.16</td>
<td>-1.5</td>
<td>.05</td>
</tr>
<tr>
<td>Maize</td>
<td>4.4</td>
<td>.90</td>
<td>2.1</td>
<td>.69</td>
</tr>
<tr>
<td>Gram</td>
<td>-1.2</td>
<td>.25</td>
<td>2.9</td>
<td>.45</td>
</tr>
<tr>
<td>Cotton</td>
<td>4.8</td>
<td>.77</td>
<td>-2.0</td>
<td>.08</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>3.1</td>
<td>.58</td>
<td>2.5</td>
<td>.22</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>2.1</td>
<td>.51</td>
<td>.8</td>
<td>.12</td>
</tr>
<tr>
<td>Sesamum</td>
<td>2.1</td>
<td>.16</td>
<td>-6.1</td>
<td>.26</td>
</tr>
<tr>
<td>Tobacco</td>
<td>2.4</td>
<td>.15</td>
<td>-6.5</td>
<td>.32</td>
</tr>
</tbody>
</table>

2.14 Minor crops, particularly fruits, vegetables and nuts, have also continued to show significant growth rates over the periods measured. Again, these observations coincide with a priori expectations. Unlike a number of the most important major crops, notably cotton and rice, minor crops have escaped government procurement policies and the substantial relative price increases have been a function of unregulated supply and demand. Also, while vegetables historically have not been a preferred part of the rural diet, the increasing sophistication of the urban diets and intermittent exports...

Figure 3: Production Indices for Selected Major Crops
(1959/60 = 100)
to the Middle East have reflected a substantial increase in demand, particularly for potatoes and onions. Perhaps even more important has been the increasing acreage devoted to orchards: citrus, mango, and assorted nuts.

2.15 Regional and district growth estimates: No value-added time series has been calculated for the various sub-national units in Pakistan. However, an approximation of their growth can be obtained by looking at the statistics for the production of major crops. As shown in Table 3, crop data indicate that the Sind is the fastest growing province with a long-term growth rate of nearly 6.0 percent per annum. The increased output is due largely to a rapid expansion in the acreage and yield of coarse rice. Despite the price discrimination directed against coarse rice, the productivity increases resulting from the introduction of HYV have been sufficient to prompt acreage expansion.

2.16 While data are not adequate to calculate a regression value for NWFP, the least growth has occurred in that province. To those familiar with Pakistan, this will come as no surprise. N.W.F.P. is, for the most part, mountainous with relatively little rainfall. From an agricultural point of view, it is an inhospitable environment. Only a few parts have been able to take advantage of the new high yielding varieties.

2.17 The high short-term growth rate indicated for Baluchistan in 1970/71 - 1975/76 is of doubtful significance. Data for the province show substantial year-to-year fluctuations, and hence there is little reason for confidence that the estimate represents any sustained growth process \( R^2 = 0.23 \). Indeed, inspection of the regression analysis indicates that the figure of 7.9 percent is largely a matter of several relatively good wheat harvests in the late 1960s and in 1972/73.

2.18 Perhaps the most significant deviation from the long-term trend is the short-run growth rate shown for the Sind in the period 1970/71 - 1975/76. Both cotton and rice yields have stagnated and the acreage increases in rice that produced such a favorable long-run statistic appear to have been exhausted. Under any circumstances, the variance is so high that no conclusions can be drawn about the establishment of a new trend line.

2.19 The disparity in growth rates between districts is every bit as great as the disparity between provinces. Disaggregation of data for the Punjab, (Table 4), shows that the areas characterized as being poor, old and settled have shown a significant decline in output recently while other relatively homogenous areas have shown handsome gains in gross value of product or output (GVP). Much the same picture would emerge in N.W.F.P. if the districts of Peshawar and Mardan were combined and compared with the rest of N.W.F.P. Both these districts reflect the impact on gross output of the provision of additional irrigation water through both public and private irrigation systems.
### Table 3 AGRICULTURAL PRODUCTION GROWTH RATE BY PROVINCES

<table>
<thead>
<tr>
<th>Area</th>
<th>1960/61 - 1975/76 Rate (%)</th>
<th>1970/71 - 1975/76 Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R²</td>
<td>R²</td>
</tr>
<tr>
<td>Baluchistan</td>
<td>3.2</td>
<td>7.9</td>
</tr>
<tr>
<td>N.W.F.P.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Punjab</td>
<td>4.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Sind</td>
<td>5.8</td>
<td>1.2</td>
</tr>
</tbody>
</table>

/a Contains Quetta and Kalat Divisions.
/b Contains Peshawar and D.I. Khan Divisions.
/c Contains Rawalpindi, Sargodha, Tahau, Multan Bahawalpur and Khaupur Divisions.
/d Contains Hyderabad and Karachi Divisions.

### Table 4 DISTRICT GROWTH RATES OF GVP BY ECOLOGICAL REGIONS IN THE PUNJAB

<table>
<thead>
<tr>
<th>Region</th>
<th>1960/61 - 1975/76 Rate (%)</th>
<th>1970/71 - 1975/76 Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R²</td>
<td>R²</td>
</tr>
<tr>
<td>Canal Colonies</td>
<td>6.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Western areas</td>
<td>6.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Poor, old settled</td>
<td>2.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Rich, old settled</td>
<td>4.6</td>
<td>4.8</td>
</tr>
</tbody>
</table>

/a Shahpur, Lyallpur, Jhan, Multan, Sahiwal.
/b Muzzaffargar, D. G. Khan, Mianwali.
/c Rawalpindi, Jhelum, Attock, Campbellpur.
/d Lahore, Sheikhpura, Sialkot, Gujranwala.

Sources of Growth

2.20 The logical question that follows a description of output statistics concerns the source or reason for the observed results. As a first step in this direction, changes in the gross value of output in the various areas have been partitioned into yield, acreage and cropping pattern effects. These in turn are linked to particular inputs to provide a first step in developing more detailed insights into the growth/incentive question.
2.21 **Partitioning growth:** Table 5 presents calculations showing a breakdown in the value of gross product (major crops) for several time periods. The resultant estimates indicate that while there may be relatively little to differentiate the early and late sixties with respect to aggregate growth, there is little doubt that different growth processes were at work. For example, the increases in output that occurred from 1960 to 1966 were heavily dependent on the area effect (39 percent). By contrast, the growth in the five-year period (1966-71) was dominated by increased yields and changes in the cropping pattern. The former (yield) effect is to be expected given the substantial improvement in the yields of wheat and rice resulting from the introduction of improved varieties and the application of significantly higher dosages of fertilizer (see Figure 4).

2.22 Partitioning the performance of the last few years, i.e., comparing 1970/71 and 1975/76, yields about the same results as in the 1964/65 - 1970/71 period. Even the magnitudes of the changes are roughly the same. Table 6 gives some indication of why this is so. For example, while cotton yields have declined significantly, the drop from 1970/71 to 1975/76 (12 percent) does not measure the full impact of the decline as it was experienced by farmers in the economy. That can only be appreciated by comparing 1975/76 output with an average of the preceding three years; the decline measured against this standard was approximately 20 percent (Figure 3).

2.23 In terms of the partitioning-of-growth exercise, the decline in cotton yields was in large measure made up by significant improvements in wheat (24 percent) and maize (15 percent) yields. The remaining major crops, including rice and sugarcane, varied little from their 1970/71 levels. These were both crops in which yield increases have accounted for a significant portion of the estimated increase in agricultural output during the Third Plan period (1965-70).

<table>
<thead>
<tr>
<th>Table 5</th>
<th>DISAGGREGATION OF THE GVP OF MAJOR CROPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
</tr>
<tr>
<td>Gross value</td>
<td>1,198</td>
</tr>
<tr>
<td>Area Effect (Intensity)</td>
<td>464</td>
</tr>
<tr>
<td>Yield Effect</td>
<td>420</td>
</tr>
<tr>
<td>Cropping Patterns Effect</td>
<td>184</td>
</tr>
<tr>
<td>Interaction</td>
<td>130</td>
</tr>
<tr>
<td>Year</td>
<td>Total Wheat</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>1960/61</td>
<td>8.9</td>
</tr>
<tr>
<td>1961/62</td>
<td>8.8</td>
</tr>
<tr>
<td>1962/63</td>
<td>9.0</td>
</tr>
<tr>
<td>1963/64</td>
<td>9.0</td>
</tr>
<tr>
<td>1964/65</td>
<td>9.0</td>
</tr>
<tr>
<td>1965/66</td>
<td>8.2</td>
</tr>
<tr>
<td>1966/67</td>
<td>8.8</td>
</tr>
<tr>
<td>1967/68</td>
<td>11.6</td>
</tr>
<tr>
<td>1968/69</td>
<td>11.6</td>
</tr>
<tr>
<td>1969/70</td>
<td>12.7</td>
</tr>
<tr>
<td>1970/71</td>
<td>11.7</td>
</tr>
<tr>
<td>1971/72</td>
<td>12.9</td>
</tr>
<tr>
<td>1972/73</td>
<td>13.5</td>
</tr>
<tr>
<td>1973/74</td>
<td>13.5</td>
</tr>
<tr>
<td>1974/75</td>
<td>14.3</td>
</tr>
<tr>
<td>1975/76</td>
<td>14.8</td>
</tr>
</tbody>
</table>

1960-1976 Trend (%) 4.3 5.0 2.2 1.6 1.4 0.6
R² 0.86 n.a. 0.82 n.a. 0.56 0.61 0.45 0.06

1970-76 Trend (%) 4.3 1.7* -0.8 -2.3* 2.7 0.6 3.1 -1.3
R² 0.92 0.58 0.06 0.39 0.07 0.23 0.73 0.04

*1970-75
2.24 The large positive cropping pattern effect is interesting because it again suggests that the variations in the crop mix are not a random weather phenomena, but represent an adjustment by farmers to changes in relative profitability among crops.

2.25 A disaggregation of growth in a number of selected districts (not shown) produces familiar results. In those well watered areas (e.g., Lyallpur Lahore, Sahiwal, Multan) growth is substantial in both periods, and the partitioning demonstrates cumulative effects of the adjustments that farmers have been able to make: more acreage (absolutely and relatively) under high value crops. Those areas less favored in terms of water availability and cropping alternatives show no consistent pattern, e.g., at times there has been a growth in acreage that has been cancelled out by a decline in yield.

2.26 Input use: The partitioned effects can be associated roughly with the provision of purchased inputs. For example, seeds, fertilizer and pesticides can be expected to affect output by increasing yields. Additional supplies of irrigation water, however, are more complex in their effects. Water makes possible increases in the acreage cropped, and tubewell-produced water also adds flexibility in water use. The result is to permit a variety of new, high-valued crop rotations. In addition, large increases in irrigation supplies in areas where farmers are accustomed to maximizing returns to water probably also increase yields. When used in combination with higher dosages of inorganic nutrients and improved seeds, this is sure to be the case.

2.27 The increased yields reported earlier could not have been achieved without accelerated fertilizer use. From only twenty thousand nutrient tons in 1960/61, offtake has been increased by a multiple of over 20 to roughly 425 thousand tons in 1974/75. In only two years during the past ten has there been an absolute decline from the preceding year. Most of the increase has occurred since 1967/68 and is related to the introduction of high yielding varieties of wheat and rice.

2.28 Disaggregation of the fertilizer offtake figures shows the source of the concern among agriculturalists that a highly unfavorable ratio of phosphatic to nitrogenous fertilizers has developed. Indeed, many knowledgable scientists attribute at least a part of the decline in wheat yields to the failure to replace residual soil phosphates that were exhausted during the first spectacular years of the "green revolution." (Developments of the current crop year, when the offtake of phosphates rose significantly, give some ground for optimism that the government's efforts to rectify the imbalance are beginning to have an effect.)

2.29 The accuracy of the fertilizer data is substantially greater than for other inputs. However, by using rough estimates of per unit tubewell discharges, it is also possible to reach some conclusions about the order of

1/ A preliminary estimate for 1976/77, places offtake at 700,000 tons.
magnitude of increased water supplies from this source. Figure 4 provides a measure of increases in overall tubewell water availability from 1960/61 to 1975/76. Given that the roughly 10,000 public sector tubewells in use are above one cusec in capacity, and that a number of the private sector wells are less, an estimate of 150,000 cusecs of installed capacity in 1975/76 is probably as accurate a figure as one is likely to get. Assuming that each well were to operate between 1,500 and 2,000 hours per year, an increase of roughly 20 million acre feet over the 65 m.a.f. of canal water normally supplied could be expected. This means that, for the whole of Pakistan, groundwater development has added some 30 percent to irrigation supplies. Since only a portion of the country has access to groundwater, in many areas groundwater must have added 50-100 percent to water availability. The crucial character of water availability is underscored by the observation that in two bad years, 1970/71 and 1971/72, water supplies went from 70 m.a.f. to 61.2 m.a.f. in 1970/71 and 60.6 in 1971/72. The performance of 1974/75 is also explainable, at least in part, by the lack of irrigation water.

2.30 Mubasher Lal Khan demonstrates the importance of groundwater in an interesting and different way by comparing data on farms with and without tubewells for 1970/71 and 1971/72. As Table 7 indicates, instead of a decline in area cropped that would have been expected as a result of the low surface water availability in 1971/72, tubewell farmers actually increased their cropped area by 25 percent.

<table>
<thead>
<tr>
<th></th>
<th>Tubewell Farms</th>
<th>Non-Tubewell Farms</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>3.31</td>
<td>3.67</td>
<td>5.04</td>
<td>4.55</td>
<td>+10.9</td>
</tr>
<tr>
<td>Rice</td>
<td>0.90</td>
<td>0.86</td>
<td>0.88</td>
<td>0.78</td>
<td>-4.4</td>
</tr>
<tr>
<td>Maize</td>
<td>0.16</td>
<td>0.18</td>
<td>0.42</td>
<td>0.39</td>
<td>+12.5</td>
</tr>
<tr>
<td>Cotton</td>
<td>1.07</td>
<td>1.33</td>
<td>2.16</td>
<td>2.34</td>
<td>+24.3</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.27</td>
<td>0.23</td>
<td>0.89</td>
<td>0.71</td>
<td>-14/8</td>
</tr>
<tr>
<td>Other</td>
<td>0.98</td>
<td>2.17</td>
<td>6.81</td>
<td>4.93</td>
<td>+121.4</td>
</tr>
<tr>
<td>Total</td>
<td>6.69</td>
<td>8.44</td>
<td>15.20</td>
<td>13.70</td>
<td>+26.2</td>
</tr>
</tbody>
</table>

The fact that both wheat and cotton have increased suggests that tubewell farmers are beginning to engage in substantial amounts of double cropping. Table taken from Mubasher Lal Khan, "Current Agricultural Situation, Problems and Prospects," Ministry of Agriculture, mimeograph, 1973.

1/ One cusec is one cubic foot per second.
2/ Million acre feet.
Figure 4: Indices of Input Use

Fertilizer: 16.2% growth, $R^2 = .93$
Water: 3.2% growth, $R^2 = .92$
Tubewell Water: 13% growth, $R^2 = .99$
(Not shown)

Total Fertilizer

Total Water

2.31 A third ingredient of recent increases in output has been the rapid growth in area under improved seeds. Most of the increase occurred in the late sixties and early seventies. In the past several years, the impetus has slowed considerably, and in the case of rice, the acreage under IRRI varieties may have declined slightly. This point will be raised again in a subsequent section on long-run growth potentials. For when the area under improved wheat varieties is compared with total wheat acreage, it appears that approximately 75 percent of the wheat land is now under HYV. When the acreage that is unsuitable for such varieties because of low rainfall is subtracted, the percentage is even higher. Similarly, IRRI rice now occupies nearly 60 percent of the acreage devoted to rice. When basmati or fine rice tracts are subtracted, it would appear that the acreage under rice likely to go to HYV has now also been largely planted. (This does not preclude, of course, some shifts in the "swing areas" in favor of rice and away from cotton and sugarcane.) Consequently, the initial effects of what was literally a revolution in technology have largely been spent, and a somewhat lower growth rate can be expected.

2.32 The impact of mechanical inputs on growth and structural change in the agricultural sector continues to be somewhat obscure. While there is no doubt that the 13 percent annual increase in groundwater supplies has had an enormous positive effect on output, there is still the question of the breadth of the market for groundwater sales. Tubewells are a "lumpy" input, and although they are highly profitable, at some point—say below fifteen acres—farmers can no longer meet both fixed and variable costs out of the increase in incomes. As expected, markets for water have developed, but there is little information on the extent of the purchase and sales activities.

2.33 More controversial than the impact of the tubewell is the effect of the continued increase in the use of tractors. Here the principal issue is whether tractors are, in fact, necessary to increase cropping intensities when supplementary irrigation water is available. For if it could be shown that significant intensity increases accompanied tractorization, then the argument about detrimental employment would be negated, or at least mitigated.

2.34 In an IBRD study done in 1968, it was reported that while there was substantial increase in farm size when a tractor was acquired, there appeared to be no increase in the intensity of land use. 1/ Indeed, intensity decreased with farm size in much the same way that intensity and yields decrease with farm size under pre-tractor conditions.

2.35 The recent Census of Agriculture (1972) supports the IBRD findings on the relationship between cropping intensities and tractorization. All

small farms, regardless of the source of power, have higher cropping intensities than large farms. While within the medium-sized farms (25-50 acres) tractor farm intensities are slightly higher, the effects on the cropping pattern have been more significant. In keeping with expectations, with the resumption of the land for self-cultivation, such crops as fodder, oilseeds and pulses have decreased in favor of cash crops, such as wheat, rice and cotton.

2.36 The contributions of mechanization to growth, at least the impact of tractors, is closely related to several distributive issues and hence is unlikely to be resolved for some time. However, the available evidence points to the following conclusions:

- There has been little or no yield effect from tractors.
- The very large farms, fifty acres and over, have probably not increased cropping intensity as a result of mechanization. As the calculation of effective subsidy coefficients in Chapter IV indicate, the demand for tractors was fueled by distorted economic policies and the desire to resume land for self-cultivation.
- Farmers in the 30- to 50-acre category who purchased tractors appear to have reached somewhat higher cropping intensities than non-tractor farmers in the same size class.
- A considerable portion (20 percent) of the lands being farmed by all size groups having tractors was formerly unreclaimed land. These lands represent an addition to the amount of acreage available for cropping and hence an important contribution to growth. The extent to which this growth in acreage is attributable to mechanization is not clear. But if it were even partly attributable to tractors, it would increase substantially the rate of return on tractors.

2.37 In comparing "with" and "without" models of mechanization, it is clear that the rate of return at social accounting prices is significantly influenced by the availability of supplementary irrigation water. Where such water is available, the use of tractors (especially by middle-sized farmers) has probably created as much demand for labor as it has displaced. However, this process may also have been accompanied by a transformation of a sharecropping system into one of wage labor.

2.38 Least reliable of the purchased input data are those associated with plant protection. Although the figures in Table 8 show a steady increase in area covered, the effectiveness of this coverage remains open to question. Indeed, as noted earlier, the Goldman study suggests that lack of an effective pest management system must bear responsibility for part of the drastic fluctuation in cotton yields.
Table 8 AREA COVERED WITH GROUND AND AERIAL PLANT PROTECTION MEASURES

<table>
<thead>
<tr>
<th>Year</th>
<th>Ground Operation (000) acres</th>
<th>Aerial Operation (000) acres</th>
<th>Total (000) acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965/66</td>
<td>2,260</td>
<td>2,490</td>
<td>4,550</td>
</tr>
<tr>
<td>1966/67</td>
<td>1,895</td>
<td>2,040</td>
<td>4,140</td>
</tr>
<tr>
<td>1967/68</td>
<td>1,072</td>
<td>1,208</td>
<td>2,822</td>
</tr>
<tr>
<td>1968/69</td>
<td>1,744</td>
<td>1,641</td>
<td>3,385</td>
</tr>
<tr>
<td>1969/70</td>
<td>1,489</td>
<td>1,625</td>
<td>3,114</td>
</tr>
<tr>
<td>1970/71</td>
<td>1,614</td>
<td>625</td>
<td>1,697</td>
</tr>
<tr>
<td>1971/72</td>
<td>2,100</td>
<td>551</td>
<td>2,446</td>
</tr>
<tr>
<td>1972/73</td>
<td>2,060</td>
<td>376</td>
<td>2,636</td>
</tr>
</tbody>
</table>


An Anatomy of the Green Revolution

2.39 From the foregoing observations the following scenario is a plausible reconstruction of agricultural growth during the past decade and a half:

- The beginning of the green revolution can be dated somewhere around 1960. Undoubtedly aided by several good weather years, this period nevertheless marks the introduction of discernible quantities of fertilizer and the spread of privately installed tubewells. As would be expected, (a) an important growth element was increased acreage under crop and (b) sugarcane, a crop with high water and fertility requirements, benefitted most from these inputs and became the cutting edge of the increased output.

- The distributive effect of this period was overwhelmingly in favor of the larger farmers since (a) tubewells are "lumpy" inputs requiring significant capital investments, (b) percentage of cash crops on large farms unconstrained by subsistence requirements is much larger, (c) fertilizer was in short supply and obtaining adequate supplies was often a matter of exercising social influence.

- This initial impetus—which established the approximate trend line for the decade—was interrupted by two drought years, 1965/66 and 1966/67. Although these years saw a significant decrease in output as a result of weather, the impact of the use of inputs was less severe. Indeed, there is undoubtedly a good deal of truth in the argument that the prolonged drought stimulated the installation of tubewells as nothing else could have done.
The year 1967/68 was the year of the Mexi-Pak wheat variety. The government launched an all-out campaign, sometimes bordering on coercion, to diffuse the Mexican wheat seeds as widely as possible. Good weather, a record offtake of fertilizer and the water from some sixty thousand tubewells boosted wheat output from an average of 3.8 million tons, obtained during the first part of the decade, to 6.3 million tons, an increase of 65 percent. Although certain crops, notably sugarcane, suffered in the process, the net result was a recovery from the slump caused by the drought plus an increment that re-established the trend value for the earlier period.

In 1968/69 rice, sugarcane and cotton again emerged as the leading growth crops, with rice output jumping 75 percent, from 2.2 million to 3.9 million tons. Due to the over-valuation of domestic prices (200 percent above world prices) sugarcane, in that year, continued to be more profitable than all other crops when supplementary water supplies were available. Growth therefore continued to be the response to a disequilibrium condition that began with the introduction of tubewells. Because of the lack of improved sugarcane technology, the growth was associated with large increases in sugarcane acreage. The output of rice has also increased rapidly, particularly in the Sind. However, unlike sugarcane, its comparative advantage was tremendously enhanced by rising productivity. Due to the introduction of HYV, yields in the two years ending in 1969/70 increased by 44 percent over their 1967/68 level.

1970/71 and 1971/72 were disappointing years involving substantial retreats in output from the 1969/70 peak. A combination of events, including the trauma of war, resulted in significant declines in all major crops except maize and cotton. The latter, capitalizing on unprecedented prices and unusually favorable summer weather, registered a gain of 35 percent in production over a period of two years.

