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AGRICULTURAL PRICES IN ECONOMIC DEVELOPMENT

- THEIR ROLE, FUNCTION AND OPERATION

A Final Summary Report on Contract AID/csd 1438

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## I. Introduction

### Objectives and Approach

The objective of this research is to provide understanding of the role, function and operation of agricultural prices in the context of economic development, in order to improve the basis for determining public agricultural price policy. The focus of the research is on agricultural prices because of their important role in public policy affecting agricultural development.

The approach of the study recognizes that agricultural prices influence not only the level and organization of production in the agricultural sector but also the size of resource transfers between agriculture and other sectors and hence relative rates of capital formation and growth in various sectors of the economy. Potentially conflicting influences of the relative level of agricultural prices are recognized throughout the study. This balanced approach provides a basis for an optimal agricultural price policy suited to overall objectives of economic growth and equitable distribution of income.

The research design also recognizes that price policy is only one of several interacting means for achieving the growth and distribution objectives set for the agricultural sector. Therefore, agricultural prices are analyzed in relation to other policies. Background is thereby provided for an optimal choice between price policy and other policies to meet set objectives. With this perspective the use of price policy may be minimized in situations in which it has deleterious effects with respect to other objectives of development.

Within the broad context of analysis set forth above, thirteen detailed studies were undertaken in seven countries to provide depth and detail concerning various aspects of agricultural price functions and operations under various circumstances. Several smaller studies were also made to supplement the larger ones. Thirty-eight papers have been issued reporting the major and minor studies and summarizing conclusions. These reports are the primary output of the project. A list of the reports is appended.

### Organization of the Report

Parts II through V of this report provide integrated summaries and conclusions of the major reports issued. These statements are in essence a guide to those reports for those who would like to see the support for our final conclusions. The basic reports are exceedingly useful for providing understanding of past policy and guides to future policy for the specific countries and circumstances within which they were made. They are also useful in giving general guidelines for other countries and circumstances.

Part II deals with the effect of relative agricultural prices on transfers of resources among sectors of the economy and consequent impact on rates of growth in the nonagricultural sector and on overall growth processes. This section also compares the role, function and operation of agricultural prices in these processes with other devices for achieving the same ends.

Part III deals with the effect of relative agricultural prices on growth of the agricultural sector. It concentrates on the influence of prices on agricultural production within the context of technological change. Particular emphasis is given to the relationship between agricultural price policy and increased use of those inputs such as water and fertilizer which are closely associated with technological change. Attention is also given to processes of diffusion of innovation and the role of prices, relative to other factors in influencing diffusion rates.

Part IV deals with the efficiency of price-making mechanisms. If agricultural prices are to play an effective role with respect to the generation and allocation of resources for economic growth, pricemaking mechanisms must work efficiently. Studies in this section emphasize marketing and the relationship between marketing and price-making processes to provision of time, space and farm utilities.

Part V deals briefly with problems of price stabilization. This is an exceedingly complex area in which exploratory work was initiated through a special addition in the last year of the project.

Part VI is an overall summary of the conclusions concerning the role, function and operation of agricultural price policy. It states the limitations of agricultural price policy in contributing to the development process and provides a set of recommendations for defining an effective agricultural price policy for meeting growth and distribution objectives. Because of the ready availability of the 38 individual reports, including four summary reports, this final report is intended only as a broad overview of the work conducted.

Part VII is a brief summary.

### Countries of Study

Field work for this project was performed in India, Pakistan, Nepal, Thailand, Taiwan and Chile, with a related study carried on in Mexico.

### Development of Research Institutions and Personnel

Training of Americans and of nationals of the countries within which research was performed was an important objective of the contract. Studies were initiated in close association with research institutions, such as

agricultural universities, in the countries within which work was performed. Systems of collaboration and joint publication of results were developed. Significant institutional development occurred in this process. In most cases, sub-projects were under the direction of relatively young research people, with consultation and general guidance from the senior personnel. As a result, a cadre of more than a dozen highly effective and experienced research people has been developed.

## II. Agricultural Prices and Intersectoral Resource Transfers<sup>1/</sup>

### Introduction

Changes in relative agricultural prices shift real incomes and resources among individuals, income groups and sectors of the economy. These shifts in turn affect relative rates of growth in the capital stock, relative incentives to technological change and relative rates of economic growth among various groups and sectors of the economy. By fostering optimal allocation of resources among groups and sectors, agricultural price policy can contribute to accelerated over-all growth. Rational development policy requires that agricultural prices be seen in context as one of several alternative policy means for directing resources so as to achieve particular policy ends.

A rise in agricultural prices relative to those in other sectors of the economy transfers income towards farmers in proportion to their sales of agricultural commodities (Paper 6). In low income societies, where those with small farms sell a relatively small proportion of what they produce, the effect of relatively high agricultural prices is to transfer income disproportionately to the higher income farmers. The income transferred towards agriculture is provided by urban people in proportion to their purchases of agricultural commodities. The relative burden falls according to the proportion of expenditure on agricultural commodities to total expenditures. Thus the burden is heavy on unskilled laborers who spend up to 80 percent of their income on agricultural commodities. That burden may be shifted so as to reduce industrial profits if laborers' money wages are raised in response to the higher cost of living.

A relative rise in agricultural prices reduces the net transfer of resources from agriculture to other sectors of the economy and may thereby reduce the rate of capital formation and growth in other sectors of the economy. It is generally recognized that in the long run the non-agricultural sector must grow considerably more rapidly than the agricultural sector if growing populations are to be productively employed and per capita national income is to have a continuous high rate of growth. Transfer of resources from agriculture through lower relative agricultural prices, or other devices, provides food for a growing urban labor force which can produce capital goods and thereby accelerate later growth. This argument is spelled out more fully in Paper 34 as well as in Papers 6, 11 and 25.

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<sup>1/</sup> The material in this section is summarized in greater detail in Paper 34. Papers to which reference is made are listed at the end of this report.

There is considerable controversy concerning the extent to which net resource transfers from the agricultural sector must play a role in facilitating growth in the nonagricultural sector of the economy. There is a further controversy concerning the timing of any net resource transfers which may occur. It is widely recognized that rapid development of the agricultural sector can play a major role in facilitating overall economic growth. It is also recognized that rapid growth of the agricultural sector requires substantial resources from other sectors of the economy including inorganic fertilizers and much of the resources required for extensive irrigation development.

If agricultural price policy is to make a maximal contribution to over-all rates of growth it must be formulated in the light of a clear set of conclusions regarding the phasing of intersectoral flows of resources and the relative role of prices in the phasing of these resource flows. This research project has dealt with this problem through four major studies covering the three countries of India, Taiwan and Chile. In addition, review of the existing literature on this point was performed with respect to Japan, England and France.

The study of Taiwan (Paper 11) provides a theoretical model for analysis of intersectoral resource flows and a complete social accounting system for measuring the visible and invisible intersectoral resource transfers for Taiwan for the period 1895 to 1960. Taiwan is of particular value for this subject because we have unusually detailed and complete information over a period of time that includes at least one period of relative technological stagnation in agriculture (1895-1920) and at least two periods of highly dynamic technology (1920-1930 and 1950-1960). The rate of technological change in the agriculture of Taiwan in both of these dynamic periods was much more rapid than during comparable periods for Japan. The rate of population growth in the last period was greater than for any period in Japan or for any contemporary low income country. Thus, the Taiwan study provides data for intersectoral resource flows for a major success story in agricultural development.

Similar study was made of India. India is a contemporary low income country, initially attempting development with a technologically stagnant agriculture (1950-1965) and now moving into a period with potential for a technologically dynamic agriculture. Comparison of India with Taiwan provides insight into the effects of sharply variant policies with respect to resource transfers from agriculture.

Because the data available for India were much less detailed than for Taiwan, they required complex extrapolations and the analysis is less well integrated. It was necessary to carry on three substantial studies in order to provide a full picture. One of these studies (Paper 25) is primarily a statistical analysis of the relationship between agricultural production and relative agricultural prices on one hand and the rate of savings and capital formation in various sectors of

the economy on the other hand. These statistical analyses were supplemented by analysis of the cost structure of the industrial sector and of urban consumption, with emphasis on the relative importance of agricultural commodities in these cost structures.

In addition a detailed analysis was made of changes in price relationships for the Indian economy during the period of the first three five-year plans (Papers 3 and 4). This study provided detailed information concerning the extent to which relative agricultural prices changed during this period and the effects of these changes.

The work of this project was greatly facilitated because Dr. Ved Gandhi had completed, just before this work was undertaken, a major study of tax burdens on the agricultural sector of the Indian economy and of transfers among sectors on government account. Thus between our studies and those by Gandhi we were able to put together a general picture of intersectoral resource flows for India and to compare these with the much more detailed analysis which we had done for Taiwan (Paper 34).

A detailed study of income transfers effected by relative price changes was also carried on for Chile (Paper 30). Great difficulty with the data required that we concentrate this study on changing price relationships. The nature of contemporary economic problems in Chile and the structure of the Chilean economy demanded that we emphasize the income distribution aspects of relative price changes. The economy was divided into several sectors defined in socioeconomic terms. Analysis was then made of shifts in relative prices in the economy of Chile and the effects of those shifts on the distribution of income amongst the various socioeconomic groups.

These detailed studies of India, Taiwan and Chile were supplemented with comparative information from other studies of Japan, Britain and France (Papers 33 and 35). This collection of studies is the only comprehensive set of studies of intersectoral resource flows and the role of agricultural prices in those flows. The study of Taiwan marks a major advance in the methodology of analyzing and measuring such flows. The study of Chile makes substantial contributions to the methodology of measuring the effect of relative price changes on relative incomes of various socioeconomic groups.

#### Taiwan

The detailed study of intersectoral resource flows for Taiwan (Paper 11) shows continuous large net transfers of resources from the agricultural sector of Taiwan throughout the period from 1895 to 1960.

The period prior to the mid 1920's was one of rapid expansion of irrigation investment but was otherwise technologically stagnant. Large investment in irrigation was financed from within the agricultural sector

either by direct investment by agriculturalists or by taxation as a source of funds for government investment in irrigation. From 1911 to 1920 the net resource transfer from the agricultural sector was equal to over half the value of agricultural sales and 30 percent of total agricultural production.

For the period 1926-30 to 1936-40, the pace of technological change in Taiwan's agriculture doubled. The real value of the net resource outflow increased by nearly 25 percent from 1911-15 to 1916-20 and remained at about that level throughout the 20's, and then increased by 50 percent in the 1930's and increased by another 27 percent for the period 1950-55. In the technologically dynamic period of the 1920's when, for example, the new ponlai rice varieties were introduced and fertilizer use was increasing rapidly, purchases of nonagricultural commodities by the agricultural sector more than doubled. Nevertheless the net outflow of resources from agriculture maintained a high level throughout this period. Agriculture was able to pay fully for the added inputs it required -- presumably because of the high level of productivity at which they were used.

The net transfer out of agriculture in 1926-30 was equal to nearly 30 percent of sales of agricultural commodities and 1/5 of total agricultural production. The value of net resource transfers expressed as a percent of production and marketings declined from the earlier period. However increased production allowed a larger absolute net transfer along with increased use of industrially produced capital and consumer goods.