1972/73 and 1973/74 marked new highs in agricultural output and continued the long term trend of approximately 4.5 percent per annum. The 1973/74 cotton crop was down approximately 7 percent from the all time high of 1971/72. Rice and sugarcane increased in acreage and the two reached new highs in output. In 1973/74, wheat also achieved a new record with an estimated 8.3 million tons—nearly 15 percent above the previous level achieved in 1972/73.

1974/75 was a serious blow to efforts to regain the momentum of the mid-1960s. It was attributable, at least in good measure, to a significant decrease in the availability of surface water supplies for irrigation.
2.40 From this brief description, it is apparent that the green revolution in Pakistan was a revolution carried out largely by farmers. Government activities and government institutions sometimes played a facilitating role but were never called upon to provide the initiative in either the early phases in which the production of water was the essential element nor in the latter stages when yields were significantly increased through the application of improved seeds and fertilizer.

**An Aggregate Production Function**

2.41 Although the consistent upward trends in the use of all inputs promise statistical problems, it seemed useful to summarize the foregoing discussion of growth and its component with a simple production function. Only the major inputs: fertilizer, water, and land (plus a trend value to capture the effects of technical change) were included, i.e.:

\[
\text{GDP}_A = f(CA, H_2O, F, t) 
\]

\[\begin{align*}
CA & = \text{total annual cropped acreage} \\
H_2O & = \text{total annual water availability} \\
& \quad \text{(surface plus groundwater)} \\
F & = \text{total annual fertilizer offtake} \\
& \quad \text{expressed in nutrient tons} \\
t & = \text{trend variable designed to capture} \\
& \quad \text{the effects of technological change}
\end{align*}\]

2.42 The results of estimating such a relationship, after converting the previously presented data to logs, is given in Equation (2).

\[
\log \text{GNP}_A = 6.88 + 0.03 \log CA + 0.18 \log H_2O + 0.23 \log F + 0.43 \log t \\
(1.90)(0.50) \quad (0.35) \quad (0.05) \quad (0.06)
\]

D.W. 2.02
\[\bar{R}^2 = 0.98\]

2.43 According to this model, only variations in fertilizer availability play a significant role in determining output once the trend effect is accounted for.\(^1\) Fluctuations in cropped acreage and water availability about the trend are not significant enough to produce estimates that fall within the usual confidence intervals. (The trend variable is, of course, highly significant.)

---

\(^1\) Because all variables are in logarithmic form, the coefficients can be read off directly as elasticities. For example, according to the model, GNPA can be expected to increase by 2.3 percent with every 10 percent increase in fertilizer.
Given previous comments on the role of water in determining overall output, the failure to obtain a significant result is somewhat surprising, although water effects may in fact be included in the "time" variable. Even with the crude measurements of growth being used as the dependent variable, one might have expected total irrigation supplies to be an important determinant of output.

Work done by Hicks and Caden suggest that disaggregation, both in terms of crops and seasons, gives improved results. 1/ For example, variations in sugarcane production were correlated with canal flows in the kharif season and with a measure of annual supplies of tubewell water. Similarly, canal water in the rabi season and annual tubewell water were both significant determinants of the area under wheat. In the case of cotton, on the other hand, only annual tubewell supplies were significant. In none of these cases do data exist that make it possible to relate proportion of water used directly to a particular crop. But the results are more indicative of expected relationships between water availability and crop production than those displayed in equation (2).

Growth and Structural Change

The process of economic growth involves two simultaneous phenomena. The first, to which the major portion of this chapter is addressed, can best be characterized as accumulation, i.e., as the way in which individual economic and social variables change relative to a previous time period. The following section deals with a second intrinsic aspect of economic growth, namely, with changes in the variables often used to describe the agricultural economy relative to each other. This distributive process will be called structural change and is assumed to occur at several levels of aggregation, e.g., sector, region, and village. 2/

The range of issues that have been investigated by various writers under the rubric of structural change is extensive. The following comments, however, are relatively narrow and deal primarily with those aspects of the structural change process that are directly related to the prices and subsidies issue. Of particular significance in this context is the issue of relative factor prices and the extent to which these created incentives for a pattern of change that was consistent with the country's factor endowments.


2/ For a time series analysis of accumulation and structural change in a number of important countries, see Simon Kuznets, Modern Economic Growth. Cross sectional or cross country analysis of similar problems can be found in a series of papers by Hollis Chenery and his associates. Cf. Hollis Chenery and Moises Syrquin, Patterns of Development: 1950-1970, Oxford University Press, 1975.
Structural Change: A Sectoral Perspective

2.48 It is difficult to measure the impact of individual factor price distortions on structural change at the sector level. However, some brief observations to indicate that Pakistan is developing "normally" seem useful as a background against which to evaluate more detailed studies.

2.49 **Sector shares:** One of the statistics most often cited as an indicator of development—and the extent to which the general structure of the economy has been transformed from an agrarian to an industrialized one—is the sectoral breakdown of GDP. The basic mechanisms, heavily dependent on the decreasing relative demand for food as incomes rise, are well established and have been observed in both time series and cross-sectional studies. Thus, in 1959/60, nearly half of the country's GDP was contributed by agriculture. By 1971/72, largely as a result of the rapid growth in large-scale manufacturing, agriculture's share had declined to 38 percent. In 1975/76, agriculture's share had declined still further to 32 percent. The share of exports, however, did not change appreciably; rice and cotton have continued to supply roughly a third of the foreign exchange earned.

2.50 **Population by sector:** A second important statistic useful in describing the stage of a country's structural transformation is the share of the population residing in rural areas and linked closely to production in the agricultural sector. Typically, this will be higher than the share of agriculture in GDP both because of the lower productivity of labor in the agricultural sector and because some considerable portion of the labor force residing in rural areas is not engaged in agriculture or agriculturally related pursuits.

<table>
<thead>
<tr>
<th>Type of Residence</th>
<th>1951</th>
<th>1961</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Millions</td>
<td>%</td>
<td>Millions</td>
</tr>
<tr>
<td>Metropolitan areas (3)</td>
<td>2,151</td>
<td>6.4</td>
<td>3,549</td>
</tr>
<tr>
<td>Medium cities (16)</td>
<td>1,647</td>
<td>4.9</td>
<td>2,640</td>
</tr>
<tr>
<td>Large towns (20)</td>
<td>636</td>
<td>1.9</td>
<td>888</td>
</tr>
<tr>
<td>Other Urban</td>
<td>1,585</td>
<td>4.7</td>
<td>2,577</td>
</tr>
<tr>
<td><strong>Total Urban:</strong></td>
<td>6,019</td>
<td>17.9</td>
<td>9,654</td>
</tr>
<tr>
<td><strong>Total Rural:</strong></td>
<td>27,761</td>
<td>82.1</td>
<td>33,226</td>
</tr>
</tbody>
</table>

2.51 Table 9 provides a breakdown of the data on residence for the three most recent census years: 1951, 1961, and 1972. These show clearly that while there has been a substantial increase in the absolute number of rural residences, there has been a significant decline in the relative size of the rural population.

2.52 It is obvious that substantial rural to urban migration has taken place during the 1960s and early 70s. 1/ However, many of the causal arguments that seek to relate population pressures to the interests of political constituencies depend very much on the kind of migration that has taken place. For example, part of the increase in city size is the result of traditional patterns that have existed for decades. A particularly interesting case is that of unskilled labor from certain districts of N.W.F.P. moving to Karachi in search of jobs in the construction industry. Similarly, the districts of the northern Punjab continue to supply large numbers of recruits to the Armed Forces. (The earnings remitted in both these cases are a major factor in the welfare of the labor-exporting area.)

2.53 However, recent years have established new patterns of migration from the agricultural areas to the towns and cities. For example, S.J. Burki's survey of a number of smaller urban areas shows that these towns have grown at rates that suggest nearly 30 percent of their growth is attributable to in-migration. (See Table 10.) Unlike the unskilled laborers that constitute the bulk of the migrants from the mountainous areas of N.W.F.P., migrants to urban areas from neighboring agricultural areas comprise a much broader spectrum of the population. Small landlords, tenants and skilled artisans, as well as landless laborers have been a part of the influx. (As subsequent sections indicate, this kind of diversity is consistent with the changes that have taken place in the agricultural economy.)

**Structural Change: A Micro Perspective**

2.54 The impact of agricultural prices and subsidies on aggregate sectoral relationships is difficult to discern because the effects are so indirect and long run. Moreover, they are often masked by other variables, e.g., the rate of industrialization, that play an important role in determining the sectoral shifts that characterize "normal" development. As a result, efforts to ascertain the role of market interventions on such structural variables as the distribution of farm sizes, land tenure arrangements, the composition of the rural labor force, etc., are more likely to be successful when examined at the micro level. Unfortunately, while there is little doubt about the general direction of changes in many of the basic parameters that would be used to describe the state of Pakistan agriculture, there is relatively little hard evidence about the magnitude and rapidity with which

---

Table 10: GROWTH OF SURVEY TOWNS AND PROPORTION OF MIGRANTS IN THEIR POPULATIONS, 1951-69

<table>
<thead>
<tr>
<th>Town</th>
<th>District</th>
<th>Population</th>
<th>Rate of Growth</th>
<th>Migrants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haripur</td>
<td>Hazara</td>
<td>7,979</td>
<td>10,217</td>
<td>12,200</td>
<td>28.0</td>
</tr>
<tr>
<td>Charsadda</td>
<td>Peshawar</td>
<td>27,048</td>
<td>37,396</td>
<td>49,300</td>
<td>38.3</td>
</tr>
<tr>
<td>Gujarkhan</td>
<td>Rawalpindi</td>
<td>8,496</td>
<td>11,529</td>
<td>15,700</td>
<td>35.7</td>
</tr>
<tr>
<td>Gojra</td>
<td>Lyallpur</td>
<td>20,409</td>
<td>29,665</td>
<td>43,200</td>
<td>45.4</td>
</tr>
<tr>
<td>Jarnawala</td>
<td>Lyallpur</td>
<td>17,969</td>
<td>26,953</td>
<td>39,600</td>
<td>50.0</td>
</tr>
<tr>
<td>Kot Radha</td>
<td>Lahore</td>
<td>8,657</td>
<td>10,536</td>
<td>12,100</td>
<td>21.7</td>
</tr>
<tr>
<td>Krishna</td>
<td>Gujranwala</td>
<td>5,588</td>
<td>25,124</td>
<td>40,300</td>
<td>61.5</td>
</tr>
<tr>
<td>Sangla Hill</td>
<td>Sheikhupura</td>
<td>9,379</td>
<td>13,738</td>
<td>19,200</td>
<td>46.5</td>
</tr>
<tr>
<td>Daska</td>
<td>Daska</td>
<td>15,375</td>
<td>20,406</td>
<td>27,600</td>
<td>32.7</td>
</tr>
<tr>
<td>Pasrur</td>
<td>Sjalkot</td>
<td>9,403</td>
<td>10,836</td>
<td>12,000</td>
<td>15.2</td>
</tr>
<tr>
<td>Burewala</td>
<td>Multan</td>
<td>15,372</td>
<td>34,237</td>
<td>61,800</td>
<td>122.7</td>
</tr>
<tr>
<td>Rohri</td>
<td>Sukkur</td>
<td>13,243</td>
<td>19,072</td>
<td>24,200</td>
<td>44.0</td>
</tr>
<tr>
<td>Larkana</td>
<td>Larkana</td>
<td>33,248</td>
<td>48,008</td>
<td>63,900</td>
<td>44.4</td>
</tr>
</tbody>
</table>

Total       |          | 202,166    | 297,772        | 421,100  | 47.3     | 41.4     | 103,460 | 24.6 |

changes are taking place. Consequently, the best that can be done is to examine a number of limited surveys and to try to infer something about directions of change from their results. 1/

2.55 Perhaps the most revealing evidence concerning the structure of holdings is to be found in a series of field surveys done under the supervision of S. J. Burki in 1969. After tabulating the results of several hundred interviews done in twenty-seven villages of the Punjab, he concludes:

"... of the total land held by the farmers owning between 50 and 100 acres, as much as 19.2 percent was acquired through purchases in the 10-year period between 1959 and 1969...the owners of less than 10 acres and between 10 and 25 acres held respectively 12.2 percent and 6.9 percent less land in 1969 than they did a decade earlier. The big landlords, with holdings of more than 100 acres, also lost 15.7 percent of their land in the same period. The principal beneficiaries were the middle landlords, with the 50-100 category having acquired 19.2 percent of the total land transfers." 2/

2.56 These data suggest that a pattern typical of advanced countries is being followed in Pakistan also. Medium landlords, seeking to increase their holding sizes in order to utilize fully lumpy mechanical technology in the form of tubewells and tractors, were the most aggressive group in acquiring additional land. Their smaller neighbors, unable to reduce unit costs without access to the technology, often found it advisable to rent or sell their land and move to the city. The larger landlords were not confronted with the same incentives and hence tended to be less active in increasing farm size.

2.57 Evidence on the role of mechanization in producing changes in operating structure is contained in an IBRD survey carried out by the technical staff of the Agricultural Development Bank of Pakistan. 3/ Perhaps the principal result of the survey is that after the introduction of the tractor, average farm size (operated) grew by a factor of 2.4. Table 11 shows the percentage breakdown of the sources of the increase.

1/ It is unfortunate that as a result of the change in methods of enumeration, the 1972 Agricultural Census is of only limited value in ascertaining changes in such crucial variables as the size of operated holdings and the extent of tenancy.


Table 11 SOURCES OF INCREASE IN FARM SIZE
IN IBRD TRACTOR MECHANIZATION STUDY

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land previously uncultivated</td>
<td>22 percent</td>
</tr>
<tr>
<td>Land previously rented out</td>
<td>42 percent</td>
</tr>
<tr>
<td>Land newly rented in</td>
<td>24 percent</td>
</tr>
<tr>
<td>Land newly purchased</td>
<td>12 percent</td>
</tr>
</tbody>
</table>

2.58 Some evidence on the changing of circumstances of rural social groups has been gathered by Eckert in his survey of rural employment in the Punjab. In a detailed report written well after the introduction of the HYV package had benefited many segments of the rural population, he points to several groups for whom basic changes in the agricultural economy are creating particular difficulties:

- Temporarily hired landless labor: This group is estimated to number nearly two million households. They averaged 135 days of work in 1971; annual cash household income averaged Rs 175.

- Permanent hired landless labor: Estimated at 1.3 million in the Punjab, cash household income for this group was Rs 193 per year. However, they received a substantial amount of income in kind.

- Tenant farmers: In addition to the uncertainties of displacement, tenants are vulnerable to a continued upward pressure on rents as more and more landless compete for less and less land. Eckert estimates that there are over four million families in this category. There is no reason to expect that over time their position will improve relative to landless labor.

- Small farmers: The Census of 1960 suggests that some 20 million households live on operated holdings of less than 7.4 acres. These farmers are often among the poorest families in the village since the social status associated with land holdings often acts as a deterrent to part-time labor on neighbor's field. With increasing self-management on the part of the larger farmers, many have found it increasingly difficult to rent in enough land to provide a minimum holding.

- Artisans: The traditional artisans class has been declining in size for several decades both as a result of increasing

1/ Jerry B. Eckert, Rural Labor in Punjab, Planning and Development Department, Lahore, 1972, mimeograph.
monetization of rural transactions and greater access by rural people to small towns where cheaper and better quality goods are available.

2.59 The Eckert survey, although limited to the Punjab, is extremely useful in thinking about the process of rural transformation since it identifies specifically those groups whose welfare will be most seriously affected.

Summary and Conclusions

2.60 Although the foregoing discussion covered only the high ground of events of the period 1960-1975, it does provide the basis for a series of propositions about the process of agricultural growth that merit further investigation:

- There has been an almost uninterrupted increase in value-added by the agricultural sector with only two years out of fifteen in which absolute increases were not recorded. Growth rates in the 1960s were substantially higher than in the latter part of the period, but these are dependent on the choice of time period. (For example, the rapid growth rates of the Third Plan period (1965-1970) are as much a function of the drought year 1965/66 as of the unusual bumper crops harvested in 1969/70.)

- Similarly, the performance of the 1970s is dominated by (a) the comparison with 1969/70 and (b) the very bad year in 1974/75 and the mediocre performance in 1975/76. Otherwise, 1970/71, 1971/72, 1972/73, and 1973/74 are all on or above the trend line that represents a 4 percent rate of growth. In a sector as subject to climatic variation as agriculture, talk of "stagnation" therefore requires substantial qualification. This warning is particularly apt when the dips in performance can be identified with water shortages, disruption of the fertilizer distribution system, floods, pest attacks, etc.

- Efforts to estimate an aggregate production function encountered problems of collinearity. However, the fertilizer coefficient appears to be both statistically significant and stable. It suggests that for every 10 percent increase in fertilizer offtake, \textit{ceteris paribus}, GNP in agriculture can be expected to increase by 2.3 percent.

- Structural change has probably been occurring at a rapid rate in the agricultural sector. As of yet, there are no comparable data that permit conclusions about the extent of change in the holding size structure, but most farm management studies suggest that considerable land has been resumed for own cultivation. At a more aggregate level, the most interesting migration patterns involve the rapid growth of rural towns in the medium sized group.
III. PRICES, INSTITUTIONS AND DOMESTIC INCENTIVES IN PAKISTAN AGRICULTURE

3.01 The foregoing chapter provided data on the increase in agricultural outputs during the period 1960-1975, and, to a lesser extent, estimates of the inputs that were responsible. While the dominant mode was clearly one of substantial growth, disaggregation of sectoral data revealed a good deal of year-to-year variation, especially in the crop mix. Water availability, fertilizer offtake, pesticide use, and the purchase of mechanical inputs, on the other hand, all showed virtually uninterrupted upward trends and were consistent with the upward trend in gross domestic product originating in the agricultural sector.

3.02 Hypotheses concerning the "engine of growth" that characterized the period under study have thus far been mentioned only in passing. These comments have given primacy to private economic incentives in explaining the motivation for investment in agriculture. Indeed, there is some evidence that those instances in which investment slackened were a partial result of direct institutional interventions by the government and were not simply a reflection of basic economic policies. For example, the explanation of "bad" fertilizer years appears to have been affected as much by an inadequate and vacillating approach to logistics and distribution as by water shortages or the decline in benefit-cost ratios that marked the 1970s. The three taken together, of course, create a highly effective deterrent to adoption -- as the decline in offtake in 1973/74 amply demonstrates. Between September 1972 and August 1973, the government announced three successive price increases that nearly doubled the controlled price of fertilizer. 1/ At the same time (August 1973), the Punjab government announced that henceforth fertilizer in that province could be sold only through government distribution centers. 2/ As a consequence, the number of distribution points was cut back from 2,200 to 700.

3.03 While it is not possible to isolate the separate effects of these changes in the distribution system and in fertilizer prices, variations in provincial data suggest that the drop in fertilizer consumption in 1973 was primarily caused by the Punjab government's takeover of distribution and the decline in the number of distribution centers, while the continuing stagnation in use during 1974/75 was attributable more to higher fertilizer prices. Offtake in the Punjab in 1973/74 was down 16 percent while consumption in other provinces rose by a further 10 percent, or at somewhat more than half the rate of growth over the previous seven years. Punjab and Sind suffered flooding in August 1973, but an intensive government effort to

1/ The price of urea was raised from Rs 28.5/kilograms bag to Rs 35 in September 1972 to Rs 42/bag in March 1973, and to Rs 55/bag in August 1973.

2/ The only exception was the continuation of ESSO's right to sell through a limited number of private distributors in the northern Punjab.
distribute fertilizer on credit probably offset the effect of the floods as fertilizer distribution and consumption rose in the Sind. During 1974/75, fertilizer consumption in Punjab recovered most of its loss from the previous year, but consumption in other provinces dropped by nearly 15 percent. This seems to have reflected some recovery in the functioning of the distribution system in Punjab, but a decline elsewhere due to reduced price incentives.

3.04 In the observations that follow, attention is given both to the domestic price structure and to the institutions through which it was implemented. It is no secret that the published "procurement" and "market" prices on which most of the economic analysis is based frequently do not reflect the realities of the countryside. Farmers, especially small farmers, confront a wide range of marketing institutions (ranging from sugarcane millers to the village middleman) from a relatively weak bargaining position. Most studies show that where these market outlets exist in numbers, competition has kept economic rents to a minimum. However, cotton gins and sugar mills with their spatial monopolies, clearly do not fall into this category, and their behavior towards farmers has reflected their superior market power.

3.05 As a first step in the analysis of price incentives, the domestic gross barter terms-of-trade between agriculture and non-agriculture have been calculated. This ratio provides a relative measure of changes in price and subsidy policies. On the basis of the estimates derived, several "eras" are identified and related to the magnitude of agricultural growth taking place during each period. Attempts to develop a more rigorous test of the aggregate supply response, by regressing the gross domestic product in agriculture on the terms-of-trade, yield insignificant results in both naive and distributed lag models.

3.06 A separate estimate of the terms-of-trade, containing only investment and intermediate goods in the prices-paid index, underscores the fact that in recent years the costs of purchased inputs have increased more rapidly than the index of "all manufactures" purchased by the agricultural sector. Again, however, econometric tests in which the terms-of-trade are treated as the independent variable fail to show a statistically significant relationship.

3.07 The relatively rapid rate of increase in the prices of investment and intermediate goods is further illustrated by the ratio of prices-received/prices-paid for particular inputs. While these ratios show considerable variation both from year to year and over the decade as a whole, a weighted index of the observed changes does not yield a statistically significant relationship with indices of fertilizer offtake, tractor sales, and tubewell installations.

3.08 The time variable included in each of the response equations mentioned above was always highly significant. This suggests that, at least for most of the period under study, the level of profitability generated by the productivity of improved technology was sufficient to maintain incentives for its diffusion. These observations lend further weight to the argument that, in general, where the use of inputs declined, the reasons had more to do with supply constraints and institutional (distribution) difficulties than with low rates of return.
Lastly, changes in the relative prices of commodities were also investigated. Here the role of prices is clearer and the econometric analysis yields well-known conclusions regarding the supply-response of crops that compete for domestic resources in the rabi and kharif seasons. The price elasticities derived from a Nerlovian distributed lag model are approximately the same when measured over the past two decades as those obtained in previous analysis for an earlier time period.

**Prices-Received/Prices-Paid Ratios**

3.10 **Sectoral terms-of-trade (all manufacturing):** The data presented in Figure 5 suggest that there have indeed been several identifiable "periods" in overall government economic policy. Period I undoubtedly represents, as Lewis and Hussain argue in their original study, the impact of the partition of Pakistan from India. 1/ Prior to the separation of the two countries, Pakistan's resources had been devoted to the production of agricultural commodities that were exchanged for manufactured goods imported from India. The destruction of this trade relationship led naturally to a significant change in rates at which the agricultural/non-agricultural exchange took place.

3.11 The second period is one that might be called the "Golden Age" of agriculture, at least insofar as prices were concerned. By 1960, the disequilibrium process had tended to work itself out and a period of improved sectoral relative prices, as seen from agriculture's perspective, began. In part, this was due to the Second Five Year Plan, beginning in 1960, which was positive in its approach to agriculture. Perhaps more relevant, however, was the sense of momentum developed in the early 1960s by the obvious growth in output of virtually all crops as the impact of good weather and the increased availability of supplementary water made itself felt. The continuation of favorable prices for agriculture was, in a very real sense, a reward for performance.