By 1950-55 the net real resource transfer from agriculture still represented over 1/3 of the real value of sales and over 1/5 of total agricultural production. Transfers of this magnitude offer potential for adding substantially to over-all savings and investment rates in the economy. In Taiwan these resources have been used to achieve rapid rates of growth of industry and rapid growth in provision of nonfarm jobs. By 1956-60 the extent of the net transfer had begun to decline slightly in real absolute terms and substantially as a percentage of agricultural production and sales. But by then the industrial sector was large enough to maintain rapid growth through self financing.

Just as revealing as the large net transfers from agriculture is the sharply changing role of various transfer mechanisms. In the post World War II period the transfer of resources was achieved primarily by a sharp turn in the terms of trade against the agricultural sector. The most important mechanisms of this change were barter exchange of rice for fertilizer and compulsory purchase programs. Production incentives in agriculture were substantial despite these comparatively unfavorable price relationships, because technological change provided greatly improved physical input-output relationships. High yielding crop varieties provided a value of added yields much greater than the added cost of producing them. In the pre World War II period financial mechanisms and land rent payment provided the means of transfer of resources out of agriculture.

The importance of particular methods and institutions for financing resource flows changed substantially from time to time according to economic and political factors. The method chosen was not necessarily the most efficient by economic criteria alone. For example, the heavy reliance in the post war period on what was in effect a tax on fertilizer presented to farmers one of the most unfavorable fertilizer-rice price ratios in the world. It is important to note in this respect, however, that major expenditures were made in Taiwan to develop new crop varieties which provided high yields at considerably lower cost per unit of output. Thus farmer incentives were not only maintained but increased despite unfavorable price relationships. Paper 11 documents these points in detail.

### India

Recent experience in India lies in sharp contrast to the historical evidence for Taiwan and illustrates some of the special development problems of contemporary low income countries. Paper 25 presents a detailed analysis of the relationship between agricultural production, agricultural prices, and industrial capital formation in India for the period of the first three five-year plans. During this period there were a number of substantial fluctuations in relative agricultural prices. Savings and investment rates in the industrial sector were considerably higher during periods of high agricultural production and low agricultural prices. Conversely, low savings and investment in the industrial sector were associated with high agricultural prices and low agricultural production.

Detailed analysis of the structure of industrial costs showed that high prices of industrial raw material crops such as fibers and oil seeds were as important in putting a squeeze on industrial profits and discouraging savings and investment as were the effects of high food prices on the cost of labor. The analysis of cost structures showed that in the manufacturing sector labor costs and food prices were much less important than in the service sector. Thus the effect of high food prices tends to influence the industrial sector more through its indirect influences through the services sector than through direct influences. This makes the patterns of relationship considerably more complex and makes statistical analysis less precise and less revealing.

Paper 4 provides detailed analysis of changing price relationships in the Indian economy. In this detailed analysis it was found that there was no upward or downward trend in the ratio between agricultural and nonagricultural prices in the period from 1949 to 1965. Within the agricultural sector food grain prices declined relative to industrial raw material crops, vegetables, fruits and livestock products.

The substantial short term fluctuations in relative agricultural prices were due primarily to weather. These carefully documented findings are contrary to the popular belief that emphasis on industrial

development in India had been accompanied by policies which depressed agricultural prices relative to nonagricultural prices. The analysis of trends in relative agricultural prices is developed more fully in Papers 1 and 3. A major compilation of data with respect to Indian agricultural prices and price relationships is presented in Paper 13. Papers 2 and 5 represent applications of the price formulae developed to prediction of relative agricultural prices in India for various future years. Papers 9 and 10 represent further applications to Nepal.

When we combined the information from the various studies which we have done on intersectoral resource flows for India and the studies by Ved Gandhi on tax burdens and government expenditure regarding agriculture we find that during the period of the first three five-year plans (1950-1965) there was a net resource flow into the agricultural sector. This is, of course, in contrast with many of the prevailing criticisms that India's economic policy during the first three plan periods was one of neglect of agriculture. It is particularly striking that both the working of price policy and tax policy left rural people in the upper income classes taxed at much lower rates than people in urban areas with comparable incomes. This is in sharp contrast to Taiwan where the tax burden on agriculturalists in any individual income class was heavier than for nonagriculturalists.

Part of the problem becomes clear from data in Paper 25 in which simple lag correlations of government expenditure on agriculture in India showed little relationship to growth in agricultural output, whereas in Taiwan government expenditures induced large complementary investments by farmers and large increases in output. The effectiveness of expenditure on agricultural development depends very much on the optimality of its allocation and the technical environment within which allocations are made. Both appear to have been unusually favorable in Taiwan and not particularly favorable in India prior to the mid 1960's.

### Other Countries

Papers 33 and 35, which provide brief reviews of available literature and data with respect to Japan, England and France, suggest that the outlines of Taiwan's experience are not unique. It is generally agreed that Japan provided a major portion of the capital for early stages of development by resource transfers from the agricultural sector. The mechanisms of transfer did differ. In Japan direct investment by landlords in the nonagricultural sector was relatively more important than in Taiwan. Also Japan gave major weight to land taxes while Taiwan emphasized taxes on crop output, particularly on sugar cane, and relatively low agricultural prices.

More detailed analysis of the manner in which changes in relative agricultural prices redistribute income and the capacity to save and invest amongst various socioeconomic groupings is given for Chile in

Paper 30 Given the nature of the Chilean economy and the available data it was necessary to develop a methodology of accounts and matrices for analysis and presentation of the data on the impact of relative agricultural price changes. In the period studied, 1959-1967, agricultural workers improved their position relative to other groups. Nonagricultural workers lost position relatively in the first part of the period but then gained very substantially in the second part of the period. The contrasting role of various elements of price policy is discussed and documented in this paper.