3.12 However, as theoretical considerations would suggest, the very successes of the agricultural sector in the period of the water-seed-fertilizer revolution led to the need for an adjustment in the sectoral terms-of-trade. Prices of output were stabilized and the rate of subsidies on inputs reduced. Supplementary irrigation water, plus high yielding varieties and fertilizer, were proving to be "too profitable" in terms of investment. It was felt that the agricultural community should share its productivity increases with the

Figure 5: Three-Year Moving Average of the Gross Barter Terms-of-Trade for Pakistan Agriculture: 1950-1975
rest of the society. In the absence of a mechanism for direct taxation, this was accomplished by permitting the barter terms-of-trade to deteriorate. The prices of imported inputs such as fertilizer, chemicals, fuel, metals and machinery were permitted to rise rather drastically, while major exports such as cotton and rice continued to be taxed via an overvalued exchange rate and specific export cesses.

3.13 The farming community naturally resented the deteriorating price situation and made the usual "cost-price squeeze" arguments. Their ire against the government was directed not only at export taxes and increases in the prices of inputs, but at increased water charges and nominal land revenue assessments. The issues were brought to a head in 1972/73 when the government sought to implement a mandatory wheat procurement scheme in which growers were to hand over a portion of their wheat at well below the world price. Substantial political repercussions followed this proposal and the government was ultimately forced not only to abandon its efforts at procurement, but to begin to improve the price of wheat and other cereals. These moves were continued as a result of the continuing tight world food situation in 1973/74. The procurement price of wheat was raised from Rs 22.5/maund to Rs 37.0/maund in two years. Fine rice increased from Rs 62/maund to Rs 90/maund in the same period. Maize prices have also increased significantly in the past several years.

3.14 As the annual data for the past few years make clear, however, even these increases were not sufficient to remain ahead of rapidly rising prices in the non-agricultural sector. According to the estimates presented in Figure 6, in 1973/74 the parity ratio stood at a record high. But 1974/75 and 1975/76 mark consecutive years of decline that resulted in one of the most unfavorable ratios to be found in the entire 20 years for which the index has been calculated. While weighted average agricultural wholesale prices were 30 percent above 1973/74 levels, non-agricultural prices had increased by 55 percent over the same period.

3.15 The existence of a limited number of "periods" with policy determined, serially correlated prices raise immediate questions about the validity of a statistical model purporting to establish links between the terms-of-trade and value-added in agriculture. However, simple curiosity prompted at least an attempt to fit a distributed lag model to the available data. 1/

\[
GDP_A = f(TT_{t-1}, GDP_{At-1}, t)
\]

Where

\[
GDP_A = \text{gross domestic product at constant factor costs}
\]
\[
TT_{t-1} = \text{terms-of-trade lagged one period}
\]
\[
t = \text{index of time}
\]

Figure 6: Annual Gross Barter Terms-of-Trade at Domestic Prices:
Pakistan Agriculture, 1965-1975
3.16 Various formulations of the model all led to unsatisfactory results. When the time variable is included, neither the terms-of-trade lagged one year nor the proxy for the distributed lag (GDP$_{t-1}$) were statistically significant. When the trend was not removed with the time variable, both price and lagged output were significant, but the price variable had the wrong sign.

3.17 The results of the regression analysis were to some extent predictable. Annual variations in aggregate supply are not correlated primarily with changes in the terms-of-trade, because of the greater impact of variations in weather. However, this does not settle the matter of the impact of the terms-of-trade on agricultural growth. In all variations of the model, the time variable (or lagged output in the absence of the time variable) was highly significant. This points to the issue of the general profitability of agriculture and the obvious fact that in the Pakistan case, the productivity of improved technology was sufficient to provide the incentives necessary for a respectable rate of growth.

3.18 **Sectoral terms-of-trade (intermediate and investment goods):** The data presented in Figure 7 confirm the earlier Lewis-Hussain conclusion that separating out the intermediate and investment goods component of the non-agricultural manufactures would not materially affect the terms-of-trade for the 14 years preceding 1967/68. Second, it is equally clear that there has been a significant departure from this relationship in the recent past. The same weighted average wholesale prices for agriculture have been used in both series. Hence, the steep decline in the terms-of-trade ratio in the post-1968 period is to be attributed to a relatively rapid increase in the prices of the consumption goods that go into the non-agricultural index. Indeed, so substantial has the difference been that the policy shifts claimed for Period IV in the analysis of the general terms-of-trade are only barely evident when prices received are compared with prices paid for intermediate and investment goods. That is, although the prices of a number of agricultural commodities have improved significantly in the past few years, the prices of manufactures related to agricultural output were at levels that precluded a return to the relatively favorable period of the early and mid-1960s. (As indicated below, it is important to keep in mind the incentives to invest have not necessarily decreased during this period because the productivity of the new agricultural technology was sufficient to generate high benefit-cost ratios).

3.19 The conclusions drawn in the previous paragraph are unchanged when the index of investment goods is reduced to only the most obvious commodities: fertilizer, machinery, chemicals, metal products, etc. Even with fertilizer, whose price rose rather slowly over the past few years in relative terms, getting a weight of 40 percent, the terms-of-trade ratio does not improve significantly. Efforts at establishing a statistical relationship between growth and the terms-of-trade when intermediate goods are used in the denominator of the ratio were also unsuccessful.
Figure 7: Three-Year Moving Average of the Gross Barter Terms-of-Trade for Pakistan Agriculture: 1955-1975*

- All manufactures purchased by agriculture included in the manufacturing index
- Only investment goods and intermediate goods purchased by agriculture included in manufacturing index

*Years represent the center of the average
3.20 Relatively little can be expected from models as crude as those that have been fitted. However, they do raise an issue central to the interpretation of the Pakistani experience with agricultural policy, namely the relative importance of prices and technology in providing the incentives that generated the growth described in Chapter II. As Table 12 indicates, the income of Pakistani farmers increased during many of the years that the barter terms-of-trade were declining.

3.21 **Commodity-fertilizer price ratios:** Figure 8 presents a variant of the prices-received/prices-paid ratio, namely, indices of the real cost of acquiring inputs. The results support earlier comments that rapidly rising input costs have made it difficult to maintain favorable input-output price relationships in recent years. After the dip in 1972/73 that coincides with across the board increases in output prices, several of the ratios quickly rebound to values prevailing around the turn of the decade. In the initial years of the green revolution (e.g., 1964/65), the amount of various commodities required to purchase a kilo of N reached an all-time low. Subsequently, in the years immediately preceding and following the devaluation, the index of the real costs ratio reached an all-time high. Only in the most recent past do these indices decline substantially to reflect relationships that are more in keeping with the late 1960s.

3.22 To a larger extent, the indices move together, reflecting changes in fertilizer prices. However, there is some variation in the value of the yearly indices throughout the period that results from changes in the relative prices among crops. For example, fertilizer used on wheat continues a real cost ratio that is significantly different from the ratio describing the number of kilos of rice required to purchase a unit of N. This result implies, of course, that not only have output-input price ratios changed over time, but that relative output incentives have changed also. For example, during the past three years rice has clearly increased in value relative to other competing crops such as cotton. Sugarcane, after a series of years (1967/68-1971/72) in which output prices remained constant while fertilizer prices increased substantially has also increased in relative value.

3.23 The substantial variation in the weighted fertilizer-commodity price ratio over time suggests that insights into the demand for fertilizer might be derived econometrically, and several Pakistani scholars have attempted such estimates. M. A. Ayub's 1975 study, and work published in 1977 by A. Salam, merit particular attention. 1/

3.24 Ayub's point of departure is an earlier study by Leonard, which, he argues, was not done correctly. Leonard estimated several equations using the following independent variables:

---

Table 12: INDICES OF OUTPUT, PRICES AND INCOME
FOR PAKISTAN AGRICULTURE
(FY 1960 = 100)

<table>
<thead>
<tr>
<th>FY</th>
<th>(1) Output</th>
<th>(2) Terms of Trade</th>
<th>(3) Real Income</th>
<th>(4) Rural Population</th>
<th>(5) Income per Farmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1961</td>
<td>100</td>
<td>115</td>
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<td>1962</td>
<td>109</td>
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<td>123</td>
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<td>1963</td>
<td>119</td>
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<td>129</td>
<td>108</td>
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<tr>
<td>1964</td>
<td>118</td>
<td>111</td>
<td>131</td>
<td>111</td>
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<td>1965</td>
<td>128</td>
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<td>147</td>
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<td>129</td>
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<td>1966</td>
<td>127</td>
<td>108</td>
<td>137</td>
<td>117</td>
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<tr>
<td>1975</td>
<td>187</td>
<td>108</td>
<td>202</td>
<td>147</td>
<td>137</td>
</tr>
<tr>
<td>1976</td>
<td>199</td>
<td>102</td>
<td>203</td>
<td>151</td>
<td>134</td>
</tr>
</tbody>
</table>

Sources:

(2) C. Gotsch, "Working Note #1", December 2, 1976. Output prices deflated by index of all manufactured goods.
(3) = (1) x (2).
(4) Constructed assuming 2.6% per annum growth of rural population.
(5) = (3) + (4). Assumes number of farmers growing at same rate as rural population.

*This table was calculated by N. Hicks as part of his comments on the first draft.
Figure 8: Indices of the Real Cost of Purchasing a Unit of Nitrogen (Selected Commodities)
$X_1$ - a time variable for measuring levels of technology and information,

$X_2$ - deflated price of fertilizer at farm level (deflated by agricultural income index $X_5$),

$X_3$ - the total acreage of cultivated land in the previous twelve months,

$X_4$ - the average size of holding cultivated,

$X_5$ - index of agricultural income, based on average net income for four major crops in (West) Pakistan—wheat, rice, sugarcane and cotton,

$X_6$ - sales of fertilizer in the previous year,

$X_7$ - irrigation index — the percentage of the cultivated land which is irrigated.

3.25 Ayub notes that Leonard's use of a lagged dependent variable (fertilizer sales) as an independent variable creates well-known estimation problems. He re-estimates the equations and shows that Leonard's conclusion that prices are not important are the result of both an inappropriate estimation technique and the use of a single time period that spanned two periods during which substantial changes in the fertilizer industry took place. In Ayub's linear estimate for the 1966-73 period, the price variable is significant at the 10 percent level and suggests that if deflated fertilizer prices were lowered, demand would increase significantly.

$$Y = 2348.5 - 11.18 X_2 - 165.36 X_3 + 221.04 X_5 + 0.40 X_6$$  (1)

$$R^2 = 0.99$$

$$\text{D.W.} = 3.05$$

3.26 A more recent study by A. Salam produces similar results, although the explanatory variables are somewhat different.
the explanatory variables are somewhat different.

\[ X_{1t} = \text{price of nitrogen deflated by weighted prices of major crops} \]
\[ X_{2t-1} = \text{weighted prices of major crops in year } t-1 \]
\[ X = \text{number of private tubewells} \]
\[ X_{3t} = \text{area under major crops in irrigated area or total cropped area} \]
\[ T = \text{time trend} \]

3.27 The resulting estimates also place the price elasticity of demand for fertilizer at roughly 5 percent when prices are increased by 10 percent. In logarithms, the results of the estimation procedures were as follows:

\[ Y = -9.175 - 0.522 - 0.582 0.155 2.079 0.152 \]
\[ (0.273) (0.490) 0.155 (1.272) (0.041) \]

\[ R^2 = .988 \]
\[ \text{F Ratio} = 141.104 \]

3.28 Earlier comments have indicated that virtually all variables associated with Pakistan agriculture over the last several decades contain strong time trends. It is not unreasonable, therefore, to estimate a simple model consisting of nothing more than relative fertilizer prices and a time variable. The latter can be expected to contain not only the usual residual of technical change, but other demand-related variables such as the availability of irrigation water. The results of such a model are shown below.

\[ F = -1.4 + .83 t_{-1} + .98 t \]
\[ (.42) (.16) \]

\[ R^2 = .96 \]
\[ \text{D.W.} = 1.70 \]

Where

\[ F = \text{log of fertilizer offtake in period } t \]
\[ X_{t-1} = \text{log of the lagged index of commodity-fertilizer price weighted by crop} \]
\[ t = \text{log of time} \]
3.29 The price coefficient is significant at the 90 percent level and the results are therefore consistent with previous studies that have shown relative input-output prices to be significant determinants of demand. In this simple model, however, the anticipated effect of changing the prices paid - prices received relationship was somewhat greater than those presented by Ayub and Salam. According to the model, for every 10 percent improvement in the index, an 8.3 percent increase in fertilizer could be expected. 1/

3.30 The trend variable in the equation is also highly significant. This suggests that while relative prices may have had some impact on use, the underlying productivity of the input was sufficient to guarantee continued increases in offtake even in the presence of adverse movements in price ratios.

3.31 Commodity-tractor price ratios: Indices of the real cost of purchasing tractors as expressed in units of cotton, rice, sugarcane, and wheat are shown in Figure 9. The pattern that is reflected in the estimates is rather different from that shown in the fertilizer calculations. Perhaps the most obvious example is the impact of the devaluation on the prices received - prices paid ratio. Whereas 1972/73 marked a period of substantial increase in output prices that produced a sharp downturn in the real cost of fertilizer, it marked a sharp upturn in the cost of purchasing tractors. Since the same output prices obtained in both periods, the result is a measure of the decision to let the devaluation be reflected fully in the price of tractors but to maintain a substantial subsidy on imported fertilizer. These policies were reversed in 1974/75 when tractors became relatively cheaper and again reversed in 1975/76 when the price of fertilizer was held constant in the face of substantial increases in output prices. On the other hand, tractors, at least the popular Massey-Ferguson model, increased sharply in their real costs. (Curiously, the indices for International Harvester show a somewhat different pattern, one more nearly corresponding to fertilizer. That is, high real costs in 1973/74 and much lower real costs in 1975/76.)

3.32 The element that all indices have in common is the ranking of commodities in terms of kilos required to purchase a unit of input. From a common base of 100, wheat and cotton are now substantially above sugarcane and rice. In the case of wheat, it has continued to dominate the rabi season because of both the extent of its initial comparative advantage--no other crop was really close--and because of the substantial gains in productivity. Cotton, on the other hand, has not experienced sustained yield increases, and in the face of rising productivity in rice and maize, the result has been a lessening of farmer interest in cotton in the "swing" areas of the Punjab.

1/ For cross-country estimates of the demand for fertilizer, see Peter Timmer, "The Demand for Fertilizer in Developing Countries," Food Research Institute Studies, Vol. XIII, 1974. The price elasticities suggested in the studies described above are all within the ranges reported by Timmer.
Figure 9: Indices of the Real Cost of Purchasing a Tractor (Selected Commodities)
3.33 In summary, the increases in productivity associated with purchased inputs appear, on the whole, to have been sufficient to provide the necessary incentives for relatively rapid increases in their use. The initial benefit-cost ratios, generated in the past by large subsidies, were sufficient to secure adoption and diffusion of hitherto unknown technologies. While subsequent declines in profitability occurred, these were not so drastic as to produce a general stagnation in offtake.

3.34 Based on the above description, it could be argued that the Pakistan experience represents a classic use of agricultural price policy to implement a growth-oriented development strategy. Even the suspicion that the drastic declines in benefit-cost ratios in the recent past may have had something to do with stagnation in output that has occurred in the last few years, does not negate the general conclusion. It may be that Pakistan had begun to take the green revolution for granted; but the number of observations are too few to establish the argument with quantitative rigor.

Commodity Prices and Domestic Resource Allocation

3.35 The graphs showing changes in the real cost of purchasing inputs provided insights into two issues, i.e., changes in the relative profitability of inputs and changes in relative commodity prices. The impact of the latter on output can be investigated more directly by utilizing what has become a rather conventional approach to estimating supply response—a Nerlovian distributed lag model. The estimating equation used is:

\[ A_t^c = a + bP_{t-1} + dA_{t-1}^c - eW_{t-1} \]  \hspace{1cm} (4)

where

- \( b \) = the short run supply response to price
- \( \frac{b}{1-d} \) = the long run supply response to price
- \( e \) = the short run supply response to water
- \( \frac{e}{1-d} \) = the long run supply response to water
- \( A_t^c \) = acreage of the commodity in year \( t \)

---

\[ \]  

/ \ See Marc Nerlove, The Dynamics of Supply Response, Johns Hopkins University Press, 1958, for the derivation of this form of the "expectations" model. Considerable criticism has been leveled at this approach because of the autocorrelation that tends to accompany the inclusion of a lagged dependent variable on the right hand side. Consequently, \( R^2 \)'s derived from such estimates should not be taken seriously.
\[ p_{t-1}^C = \text{ratio of crop price in } t-1 \text{ to the weighted average price of the commodities that are production substitutes} \]

\[ A_{t-1}^C = \text{acreage of the crop in period } t-1 \]

\[ W_{t-1} = \text{amount of water available in } t-1 \]

3.36 The argument for this formulation is that decisions by farmers are made on the basis of "expectations" of prices they will receive and that these expectations are determined by their past experience. Furthermore, it is assumed that these expectations are not simply the result of the most recent past but reflect the experience of recent years with an ever-declining intensity.

3.37 The introduction of the lagged water terms has the same rationale, i.e., in a water-short environment, farmers will adjust their crop acreages to reflect their more recent experience with water availability. 1/ If it can be assumed that the intensity of past experiences with water is roughly the same as that of prices, the \( A_{t-1} \) term can also be used to calculate the long run response elasticity with respect to water.

3.38 The results of fitting Equation (3) to data from the Central Punjab for the period 1960-1975 are shown in Table 13. The standard errors for the coefficients representing both short and long run price elasticities are significant for most crops and do not represent important departures from previous estimates for the Pakistan and Indian Punjabs. What is of some interest in comparison with the earlier estimates, however, is that the lagged water variable representing the flows in eight major canal commands generally has smaller coefficients associated with it and is less significant. This suggests that the ability to produce substantial amounts of supplementary irrigation water by sinking tubewells has altered the role that water has traditionally played in forming farmer expectations. (The time series is also much shorter and hence part of the relative decline in significance is possibly due to the decline in the number of observations.)

3.39 While the elasticities indicated in Table 13 are modest, in absolute terms they represent rather substantial areas. For example, using the short run elasticity for cotton versus rice, a 10 percent change in relative prices would imply a 1.5 percent change in cotton acreage. In the Punjab alone, this would mean some 50,000 acres.

1/ The logic for including the terms is based on the differential water requirements of, say, rice, cotton and maize, all of which are grown during the summer months.
Table 13: ACREAGE RESPONSE ESTIMATES FOR CENTRAL PUNJAB

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>P&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>A&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>W&lt;sub&gt;t-1&lt;/sub&gt;</td>
</tr>
<tr>
<td>Rainfed wheat</td>
<td>-0.09&lt;sup&gt;a&lt;/sup&gt; (0.08)</td>
<td>0.51 (0.11)</td>
<td>0.07 (0.01)</td>
</tr>
<tr>
<td>Irrigated wheat</td>
<td>0.06&lt;sup&gt;c&lt;/sup&gt; (0.03)</td>
<td>0.81 (0.09)</td>
<td>0.12 (0.06)</td>
</tr>
<tr>
<td>Cotton (Rice area)</td>
<td>0.29 (0.08)</td>
<td>0.92 (0.14)</td>
<td>0.45&lt;sup&gt;d&lt;/sup&gt; (0.15)</td>
</tr>
<tr>
<td>Cotton (Sugarcane area)</td>
<td>0.46 (0.10)</td>
<td>0.50 (0.12)</td>
<td>0.09 (0.04)</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.14&lt;sup&gt;k&lt;/sup&gt; (0.08)</td>
<td>0.88 (0.06)</td>
<td>0.89 (0.37)</td>
</tr>
<tr>
<td>Rice (Sugarcane area)</td>
<td>0.16&lt;sup&gt;f&lt;/sup&gt; (0.09)</td>
<td>0.61 (0.14)</td>
<td>0.63 (0.15)</td>
</tr>
</tbody>
</table>

a) Wheat price + gram price.
b) September + October rainfall.
c) Wheat price + weighted average cotton and sugarcane prices.
d) Rabi water supplies, eight major canals.
f) Rice price + weighted average rice and sugarcane prices.
g) Rabi water supplies, eight major canals.
h) Cotton price + weighted average rice and sugarcane prices.
i) May + June water supplies, eight major canals.
j) Sugarcane (gur) price + weighted average cotton and oilseed prices.
k) Rabi + kharif + water supplies, eight major canals.
m) Expectations for water were assumed to have the same lag structure as those involving prices.
n) Cotton price + rice price.
3.40 More precise estimates of acreage changes would require a careful
delineation of areas where crops were competitive. For example, because of
the differences in elasticities, it would be important to distinguish areas
in which cotton competes primarily with rice from areas where the chief com-
petitor is sugarcane. Under any circumstances, it is clear from simply looking
at the total acreage under various crops that the absolute acreage changes that
might be expected from changes in relative prices would be substantial.

Institutions and Economic Incentives

3.41 The prices used in the quantitative analysis were obtained from
published sources. It is no secret that these frequently do not reflect the
conditions the farmer actually faces in the marketplace. Although the evi-
dence is limited to anecdotal material, travel in Pakistan's rural areas
suggests that corruption and bribery often produce a substantial divergence
between nominal prices and the actual prices paid to farmers. There is no
implication in such an observation that Pakistan is any worse than many other
countries. Indeed, the opposite is probably the case. But the divergences
between reported and realized prices are so significant that some comment on
the bias that they might introduce in earlier results seems necessary.

3.42 A frequently cited example of what might be called the "micro-
manipulation" of incentives involves the ups and downs of the fertilizer
distribution system. During some periods, the number of vendors was suf-
ficiently small to create monopoly positions in the countryside. (Given the
lack of transport among small farmers, this was not particularly difficult to
do.) For a small farmer to purchase fertilizer on credit in this situation
required (1) a payment to the revenue official (patwari) to secure an
affidavit certifying land ownership or tenancy, (2) a payment to the bank
official to obtain the loan, and (3) the payment of so-called "black-market"
prices to the fertilizer vendors. 1/ As a result of this combination of
payments, the real "price" of fertilizer to small farmers was often substan-
tially above its official price. For larger farmers, the actual price was
much closer to the official price.

3.43 Nationalization of virtually all rice and flour milling and of
cotton ginning in mid-1976 gave rise to new points of control by government
officials, and hence the extension of institutional rents that affected actual
prices. For the first time farmers had little choice but to deal directly (or
indirectly through the arthis) with government bureaucrats (and with the pos-
sibility of corruption) in the sale of their crops. 2/ In the past, farmers

---

1/ Note that the effect of such institutional payoffs is often quite regres-
sive. The first two payments are in the nature of fixed costs and are
apparently approximately the same regardless of the size of the loan.