### Conclusion

The bulk of the conclusions from the above analysis are summarized in Paper 34. It is shown that both conceptually and in practice it is clearly possible for the agricultural sector to make large net transfers of resources to other sectors of the economy. It is shown that if these resources are used productively the rate of economic growth can be accelerated. The analysis shows further that net resource transfers are technically possible with a technologically stagnant agriculture but that under such circumstances transfers are difficult to achieve without an economically and politically powerful landlord class motivated to invest in the domestic industrial sector, a powerful unitary government or major export crops. It is pointed out that the first two conditions rarely hold in contemporary low income countries. Contemporary low income countries with major export crops are among the few that tax agriculture heavily.

Thus it is shown that a process of rapid technological change in agriculture will normally be necessary to net resource transfers from the agricultural sector. The implications of the tendency for technological change in agriculture to be associated with requirement of large additional investment in fertilizer and water is discussed in detail. This has complex implications to the determination of price policy. Once effective devices have been developed for achieving technological change in agriculture a wide range of devices may be used to facilitate transfers of resources--including taxes of many types, lower relative agricultural prices and direct investment outside of agriculture by wealthy agriculturalists.

If a low income country is to grasp the type of opportunities so well exploited by Japan and Taiwan it must develop the infrastructure of research and related institutions for developing, adapting and applying suitable high yielding crop varieties and then must insure ready availability of a large quantity of complementary inputs such as fertilizer. The ready supply of inputs is crucial to the process as the economic incentive for using the inputs is raised by technological change itself. As will be indicated later in this report the processes of technological change open major opportunities for a positive agricultural price policy at the same time that they set many restraints upon the form which that price policy may take.

### III. Agricultural Prices and Growth in Agricultural Production

#### Introduction

Agricultural price policy can play a useful role in facilitating technological change and increased production. Unfortunately public policy pronouncements tend to exaggerate what price policy alone can do and to understate its complementary relation to other policies for agricultural development.

A technologically stagnant agriculture depending primarily on family supplied inputs and very little upon purchased inputs will at best provide a much smaller percentage increase in aggregate production than any given percentage increase in prices. Aggregate supply response is highly inelastic. Thus the cost of increasing aggregate production through price increases is high in relation to the increase in production.

There is ample evidence that a traditional agriculture may respond to changes in relative prices of agricultural commodities by changes in the proportion of acreage devoted to those commodities. However, the increase in production of one commodity is largely balanced by a decline in production of another commodity as acreage is transferred from one to the other.

There is also ample evidence that in the case of those traditional agricultures which experience extremely large price increases, for example, due to radical improvement in transportation, large increases in agricultural production may be provided. However, large price increases in the agricultural sector will normally be disastrous for the development of other sectors of the economy unless they arise from major changes in costs such as those accompanying major innovations in transportation.

Where a stagnant agriculture is accompanied by a dynamic nonagricultural sector the growth of the nonagricultural sector will increase demand for agricultural commodities and will of course drive up agricultural prices. This will encourage some increase in production but not nearly proportionate to the increased prices. Such price increases are a sign of relative failure in agriculture, not a cause of later success.

Major technological change such as the recently developed high yielding varieties of food grain crops have two influences which are of importance with respect to price response and price policy. First, such technological changes reduce the per unit cost of production. Since farmers respond to profitability, the effect of such per unit reductions in cost are similar to the incentives of increased prices. There is thus incentive to increase production. Second, such innovations normally increase the profitability of using much larger quantities of purchased inputs, fertilizer in particular, which have elastic supply functions. The result is to make production more dependent on purchased fertilizer and to make production more responsive to relative crop fertilizer prices.

In the context of technological change in agriculture one must be concerned with the effect of price policy on (a) the relative profitability of the associated purchased inputs and (b) the absolute level of profitability and consequent effect on capital availability and the slope and shape of diffusion curves. The studies which we have conducted place particular emphasis on the latter. Because we have been largely concerned with the dynamics of agricultural development, our studies of price response have emphasized price policy as related to technological change and the inputs associated with technological change. We conducted one major study of the demand for fertilizer in India and three studies of the economics of water use and pricing. In addition, a substantial study has been conducted in Thailand of diffusion patterns and the factors which affect diffusion patterns for a series of innovations.

#### Determinants of the Demand for Fertilizer

The detailed analysis of fertilizer use in India (Paper 24) showed that relative price of fertilizer was an important factor in determining the rate of growth of fertilizer use. Analysis of the data suggests that this is not because it substantially affects the most profitable quantity of fertilizer used but rather it is because a highly favorable price relationship greatly accelerates the diffusion pattern for fertilizer. This is presumably because the greater total profit from the use of fertilizer reduces risks by giving a shorter pay-off period, increases capital availability through the higher rate of return and results in much larger forgone profits if fertilizer is not used. This suggests that a very favorable fertilizer price relationship may be useful in accelerating the spread of fertilizer in early stages of adoption. However, after fertilizer use has become widespread a modest drop in the relative price of fertilizer is unlikely to result in a drop in fertilizer use. This hypothesis was substantiated by the observation that in a period of favorable price relationships, fertilizer use was taken up by many farmers who had not previously used it but the rates of application did not increase significantly on farms which had already been using fertilizer. Likewise, when relative fertilizer prices rose, farmers who had recently taken up the use of fertilizer apparently continued their level of use.

The analysis also showed that applying fertilizer at rates of 50 percent to 75 percent of optimal levels resulted in only very small declines in total net income from use of fertilizer. This suggested that farmers are well advised to follow their normal practice of using fertilizer at well below normally calculated optimal levels, particularly when one takes into account risk and risk related factors.

It was also found that the tendency for those with small farms to use less fertilizer than those with large farms seemed more related to differences in irrigation potential, in soils and other physical factors rather than capital, credit availability and education. Similarly, it

was found that the rate of return to fertilizer use on certain cash crops such as sugarcane and various vegetable crops were higher than to food grains. Where food grains were grown on the same farm with high response commercial crops the rate of fertilizer use on the food grain crops was greater and a higher proportion of farmers used fertilizer than where food grains were not grown in association with high response cash crops. It was noted that a number of cash crops such as oil seeds did not respond at high profit levels to fertilizer use and hence were not fertilized more heavily than food grains. It was found that the profitability of fertilizer use and intensity of use was very closely associated with irrigation.

Where technological change associated with new high yielding varieties was available, profitability of use of fertilizer rose to extremely high levels and the rate of diffusion was extremely rapid. In these situations the most important factor associated with rapid growth in fertilizer use was solving problems of supply and distribution rather than price.

#### Determinants of the Demand for Irrigation

A detailed study of well irrigation in northern India where the new high yielding varieties of wheat had been very successful, provided additional important information with respect to the role of prices on diffusion of innovation (Paper 29). It was found that where the traditional system of providing water from leather buckets lifted by oxen prevailed that the cost of water was so high that for the quantities required to obtain high yields from new varieties it did not pay to use sufficient water to make the high yielding varieties more profitable than traditional varieties. As a result, where this type of irrigation prevailed, the new high yielding varieties were not grown. Thus lower cost water was crucial to adoption of the new high yielding varieties.

Private tube wells provided water at one-sixth the cost of water from the traditional system and at less than one-third the cost with the persian wheel, a commonly used improvement over the traditional system. With such very low cost water and with a fully assured supply farmers took up the high yielding varieties very quickly and obtained a high rate of return on the package of the high yielding variety, high utilization of fertilizer and substantial use of water.

The study also showed, however, that an assured supply can be much more important than a substantially lower price. For example, if farmers without a private tube well purchased water on a contract basis from a private tube well owner, he would have to pay 30 percent more per unit for the water than if he had obtained it from a state tube well. However, because the private tube wells were used at a much lower percentage of capacity, supply of water was much more fully assured and reliable than that from the state tube well. As a result, cultivators who purchased

the private tube well water had much higher levels of fertilizer application and a much higher proportion of their land planted to high yielding varieties.

Thus we find confirmed results from the fertilizer study that price policy should be seen as a supplement to other policies for increasing production. First, one requires rapid technological change, and second, one must be sure that complementary inputs are readily available. It is only after these two conditions are met that a positive price policy may be useful. It is then most useful in accelerating diffusion of already profitable innovations.

The second study of irrigation in India (Paper 26) confirmed the results of the first in a quite different set of circumstances. Returns to water from traditional systems of irrigation were relatively low even with high yielding varieties. Introduction of the high yielding varieties however, substantially increased returns to water and made it highly profitable to make investments in private tube wells in situations in which it had been at best marginally profitable previously.

An associated study dealing with returns to supplemental irrigation of rice in the context of traditional technology (Cornell IADP Bulletin 10) further reinforced the point that even with very favorable output prices, returns to investment in irrigation are quite low in the context of traditional technology unless the costs of developing the water are exceptionally low. This confirms once again that price policy alone has very limited potential for bringing about increased production or increased input use within the context of traditional low yielding varieties which have low response to increased input use. In the process of developing this part of the study major methodological contributions were made to the study of returns to supplemental irrigation in situations of highly variable natural rainfall. Such analysis poses a number of complex problems in probability analysis which are dealt with in this study.

#### Diffusion Patterns for New Technology

The study of diffusion of several agricultural innovations in Thailand (Paper 36) again shows the important role played by ready availability of inputs such as fertilizer in the timing and rate of adoption of innovation. Ready availability of fertilizer in nearby locations led to relatively rapid rates of adoption of fertilizer even under quite unfavorable price relations by world standards. The study also documents that rates of diffusion of particular innovations differ substantially according to the physical and economic characteristics of the innovation, input availability, relative rates of return as well as various socioeconomic characteristics of the farmers. Thus to be effective, policy to accelerate diffusion must be developed with a clear

understanding of the nature of the innovation and the environment within which it will be applied. Use of price policy to supplement a well chosen set of other measures can be useful. Price policy alone will often be an expensive and inefficient means of achieving accelerated diffusion. The study dealt with double cropping, tractor plowing, power driven water pumps, and various pesticides in addition to fertilizer.

#### IV. Efficiency of the Price-Making Mechanism

##### The 'Stereotype Position

It is commonly assumed that major imperfections in the marketing channels for agricultural commodities in low income countries prevent agricultural prices from efficiently signalling for changes in allocation of resources and encouraging increased agricultural production through improved producer incentives. It is generally assumed that market channels are dominated by middlemen who are collusive and exploitive, who have high profits, maintain high margins between producer and consumer and who, perhaps, use resources inefficiently.

An effective public price policy for the agricultural sector requires that it be applied in the context of well working markets in which middlemen pass consumer and producer signals efficiently and effectively and that middleman margins are minimized subject to the resources required to provide the optimal space, time and form function. Given the stereotype of the working of markets and the importance of efficiently operating markets to effective price policy this research project put major emphasis on study of the marketing channels and the effectiveness with which market signals were transmitted.

First, a major analysis was undertaken of the relationship between supply and demand factors and price to see whether producer and consumer prices reflect underlying supply and demand shifts (Papers 3 and 4). If they do not, there would be a clear indication of ineffectively operating markets.