2/ Initial regulations required the taken over units to purchase rice
and cotton only from farmers, not from arthis. Farmer complaints
were loud against this because of the high cost of their time to
transport crops to mills, etc., and arthis brought crops in the name
of individual farmers. These regulations were soon changed for
cotton and were never enforced for rice.
were accustomed to illegal "rationing" in obtaining inputs. Bribes required to obtain bank credit for fertilizer have already been described. Similar problems existed with respect to electrical connections for tubewells, prompt delivery of tractors, additional irrigation water, or timely pesticide spraying. Conversations with farmers suggest that while they were often angered by these problems, they were accepted as being the "traditional way of doing things." (Observers often justified the presence of bribes as a system of improving the efficiency of allocation in a system where inputs were often in scarce supply. Aid donors correctly concentrated their efforts mainly on increasing the total availability of inputs).

3.44 The specter of having to pay bribes to government employees who had monopoly (monopsony) power over the purchase of major farm crops raised a new and potentially more disturbing relationship between farmers and local functionaries. A common example, often recited by cultivators in field interviews, involved an initial rejection of their crops by buyers at government rice mills. They were told to take it home and dry it for another week, or that it was too dirty, or not acceptable for other reasons. To have taken the rice back with them would have been a serious hardship to farmers, many of whom had brought their rice at least several miles or more by bullock cart. With a bribe to the mill purchaser, of course, the rice suddenly became acceptable. At the cotton gins, the farmers often had to wait two days or more to get their cotton weighed, since they did not trust anyone to have it weighed in their absence, as they sometimes did in the past when they sold it to a private gin or to an arthis. Again, they often reported having problems about acceptance and weight until bribes were paid. 1/

3.45 Similarly, a study of wheat marketing brought widespread complaints from farmers and arthis about underweighing of the wheat they delivered. According to an unpublished study, government procurement agents admitted that they cheated when buying wheat (and described how they did it), but said they must because government regulations allowed for no subsequent loss of weight in the wheat during storage or transportation. Therefore, the procurement agents cheated those from whom they bought so that when wheat they purchased was later weighed after removal from storage or shipment it would not be found underweight, for which the government would have made deductions from their salaries. A more reasonable set of administrative rules might have helped alleviate the corruption or cheating experienced at the hands of government buyers.

3.46 The problem during the nationalization period was not, however, merely one of changing government regulations and procedures. Reportedly, some of the excess wheat was secreted out of the government godowns and distribution system for private sale. Similar charges were levied against the nationalized export trade in basmati rice. Complaints from both foreign

1/ When confronted with farmer complaints, executives of the Rice Milling Corporation replied that procurement officers were given authority only to accept or reject rice, and not to make payment according to its moisture content, quality, etc., precisely in order to reduce the authority of the buyers and hence the possibility of corruption.
importers and domestic consumers about the mixing of other varieties with basmati rice also increased during the nationalization period. Knowledgable persons reported that such mixing reached 50 percent, i.e., what was sold as basmati rice was actually only about 50 percent basmati and the remainder largely IRRI rice. Rice Milling Corporation executives cited reduced mixing of other varieties with basmati as one of the intended benefits of nationalization and claimed that previous mixing was done on orders of or by the mill owners; after nationalization, it was at least against official orders.

3.47 The accepted explanation for petty corruption during the nationalization period is that the temptation was great because of low salaries and that government employees had no incentives not to do so (i.e., there were no severe penalties for doing so). The private miller, fertilizer dealer, arthis, or other businessman knows that dishonesty may cost him customers and future income. Government institutions, by contrast, tend to provide few incentives to increase the volume of business of their establishments and, therefore, the satisfaction of their customers.

3.48 This is not to say that all government employees of the processing plants were or are corrupt. It is evident, however, that large numbers participated in a system that produced market interventions contrary to official policies. A significant reduction of such practices in the marketing of major agricultural crops would have been much more difficult to accomplish than was the establishment of private fertilizer dealerships in competition with government distribution points. Enforcing discipline on 3,000 rice, flour and cotton mills and gins would have been hard to do had a serious attempt been made to curtail abuses.

3.49 With the recent change in political leadership, the commodity trade has largely been returned to the private sector. Ideology has, of course, played a role in the decision to return the cotton gins to their previous owners and to put the marketing of grains back in the private sector. However, many Pakistani planners concede that the relatively short period during which the government was deeply involved in the marketing and distribution of agricultural commodities was marked by substantial inefficiency and bureaucratic confusion. While management of government programs might have been improved if given more time, the experience of other planned economies in the Third World is not a very good advertisement for nationalization of traditional sectors as a development strategy. 1/ Whether the present government will be able to resist recreating the previous system of interventions when the economic waters become a bit more turbulent remains to be seen.

Summary and Conclusions

3.50 Chapter II sought to develop a picture of the growth process in Pakistan's agricultural sector over the past decade and a half. Chapter III tried to link the system of domestic economic incentives that were in force during this period to the pattern of growth that was observed. The results were mixed and can be summarized in the following propositions:

1/ The Indian experience with efforts to nationalize the grain trade provides a similar lesson.
There appear to be several definable "eras" in economic policy as evidenced by the gross barter terms-of-trade, but simple statistical models do not provide evidence of correlation between the increases in value-added and the terms-of-trade, however lagged. In part, this may be the result of a limited number of observations and simplistic models. However, when the index of output in constant prices is deflated by the terms-of-trade index, the resulting ratio suggests that productivity increases during this period were probably sufficient to create the incentives for the investment implied by the growth rate.

There is some evidence that relative output-input prices have had an effect on the offtake of fertilizer. The trend variable was also highly significant in the demand equation. This was interpreted as indicating that, despite adverse movements in relative prices, the productivity of fertilizer was such that it continued to be sufficiently profitable to induce adoption.

Shifts in the relative prices of crops appear to be a significant part of the explanation of changes in the cropping patterns that occurred during the study period. The magnitude of the price elasticities appear to be approximately the same as those obtained using earlier time periods. As might be expected, the price elasticity of the subsistence crop, i.e., wheat, continues to be well below the elasticity for a cash crop such as cotton.

The behavior of the organizations that actually implement government policies and the institutions that influence organizational decisions are often as important to the effects of price and subsidy policies as purely economic relationships. Government nationalization led to a different way of doing business, one which did not contain the self-correcting mechanisms of a private firm. It is too early to tell how the efforts being made by the new political leadership to reverse the trend toward nationalization will fare.
IV. TRADE POLICY AND AGRICULTURAL INCENTIVES

4.01 In preceding chapters, data were presented that described Pakistan's agricultural development during the period 1960-75 and the domestic incentives that guided the growth and structural change process. Statistical tests suggested that although there appeared to be little evidence that movements in the aggregate prices received-prices paid ratio (PPR) had influenced agricultural GNP, several studies found that prices were important in explaining fertilizer use. However, the high coefficients of determination produced by the inclusion of a trend variable also suggested that, despite fluctuations in the PPR, the profitability of purchased inputs in the irrigated areas had provided sufficient incentives for investment during most of the study period. 1/ In those years where significant declines in the demand for inputs occurred, extraneous factors involving severe agro-climatic and institutional disturbances (e.g., the nationalization of the fertilizer distribution system in the Punjab) appear to have been important causes.

4.02 The analysis of shifts in relative prices on the allocation of domestic resources between crops gave more solid evidence that prices matter. Significant short- and long-run price response coefficients were obtained for major crops when relative prices were used as the independent variable in a distributed lag formulation.

4.03 Although the issue of market intervention was not addressed in any detail in previous chapters, enough was said to suggest that the levels of prices and subsidies were considered important instruments of policy by the Pakistan government. Chapter IV carries the argument forward by examining the magnitude and the mechanisms by which world price signals were distorted to produce the domestic incentives that farmers actually faced.

4.04 As a first step, the nominal protection coefficients (NPC's) were calculated for a number of the most important agricultural crops. These estimates show a rather wide range of distortions from world prices, although all commodities appear to have benefitted from policy changes made in the past few years.

4.05 Secondly, effective protection and effective subsidy coefficients are calculated for selected years to see if conclusions about the degree of protection or taxation of output would be altered if market intervention on the input side were also considered. Comparison with nominal protection coefficients suggests that such intervention has not been a major factor in determining the structure of incentives, primarily because tradeable inputs are a small portion of the total cost of producing agricultural commodities.

Calculation of Nominal Protection Coefficients

4.06 The nominal protection coefficient is defined as the ratio of domestic prices to world (border) prices.

1/ The "t," or time variable, must be given a very broad interpretation; it was undoubtedly also picking up the influence of increased cropping intensity and increases in the total water supply.
NPC\(_i\) = \frac{p_d^i}{p_b^i} \tag{1}

Where

- \(NPC\(_i\)\) = nominal protection coefficient of the \(i\)th commodity
- \(p_d^i\) = domestic price of the \(i\)th commodity
- \(p_b^i\) = border price of the \(i\)th commodity (foreign price times the official exchange rate)

4.07 NPC ratios are the simplest measure of protection to calculate, involving, as they do, only the prices of outputs. However, finding appropriate values for border price calculations is no mean task. Using international price sources, for example, raises serious questions of seasonality and comparability of quality. Foreign trade data of a particular country, on the other hand, are often poorly collected and in some areas, missing altogether. (Pakistan, for example, has no data on the unit values of most imports from 1964/65 to 1969/70).

4.08 Fortunately, for the major export crops, Pakistan's foreign trade data appear to provide reasonable estimates of world prices when compared with international sources for corresponding time periods. 1/ A joint effort by the Ministry of Agriculture and by the Planning Division also produced relatively complete data on the three imported crops: wheat, sugar, and edible oils. Where there were gaps, e.g., years in which a commodity was not traded, international prices, adjusted for transportation and handling costs, were used.

4.09 Domestic and border prices must, of course, be compared at the same point. In the case of Pakistan, the obvious choice is the port city of Karachi. All farmgate prices were therefore adjusted, not only for the processing that took place between the farm and the ship, but for transportation and handling charges as well. (For the purpose of this study, it was assumed that all commodities moved by rail and that the railroad's official tariffs and charges were imposed. In reality, some portion of all commodities moved by truck. Prices per ton-mile appear to be somewhat higher for truck transport, but these were ignored in the calculations).

4.10 NPC's for the Central Punjab: Results shown in Table 14 for the major "swing" area in Pakistan's agriculture can be summarized in a series of propositions:

\[\text{1/ See Working Note No. 4, Volume II, for a detailed comparison of the two series.}\]
Table 14: NOMINAL PROTECTION COEFFICIENTS
FOR MAJOR CROPS IN THE CENTRAL PUNJAB

<table>
<thead>
<tr>
<th>Year</th>
<th>Wheat</th>
<th>Basmati Rice</th>
<th>IRRI Rice</th>
<th>Cotton</th>
<th>Maize</th>
<th>Oilseeds</th>
<th>Sugarcane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>E</td>
<td>O</td>
<td>E</td>
<td>O</td>
<td>E</td>
<td>O</td>
</tr>
<tr>
<td>1960/61</td>
<td>1.20</td>
<td>.57</td>
<td>.84</td>
<td>.40</td>
<td>1.05</td>
<td>.50</td>
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<tr>
<td>1961/62</td>
<td>1.27</td>
<td>.61</td>
<td>.87</td>
<td>.42</td>
<td>1.10</td>
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<td>1.46</td>
</tr>
<tr>
<td>1962/63</td>
<td>1.26</td>
<td>.60</td>
<td>.80</td>
<td>.38</td>
<td>1.06</td>
<td>.51</td>
<td>1.40</td>
</tr>
<tr>
<td>1963/64</td>
<td>1.27</td>
<td>.61</td>
<td>.86</td>
<td>.41</td>
<td>1.15</td>
<td>.55</td>
<td>1.51</td>
</tr>
<tr>
<td>1964/65</td>
<td>1.37</td>
<td>.66</td>
<td>1.22</td>
<td>.58</td>
<td>1.20</td>
<td>.58</td>
<td>1.39</td>
</tr>
<tr>
<td>1965/66</td>
<td>1.54</td>
<td>.74</td>
<td>.90</td>
<td>.43</td>
<td>1.03</td>
<td>.49</td>
<td>1.44</td>
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<tr>
<td>1966/67</td>
<td>1.74</td>
<td>.83</td>
<td>.83</td>
<td>.40</td>
<td>1.05</td>
<td>.50</td>
<td>1.59</td>
</tr>
<tr>
<td>1967/68</td>
<td>1.35</td>
<td>.65</td>
<td>.72</td>
<td>.35</td>
<td>1.18</td>
<td>.57</td>
<td>1.91</td>
</tr>
<tr>
<td>1968/69</td>
<td>1.80</td>
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<td>.97</td>
<td>.47</td>
<td>.95</td>
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<td>1.63</td>
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<tr>
<td>1969/70</td>
<td>1.72</td>
<td>.83</td>
<td>.96</td>
<td>.46</td>
<td>.80</td>
<td>.38</td>
<td>1.02</td>
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<tr>
<td>1970/71</td>
<td>1.59</td>
<td>.76</td>
<td>.84</td>
<td>.40</td>
<td>.87</td>
<td>.42</td>
<td>1.20</td>
</tr>
<tr>
<td>1971/72</td>
<td>2.20</td>
<td>1.06</td>
<td>.75</td>
<td>.36</td>
<td>.76</td>
<td>.36</td>
<td>.69</td>
</tr>
</tbody>
</table>

DEVALUATION

<table>
<thead>
<tr>
<th>Year</th>
<th>Wheat</th>
<th>Basmati Rice</th>
<th>IRRI Rice</th>
<th>Cotton</th>
<th>Maize</th>
<th>Oilseeds</th>
<th>Sugarcane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>E</td>
<td>O</td>
<td>E</td>
<td>O</td>
<td>E</td>
<td>O</td>
</tr>
<tr>
<td>1972/73</td>
<td>.89</td>
<td>.89</td>
<td>.53</td>
<td>.53</td>
<td>.55</td>
<td>.55</td>
<td>.64</td>
</tr>
<tr>
<td>1973/74</td>
<td>.50</td>
<td>.50</td>
<td>.38</td>
<td>.38</td>
<td>.22</td>
<td>.22</td>
<td>.57</td>
</tr>
<tr>
<td>1974/75</td>
<td>.66</td>
<td>.66</td>
<td>.34</td>
<td>.34</td>
<td>.35</td>
<td>.35</td>
<td>.62</td>
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<tr>
<td>1975/76</td>
<td>.84</td>
<td>.84</td>
<td>.50</td>
<td>.50</td>
<td>.75</td>
<td>.75</td>
<td>.68</td>
</tr>
<tr>
<td>1976/77</td>
<td>.88</td>
<td>.88</td>
<td>.76</td>
<td>.76</td>
<td>.85</td>
<td>.85</td>
<td>1.04</td>
</tr>
</tbody>
</table>

0 = Official
E = "Equilibrium", i.e. net protection after adjustment for over-valuation of the official exchange rate.
NPC's calculated on the basis of the official exchange rate show a substantial decline in the post-1970 period. There are two reasons for this: (a) the devaluation of May, 1972, and (b) the dramatic increase in the world market prices of virtually all agricultural commodities.

The devaluation affected all crop prices. However, exported crops, such as coarse and fine rice, were immediately assessed a substantial duty that nullified much of the effect of the exchange rate adjustment on domestic incentives.

NPC's calculated on the basis of net protection, i.e., NPC's adjusted for the over-valuation of the exchange rate that characterized the Pakistan economy in the 1960s, would alter conclusions regarding protection substantially. The experience with a Rs. 9.9/dollar rate since 1972 suggests that this is a reasonable approximation for the equilibrium rate for the period under study; applying this estimate to prices (instead of Rs. 4.75/dollar) would reduce the NPC's for the 1960/61 to 1971/72 period by roughly one half.

The lowest values of NP coefficients were reached when inflated world prices were added to the effects of the devaluation. In 1973/74, for example, the average coefficient for major crops was less than .5. However, since that time, there has been a substantial recovery (i.e., movement in the direction of 1), resulting from both increases in domestic prices and a decline in world commodity prices.

Broadly speaking, export crops have historically been taxed and import crops subsidized. This general tendency underlies a rather natural attempt to lean in the direction of food self-sufficiency. The most significant deviation from international prices occurred in sugarcane. Prior to the devaluation of the rupee in May of 1972, the NPC moved between 2.00 and 4.00. At the new official rate, sugarcane was no longer protected, a trend that was reinforced by the substantial increase in world prices. The scarcities in the world sugar market have abated somewhat, but sugarcane has not yet reverted to its prior position vis-a-vis other crops.

As Figure 10 indicates, NPC values for individual crops have fluctuated substantially from year to year. Such annual changes are attributable almost entirely to conditions in world commodity markets; domestic prices have, for the most part, shown a steady upward trend with small variations as local market prices diverged from government support and procurement prices. Figure 9 also shows, however, that in
Figure 10: Nominal Protection Coefficients for Major Crops in the Central Punjab (Semi-log Scale)
recent years, domestic relative prices of the major crops have tended to reflect somewhat more closely relative world market prices than was the case in the pre-devaluation period. Given that purchased inputs do not yet play a really significant role in Pakistan's agricultural output, it is to be expected that the EPC's will possess a similar pattern. Should this be the case, it would appear that Pakistan's policymakers have managed, with a little help from world conditions, to adjust incentives to the point where they provide the signals for a reasonably efficient allocation of the country's domestic resources.

While relative price relationships have improved, the NPC's in 1975/76 were still below 1, indicating that trade policies continue to tax agriculture relative to international prices. There is, of course, nothing inherently "wrong" with taxing agriculture; under any circumstances, the absolute NPC values are of little help in evaluating profitability. As far as farmers are concerned, improvements in technology are every bit as valuable as increased prices. The danger is that the domestic terms of trade may be turned against agriculture sufficiently to reduce investment and production in agriculture and overall economic growth.

4.11 Subsequent calculations show that extending the analysis to encompass distorted input prices (EPC) does not alter the incentive picture significantly. Consequently, the rough similarity of NPC's for the last year (1975/76) and their proximity to 1 sets the stage for the test of Pakistan's future agricultural policy. NPC's are not expressions of domestic comparative advantage and are only one datum that farmers take into account when making their production decisions. Eighty to ninety percent of the production costs in agriculture are domestic resources: land, water, labor, and capital. It is only when these have been taken into account that private comparative advantage will become apparent. If the mix of crop output forthcoming with current incentives fulfills the objectives discussed in greater detail in Chapter VI, it may well be that the incentive structure will be permitted to stand. If not, further modifications, possibly in the direction of predevaluation levels, are likely to be implemented.

4.12 Regional NPC's: The commodity markets in Pakistan are reasonably well integrated. The major exception until recently was the existence of a limited, compulsory basmati rice procurement scheme in the Central Punjab. As a result of the substantial divergence between procurement prices and the higher domestic prices generated by local demand, fine rice production expanded rapidly in districts bordering the procurement area. Since 1973, provincewide procurement has been implemented. 1/

1/ Procurement prices for sugarcane are slightly higher in the Sind (3%) and slightly lower in N.W.F.P. (6%) than those prevailing in the Punjab.
4.13 The major source of regional divergence of NPC's is transportation. An example is provided in Table 15 for wheat, a commodity grown in all three of the major agricultural areas for which NPC's were calculated. (see Map 1.) Because no significant attempts at domestic zoning have been implemented in recent years, regional incentive coefficients are of minor policy interest.

<table>
<thead>
<tr>
<th>Table 15 REGIONAL NPC's FOR MEXI-PAK WHEAT (1975/76) /a</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.W.F.P. (Peshawar)</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Distance from Karachi (Approximate miles)</td>
</tr>
<tr>
<td>Costs per ton-mile (Rupees)</td>
</tr>
<tr>
<td>Transportation cost</td>
</tr>
<tr>
<td>Local price, exclusive of transportation (Rupees/ton)</td>
</tr>
<tr>
<td>Border price (Rupees/ton)</td>
</tr>
<tr>
<td>NPC</td>
</tr>
</tbody>
</table>

/a Calculated at the official exchange rate.

Calculation of Effective Protection Coefficients

4.14 Nominal protection coefficients describe the divergence between domestic and world market prices for agricultural outputs. But, as in other sectors, intermediate and investment goods are used in production, and these too may be protected (or taxed). The result, if intermediate purchased inputs are a large part of the cost of production, and their NPC's are different from those attached to outputs, is that EPC for a particular commodity may differ significantly from its NPC.

4.15 The general formula for the estimation of EPC's is given in Equation 2.

\[
\text{EPC}_i = \frac{Q_i \left[ \sum_{j=1}^{k} a_{ij} \cdot p_j^d \right]}{Q_i \left[ \sum_{j=1}^{k} a_{ij} \cdot p_j^b \right]}
\]
Where

\[ Q_i = \text{quantity of output of the } i^{th} \text{ commodity}; \]
\[ a_{ij} = \text{quantity of the } j^{th} \text{ input used to produce one unit of the } i^{th} \text{ output} \]
\[ p^d_{i,j} = \text{domestic price of output/input for the } i^{th} \text{ commodity or } j^{th} \text{ input} \]
\[ p^b_{i,j} = \text{border price of the output/input for the } i^{th} \text{ commodity or } j^{th} \text{ input} \]
\[ j = 1...K = \text{all traded inputs, direct and indirect} \]

4.16 Capturing the effects of protection on purchased inputs requires a substantial extension of the NPC calculations in two directions. First, it requires the introduction of production relations (i.e., farm budgets) to obtain estimates of the type and quantity of inputs used. Second, it requires, in the case of non-tradeable inputs, the decomposition of costs into two categories: tradables, and primary factors. The indirect tradeables that result from the decomposition procedure must, in turn, be valued at border prices.

4.17 Because production relationships, i.e., input-output relationships, are now involved in the calculations, it is necessary to distinguish farming systems by type of technology. For the purposes of this exercise, three different types of farmers have been delineated:

- Traditional farmers—those who use (a) traditional varieties, (b) few purchased inputs, (c) animal power, and (d) do not have access to supplies of supplementary irrigation water.

- Progressive farmers—those who use (a) improved varieties, (b) substantial amounts of purchased inputs, including water and (c) animal power.

- Mechanized farmers—those who use (a) improved varieties, (b) purchased inputs, and (c) have installed tubewells and have purchased tractors.