In addition, a series of studies were made of the operation of marketing channels with respect to basic food grains (Papers 12 and 31). One study was undertaken of milk marketing in India, to test the concepts developed for a perishable commodity for which demand is likely to increase sharply with economic development (Paper 17).

Finally, special note was taken of the effect of transportation facilities and costs on the operation of markets and in price determination. A study of transportation economics in Nepal provided information on this question in an environment which accentuated the factors being studied (Paper 32).

##### Price as a Reflector of Underlying Supply and Demand

In the case of India agricultural prices were very closely related to underlying supply and demand factors (Papers 3 and 4). For the period 1949-1964 more than 80 percent of the variation in the food grain price index was associated with the real supply and demand factors. These factors included population growth, income growth, change in the money supply and changes in production, imports and publicly held stocks. A sub-

stantial coefficient on a lagged supply-demand variable suggests that year to year changes in farmer storage stocks are an important determinant of food grains prices in any one year. This close correspondence of prices and underlying supply and demand factors suggests that the signals have not been significantly blunted by inefficient operation of the marketing channels or by government policy suppressing agricultural prices.

### The Structure and Operation of Markets

Direct analysis of the operation of markets in India confirmed the above analysis. Papers 12 and 37 report these studies and serve as the most carefully developed and definitive study of the operation of marketing channels for food grains in any low income country. These studies were based on and further refined the methodological contribution to measuring the degree of perfection with which markets operate developed at Cornell by Dr. Uma J. Lele. Careful statistical analysis was made of the relationship between prices in different markets at the same point in time, at different points in time for the same markets and from one form of a commodity to another. In each case very close correspondence was found between the various prices examined. Differences in prices from market to market, over time and from one form to another, were roughly commensurate with the costs of providing those space, time and form utilities.

The close correspondence of prices in different markets suggested that markets are highly integrated in India, greatly increasing the difficulty of following collusive practices. Although average return to investment and storage were commensurate with costs the pattern of seasonal price variations from one year to another changes radically. As would be expected, in reasonably well working markets there was no consistent means of explaining the erratic changes - the seasonal pattern from one year to another.

Substantial imperfections were found in the working of markets but these, in general, were not due to lack of competitiveness among the market operators but rather to deficiencies in transport systems and deficiencies in knowledge concerning crop size and storage stocks. In addition it was found that a number of government price policies were impeding modernization of the processing of rice. As one moves to processing technologies which require increased capital investment it becomes increasingly important to keep processing facilities operating over a long period of time and close to engineering capacity. Erratic fluctuations in prices increase the cost of operation on a year round basis and thereby impede this type of technological development. Marketing margins are therefore higher than they would otherwise be.

A further detailed study of rice marketing in East Pakistan (Paper 31) largely confirmed the results of the Indian studies. It was

found that markets work somewhat less perfectly in East Pakistan as compared to West Bengal in India where in turn, markets work somewhat less perfectly than in other parts of India. The less perfect working of markets in East Pakistan seemed to be due largely to poorer transportation and communication facilities. The East Pakistan study was particularly useful in showing the complex but economic patterns of rice shipment, thereby indicating the difficulty of operating tight control of market operations.

### Special Problems of Milk Markets

Rapid technological change in agriculture and rising per capita incomes will bring about large relative increases in the demand for high income elasticity of demand commodities such as milk. Likewise, major success in increasing production of grain crops will encourage shifts of resources to other types of agricultural production. Marketing problems may well impede such shifts. A special study was undertaken of milk marketing in India (Paper 17). A comparison of traditional and modern systems was made. Such study was felt necessary to development of price policy appropriate to such commodities.

It was found that paucity of marketing facilities was a major factor inhibiting the development of the dairy industry. Such marketing deficiencies lead to much lower producer prices than would otherwise be the case resulting in lesser incentives to producers and a much slower rate of growth of production with consequent unfavorable effects on total agricultural production and on rural incomes. The study suggested a number of means by which the traditional sector could be improved so as to play an important role in the development of milk marketing and production. Paper 17 spells out in detail these and related points.

### Transportation and Market Operation

Because the marketing studies which we performed showed deficiencies in transport as a major source of imperfections in the marketing system a special study of transportation was undertaken in a situation which would spotlight the effects of transport improvement (Paper 32). The area studied was the Pokhara Valley in Nepal which was just being connected to the Terai of India by a new road. Major changes in agricultural price relationships took place as a result of the substantial improvement in road transport which was reported. It is clear from the study, however, that nonprice effects can be as or more important than the direct price effects of improved transport. If full advantage is to be taken of major improvements in transport it is necessary to combine them with technological changes in production and institutional facilitation of increased input supplies. Under these circumstances the price changes themselves may then have useful effects in encouraging increased production.

## V. Price Stabilization

Through a small addition to the contract in the final year an exploratory analysis was made into the question of stabilizing prices of primary products (Paper 28). It is clear from the analysis that if price stabilization programs are to be effective they must be based on detailed understanding of the nature and source of instability. Price fluctuations may be a symptom of a more fundamental problem and hence a price stabilization program may simply mask the underlying problem and divert attention from its solution.

It is also important to the development of price stabilization policy whether the major source of instability is yield fluctuations or price fluctuations. Empirical evidence indicates that the relative importance of yield and price instability varies considerably from place to place and time to time. The research also indicated that specific programs for price stabilization may under certain circumstances destabilize income and other variables which may be of importance.

The paper discusses a number of alternative stabilization policies and a number of budgets are constructed showing the effects of various types of stabilization policies. Programs discussed include buffer programs, hedging on futures markets and price discrimination programs. The paper also indicates that we have very little knowledge of the extent of benefits of stabilization programs and hence it is difficult to know whether the benefits from stabilization are greater than the substantial costs which are often involved in stabilization programs.