4.18 Effective rates of protection for the Central Punjab: To facilitate comparisons, Table 16 reports only four time periods for the three technologies being studied.
Table 16: Effective Protection of Major Crops in the Central Punjab

<table>
<thead>
<tr>
<th>Crops</th>
<th>Traditional Farmers</th>
<th></th>
<th>Progressive Farmers</th>
<th></th>
<th>Mechanized Farmers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60/61 65/66 70/71 75/76</td>
<td>60/61 65/66 70/71 75/76</td>
<td>60/61 65/66 70/71 75/76</td>
<td>60/61 65/66 70/71 75/76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>1.20 (.57) 1.54 (.72) 1.59 (.76) .84 (.84)</td>
<td>1.26 (.60) 1.58 (.76) 1.55 (.74) .80 (.80)</td>
<td>1.27 (.61) 1.57 (.75) 1.54 (.74) .82 (.82)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basmati Rice</td>
<td>.84 (.40) .90 (.43) .84 (.40) .50 (.50)</td>
<td>.86 (.41) .93 (.45) .82 (.39) .48 (.48)</td>
<td>.85 (.41) .92 (.44) .84 (.40) .50 (.50)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRRI Rice</td>
<td>.87 (.42) .75 .86 (.41) .74 (.74)</td>
<td>.87 (.42) .75 .86 (.41) .74 (.74)</td>
<td>.87 (.42) .75 .86 (.41) .74 (.74)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>1.05 (.50) 1.03 (.49) 1.20 (.57) .68 (.68)</td>
<td>1.08 (.52) 1.04 (.50) 1.20 (.56) .67 (.67)</td>
<td>1.08 (.52) 1.05 (.50) 1.18 (.57) .68 (.68)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>1.40 (.67) 1.44 (.69) 1.68 (.80) 1.02 (1.02)</td>
<td>1.43 (.69) 1.46 (.70) 1.67 (.80) .99 (.99)</td>
<td>1.44 (.69) 1.45 (.70) 1.64 (.79) 1.01 (1.01)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td>1.58 (.56) .90 (.90)</td>
<td>1.53 (.73) .90 (.90)</td>
<td>1.50 (.72) .89 (.89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>2.71 (1.30) 3.83 (1.84) 2.15 (1.03) .68 (.68)</td>
<td>2.79 (1.34) 3.85 (1.84) 2.14 (1.03) .67 (.67)</td>
<td>2.76 (1.32) 3.87 (1.86) 2.11 (1.01) .68 (.68)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations using the equilibrium rate of exchange (Rs. 9.9/dollar) shown in parentheses.
4.19 When estimates of EPC's in Table 16 are compared with the NPC's for the same years in Table 14, the divergences are quite small. The most important and most obvious reason has been alluded to earlier, namely, purchased inputs make up only a small portion of the total costs of production. In addition, the NPC's for many tradeable inputs are roughly the same as the commodities in whose production they are used. For example, the tradeable component of seeds, which figures prominently in the production of sugarcane, has been valued at the same border prices as cane. A similar phenomenon occurs in the case of fertilizer, where subsidies ranging from 20 to 50 percent have been in force during the entire period under review. During the post-devaluation period, this has often produced an NPC for fertilizer that is approximately the same as the NPC for various commodities.

4.20 The result of the EPC exercise in the case of the traditional farmer is to leave the NPC's unchanged. However, in the case of the progressive and mechanized farmers, changes in the extent of the subsidies on fertilizer, fuel, and plant protection materials over time do result in somewhat higher EPC estimates for the 1960s (as compared to NPC's) and lower values in recent years.

4.21 Attempts to weight the EPC calculations by technology to obtain a single figure for each crop would be a relatively sterile exercise. No data exist that can be used to establish the proportions of each type of holding in a particular year. However, in 1960 there were few "progressive" and "mechanized" farmers. Fertilizer was first introduced into the country in the mid-50s, and it was nearly a decade later before fertilizer use began to reach significant proportions. With respect to mechanical inputs, in 1960, it is estimated that private tubewells pumped only about 1.78 m.a.f. of water. The number of tractors was miniscule--less than 1,000--indicating that little weight should be given the "mechanized farmer" category.

4.22 From these beginnings, fertilizer offtake has reached 450 thousand nutrient tons, tubewells have pumped 22.8 m.a.f. of water, and there are some 40,000 tractors in the country. Obviously, the EPC's of the progressive and mechanized farmers would now play a much more important role in the determination of a weighted estimate.

4.23 According to numerous field surveys, however, the traditional farmer has by no means vanished. Large numbers of small operators continue to use very limited amounts of fertilizer and pesticides. Many live in areas where the groundwater is saline and cannot be pumped for irrigation. In such cases, the use of purchased inputs continues to be negligible and the EPC is dominated by the divergence between domestic and world output prices.

**Calculation of Effective Subsidy Coefficients (ESC)**

4.24 The ESC is the EPC adjusted for subsidies and taxes. It is calculated by adjusting (+) the numerator of Equation (2) by the sum of the difference between profits, taxes, interest, and the prices of non-traded goods actually paid and what are considered to be "normal" charges, i.e., the value of direct and implied subsidies.
Where

\[ S_j = \text{subsidy on the } j^{th} \text{ non-tradeable input} \]

\[ T_j = \text{tax on the } j^{th} \text{ non-tradeable input} \]

\[ j = k + 1, J \text{ non-tradeable inputs} \]

### 4.25

The ESC coefficients calculated for Pakistan show some differences from EPC's as regards to both time periods and technologies. The most important elements that have produced this result include the following:

- There is a substantial subsidy on the provision of irrigation, especially in the operation and maintenance of the public tubewell system.

- There was, in the pre-devaluation period, a large subsidy element in the sale of tractors. Smaller subsidies were associated with the sale of other agricultural equipment assigned by local extension personnel to carry out various spraying operations for individual farmers.

- Budgeted subsidies on surface irrigation water are spread across all of agriculture and, when divided among the crops that are irrigated, amount to only a fraction of a rupee per acre of crop. 1/ Pesticide subsidies are equally miniscule when spread over the crops affected. However, in the case of tractors and other mechanical inputs, the groups that are the major beneficiaries of both credit and price subsidies can readily be identified.

1/ Much more sizeable are the subsidies implicit in the failure of water charges to cover the full economic cost of such service. These include the shortfall between present operating and maintenance expenses and what would be required to maintain the irrigation system at a fixed level of efficiency and repair, plus an allowance for capital costs to finance replacement and/or drainage costs.
As Table 17 shows, for those farmers who were able to purchase a tractor in the pre-devaluation period, a discernible subsidy was involved. 1/ An annual value for the subsidy was obtained by calculating the difference between the cost of the tractor and its international price and amortizing this sum at the same rate that was applied to the purchase price. The resulting estimate was allocated across crops on the basis of tractor hours used. 2/ The subsidy on tube-wells (both direct and indirectly through the interest rate) was treated similarly.

Table 17. EFFECTIVE SUBSIDY COEFFICIENTS FOR THE CENTRAL PUNJAB
(MECHANICAL TECHNOLOGY, 1970/71 AND 1975/76)

<table>
<thead>
<tr>
<th></th>
<th>1970/71 /a</th>
<th>1975/76</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EPC</td>
<td>ESC</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.70</td>
<td>1.86</td>
</tr>
<tr>
<td>Basmati rice</td>
<td>.84</td>
<td>.95</td>
</tr>
<tr>
<td>IRRI rice</td>
<td>.87</td>
<td>.98</td>
</tr>
<tr>
<td>Cotton</td>
<td>1.18</td>
<td>1.26</td>
</tr>
<tr>
<td>Maize</td>
<td>1.74</td>
<td>1.79</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>1.50</td>
<td>1.54</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>2.11</td>
<td>2.20</td>
</tr>
</tbody>
</table>

1/ Pre-devaluation, i.e., Rs. 4.75/dollar.

4.26 The subsidies on mechanical inputs incorporated in the ESC were undoubtedly of some influence in producing the pattern of structural change described in Chapter II. Judging by the subsequent demand for tractors in the period following the devaluation, had it not been for the government's provision (before 1972/73) of the resources that permitted farmers to purchase tractors for approximately 60 percent of their world price, substantially fewer would have been bought. In turn, significantly less land would have been resumed for self-cultivation.

1/ Many farmers with whom this question was discussed maintained that the payments required to obtain the licenses necessary to acquire a tractor ate away at least 50 percent of the apparent value of the subsidy.

2/ The familiar problem of allocating fixed overhead among crops thus arises early in the game. It becomes much more substantial when capital costs must be allocated among crops in the DRC calculations.
Summary and Conclusions

4.27 The calculations made in this chapter indicate that agricultural incentives in Pakistan have varied widely both between crops and between time periods when compared with those in world markets. In part, this was a function of deliberate efforts on the part of planners to tilt the system in favor of import-substituting food crops, particularly sugar, and to tax or prohibit such agricultural exports as cotton and food, in order to lower domestic prices. However, fluctuations in the recent past were also very much a function of world market prices against which most importing countries were forced to seek protection. With recent increases in domestic prices and declines in world prices, the gap between the two has been narrowed. Currently, domestic relative prices seem to be providing roughly the same resource allocation signals as relative prices in world markets.

4.28 The issue that these results now raise directly is whether the agricultural sector might have grown more rapidly had a greater share of the increased productivity been channeled back to the farming community. Earlier chapters established two points:

- Annual variations in prices and subsidies were not significant determinants of agricultural output and the demand for inputs.
- The level of prices and subsidies was, along with the productivity of improved inputs, sufficient to produce a rate of growth well in excess of population growth.

4.29 The question of whether increased agricultural incomes would have resulted if world prices had been more fully reflected in domestic incentives requires a contra-factual proposition that is well beyond the scope of this study. However, several partial observations might be offered in its support, recognizing that these do not take into account the complete range of considerations that prompted market interventions:

- With respect to the role of private investment, perhaps the most persuasive evidence regarding the potential for more rapid development comes from the neighboring Indian Punjab. After a decade of relatively equal performance, East Punjab (India) has begun to grow more rapidly than West Punjab (Pakistan). Undoubtedly, this is in part due to institutional development; but the more rapid acquisition of small scale technology such as pumps, motors, thresher and improved bullock equipment has surely been influenced by the fact that, in real terms and largely because of higher crop prices, these implements cost Indian farmers half as much as they cost their Pakistani counterparts. 1/

1/ For evidence on this point see Carl H. Gotsch, "Agricultural Mechanization in the Punjab: Some Comparative Observations from India and Pakistan," in Land Tenure and Peasant in South Asia, New Delhi, 1977.
A second pertinent observation has less to do with the terms-of-trade confronting agriculture than with the Pakistan government's motivation in the strategy of interventions that was followed. Currently, the agricultural sector is in difficulty because of failure to continue with investments in drainage works, and failure to create a viable research and extension service capable of generating a flow of new technology to the rural sector. Thus, it could be argued that turning the terms-of-trade against agriculture for the benefit of public sector savings was not the most fundamental problem as far as realizing the country's comparative advantage was concerned. Had this surplus been reinvested in agricultural works which inherently require public investment (e.g., waterlogging and salinity control), the increment in long term growth that would have resulted would have put the economy on a better economic footing than it is today.
V. AGRICULTURAL TRADE POLICY AND COMPARATIVE ADVANTAGE

5.01 Incentive coefficients of the type calculated in Chapter IV reflect the price signals that are being transmitted by the government to farmers. They are, however, only one of several pieces of information that farmers use when implementing a production program. Other equally important considerations are the amounts of fixed resources that they have at their disposal and the relative demands made on these resources by the crops they can potentially produce. Only when the opportunity costs of these (domestic) resources are taken into account can the social costs of market interventions be clarified. The first part of Chapter V attempts to shed light on the comparative advantage of crops in the Central Punjab by calculating the so-called DRC (domestic resource cost) coefficients. Subsequent sections compare the results (1) with those of other researchers, and (2) with a linear programming approach in which shadow prices are generated endogenously by the model rather than approximated by adjusting domestic market prices.

Calculation of Domestic Resource Costs

5.02 Altering the effective protection coefficients calculated in the previous section to include considerations of domestic resource costs (DRCs) is, theoretically, rather straightforward. Non-tradeable material inputs have already been decomposed to reveal their primary (domestic) factor content. To these must be added direct use of labor, capital, and land. The totals in each category must then be weighted by an appropriate "shadow price", and the sum divided by value-added at world market prices.

5.03 Several approaches to the presentation of DRC coefficients have been utilized since the early work of Bruno and Kruger, and there continues to be debate about the most useful mode of presentation. The present study uses the following formula:

\[
DRC_i = \frac{\sum_{j=1}^{k} a_{ij} \cdot MPP_{j}^{Y} \cdot p_{y}^{b}}{\sum_{j=k+1}^{J} a_{ij} \cdot MPP_{j}^{Y} \cdot p_{y}^{b}}
\]

where the denominator is value-added in border prices (exactly as in the EPC calculation, para 4.15) and the additional terms are:

\(MPP_{j}^{Y}\) = marginal physical product of the \(j^{th}\) factor in its best alternative use, \((y)\)

\(p_{y}^{b}\) = border price of the \(j^{th}\) factor in its best alternative use, \((y)\)
j = 1, 2 ... k = inputs of directly traded goods plus the indirect traded inputs derived from non-traded goods upon decomposition.

j = k+1, k+2 ... J = inputs of primarily non-traded factors, including those obtained as a result of decomposing non-traded goods.

5.04 Equation (1) has several virtues that recommend its use. First, it is directly comparable with the EPC coefficient. The only difference between the two is that the numerator in the EPC calculation expresses the value of domestic factors at domestic market prices while the DRC calculation expresses them at border or shadow prices. Second, it has the virtue of consistency in that an effort is made to relate the value of all domestic resources to their border prices. The problem of having a different numeraire for tradeables and non-tradeables when land, labor and capital are used in the production of both is thereby avoided.

5.05 Official exchange rates are used throughout to convert world (border) prices to domestic currency. The pure number thus obtained can be used to rank projects relative to each other when directly competitive alternatives are being considered. To compare projects across countries, or for comparison with other sectors in the economy, i.e., in a general equilibrium context, the DRC coefficient can be expressed in units of domestic resources (measured in domestic currency at economy-wide alternative use values) required to earn (save) a unit of foreign exchange, and adjusting by any disparity between the official and the "shadow" exchange rate. The cut-off point for socially desirable projects is reached when this exchange-rate adjusted DRC rises to 1.

\[
\text{DRC} = \frac{V_1}{V_2} = 1
\]

where

- \( V_1 \) = the official exchange rate
- \( V_2 \) = the "shadow" exchange rate

Study Estimates

5.06 Practically, the application of the DRC formula contains substantial difficulties. Chief among these relates to obtaining values for \( P \). The economic experiment performed by the rest of the world—on which the value of traded inputs is based—is, by definition, unavailable for pricing domestic resources. Prices that are observed for domestic factors are the result of an interplay of economic forces when outputs and tradeable inputs are valued at domestic prices. Outside the framework of an economy-wide optimizing model, the impact of changes in the domestic prices of tradeables on the price of capital, labor, and land are unknown. This requires that some sort of conversion factor, drawn from the discrepancy between world and domestic prices, must be used to adjust the market prices of domestic resources to more nearly reflect the border prices called for in the DRC formula.
5.07 A number of other problems were encountered in calculating the DRC coefficient. In Pakistan, for example, data on the MPP of resources in their best alternative are almost non-existent. The result is that market prices must frequently be used as the basis for obtaining an initial value of the marginal product. In some instances, e.g., casual labor used in rice transplanting and wheat harvesting, the labor market can be assumed to be fairly competitive. Wages probably reflect fairly accurately the value of labor's marginal product and need only be adjusted to take into account the impact that valuing tradeables at world prices would have on the value imputed to domestic resources. In other slack periods, however, the remuneration of labor is undoubtedly governed by institutional considerations. In the DRC calculations, it has been assumed that the market wage of labor during the peak periods of May-June and October-November reflected its opportunity cost. For other periods, the wage was reduced by one-half. (All wages were, of course, subsequently corrected for market interventions on the output side.)

5.08 Valuing capital also involved well-known difficulties. Aside from fixing on a figure for its opportunity cost, perhaps the most important of these concerned the treatment of the progressive and mechanized farmer technologies. In the case of the former, it was assumed that several supplementary irrigations were purchased from a neighbor who owned a tubewell. The water was treated as a non-traded input and decomposed. The major tradeable item was fuel; the remainder was allocated between capital and labor. While it was not difficult to establish the fuel costs since the use of fuel (electricity) per hour was known, assigning a value to capital required not only data about tubewell costs, but an assumption about total hours of tubewell operation. This assumption was in turn used to determine that portion of the tubewell's capital and labor costs that should be allocated to the purchaser of the water.

5.09 In the case of the mechanized farmer, fuel was again designated as a tradeable input, but under the assumptions of a one-year time horizon, the entire complement of implements was shown as a domestic resource, amortized and allocated among crops on the basis of hours used.

5.10 Land presented special problems of seasonality that are closely linked to the technology assumed. Figure 11 illustrates a typical cropping pattern in the Central Punjab and shows the potential for a number of rotations that compete for land—and associated water—resources. The situation pictured is that associated with the traditional farmer, i.e., with approximately 100 percent cropping intensity. 1/ Under these circumstances, it is water, not land, that is the scarce resource, and hence, the claimant of the residual when the value of capital and labor has been subtracted from value-added at world market prices. This is, in the calculations for the traditional farmer shown in Table 18, the next best alternative to be included in the numerator of the DRC coefficient estimate was defined in terms of returns per acre inch of water.

1/ The "traditional" farmer is assumed not to have access to supplementary irrigation water. There is some difficulty with this definition since there are large tracts—several million acres—in which saline groundwater has made all farmers "traditional."
Figure 11: Typical Cropping Pattern, Central Punjab Canal Plus Tubewell
Overall Intensity 150%
### Table 18: Domestic Resource Cost Coefficients, Three Technologies, Central Punjab: 1970/71, 1975/76

<table>
<thead>
<tr>
<th>Crops</th>
<th>Traditional Technology&lt;sup&gt;a/&lt;/sup&gt;</th>
<th>Progressive Technology&lt;sup&gt;b/&lt;/sup&gt;</th>
<th>Mechanical Technology&lt;sup&gt;b/&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mds/a in/a DRC DRC</td>
<td>mds/a DRC DRC</td>
<td>mds/a DRC DRC</td>
</tr>
<tr>
<td>Winter Crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>17 20 .93 22 .74 .80 22 .74 .80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td>8 15 1.08 9 1.35 1.25 9 1.35 1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>10 40 .83 .99 11 1.11 1.01 10 1.11 1.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basmati rice</td>
<td>12 53 1.45 1.01 14 1.06 .67 14 1.06 .67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRRI rice</td>
<td>17 50 1.15 1.54 20 .94 1.88 20 .94 1.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>20 35 1.79 1.46 25 1.81 1.99 25 1.81 1.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>400 80 2.80 1.47 450 1.25 .61 450 1.29 .90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat-cotton</td>
<td></td>
<td></td>
<td>1.07 1.44</td>
</tr>
<tr>
<td>Wheat-rice (Basmati)</td>
<td></td>
<td></td>
<td>1.04 1.11</td>
</tr>
<tr>
<td>Wheat-rice (IRRI)</td>
<td></td>
<td></td>
<td>.96 1.63</td>
</tr>
<tr>
<td>Wheat-maize</td>
<td></td>
<td></td>
<td>1.42 1.68</td>
</tr>
</tbody>
</table>

<sup>a/</sup> Water claimant of the residual rent

<sup>b/</sup> Land claimant of the residual rent
5.11 As indicated above, in the case of the progressive and mechanized farmers, additional water was assumed to be a non-tradeable cost and decomposed. The additional water in turn was assumed to make land the scarce resource, and hence the recipient of the residual rent left after the costs of capital and labor were subtracted from value-added at world prices.

5.12 The assumption that land, not water, was the scarce fixed resource was further modified in the case of the progressive farmer when he was defined as a farmer who depended upon animal power. Although there continues to be substantial debate about the proposition, most agriculturalists seem to feel that complete double cropping is unlikely to emerge except in the presence of mechanical power. They do concede, however, that a wheat-coarse rice rotation is possible using only bullocks and the calculations assume that this is a permissible cropping system for the progressive farmer in the Central Punjab. (Wheat-cotton and wheat-basmati rice are ruled out.)

5.13 The mechanized farmer is assumed to have the power and the implements not only to produce the supplementary irrigation water required for double cropping, but to have the draught power to do the tillage and seeding activities in the time available.

5.14 DRC coefficients: Table 18 again limits the number of time periods presented in an attempt to highlight the importance of technological assumptions to the determination of comparative advantage. Without going into a lengthy discussion of the intricacies of Punjabi agriculture, the estimates suggest a number of conclusions about comparative advantage within agriculture in the pre- and post-devaluation periods.

5.15 The use of water as a claimant of the "rent" in the "traditional" farmer case produces several significant changes in the DRC coefficients. In the winter crops, for example, wheat and oilseeds come much closer to 1, i.e., oilseeds improve their comparative advantage with respect to wheat. This is a function of the yield-water relationship of the two crops. Among the summer crops, cotton uses water most efficiently, at least at 1970/71 prices. Sugarcane is an extremely inefficient user of water resources at 1970/71 world prices, a point that was frequently made in price policy papers written around the turn of the decade.

5.16 With the exception of IRRI rice, all of the DRC ratios have moved closer to 1 in the 1975/76 period. This would also have been the case for IRRI had 1974/75 prices been used. However, world market prices for coarse rice dropped sharply in 1975/76, and this accounts, at least in part, for the results that are shown.

5.17 The high DRC for sugarcane on traditional farms results from a comparison with a wheat-coarse rice rotation. Many traditional farmers found management and power constraints important as evidenced by the fact that increases in available water supplies did not lead directly to double cropping. If the wheat-IRRI rice is not assumed, sugarcane has a decided comparative advantage over all other crops at 1975/76 prices. Because it occupies the land 10 to 12 months out of the year, farmers reap the benefits of high cropping intensities with minimal seasonal power and management problems.
5.18 When land is assumed to be the scarcest part of the water-land package and outputs and inputs are measured per acre (i.e., the progressive and subsidized farmer cases), some important changes in the DRC's of the summer crops occur. In particular, at least at 1970/71 prices, IRRI rice becomes the most efficient summer user of domestic resources in the Central Punjab. It is closely followed by basmati rice and by cotton. This finding is consistent with Lawrence's rankings for roughly the same period and is again an indication of changes in the relative prices of the rice (basmati) that flows into very specific markets in the Middle East and Africa, and of the rather low quality coarse rice in world markets.

5.19 This move is reversed in the 1975/76 period, when basmati prices improve relative to coarse rice prices and IRRI rice drops sharply in its comparative advantage. 1/

5.20 Unlike the traditional farmer case where outputs and inputs were standardized on acre inches of water, sugarcane, at 1975/76 prices, has a comparative advantage over all crop rotations on both the progressive and mechanized farms. In the former, the DRC is relatively more favorable because of the assumption that farmers dependent on animal power would not be able to implement wheat-basmati rice or wheat-cotton rotations. That is, the next best alternative to sugarcane is assumed to be wheat-IRRI rice. However, even in the case of wheat-basmati case, the DRC for cane is less than 1.

5.21 The DRC coefficients are highly sensitive to relative crop yields. Because, under Pakistan conditions, the tillage, planting, weeding, and harvesting of most crops involves a reasonably standard set of operations, the cost of labor (valued at an opportunity cost based on its market price) and capital (based on a share of amortized cost and valued at its opportunity cost) was quite similar across crops. However, the residual accruing to the land and water package varied widely depending upon gross revenues at world prices. When this residual was used to represent the value of land in its next best use (i.e., its opportunity cost) for a particular crop—and added to the already calculated values of labor and capital—domestic resource costs varied considerably between crops.