## VI. Summary - Development of Agricultural Price Policy

The Occasional Paper series includes four summary papers. Paper 34 summarizes the relationship between agricultural prices and other devices for facilitating intersectoral resource flows. Paper 38 summarizes various aspects of the marketing efficiency studies in terms of their policy implications. Papers 6 and 27 summarize various aspects of the studies with respect to the functions of agricultural prices and development of a practical agricultural price policy.

### Criticism of the Past

Much past discussion of agricultural price policy has suffered from misplaced emphasis. First, agricultural price policy has been viewed too much in the context of a technologically stagnant agriculture and not enough in the context of production increasing technological change. Second, emphasis has been too much on effects of the average level of agricultural prices relative to other prices rather than on the effects of instability of agricultural prices. Third, policy has been too much concerned with the direct relationship between agricultural prices and farm level production and not enough with implications of price instability to development of a marketing and processing industry which is efficient, technologically advanced and stimulating to increased production, likewise there has been insufficient recognition of agricultural price effects on consumers and industrial cost structures. Fourth, past discussion has been too much concerned with prices of food grains relative to other agricultural commodities which have elastic demand and which offer potential for increased intensification of farming and expanded rural employment.

These misplaced emphases reflect first of all a scarcity view of the agricultural sector which sees a food production crisis in the face of rapidly growing population and does not look beyond immediate food needs to the broader positive role which the agricultural sector can play in the total development process. Second, it reflects failure to recognize the nature of technological change in the agricultural sector, the opportunities which that provides for rapid increase in production at decreasing per unit costs and the problems which it creates with respect to financing and bearing the risks of much higher levels of input use.

In determining an effective development oriented agricultural price policy it is most important to keep in mind that agricultural prices are an exceedingly important indicator of underlying economic relationships. Agricultural price policy can play a positive role in development but that policy must not deal with just the symptoms of underlying problems and thereby divert attention from those underlying problems. When agricultural prices rise relative to nonagricultural prices, that is an indication of failure of agricultural production to keep pace with growth in demand incident to development of other sectors of the economy. In

particular it probably reflects failure to develop and diffuse production increasing technological change. It is important to find out why development processes in agriculture are not succeeding in these circumstances and to take steps to deal with this failure.

Likewise, if agricultural prices are declining relative to nonagricultural prices it may indicate substantial success in technological change in agriculture and call for effort to expand demand in the non-agricultural sector more rapidly through an expansionary employment policy. In low income countries it is easy to expand the demand for agricultural commodities by expanding employment and income of low income people, who spend a high proportion of increments to income on food. Thus, employment policy can represent one of the most effective development oriented means of influencing agricultural prices. Treatment of price symptoms may divert attention from policies which could accelerate growth and broadly diffuse the benefits of growth.

Change in domestic agricultural price relationships may also reflect changes in international prices. Again it is important not to treat the domestic price symptoms without diagnosing the underlying causes.

#### Limitations on Price Policy

There are major economic and administrative restraints limiting the exercise of agricultural price policy. On the economic side, one is limited in the use of high agricultural prices for transferring resources into the agricultural sector by the generally low incomes and consequent scarcity of capital, savings and investment in low income countries. Under these conditions there is need for agriculture to generate a substantial portion of its investment resources by its own savings efforts.

Substantial divergence of domestic prices, measured by the "real rate of exchange" from international prices gives some indication of whether or not domestic policy is using agricultural prices to transfer resources among sectors.

On the administrative side it must be recognized that a major effort to raise the general level of agricultural prices is likely to require a substantial quantity of administrative resources which are not only scarce in a low income country but are in great demand for operating other government programs--including the development of research stations, input supply lines and other institutions necessary to rapid technological change in agriculture and rapid increase in agricultural production.

Given these restraints on price policy it is important to recognize what the objectives of agricultural price policy are and what its influences may be. Then one must recognize the nature of policies

ancillary to price policy and from that proceed to determining the actual agricultural price policy.

### Objectives of Price Policy

Agricultural price policy is a means for influencing the allocation of resources for achieving society's objectives of growth and equitable distribution of income. Formulation of agricultural price policy is complicated by the multiplicity of often conflicting functions which agricultural prices perform, including (1) allocation of resources between agricultural and nonagricultural sectors, (2) allocation of resources within agriculture, (3) facilitating higher rates of savings and investment and hence growth in the capital stock, and (4) distribution of income amongst regions, sectors and income groups

Agricultural price policy is of particular importance with respect to income distribution because agriculture produces the consumer goods which comprise the bulk of expenditure by low income people. Even though agriculture is primarily a consumer goods producing industry, agricultural prices affect capital formation in the industrial sector by their influence on distribution of income, wage rates, industrial profits and government net revenues

With respect to efficient allocation of resources it must be remembered that the personnel and structure for administering price policy are also scarce resources that must be allocated efficiently. This places an important restraint on choice of optimal price policy. Finally, the actual price policy chosen will reflect the state of knowledge concerning the various variables. Uncertainty regarding the effects and objectives of price policy will normally necessitate adoption of policies different than those which would be preferable under conditions of certainty

### Policies Ancillary to Price Policy

There are three sets of policies which are particularly important as ancillaries to price policy. The burdens on price policy alone will be much less if these policies are adequately pursued.

First it is crucial that resources and administrative talent be allocated to domestic research efforts so as to generate the new crop varieties and agricultural practices that are the basis for yield increasing cost reducing technological change in agriculture. A successful program of development of research institutions for turning out a steady flow of such innovations will itself provide substantial incentives to farmers to use more inputs and to increase agricultural production, and thereby reduce the burden which must be carried by price policy. Effective government action in this respect requires allocation and adminis-

tration of substantial financial and physical resources as well as public administrative talent.