5.22 The two principal components of the real source of variation in the DRC calculation are thus relative yields and relative international prices. Reference was already made in the above observations to the role of international prices in determining the DRC's of sugarcane and IRRI rice. However, it is obvious that yields of all commodities play an equally important role in determining gross revenue. For example, in the sugarcane versus wheat-rice comparison, the appearance of HYV had an important impact on comparative advantage. Prior to the phenomenal increase in the world sugar price, the yield effect alone was sufficient to drive sugarcane from the cropping pattern. The fact that sugarcane yields did not increase in the last decade only added to the difficulty. It was this combination of low yields and low international prices for sugarcane, and high yields of wheat and rice, that made the government's sugar price support policy a target of considerable criticism in the late 1960s.

---

1/ A glance at the decline in NPC's for 1974/75 and 1975/76 indicates the reason for the relatively low standing of coarse rice in terms of DRC coefficients.
5.23 As indicated above, some year-to-year variation in the DRC's remains even when a single "average" yield (for a particular technology) has been used to make the calculations. Historically, the relationships among world market prices have changed considerably, thus creating a potential planning problem as comparative advantage changed from one year to the next. Were this merely an agricultural matter involving the switch from one crop to another, the issue would not be terribly serious. However, countries often benefit from the processing and refinement of agricultural raw materials, which in turn requires substantial investments in fixed capital assets (sugar mills, textile mills, etc.). It is the uncertainty in comparative advantage introduced by such commitments that creates the most vexing planning problems.

5.24 Fortunately, from a planning point of view, despite the fact that there is considerable variation in DRC coefficients, the crop rankings show a reasonable degree of stability. This results, of course, from the role that relative yields play in determining comparative advantage. That is, a crop may retain its comparative advantage in spite of a significant shift in relative prices because its productivity in a particular agro-climatic environment is decidedly superior to competing crops. It is this phenomenon that gives rise in Pakistan to the so-called "rice areas" and "cotton areas." These are basically areas in which relative yields play the dominant role in determining the most efficient allocation of domestic resources.

5.25 Calculating regional DRC's: Most of the calculations presented thus far have dealt with the economics of agriculture in the Central Punjab. It is the "swing area" in the heartland of Pakistan where the relative yields of crops make the cropping system sensitive to changes in relative prices. In the area to the north, cotton yields decline relative to rice and sugar-cane, and these become the dominant crops. Further to the south, the converse is true, and at least until the advent of HYV coarse rice such as IR-8 and IR-20, comparative advantage dictated the production of cotton. (This is particularly true where irrigation water is a constraint. The Southern Punjab and Bahawalpur have higher relative consumption use requirements for rice than the Northern Punjab.)

5.26 In several other regions, however, calculations of comparative advantage at world market prices produce DRC's for commodities that are quite different from those obtained for the same commodities in the Punjab. For example, Table 19 shows DRC coefficients in 1975/76 prices for wheat in the rainfed areas of N.W. F. P., and for rice in the Central part of Sind Province. In the case of the former, a drought-resistant, but low yielding lentil (gram) has been taken for comparison; in the latter, a coarse grain, jowar, has been assumed to be the next best alternative. 1/

5.27 The very low DRC's indicate, of course, that the dryland areas have a strong comparative advantage in growing wheat while the rice areas, many with poor drainage, are properly committed to rice. Substantial downward revisions in international prices would continue to support such conclusions because the productivity of the next best alternative is so low.

1/ Jowar is a member of the millet family. Its world market price has been approximated by the price of sorghum.
Table 19 DOMESTIC RESOURCES COEFFICIENTS OF WHEAT AND RICE IN N.W.F.P. AND SIND (PROGRESSIVE FARMERS, 1970/71 AND 1975/76 PRICES)

<table>
<thead>
<tr>
<th></th>
<th>N.W.F.P. (Dryland area)</th>
<th>Sind (Rice area)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
<td>Gram</td>
</tr>
<tr>
<td>1970/71</td>
<td>.54</td>
<td>1.85</td>
</tr>
<tr>
<td>1975/76</td>
<td>.60</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Comparisons With Comparative Advantage Calculations Made by Other Researchers

5.28 Over the years, a number of studies have been undertaken aimed at providing a better understanding of Pakistan's comparative advantage in agriculture when outputs, inputs and resources are valued at world market prices. These have included both partial equilibrium (budgeting) approaches and the more general linear programming framework. Although the assumptions and methodology differ from that used above, a number of the results are very similar.

5.29 Partial Budgets: Roger Lawrence (1968): The earliest major effort to examine the efficiency of domestic resource use was undertaken by Lawrence in 1968. 1/ Following the reasoning advanced by Bruno, Lawrence first prepared a series of farm budgets for different agricultural situations. 2/ Coefficients representing two types of technology were developed: (1) "optimal" coefficients that were assumed to reflect the practices of the more progressive farmers, and (2) "typical" coefficients that were assumed to reflect average practices. "Real" costs of the resources used in crop production were obtained by weighting inputs with appropriate "shadow prices" that were assumed to reflect the opportunity costs of the resources to the economy. For primary inputs, i.e., those fixed to the economy as a whole, this was done as follows:

- Labor: The frequently used estimate of one-half the observed wage was adopted. Seasonal variations were not considered.


- **Land**: Land was treated as fixed capital to which a (social) discount rate of 10 percent was applied. Annual land charges were allocated to the various crops according to the number of months the land is occupied by the crop. (The explicit assumption was that the land would be fully utilized for purposes of growing crops other than those that appeared in the analysis, i.e., that cropping intensity was equal to 200 percent.)

- **Durable implements**: No charge was made. It was argued that the effects would be too small to be worth measuring.

- **Power**: The observed rental rate for bullocks was used.

5.30 For intermediate inputs, two methods of costing were used. Traded inputs (fertilizer and insecticides) were simply valued at c.i.f. prices. Water, a non-traded input, was valued at the real cost of producing water. For all intermediate inputs, costs were broken into their domestic and foreign exchange components.

5.31 Given a shadow price for all inputs, and the physical inputs required per acre, real costs per acre were calculated by crop. This, together with data on yields per acre corresponding to the two technologies, permitted the calculation of real costs (both domestic and foreign) per maund produced. Next, the international value of a maund of output was found by taking the f.o.b. price (exports) of the c.i.f. price (imports), (both in dollar terms) from which, in turn, the foreign exchange component of the costs was subtracted. The resulting number was the net foreign exchange earned or saved by expanding production of the commodity by one maund. Dividing this into the real domestic costs of producing a maund provided the real domestic costs of earning or saving a dollar's worth of foreign exchange.

5.32 The real resource cost of earning or saving a unit of foreign exchange by expanding production of a crop was then compared with the shadow price of foreign exchange. (For example, if, by expanding production of a certain crop, Pakistan can earn a dollar of foreign exchange with the expenditure of Rs.4 of domestic resources, while the value to the Pakistan economy of this unit in foreign exchange is Rs.9, it is in the interests of the economy to expand production.)

5.33 Lawrence's calculations yielded a number of different estimates of comparative advantage depending upon the technology assumed and the prices forecast in world markets. In all cases, however, the "optimum" technologies yielded real costs of producing commodities that were well below any estimate of the shadow price of foreign exchange. The conclusion derived from this result was that the agricultural sector had clear-cut comparative advantage when improved technology is used. (The "typical" technology that assumed lower yields revealed a split. Some crops used more real resources than the foreign exchange they might have earned or saved.)
Lawrence's analysis also provided estimates of comparative advantage by crop. Table 20 shows a ranking of crops in order of increasing costs of earning or saving a unit of foreign exchange when improved technology was assumed. On the basis of these estimates, Lawrence suggested a number of policy conclusions:

Table 20 CROP RANKINGS FOR WEST PAKISTAN

<table>
<thead>
<tr>
<th>Crop</th>
<th>Real Costs per Dollar's Worth of Output (Rupees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapeseed</td>
<td>2.47</td>
</tr>
<tr>
<td>Rice (Basmati)</td>
<td>2.82</td>
</tr>
<tr>
<td>Rice (IRRI)</td>
<td>3.34</td>
</tr>
<tr>
<td>Maize</td>
<td>3.49</td>
</tr>
<tr>
<td>Cotton</td>
<td>3.84</td>
</tr>
<tr>
<td>Wheat (Mexi-Pak)</td>
<td>5.25</td>
</tr>
<tr>
<td>Sugar</td>
<td>7.34</td>
</tr>
<tr>
<td>Rice (Coarse)</td>
<td>8.00</td>
</tr>
</tbody>
</table>

- Rapeseed, the only oilseed considered in this study, stands at the top of the list as the least costly item to produce. From a practical point of view, expanding acreage under this crop would not be easy. An increase in oilseed production can be considered only jointly with the expansion of crushing facilities. Nevertheless, the evidence in Lawrence's study suggests that expansion of edible oil production in West Pakistan should be subjected to serious study. The data also suggest that, other things being equal, fall-planted oilseeds, which compete with wheat, will be preferable to summer-planted oilseeds competing with rice.

- Basmati and IRRI rice both show up as extremely efficient earners of foreign exchange. The cost differential between these two improved varieties of rice and the local coarse rice is striking. Every acre that is shifted from local coarse to IRRI or basmati more than doubles the real value of that acre's output. (For the local coarse - IRRI comparison, this statement includes an assumption that IRRI will require a 15 percent price discount from the price of local coarse.) Increased production of basmati for export must, however, be undertaken with a careful eye on the effects of increased production on the export price.
Maize appears to be a very good potential export commodity, falling between IRRI rice and cotton in the rankings. The best way to utilize this potential may be to develop the appropriate agro-industries (production of starch, sugars, glutin, etc.). This possibility would appear to merit serious study. Sugar, on the other hand, has relatively high costs of production, and considerable gains to West Pakistan agriculture would result from switching acreage from sugar to other crops. Switching an acre of land from sugar to Mexi-Pak wheat and basmati rice, for example, would increase the real value of that acre's output by between 20 to 50 percent, depending on whether one uses the high or low world prices for wheat and rice.

5.35 Partial Budgets: S. R. Khan (1975): Khan's study, using data that refer generally to the 1972/73 period, has as its primary purpose the calculation of the shadow price of land for agriculture. However, because this was assumed to be equal to the residual left when all other inputs, valued at their opportunity costs, were subtracted from outputs valued in the same way, the data can be reorganized to give estimates similar to those presented by Lawrence.

5.36 As in the Lawrence approach, outputs are weighted by border prices to obtain their "real" value to the economy. Khan extends the analysis to include more detail on the benefits derived from by-products. These are considerable and in some cases (e.g., cottonseed) appear to equal the value of the final commodity.

5.37 The by-product contribution also varies significantly between crops. In the case of straw, the domestic price multiplied by the reciprocal of the NPC (2.05) for wheat and, hence, the social cost of production, is approximately twice that of the domestic cost. Other by-products, such as cottonseed oil and cottonseed cake, are traded internationally and, hence, their f.o.b. prices were used.

5.38 Khan's treatment of input cost differs from Lawrence in both coverage and methodology. Only land is taken as a non-reproducible, non-traded good whose shadow price is to be determined. The real costs of the remaining factors are determined by various means:

- Labor: It is assumed that the market wages paid to workers reflect the value of their product at market prices. Khan argues that if there were no unpaid family labor, workers would be hired in their place and, hence, market wages would be the scarcity value of labor if output were being paid its market price. In order to get its real scarcity value, i.e., the marginal product of labor when output is measured at its opportunity cost, the market wage is multiplied by the crops "conversion factor," i.e., by the reciprocal of the NPC.
Management: Like family labor, the assumption is made that market prices do not reflect social contribution, i.e., the contribution management would make if output were valued at international prices. Consequently, an adjustment is made by multiplying the "market value of management" by the reciprocal of the NPC.

Seed: Market prices have been converted to international prices.

Fertilizers, Pesticides: They are given their c.i.f. prices.

Water: The market price of water is assumed to reflect its social value. (From comments made in the study, it appears that this refers not to the cost of producing water but to the government's water charges.)

Interest: The domestic interest rate of 10 percent has been charged on all credit expenditures. This was converted to the social rate of return on capital by applying a conversion factor that raises it to 16.5 percent.

5.39 In the Khan analysis, the value of inputs at accounting prices was subtracted from the value of output at accounting prices to give a residual shadow price for land by crop. By adding together the shadow prices of various possible cropping patterns, an annual price was obtained. Table 21 presents the results.

Table 21 ESTIMATED ANNUAL PRIVATE AND SOCIAL RETURNS TO LAND PER ACRE

<table>
<thead>
<tr>
<th>Cropping Pattern</th>
<th>Private</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat/Basmati rice</td>
<td>1,595</td>
<td>4,822</td>
</tr>
<tr>
<td>Wheat/IRRI rice</td>
<td>1,431</td>
<td>4,809</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>474</td>
<td>1,159</td>
</tr>
<tr>
<td>Wheat/cotton</td>
<td>606</td>
<td>935</td>
</tr>
</tbody>
</table>

5.40 The table can be interpreted as suggesting that cropping patterns involving wheat and rice have a clear comparative advantage over either sugarcane or cotton. Sugarcane's "unusual" ranking above cotton is related to the unprecedented boom in world sugar prices in the 1972/73 period.

5.41 Comparison of partial budgeting studies: The partial studies indicated above have much in common. However, there are some significant differences that become evident on a more direct comparison, particularly
in the area of deriving social accounting prices for various inputs. Most significant, perhaps, are differences in yields assumptions. Lawrence, for example, assumes that cotton yields will be approximately 14 maunds per acre; Khan assumes 11. This in itself would be sufficient to lower the resource costs implicit in the Khan study from Rs. 7.36/dollar to 5.32/dollar. Additional explanations, other than relative changes in costs and returns, have to do with cost categories and estimates for them. Most significant in the latter case is labor, where Lawrence assumes shadow rates to be equal to one half the observed market wage. Khan, on the other hand, takes market wages for casual labor as equal to labor's marginal product and then makes an upward adjustment on the market wage rate on the grounds that the marginal product would be higher if output were priced at its social accounting price. (None of the usual surplus labor arguments are used.) Bullock costs are also proportionately higher in part because the social discount rate for capital has been assumed to be 16.5 percent.

5.42 Offsetting some of the higher costs in the Khan study has been the assumption that the cost of water would be the Government's charge to the farmer. (This was done for the sake of convenience; a sensitivity test showed a substantial decrease in the residual for land if water charges were multiplied ten-fold, which might be the marginal cost of additional water.)

5.43 Generally speaking, however, it is significant that in both cases, when similar yields are used, there is an implication that the use of domestic resources in agriculture is an efficient way of earning foreign exchange. Both studies show domestic resource costs for a unit of foreign exchange that are substantially below any reasonable estimate of the shadow price of a dollar of foreign exchange. This finding is supported by the results obtained in the present study.

5.44 Linear Programming Estimates of Comparative Advantage: Gotsch, 1969: DRC coefficients have sometimes been referred to as "informal approximations" of estimates that would result if full-fledged general equilibrium models of the economy were employed in the analysis. The tradeoff is between a methodology that is manageable from a computational point of view and one that, while it would avoid the problems associated with shadow pricing domestic resources, would entail substantial additional effort. Earlier comments have already pointed to the conceptual problems associated with the calculation of DRC coefficients in the Pakistan context. Additional insights into these difficulties can be gained by a comparison of the results obtained by Lawrence with a linear programming exercise based on essentially the same data.

5.45 Columns (2) and (4) in Table 22 present the results of running the model under the Lawrence assumptions, i.e., the net revenues for crops have been calculated at 1968 world market prices, the wages of hired labor have been taken to be one half the prevailing market rate, the cost of pumping water has been shadow-priced by breaking its production cost down into fuel, metal, labor, etc.

5.46 A comparison with the solution using domestic prices, also for the 1968 period, indicates that only wheat retains its position in the cropping pattern when accounting prices are introduced. Sugarcane and maize, both overvalued domestically in 1968, are eliminated from the cropping pattern entirely. Their replacements, rice and cotton, are two crops whose prices during this period closely approximated world market levels.

Table 22 OPTIMAL CROPPING PATTERNS AND TOTAL REVENUES AT DOMESTIC AND WORLD MARKET PRICES FOR INPUTS AND OUTPUTS, CENTRAL PUNJAB WHEAT-COTTON AREA (acres by crop, per 12.5 acre farm, and total revenues)

<table>
<thead>
<tr>
<th>Crops</th>
<th>Traditional technology a/ Domestic prices (1)</th>
<th>Improved technology b/ Domestic prices c/ World prices (2)</th>
<th>Improved technology b/ Domestic prices c/ World prices c/ (3)</th>
<th>Improved technology b/ Domestic prices c/ World prices c/ (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>5.13</td>
<td>1.95</td>
<td>5.55</td>
<td>5.59</td>
</tr>
<tr>
<td>Barley</td>
<td>.31</td>
<td>4.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gram</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fodder (sale)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>.50</td>
<td></td>
<td>4.63</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>.13</td>
<td>.10</td>
<td>.20</td>
<td>.20</td>
</tr>
<tr>
<td>Summer Crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>.27</td>
<td>1.17</td>
<td>2.10</td>
<td>6.07</td>
</tr>
<tr>
<td>Cotton</td>
<td>3.01</td>
<td>3.75</td>
<td>2.03</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td></td>
<td>1.44</td>
<td></td>
</tr>
<tr>
<td>Fodder (sale)</td>
<td>.78</td>
<td>.67</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>.50</td>
<td>4.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>.09</td>
<td>.10</td>
<td>.10</td>
<td>.10</td>
</tr>
<tr>
<td>Total cropped acreage d/</td>
<td>11.54</td>
<td>11.27</td>
<td>19.32</td>
<td>14.66</td>
</tr>
<tr>
<td>Total Revenue I</td>
<td>Rs.2,860</td>
<td>$517.22</td>
<td>Rs.5,476</td>
<td>$748.03</td>
</tr>
<tr>
<td>Total Revenue II</td>
<td>$403.55</td>
<td>Rs.2,454</td>
<td>$558.18</td>
<td>Rs.4,131</td>
</tr>
</tbody>
</table>

a/ Traditional technology is used here to describe yields and costs under historical conditions, including historical water supplies.
b/ Improved technology assumes high-yielding cereal varieties and supplemental tubewell irrigation.
c/ Exchange rate: $1 = Rs.9
d/ Fodder required to maintain bullocks not included.
Although the use of a farm level programming model permits the adjustment in cropping patterns from a changing net revenue structure to be reflected in the shadow prices of domestic resources, it cannot claim to have captured the true social benefits of policy changes. The amount of water that can be pumped by a tubewell, for example, has been assumed to depend on its capacity, not on the share of the socially available groundwater that a 12.5-acre farm would command. Moreover, the amount of labor hired has been weighted by prevailing rural wage rates and thus does not take into account the aggregate effect of individual farm labor demands. A similar problem arises on the commodity demand side; the domestic prices used for valuing outputs do not reflect the price adjustments that would occur in the economy if all farmers were to pursue the cropping pattern shown in the domestic model. However, the results can give some indication of the losses to society due to relative price distortions. In columns (1) and (3) of the Total Revenue II row, the optimal cropping patterns generated in response to domestic input and output prices have been evaluated with new revenues calculated from world market prices. As the comparison of these calculations with those in columns (2) and (4) of Total Revenue I show, the opportunity cost of the domestic cropping pattern is quite high; net foreign exchange earned or saved is nearly 25 percent less that it would be if the cropping pattern reflected relative prices in world markets. As indicated earlier, the principal cause of the discrepancy is the large amount of over-valued sugarcane in the domestic cropping pattern.

Although it may be undesirable on some grounds to bring domestic prices in agriculture in line with those prevailing in world markets, it must be recognized that the costs in terms of static efficiency are high. If the world price cropping pattern were evaluated at domestic producer prices, it would mean a loss of approximately 15 percent in revenue to the representative farm. Assuming that it was desirable for political and incentive reasons to maintain the terms-of-trade between the agricultural and nonagricultural sectors, this suggests that the government would be well advised to pursue an agricultural price policy that set domestic prices for all crops at some uniform level above world market prices. Lest it be misunderstood, such a recommendation in no way suggests that maintaining the current terms-of-trade between agriculture under conditions of advanced technology is an appropriate development objective. Indeed, a comparison of the net revenue estimates associated with traditional technology (columns 1 and 2) shows that if the cropping pattern under advanced technology at world market prices (column 4) were used as a basis for calculation, producer prices could be uniformly reduced and still provide a net revenue for the representative farmer greater than that earned before the new technology was available.

Comparison of the DRC and LP Results. It is beyond the scope of this report to investigate in detail the relationship between the two methodologies described above. However, enough has been said in the foregoing paragraphs to make at least a start on the issue and to address several points of similarity and difference that emerge rather directly from a review of the previous studies.
5.50 There is a good deal of agreement in the empirical results of the studies mentioned. It is clear from both the DRC calculations and the programming model, for example, that when 1968 data are used, substantial opportunities to improve social efficiency could have been obtained by reallocating domestic resources in the agricultural sector. The divergences in world and domestic output prices, i.e., nominal protection generated by Pakistan's trade policies, were such that these findings were virtually guaranteed.

5.51 Where results do differ, they appear to be related in large part to different assumptions about yields. For example, while the programming exercise agrees with Lawrence's conclusion that oilseeds might be an efficient way to save foreign exchange in the rabi season if traditional technology were used, this conclusion does not stand up after the introduction of high yielding wheat varieties is simulated. Indeed, because the programming exercise does not assume that oilseed yields will increase significantly in the near future, they disappear from the cropping pattern entirely.

5.52 Differences between the earlier studies and more recent calculations stem largely from the radical changes in world market prices that have occurred in recent years. While both the Lawrence and Gotsch-Falcon studies find that sugarcane is an unusually inefficient way of using Pakistan's land and water resources, Khan, using price data from 1974/75, finds cane superior to a wheat-cotton rotation.

Summary and Conclusions

5.53 Application of the DRC methodology to Pakistan agriculture reveals both its usefulness and its limitations. On the positive side, it identified several problem areas in which inappropriate incentives could lead to substantial inefficiencies in resource allocation. For example, at 1971/72 world prices these include sugarcane which had a serious comparative disadvantage at yields that were then being obtained. Because these yields have not improved relatively, and because the world prices of sugar had plummeted by 1976/77, the comparative advantage that developed during the period of high world prices has now been wiped out. Incentives that try to keep sugarcane in the cropping pattern will obviously result in the misuse of domestic resources, at least as seen from an agricultural efficiency point of view.

5.54 Although no analysis was presented regarding the comparative advantage of different technologies, it is clear that the comparative advantage of various crop combinations is strongly influenced by the methods of production assumed. Especially important in this regard is whether water or land is the scarce domestic resource to which the residual rent is attributed. Technology is also important in determining the extent to which double cropping is feasible. This in turn has important implications for the comparative advantage of such crops as wheat, for it removes the need to consider winter cereals as competing with high value summer cash crops.
From a computational point of view, perhaps the most useful finding was that the DRC results are dominated by relative yields and relative world prices. This comes about in the Pakistan case because: (1) alternative uses of the land have approximately the same labor and capital costs, and (2) purchased inputs are only a small portion of total costs. The DRC calculation for, say, cotton then reduces essentially to:

\[
\frac{P_r^w \cdot Y_r}{P_c^w \cdot Y_c} = \text{DRC}_c
\]

where

- \( P_r^w \) = world price of rice
- \( Y_r \) = yield of rice
- \( P_c^w \) = world price of cotton
- \( Y_c \) = yield of cotton

Expression (3) is an empirical finding and holds because the cultural practices in irrigated agriculture are relatively similar between crops. It would probably not apply across enterprises that were drastically different in their use of labor and capital. However, the results emphasized what has long been known, i.e., that calculations of private or social comparative advantage are extremely sensitive to relative yields.

The brief excursion into programming methodology underlined a basic weakness of the DRC approach from a policymaker’s point of view; namely, while the coefficients assist in providing an indication of the direction in which resource shifts ought to take place, they give little help in guiding judgments about the extent that such shifts are desirable or the net benefits that might be expected. (If programming estimates are unavailable for this task, then the DRC analysis needs to be supplemented with econometric studies of the likely response of farmers to changes in relative prices.)
VI. GOVERNMENT OBJECTIVES AND COMPARATIVE ADVANTAGE

6.01 Pakistan's agricultural price policies have begun to reflect more nearly relative prices obtaining in world markets than has often been the case in times past. Farmers making decisions about domestic resource allocation have therefore been receiving signals that would move the agricultural sector in the direction of its comparative advantage. The immediate problem that this poses—assuming that the above characterization of present trends is correct—is whether the mix of commodities (and the level of investment) forthcoming from these incentives will be consistent with what the government sees as its economic, political, and social objectives in agriculture. For the appropriate incentive structure defined in terms of tradeables does no more than send signals which producers can be expected to incorporate into their decisions. The commodity mix will ultimately depend, in addition, on the technical coefficients of the crops being grown and on the relative scarcities of domestic resources.

6.02 As indicated earlier, if the government were prepared to live with whatever crop mix the incentives produce, all would be well and good. However, past history suggests that this is unlikely. The government has not hesitated to permit domestic relative prices to diverge substantially from international relative prices when it felt ends other than efficiency were being threatened.

6.03 Several questions occur naturally at this point, the most obvious having to do with the government's basic objectives vis-a-vis the agricultural sector. 1/ Can anything be said, based on past experience, about the extent to which the current output mix (and its implied income distribution) is in keeping with some notion of a political "equilibrium" among the interested constituencies? Also, what are the costs to the economy, as indicated by the DRC ratios, of changing the incentive structure in favor of certain commodity groups? Answers to these types of questions must necessarily involve large elements of judgment. What one group or individual regards as an "equilibrium" may appear rather differently to someone with different economic interests. But unless some effort is made to define objectives and economic costs rather concretely, the whole discussion of price policy becomes hopelessly diffuse and abstract.

6.04 Government decisions concerning agricultural prices have been taken after consideration of the interests of three major groups: agricultural producers, consumers, and manufacturers. The concern about agricultural producers has centered both on the interests of farmers, farm laborers and other rural groups whose incomes are closely tied to farm income levels, and also on the need for incentives to encourage farm production. Concern about consumer interests have focused on urban workers, though these has also been

1/ For a discussion of the "objectives" of governments that produce market interventions, see Kym Anderson, "The Logic of Market Interventions in Developing Countries," Working Note No. 5, World Bank Price and Subsidies Project, Stanford University, 1977, mimeo.
awareness of the interests as consumers of rural craftsmen and landless laborers. The interests of manufacturers have been a major consideration because of the high priority given to industrial development. Low urban food prices were seen as a way to maintain low wages and thereby enhance the competitive position of Pakistan's industry. Low cotton and other raw material prices were also seen as ensuring the profitability and competitiveness of Pakistan's industry, about 40 percent of which consisted of cotton processing, yarn and textiles. It is not possible to know the weight policymakers gave to each of these interests in making their decisions, but the following sections indicate the direct financial impact of those decisions on producers and consumers.

Producer Commodity Taxes and Subsidies

6.05 The commodity taxes primarily affecting prices received by agricultural producers, along with subsidies paid to farmers, are shown in Table 23. Agricultural land taxes are excluded since they are direct taxes and have little effect on either the relative or absolute levels of farm prices. 1/ The effects of such taxes and subsidies are not solely on farmers, of course, just as the effects of commodity taxes and subsidies paid or received by consumers also affect producers. 2/ While subsidies on fertilizer are received by farmers, one of their purposes is to keep the farmer producing crops (e.g., wheat and cotton) whose prices are being held down for the benefit of consumers, employers and manufacturers. Taxes on agricultural exports (and export prohibitions) fall directly on the prices received by (and incomes of) farmers, and benefit consumers and manufacturers by keeping domestic prices for these commodities below world market prices. Domestic excise taxes probably have their incidence mostly on prices paid by consumers, but these also serve to reduce the demand for these products and hence the prices received by farmers.

6.06 Table 23 shows that export duties and government profits on the export of rice, cotton and cotton yarn have been greater than total government subsidies to farmers for all purposes. The surplus of these commodity tax receipts over subsidies reached a peak in 1974, when international market prices were at record levels. For most agricultural commodities other than rice and cotton, however, there has been a heavy "hidden" tax that has not generated revenues for the government budget but rather has been directly to the purchasers of these products in the form of lower prices. For most commodities that "tax" has been imposed by a ban on exporting. Table 27 shows

1/ Since they are direct taxes, they have no effect on the profit-maximizing levels of either specific crop or total farm production. Their effect on overall costs and price levels is also small because these taxes are very modest (178 million rupees in 1975, and declining thereafter in constant prices).

2/ To the extent that any tax or subsidy effect prices, it influences both quantities of goods produced (supplied) and purchased (demanded), and hence incomes and income distribution among both consumers and producers. The largest impacts, however, are on those individuals who pay the taxes or receive the subsidies.
Table 24: AGRICULTURAL PRODUCER COMMODITY TAXES AND SUBSIDIES
(millions of rupees)

<table>
<thead>
<tr>
<th>Fiscal Year (Ending June 30)</th>
<th>Taxes on Exports</th>
<th>Farm Subsidies</th>
<th>Producer Commodity Taxes Minus Subsidies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Profits of Rice Export Plants</td>
<td>Subtotal, Export Duties</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>1970</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1971</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1972</td>
<td>-</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td>1973</td>
<td>128</td>
<td>229</td>
<td>442</td>
</tr>
<tr>
<td>1974</td>
<td>464</td>
<td>652</td>
<td>179</td>
</tr>
<tr>
<td>1975</td>
<td>333</td>
<td>30</td>
<td>535</td>
</tr>
<tr>
<td>1976</td>
<td>241</td>
<td>-</td>
<td>591</td>
</tr>
</tbody>
</table>

Source: Ministry of Finance, Planning and Economic Affairs

1/ As explained in text, prior to devaluation in May 1972, there was no explicit tax on exports, but the consequence of the multiple exchange rate priorities and export restrictions was to "tax" farms by lowering domestic market prices for these and other agricultural products.
that for wheat, the loss to farmers from receiving less than world market prices (negative price protection) for their wheat during 1974 and 1975 was more than ten times as great as the subsidies received from the government.

6.07 Prior to devaluation of the Pakistan rupee and elimination of multiple exchange rate practices in May 1972, agricultural exports did not pay an explicit tax to the government, but actually paid an even heavier tax (roughly 100 percent of domestic prices) through discriminatory treatment under Pakistan's multiple exchange rate "bonus" system. Agricultural exports (primarily cotton and rice) received the lowest exchange rates, and exports of most foodstuffs other than rice were banned in order to hold down domestic prices. As shown in Table 27, at a realistic shadow exchange rate, domestic prices of wheat (which was not exported) were lower relative to world market prices prior to devaluation rather than immediately thereafter. The same was true for cotton and rice.

6.08 The effect of these pre-devaluation exchange rates and post-devaluation export taxes has been to hold down domestic prices of foodstuffs and agricultural raw materials such as cotton, and to transfer income from farmers to consumers and manufacturers. Farm subsidies have consistently been less than the tax imposed on farmers by multiple exchange rate practices prior to May 1972, and by export taxes thereafter. The combined effects of rising subsidies on fertilizer and falling export taxes (as world market prices fell in 1975 and 1976), however, have reduced the degree of taxation relative to subsidy. This does not mean that subsidies and export taxes tended to be offsetting for individual farmers, however, since most subsidy payments (and subsidized credits) go to the largest farmers, while the effect of lower prices is felt by all farmers who sell any part of their output. The traditional farmer not only does not benefit from subsidies on improved technology, but also indirectly pays taxes out of which the subsidies are funded.

6.09 Data on government expenditures on agriculture are also revealing as to priorities. In the estimated provincial and central government budgets for 1974/75, 1/ summarized in Table 24, subsidies to consumers for wheat sold through ration shops accounted for 38 percent of all financial resources allocated to "agriculture." The crucial service sectors of extension, research, agricultural education and statistics accounted for less than 6 percent of the agricultural and water non-development budget expenses, and only 0.3 percent of all nondevelopment expenditures. Extension, research, education, and statistics fared even less well in the development budget, accounting for less than 3 percent of total agricultural and water development expenditures, while fertilizer, pesticide and seed subsidies accounted for 23 percent. When the Rs. 62 million of non-developmental expenditures on extension, research, agricultural education and statistics are added to the Rs. 72 million of development budget outlays under the same headings, the total amounts to only 0.5 percent of the total budget. 2/

1/ The only year for which data for provincial as well as central government budgets could be obtained.

2/ Consolidated central and provincial government budgets.
Table 24: ALLOCATION OF RESOURCES TO AGRICULTURE AND WATER DEVELOPMENT, NON-DEVELOPMENTAL REVENUE EXPENDITURE AND ANNUAL DEVELOPMENT PROGRAM, 1974/75 ESTIMATED BUDGETS, ALL PAKISTAN

<table>
<thead>
<tr>
<th>Item</th>
<th>Non-Developmental Budget</th>
<th>As a % of Total Non-Development</th>
<th>Annual Development Program</th>
<th>As a % of Total ADP</th>
<th>Total Non-Developmental and Developmental Budget</th>
<th>As a % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGRICULTURE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Subsidies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizer, Pesticides and Seeds</td>
<td>-</td>
<td>-</td>
<td>588</td>
<td>23.1</td>
<td>588</td>
<td>16.1</td>
</tr>
<tr>
<td>Mechanization-agricultural engineering</td>
<td>49</td>
<td>4.4</td>
<td>35</td>
<td>1.4</td>
<td>84</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Agriculture Services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>40</td>
<td>3.6</td>
<td>6</td>
<td>0.2</td>
<td>46</td>
<td>1.3</td>
</tr>
<tr>
<td>Research</td>
<td>19</td>
<td>1.7</td>
<td>52</td>
<td>2.0</td>
<td>71</td>
<td>1.9</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
<td>0.3</td>
<td>13</td>
<td>0.5</td>
<td>16</td>
<td>0.4</td>
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<tr>
<td>Statistics</td>
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<td>-</td>
<td>1</td>
<td>neg</td>
<td>1</td>
<td>neg</td>
</tr>
<tr>
<td>Marketing</td>
<td>2</td>
<td>0.2</td>
<td>2</td>
<td>0.1</td>
<td>4</td>
<td>0.1</td>
</tr>
<tr>
<td>IRDP</td>
<td>-</td>
<td>-</td>
<td>49</td>
<td>1.9</td>
<td>49</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Sub-Total--Agriculture Services</strong></td>
<td>64</td>
<td>5.8</td>
<td>123</td>
<td>4.8</td>
<td>187</td>
<td>5.1</td>
</tr>
<tr>
<td>Other Agriculture Program</td>
<td>13</td>
<td>1.2</td>
<td>224</td>
<td>8.8</td>
<td>237</td>
<td>6.5</td>
</tr>
<tr>
<td>Administration</td>
<td>31</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>31</td>
<td>0.9</td>
</tr>
<tr>
<td>Wheat Ration Subsidies</td>
<td>689</td>
<td>61.9</td>
<td>-</td>
<td>-</td>
<td>689</td>
<td>18.8</td>
</tr>
<tr>
<td><strong>Sub-Total--Agriculture</strong></td>
<td>846</td>
<td>75.9</td>
<td>970</td>
<td>38.1</td>
<td>1,816</td>
<td>49.6</td>
</tr>
<tr>
<td><strong>WATER DEVELOPMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAPDA</td>
<td>-</td>
<td>-</td>
<td>486</td>
<td>19.1</td>
<td>486</td>
<td>13.3</td>
</tr>
<tr>
<td>Irrigation</td>
<td>268</td>
<td>24.1</td>
<td>406</td>
<td>16.0</td>
<td>674</td>
<td>18.4</td>
</tr>
<tr>
<td>Indus Basin--Tarbela</td>
<td>-</td>
<td>-</td>
<td>682</td>
<td>26.8</td>
<td>682</td>
<td>18.6</td>
</tr>
<tr>
<td><strong>Sub-Total--Water</strong></td>
<td>268</td>
<td>24.1</td>
<td>1,574</td>
<td>61.9</td>
<td>1,842</td>
<td>50.4</td>
</tr>
<tr>
<td><strong>TOTAL--Agriculture and Water</strong></td>
<td>1,114</td>
<td>100.0</td>
<td>2,544</td>
<td>100.0</td>
<td>3,658</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Footnotes can be found on the following page.
FOOTNOTES - Table 24

1/ Table should be used to assess rough orders of magnitude only. Certain items are unavoidably omitted or defy unambiguous classification. Figures are ex ante estimated budget amounts and can vary considerably from amounts actually expended. Non-developmental revenue expenditures are more elusive than ADP expenditures.

2/ Provincial non-developmental allocations to veterinary services, fisheries and forestry are excluded to the extent they do not appear in agriculture's classification.

3/ Excludes interest payments on irrigation works, which must be substantial. Total interest payments budgeted for 1974/75 are 1,740 million rupees.
Consumer Taxes and Subsidies

6.10 The consuming public has also been directly affected by a number of government taxes and subsidies. Table 25 adds up the major excise taxes on farm products other than tobacco (i.e., on vegetable products (ghee), sugar and cotton), and compares them with the budget subsidies to consumers on edible oils and wheat, the latter released through the ration shops. Most significant are the massive subsidies on imported wheat during 1973/74 and 1974/75, as the government fought to isolate the domestic market from the world scarcities that prevailed at that time.

6.11 During the post-devaluation period, when the question of an over-valued domestic currency does not enter the picture, taxes on vegetable ghee, sugar and cotton products were not sufficient to cover the deficit resulting from consumer wheat and edible oil subsidies. Since refined sugar and ghee are primarily consumed by the urban middle class, and since the subsidies on wheat are implemented largely through government ration shops, it is possible to conclude that some measure of income redistribution has been involved in the government’s approach to the consuming sector.

6.12 What information do the budget data in Tables 23 through 25 and the wheat price and subsidy data in Tables 26 through 29, indicate about government priorities? Clearly the subsidies have gone mainly to consumers, and been paid for mostly by farmers through excise taxes and lower than free-market prices. Taxes on rice and cotton exports alone have been substantially greater than total farm subsidies (excluding subsidized credit) since the May 1972 devaluation. In addition, these taxes, export restriction and other measures have extracted an even larger "tax" from farmers in the form of lower than free market prices for farm commodities consumed within Pakistan. Table 27 indicates that less than free market prices (negative price protection) for wheat, for example, reduced farm income from marketed wheat by more than ten times the amount of government subsidies that might reasonably be attributed to the benefits of wheat production in the decade prior to 1976, as the domestic price of wheat fluctuated between 55 percent and 80 percent of its c.i.f. import price. 1/ Rice and cotton prices on domestic markets were comparably depressed relative to their f.o.b. export prices. 2/ As world market commodity prices rose in the period 1972-76, duties on rice and cotton exports were raised by amounts roughly comparable to the increases in consumer subsidies. Table 24 shows that slightly more was budgeted for consumer subsidies on wheat (Rs 689 million) in fiscal year 1975 than for all farm input subsidies other than for irrigation (Rs 672 million). The consumer subsidy was budgeted at nearly six times as great as both current and capital expenditures on agricultural extension and research.

---

1/ Free market price here defined as the price that would have prevailed without export or import restrictions.

2/ Exclusive of domestic handling and transportation charges, domestic procurement prices for coarse rice (e.g., FRRI-8), fell to 25 percent of world market prices in 1974, then recovered to 73 percent in 1976. Corresponding figures for basmati rice were 28 percent and 62 percent, and for cotton lint 48 percent and 38 percent.
<table>
<thead>
<tr>
<th>Fiscal Year (Ending June 30)</th>
<th>Domestic Excises</th>
<th>Consumer Subsidies</th>
<th>Net Consumer Excise Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sugar</td>
<td>Cotton Yarn &amp; Fabrics</td>
<td>Vegetable Products (Ghee)</td>
</tr>
<tr>
<td>1970</td>
<td>127</td>
<td>327</td>
<td>94</td>
</tr>
<tr>
<td>1971</td>
<td>99</td>
<td>309</td>
<td>87</td>
</tr>
<tr>
<td>1972</td>
<td>102</td>
<td>271</td>
<td>110</td>
</tr>
<tr>
<td>1973</td>
<td>120</td>
<td>234</td>
<td>125</td>
</tr>
<tr>
<td>1974</td>
<td>310</td>
<td>354</td>
<td>199</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>360</td>
<td>223</td>
<td>243</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>670</td>
<td>136</td>
<td>587</td>
</tr>
</tbody>
</table>

Source: Ministry of Finance, Planning and Economic Affairs
Table 26: Wheat Prices and Production

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Procurement Price (Rs./md)</th>
<th>Wheat Equivalent of Flour Price (Rs./md)</th>
<th>Harvest time (April-June)</th>
<th>Domestic Procurement (000 tons)</th>
<th>Wheat Imports (000 tons)</th>
<th>Wheat Acreage (million acres)</th>
<th>Wheat Production (million ton)</th>
<th>Yield per Acre (maunds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964/65</td>
<td>13.5</td>
<td>15.9</td>
<td>16.3</td>
<td>15.9</td>
<td>0.5</td>
<td>1,492</td>
<td>13.14</td>
<td>4.52</td>
</tr>
<tr>
<td>1965/66</td>
<td>13.5</td>
<td>15.9</td>
<td>15.7</td>
<td>16.2</td>
<td>21.0</td>
<td>744</td>
<td>12.74</td>
<td>3.85</td>
</tr>
<tr>
<td>1967</td>
<td>13.5</td>
<td>17.25</td>
<td>23.8</td>
<td>24.8</td>
<td>9.0</td>
<td>1,146</td>
<td>13.21</td>
<td>4.27</td>
</tr>
<tr>
<td>1968</td>
<td>17.0</td>
<td>17.25</td>
<td>16.1</td>
<td>19.3</td>
<td>18.1</td>
<td>781</td>
<td>14.78</td>
<td>6.32</td>
</tr>
<tr>
<td>1969</td>
<td>17.0</td>
<td>18.60</td>
<td>16.6</td>
<td>17.0</td>
<td>15.7</td>
<td>992</td>
<td>15.22</td>
<td>6.31</td>
</tr>
<tr>
<td>1970</td>
<td>17.0</td>
<td>17.00</td>
<td>17.9</td>
<td>17.6</td>
<td>18.0</td>
<td>1,001</td>
<td>15.39</td>
<td>7.18</td>
</tr>
<tr>
<td>1971</td>
<td>17.0</td>
<td>17.00</td>
<td>17.1</td>
<td>18.0</td>
<td>19.1</td>
<td>828</td>
<td>14.77</td>
<td>6.37</td>
</tr>
<tr>
<td>1972</td>
<td>17.0</td>
<td>17.00</td>
<td>20.8</td>
<td>20.5</td>
<td>21.3</td>
<td>205</td>
<td>14.32</td>
<td>6.78</td>
</tr>
<tr>
<td>1973</td>
<td>22.5</td>
<td>17.00</td>
<td>21.6</td>
<td>21.5</td>
<td>21.8</td>
<td>1,321</td>
<td>14.75</td>
<td>7.32</td>
</tr>
<tr>
<td>1974</td>
<td>23.5</td>
<td>21.5</td>
<td>26.8</td>
<td>27.5</td>
<td>30.9</td>
<td>1,234</td>
<td>15.10</td>
<td>7.51</td>
</tr>
<tr>
<td>1975</td>
<td>37.0</td>
<td>32.00</td>
<td>34.8</td>
<td>42.2</td>
<td>47.2</td>
<td>1,217</td>
<td>14.36</td>
<td>7.55</td>
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<tr>
<td>1976</td>
<td>37.0</td>
<td>32.00</td>
<td>36.6</td>
<td>37.4</td>
<td>36.2</td>
<td>2,340</td>
<td>15.10</td>
<td>8.50</td>
</tr>
<tr>
<td>1977</td>
<td>37.0</td>
<td>32.00</td>
<td>36.6</td>
<td>37.4</td>
<td>36.2</td>
<td>2,340</td>
<td>15.10</td>
<td>8.50</td>
</tr>
</tbody>
</table>

1/Data have been recorded according to the fiscal year of the relevant April-June harvest period. Thus domestic procurement data for FY 70, e.g., relate to the procurement period for the crop harvested from April 1970, the government practice is to report this as procurement for FY 71 rather than 1970, since procurement begun in one fiscal year does not usually end until well after the July 1 start of the following fiscal year. See also footnote b.

2/This is the price at which wheat is provided to the mills for grinding into flour (atta) for distribution to government-controlled ration shops. The actual ration shop price of atta was controlled at Rs. 18.37/maund when wheat was provided to the mills at Rs. 17.0/maund. Now that the price of ration-shops wheat to the mills is Rs. 32.0, the resulting atta is sold at Rs. 34.8/maund in the Punjab and Rs. 35.0 in Sind. The margins to the intermediaries are actually larger than this since the ration shop owner gets to keep the empty 2-maund size bags, which can be resold at about Rs. 4.5 apiece.

a/The price of Rs. 17/maund was initially announced in September 1972, but this was revised first to Rs. 20/maund and then on March 30, 1973, to Rs. 22.5/maund.
Table 26  Footnotes (continued)

b/The issue price was revised to Rs. 21.5/maund of wheat in August 1973 following the higher procurement price adopted in March 1973.

c/Announced April 8, 1975. The flour (atta) price at ration shops was at Rs. 34.8 in the Punjab and Rs. 35.0 in Sind, giving margin of Rs. 2.8 and Rs. 3.0/maund for milling and distribution changes, plus the value of the bags to the ration shop dealer.

d/Raised to Rs. 16/maund in January 1966 and to Rs. 17.25 in June.

e/Raised to Rs. 18.6/maund in June 1968.

f/Lowered to Rs. 17/maund in December 1968 and to Rs. 15 in May 1969.

g/Raised from Rs. 15/maund to Rs. 17 in October 1969.
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketed Domestic Production Value (million Rs)</td>
<td>559</td>
<td>1,152</td>
<td>1,267</td>
<td>1,493</td>
<td>1,844</td>
<td>2,778</td>
<td>2,986&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Govt. Procurement</td>
<td>7.7</td>
<td>463</td>
<td>95</td>
<td>809</td>
<td>857</td>
<td>1,226</td>
<td>2,357</td>
</tr>
<tr>
<td>Wholesale Market Sales</td>
<td>551</td>
<td>689</td>
<td>1,172</td>
<td>684</td>
<td>987</td>
<td>1,552</td>
<td>629</td>
</tr>
<tr>
<td>Policy Transfers to Producers (million Rs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketed Production at World Market Prices</td>
<td>907</td>
<td>1,862</td>
<td>1,596</td>
<td>1,940</td>
<td>3,339</td>
<td>4,866</td>
<td>4,526</td>
</tr>
<tr>
<td>Price Protection</td>
<td>-348</td>
<td>-710</td>
<td>-329</td>
<td>-447</td>
<td>-1,495</td>
<td>-2,088</td>
<td>-1,540</td>
</tr>
<tr>
<td>Direct Subsidies</td>
<td>38</td>
<td>59</td>
<td>40</td>
<td>104</td>
<td>139</td>
<td>163</td>
<td>303</td>
</tr>
<tr>
<td>Total Producer Subsidy</td>
<td>-310</td>
<td>-651</td>
<td>-289</td>
<td>-343</td>
<td>-1,356</td>
<td>-1,925</td>
<td>-1,237</td>
</tr>
<tr>
<td>Proportional Subsidy (%)</td>
<td>-55</td>
<td>-57</td>
<td>-23</td>
<td>-23</td>
<td>-74</td>
<td>-69</td>
<td>-41</td>
</tr>
<tr>
<td>Domestic Price as % of World Market Price</td>
<td>62</td>
<td>62</td>
<td>79</td>
<td>77</td>
<td>55</td>
<td>57</td>
<td>66</td>
</tr>
</tbody>
</table>

1/ Marketed production estimated as 34% of total production, on basis of 1960 Pakistan Census of Agriculture.

2/ Estimated marketed production values at average wholesale market prices in Lyallpur, April through June.

3/ Difference between value of marketed production on basis of government procurement and Lyallpur wholesale market prices and value at average import price paid. Import prices in dollars have been converted to rupees at Rs 9.9 per dollar, a shadow exchange rate that may moderately under-value the rupee for years prior to February 1973, when it became the official exchange rate.

4/ Data on budget subsidies as supplied by the Ministry of Finance, Planning and Economic Affairs. The direct subsidy to wheat growers is estimated as one-half the total subsidy on fertilizer. The monthly pattern of fertilizer purchases suggested that only about 40% is applied to the wheat crop, but the additional amount is a rough allowance for other subsidies received for wheat crop. See Table VI.1 for breakdown of budget subsidies to farmers.

5/ Subsidy calculated as a percent of the value at domestic prices of marketed wheat.

e = estimate
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Consumption at Domestic Prices(^1) (Rs million)</td>
<td>832</td>
<td>1,257</td>
<td>1,587</td>
<td>2,313</td>
<td>2,664</td>
<td>3,950</td>
<td>4,161</td>
</tr>
<tr>
<td>Government Procured, Including Imports(^2)</td>
<td>281</td>
<td>568</td>
<td>414</td>
<td>1,629</td>
<td>1,677</td>
<td>2,398</td>
<td>3,332</td>
</tr>
<tr>
<td>Wholesale Market Purchases</td>
<td>551</td>
<td>689</td>
<td>1,173</td>
<td>684</td>
<td>987</td>
<td>1,552</td>
<td>629</td>
</tr>
<tr>
<td>Value of Consumption at World Market Prices (Rs million)</td>
<td>1,421</td>
<td>2,035</td>
<td>2,073</td>
<td>2,982</td>
<td>4,885</td>
<td>7,072</td>
<td>6,311</td>
</tr>
<tr>
<td>Policy Transfers to Consumers(^3)</td>
<td>651</td>
<td>895</td>
<td>583</td>
<td>1,053</td>
<td>2,750</td>
<td>3,780</td>
<td>3,280</td>
</tr>
<tr>
<td>Price Protection(^4)</td>
<td>348</td>
<td>710</td>
<td>328</td>
<td>446</td>
<td>1,495</td>
<td>2,089</td>
<td>1,540</td>
</tr>
<tr>
<td>Direct Subsidies(^5)</td>
<td>303</td>
<td>185</td>
<td>255</td>
<td>607</td>
<td>1,255</td>
<td>1,691</td>
<td>1,740</td>
</tr>
<tr>
<td>Proportional Subsidy (%) (^6)</td>
<td>78</td>
<td>71</td>
<td>37</td>
<td>46</td>
<td>103</td>
<td>96</td>
<td>79</td>
</tr>
</tbody>
</table>

\(^1\) Consumption exceeds value of marketed production in preceding table by the value of sales of imported wheat at domestic prices. Since end of year stock data not available, these figures reflect production and imports in each year rather than actual consumption.

\(^2\) Domestic wheat purchased by the government and imported wheat are both valued at the government procurement price, since the two are intermingled and sold at the same price. Thus, subsequent milling and marketing margins are the same.

\(^3\) Calculated as sum of difference between domestic and world prices of privately marketed and government procured domestic grain plus budget subsidies to wheat consumers, calculated on basis of difference between government purchase and sale prices plus handling, storage and related costs borne by government.

\(^4\) Difference between value received by farmers and world market value of marketed domestic grain, including that procured by government.

\(^5\) This estimate of government budget cost of consumer subsidies is based on the difference between the pre-milled equivalent of the price at which the government sells flour to the ration shops and the price at which the government buys the wheat, i.e. the c.i.f. value of imported wheat and the procurement price of domestic wheat. To the extent that the wheat is imported under grants, or loans, the actual budgeted expenditures in these years is correspondingly reduced.

\(^6\) Subsidy calculated as the policy transfer to consumers as a percent of the value of consumption at domestic prices.
### Table 29: SUBSIDY TRANSFERS BETWEEN SECTORS
(million rupees)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Producer Subsidy Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from consumers</td>
<td>-310</td>
<td>-651</td>
<td>-289</td>
<td>-343</td>
<td>-1,356</td>
<td>-1,925</td>
<td>-1,237</td>
</tr>
<tr>
<td>from government</td>
<td>38</td>
<td>59</td>
<td>40</td>
<td>104</td>
<td>139</td>
<td>163</td>
<td>303</td>
</tr>
<tr>
<td><strong>Consumer Subsidy Value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from producers</td>
<td>651</td>
<td>895</td>
<td>583</td>
<td>1,053</td>
<td>2,750</td>
<td>3,779</td>
<td>3,280</td>
</tr>
<tr>
<td>from government</td>
<td>348</td>
<td>710</td>
<td>328</td>
<td>446</td>
<td>1,495</td>
<td>2,088</td>
<td>1,540</td>
</tr>
<tr>
<td><strong>Government Budget Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to producers</td>
<td>341</td>
<td>244</td>
<td>295</td>
<td>711</td>
<td>1,394</td>
<td>1,854</td>
<td>2,043</td>
</tr>
<tr>
<td>to consumers</td>
<td>303</td>
<td>185</td>
<td>255</td>
<td>607</td>
<td>1,255</td>
<td>1,691</td>
<td>1,740</td>
</tr>
</tbody>
</table>
6.13 As noted earlier, however, these data do not necessarily show the full effect of such taxes or subsidies, or their intended purpose. These data do support conclusions that the government has been primarily concerned with stabilizing (or moderating increases in) the prices paid by consumers and manufacturers for food and raw materials, however, and has systematically held prices received by farmers to far less than world market prices. These data are also consistent with the view that prices of food and raw materials (of which cotton is by far the most important) were held down to improve the competitive strength of Pakistan industry, through low wages and material costs.

6.14 The fact that government subsidies benefit mostly the wealthier and more "progressive" farmers, who get most of the subsidized institutional credit for agriculture and who buy most of the subsidized fertilizer, tube-wells and farm machinery, can be defended as making a major contribution to output. While as much or more output might be obtained by providing the same inputs to other farmers, it would require major institutional (and probably social and political) changes in order to get the same amount of inputs to the smaller farmers. From the political viewpoint, these subsidies go to those farmers who are best able to make their voices heard, and thus serve to reduce the indications of complaints from the farm community and farm organizations about inadequate production incentives.

6.15 Although these conclusions about subsidies and taxes do not provide a sufficient basis to either justify or condemn government policies, they do point out certain facts and consequences. Any judgements would need to be made in the total context of all economic, social and political consequences. Prior to 1972, the evidence seems clear that domestic terms of trade were strongly distorted in favor of manufacturing and against agriculture, to a degree that almost certainly slowed both agricultural and total economic growth. The action to moderate increases in agricultural prices between 1972 and 1976, however, can be defended as desirable on economic and welfare grounds to protect consumers against excessively rapid increases in food prices that in turn would have triggered irresistible demands for more rapid wage increases, increased the rate of inflation, and increased malnutrition among those of the poor whose real incomes declined due to inflation.

6.16 Previous paragraphs have examined the producer-consumer conflict in the aggregate. Policy, however, is usually implemented at the commodity level. Consequently, three commodities that have been the subject of the most wide-ranging government interventions are examined for further clarification of the revealed objectives of those responsible for decisions on agricultural prices and subsidies.

6.17 The wheat industry: Historically, a number of changes have occurred in the broad outlines of the government's policy. As Table 26 shows, until 1968, ration shops were stocked almost entirely with imported wheat, provided largely under the United States' P. L. 480 program. When the Green Revolution produced a 50 percent increase in wheat production in 1968, the government undertook its first significant procurement of the decade from domestic farmers in order to help support prices received by farmers. The government's procurement price was also raised substantially to bring it closer to free
market prices and to make it an effective support price for farmers. In 1969 and 1970, the government almost stopped importing and met its ration shop requirements through purchasing grain from domestic farmers. When procurement prices were raised sharply in 1968, prices to consumers at ration shops were not; the government began to incur significant deficits on the procurement and handling of wheat.

6.18 During the period 1973-1976 the government continued to import at least 1.1 million tons yearly, while procuring even larger amounts from domestic farmers. A record crop in 1976 resulted in a doubling of domestic procurement. The record 1976 crop also lowered free market prices within the country to approximately the government procurement price. The ration shop price of wheat remained at the level established in April 1975, however, and the government continued to have a negative spread between the prices at which it bought and sold wheat. The immediate beneficiaries of "negative price protection" received by wheat growers and "price protection" received by consumers were clearly the purchasers of wheat. The largest part of the wheat subsidy to consumers in every year prior to 1976 came from being able to buy wheat from domestic farmers at less than world market prices. While wheat growers received fertilizer and other subsidies from the government, these amounted to only a small part (8 percent to 20 percent) of their income loss from having to sell their wheat at less than world market prices.

6.19 Table 27 through 29 show the combined effects of both budgeted taxes and subsidies and of price distortions on the incomes and expenditures of farmers and consumers. 1/

6.20 While it is not possible to divide the benefit of subsidies between different groups of consumers, the location of ration shops suggests that most of the benefit went to urban areas. Low urban grain and other food prices also helped to keep down wage levels in both manufacturing and urban service occupations, and thus employers and wage earners jointly shared the benefits of low grain prices. While small farmers and landless agricultural laborers purchased some wheat, much of their requirements have come either from their own production or from wages received in kind from the larger farmers, and most of the balance from local markets. An unpublished survey of the disposition of the wheat crop harvested in the spring of 1975 estimated, for example, that 23 percent of all wheat grown was given in payment for services. On farms of 50 acres or more, 35 percent of the wheat crop went for payment in kind, primarily to harvest and other hired labor. While there is reportedly some tendency to replace wages in kind with money payments, most agricultural workers (including small farmers and members of their families who work on larger farms at times of peak labor demand) continue to receive their wages in grain, and thus have not been greatly affected by rising wheat prices. 2/ Rupees wage rates in rural areas have also risen as fast or faster than urban wages in the decade of the 1970s. Thus those

1/ On the simplifying assumption that quantities bought and sold do not change as a result of the taxes, subsidies and price distortions.

2/ There have been some adjustments in the in-kind payments made for casual labor. Permanent hired labor, however, has continued to receive approximately the same wages.
landless laborers who are paid in cash have probably about kept up with their urban counterparts in real wages as wheat prices have risen, although in some years (e.g., FY 1974 and FY 1975) the price of wheat in rural wholesale markets rose faster than in the primarily urban ration shops. 1/

6.21 The Cotton Industry. As previously indicated, agricultural price policy typically revolves around specific commodities and their associated constituencies. Cotton prices, for example, are of concern not only to cotton producers, but to the domestic textile industry. In Pakistan, the industry is the single largest industrial employer in the country with factories located in medium and large towns scattered throughout the country. Thousands of workers are dependent on the production of yarn and cloth for their livelihood. Moreover, the ownership of the industry is in the hands of many of Pakistan's most politically powerful families.

6.22 Unfortunately, the textile industry as measured against competitors in Hong Kong and Taiwan is generally not very competitive. Indeed, several studies done in an earlier period suggested that some segments in the industry were actually producing negative value-added when outputs and inputs were valued at international prices. It is estimated that the domestic prices of raw materials will have to be on the order of 15 percent below international prices if some of these firms are to remain in business, and this influences government policies with respect to cotton. 2/

6.23 The sugar industry: More has been written on the sugar industry in Pakistan and on the inefficient use of domestic resources to produce cane than on any other commodity issue. Reference to the NPCs shown in Figure 9 and to the calculation of the DRCs under traditional technology provides an explanation of this particular concern. Prior to 1970, nominal protection coefficients (using the official exchange rate) associated with sugarcane varied between 2 and 4. It was far and away the most heavily protected crop. In addition, it is a heavy user of water. In a period when the scarcity value of water was determined by limited canal flows, value-added at world prices per unit of water was considerably less than that obtained from competing crops such as rice and cotton. This result held even when no provision was made from cropping rotations that had a similar intensity, e.g., wheat-rice.

1/ The government also sells wheat at ration shop prices through "agents" in rural areas who receive grain supplies via the government at times of high prices. Typically they are open one week or a few days throughout the month, rather than daily. Per capita rations in rural areas are also lower than in urban areas.

2/ Some observers would argue that the protests of the cotton mill owners conceal reasonably efficient operators who are intent on increasing their profit margins. Given the range of technology and management currently employed in the industry, there is undoubtedly some merit to the point.
But sugar is a highly political commodity in Pakistan. The local diet includes a substantial amount of sweets. Indeed, per capita sugar consumption is among the highest in the world. As a result, the government pursued a policy of inefficient import substitution against the possibility of sugar shortages. Because the local industry was operating behind a substantial tariff on refined sugar, obtaining a license to construct a sugar mill was a lucrative plum. Once the mill had been established, of course, the pressure to produce the cane necessary for its operation contained a certain plausibility, and cane prices were set at levels that compensated for the intrinsically low yields and low recovery rates that typify Pakistan's sugar-cane industry.

Constituency Equilibrium

It is clear that the various groups mentioned in the foregoing paragraphs have strong conflicting interests. When farmers get more for their commodities, purchasers, whether it be the government or the public, get less for a given outlay. From a social point of view, it is precisely this short-run conflict that policymakers find themselves struggling to overcome. The danger is that the failure to insure appropriate incentives for investment will limit long-term productivity gains that would otherwise have been the basis for stable or declining real consumer prices.

Previous observations on the terms-of-trade and recent changes in commodity benefit/cost ratios all point to a significant reassessment of producer-consumer relationships beginning—roughly—in 1972/73. Movement in the direction of creating a more profitable agriculture was by no means unequivocal. The increase in prices for intermediate and investment goods more than kept pace with the increase in commodity prices. But the upward trend has continued with further increases in the prices of cotton and rice scheduled for 1976/77. Given that the costs of inputs to farmers have not increased substantially (fertilizer has actually declined), the benefit-cost ratios of such important contributors to growth as fertilizer have recently been improving. This bodes well for the possibility that the stagnant yields of wheat and rice that have hampered output growth in recent years will now make a positive contribution.

In terms of constituencies, the sick sector at the moment is obviously cotton. In 1976 and 1977 the mills have actually had to import cotton from abroad in order to keep spindles and looms operating. The increase in producer prices from Rs. 85 to Rs. 125 will surely have a positive effect on output. Whether it will be sufficient remains to be seen. 1/ In many of the cotton growing areas, the DRC ratios suggest that cotton currently has a comparative advantage over coarse rice. This is due in substantial measure to the softening of world rice prices, and may be a relatively temporary phenomenon. The EPC ratio is currently approximately the same as that of coarse rice and sugarcane, its chief competitors, but the DRC ratio clearly favors cotton over coarse rice and maize. Consequently, somewhat higher cotton prices would be consistent with comparative advantage. (In the basmati growing Central Punjab, basmati rice still produces the highest net social profits of any crop, but this area is confined to a rather limited part of
profits of any crop, but this area is confined to a rather limited part of the North Central Punjab where cotton yields are relatively low.) As long as world cotton prices continue to show strength relative to coarse rice prices, expansion of cotton production would serve the economy and the long-run interests of the cotton industry as well.

6.28 The threat to the cotton industry in the longer run is the failure thus far to develop a systematic program for increasing per acre productivity. Without such increases, it will become exceedingly difficult to supply cheap raw materials to textile manufacturers.

6.29 Increased productivity in cotton can be brought about in two ways, neither of which will be as easy as achieving the "revolution" in the productivity of rice, wheat, and even maize. First, a breakthrough must be achieved in the introduction of improved cotton varieties and improved cultural practices, including the more effective application of pesticides. Genetic materials capable of producing much higher yields exist and are slowly gaining acceptance. Admittedly, there are many unresolved problems surrounding the proliferation of cotton varieties but, until recently, progress was being made in spite of, and not because of, government activity. 2/

6.30 A second requirement, related to the first, is to develop methods of shortening the time that cotton occupies the land. This will involve breeding, improvements in agricultural techniques, and--most probably--additional farm power. For with the availability of additional water supplies in the Sind and the possibility for pumping groundwater in the Punjab, the ability to double crop (e.g., to develop wheat-cotton rotations) hinges on removing the competition of winter and summer crops for land.

6.31 If cotton productivity is not increased, and if the government, for budgetary reasons, continues to emphasize the production of rice, cotton will be hard pressed to maintain its domestic comparative advantage in all but the

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1/ Richard Goldman’s recent paper dissecting the cotton situation notes that, in 1974 and 1975, the relative profitability of cotton was low as a result of low relative prices. In 1976 relative profitability continued to be low, even in the face of improved price relationships, because of low yields. Unfortunately, lack of accurate, commodity-specific estimates of input use make it impossible to test the hypothesis that low yields were, at least in part, a reflection of low prices.

2/ An amusing--and enormously insightful--account of the problems of persuading the agricultural bureaucracy to approve Delta Pine, a U.S. variety, for distribution in Pakistan is contained in a personal memoir by a leading Pakistani cotton farmer, M.L. Kakwani, "Introducing Delta Pine Cotton in Pakistan," no date.
most favorable areas. Even in those areas, it will be difficult for the government to maintain a system of relative prices that would provide the necessary subsidies to insure that the cotton textile industry would continue to be competitive in world markets. 1/

6.32 What about the problem of sugar? World sugar prices have dropped rapidly during 1977. However, they are still well above the lows that produced the high EPC ratios of the mid-1960s. For example, New York contracts in February, 1978, are being sold for approximately ten cents per pound. In constant 1975 dollars, this would be roughly eight cents per pound as compared to the four- to six-cent level that prevailed from 1965 to 1970. Based on the latest quotation, the EPC would appear to be roughly equal to 1.

6.33 One question, of course, is whether further declines in the price of sugar relative to other commodities are to be expected. A second and equally important problem for the whole future of the sugarcane industry in the Punjab is whether double cropping of wheat-rice and wheat-cotton is likely to become commonplace. If so, sugarcane at world prices will undoubtedly be forced out of the rotation unless a breakthrough in yields is achieved. Unfortunately, commercial sugarcane production is closely tied to the presence of sugar mills. A test of the government’s concern for efficiency of domestic resource use could then very well emerge from a combination of (1) lower world sugar prices, and (2) improvements in technology and management that resulted in larger acreages being brought under double cropping. Since both events are rather likely, the controversy over sugar prices—and the location of investment in milling capacity—is sure to be on the agenda for many years to come.

Policymaking and Uncertainty

6.34 A recurrent theme throughout the study has been the high degree of year-to-year variation in the estimates of both incentive coefficients and measures of comparative advantage. This suggests that a simplistic substantive recommendation, e.g., increase cotton prices or decrease maize prices, is likely to be dated by the time it is transmitted to those in charge of making pricing decisions. Indeed, unless there are significant concomitant investments in processing and marketing facilities involved, this will almost surely be the case with studies that require months to complete.

6.35 The foregoing chapters have, however, suggested a number of short-cuts and approximations to the rather extensive calculations that were undertaken in the course of this study. Because they can be done rapidly, they should be of assistance to policymakers in providing them with the substance on which to base a flexible and responsive set of price policies. For example:

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1/ At this point, the reader may well object that this would be no great loss, i.e., that a policy of explicit export subsidies on textiles would be preferable to price distortions of raw materials. Better yet would be no subsidies at all and an economic climate that weeded out the inefficient producers. However, the concept of a "constituency equilibrium" is obviously not based on the results of economic logic alone.
NPCs are a good approximation of EPCs and ESCs. The formulas for the latter show why this is so: Purchased inputs simply do not play that significant a role in Pakistan agriculture at this stage of its development. The conclusion for policy planning is that a simple monitoring of the ratios of relative domestic and world relative prices (the NPC) would provide a sound basis for keeping domestic incentives in line with comparative advantage. (Some additional research is badly needed on processing, marketing, and transportation costs, but that would be relatively simple to do.)

The DRC of the \( i^{th} \) commodity is satisfactorily approximated by the following ratio:

\[
\frac{\frac{p_i b Q_i}{P_i}}{\frac{b Q_i}{P_i}}
\]

where

\( p_i b \) = border price of the \( i^{th} \) commodity

\( Q_i \) = yield of the \( i^{th} \) commodity

\( p_j b \) = border price of the next best alternative \( (j^{th}) \)

\( Q_j \) = yield of the next best alternative \( (j^{th}) \)

This approximation, a purely empirical result, works because (a) purchased inputs are not terribly important and hence do not significantly affect value-added between crops, and (b) capital and labor costs are sufficiently similar between crops so that the value of domestic resources, measured at their opportunity costs, is dominated by the rent accruing to the next best alternative. The latter, by virtue of point (a), is in turn determined by world prices and commodity yields.
Two of the parameters required in the EPC and DRC "shortcut" calculations, i.e., domestic and world prices, are reasonably easy to acquire. A more difficult problem is obtaining enough information to calculate incentives for agricultural investment. Ratios of prices received to prices paid, i.e., \( P_r^d P_t \), are helpful, but some knowledge of the productivity of improved technology is also essential, since it is profitability (and not prices per se) that is relevant. In this regard, the current level of professional resources devoted to monitoring the performance of the rural economy is woefully inadequate.

As a result of the failure to develop an ongoing program of micro-research, policy debates among conflicting interests are characterized by differences in priorities and by a lack of knowledge about technical coefficients. Under these conditions, it is possible for serious imbalances in incentives to arise with relatively little awareness on the part of the government that it has a problem. The complaints of various interest groups are quite properly discounted. But without alternative sources of information, policymakers are reduced to using political considerations to determine outcomes.
Gotsch, Carl.
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