Second, as technological change is successfully introduced and the demand for inputs such as fertilizer and water is sharply increased, it is necessary that administrative and resource allocational decisions be made which make a greatly increased supply of these inputs readily available to farmers. Ready availability of a large quantity of these inputs can greatly lessen the burdens on price policy. Conversely, price policy cannot be effective in increasing utilization of these inputs if basic supply problems are not solved.

Third, steps must be taken to ensure a smoothly functioning, reasonably low cost transportation system, including adequate farm to market roads. Unless efficient transport is available there will be such large price margins between producers and consumers and such poor operation of markets that a public price policy will operate exceedingly inefficiently in meeting its objectives.

Although these three sets of measures are of course not the only measures necessary to technological change and development of the agricultural sector, they are particularly important, relate particularly closely to the use of price policy and have apparently been particularly neglected in the recent past. If these measures are taken, price policy may then fit within its proper place relative to various other mechanisms for hastening technological change and growth in agricultural production in a manner which fosters over-all development processes.

#### A Positive Price Policy

Given the objectives stated above and effective operation of the ancillary policies set forth there then remains an important but modest role for price policy. Agricultural price policy will still have to be set with clear understanding of the local environment with respect to the demands on price policy and the administrative and other resources for operating it.

A price policy is suggested for the basic food grains--normally a small number of closely related commodities, relatively nonperishable and, for most countries, consumed largely in the domestic market. For these commodities, a set of support prices would be set annually, with emphasis on support of that year's harvest season prices.

The support level would be determined annually by an appraisal of the current supply and demand situation--the support level normally varying inversely with the size of the crop. The level set would be modestly below the calculated supply-demand balance price. The purposes of this policy are protection of farmers against market imperfections and consequent sharp decline in price below the normal supply-demand

balance price, stabilizing prices to processors of food grains, including rice millers and livestock feeders, protecting them from large erratic short-term fluctuations in prices and supplies, and protection of low income consumers from large erratic changes in supplies and prices.

Announcement of the support level would be made somewhat before harvest time, but sufficiently late to allow a reasonably accurate estimate of the domestic supply for that year. The Government would accept deliveries at the support price, such supplies often being sold at a seasonally adjusted price the same year, and occasionally carried over to later years.

In operating agricultural price programs it is important that provision be made for a fully adequate seasonal price rise to cover full storage costs. If that is not done the government operation will displace private storage at great total cost to the government, substantial likelihood of such a burden being placed on government administrative and financial resources that the system breaks down and very likely a general misallocation of resources. Similarly prices at specific market must reflect full transportation costs.

There is a substantial danger that price stabilization schemes will set prices in such a manner that the private trade is displaced by the government, and in circumstances in which the government is not prepared to offer the full requirements of efficient marketing services.

Setting of domestic agricultural prices must also be consistent with the set of trade policies to be followed. If domestic prices are set at a level significantly different to international prices it should be done in full recognition of the implications to transfers of resources among sectors in the domestic economy and to that country's own trade policies.

The price policy so recommended has four major assumptions. First, rapid agricultural development is based on per unit cost reducing technological change which is more a function of public policy towards research, education and input supply policies than a function of price policy. Inappropriate price policy may slow technological change, but the prime function of price policy is to meet problems resulting from technological change rather than to create technological change. Second, as compared to high income countries, the demand for agricultural commodities is less inelastic with respect to price. Third, because farmers, especially low income farmers, retain substantial proportions of what they produce for home consumption, the effect on farm incomes of given market price declines is much less than in high income countries. Fourth, in the dynamic context of technological change and economic growth the basic price problem for agriculture is one of year to year instability, a problem which is particularly great in low income countries where the operation of markets may be particularly imperfect.

The concern for year to year price instability in a context of development assumes significant market imperfections. The method suggested for setting the support level achieves little in a situation of perfect knowledge and perfectly functioning markets. However, despite competitive conditions facilitated by easy entry, a large number of participants and a high degree of market integration, there are substantial, difficult to remove, market imperfections in low income countries tracing from costly and uncertain transport facilities and lack of knowledge of crop size and storage stocks. There is a tendency for such markets to operate naively and for movement in one direction to accumulate

Particularly where technological change and economic growth are both new phenomena one can expect sharp changes in supplies of particular commodities as new technologies affect first one and then another commodity and as demand shifts accompany rising incomes. Such shifts in supply and demand can result in substantial changes in prices which may be accentuated by market imperfections. These shifts in turn are a major cause of highly erratic seasonal patterns. Long run efforts should be made to remove market imperfections at the source through investment in transport and information systems. Care should be taken that government programs do not reduce competition. Effective policy in those areas reduces the burdens on a price stabilization program.

Even supporting the prices of only the basic food grains runs the risk of exceeding the administrative, financial and physical storage facilities available to government. The problem would be accentuated if one supported prices of perishable commodities as well. In addition, the complexity of setting suitable relationships amongst prices of various commodities increases substantially as the number of commodities increases. This will further strain the government's supply of analysts and administrators. However as potentials for increased processing grow, it may be necessary to encourage such industries with price stabilization programs--perhaps through encouragement of contract relations between producers and processors.

Basic food grains are the agricultural commodities for which the income elasticity of demand is the lowest. In the context of rapid technological change and income growth, resources should gradually be shifted away from these commodities toward the more income elastic agricultural commodities. There is a danger that limiting a price support program to food grains will channel resources towards rather than away from them. Thus great care must be used in setting stabilization support levels.

It is logical to think that if the economy should be restructuring away from the basic food grains and towards the more income elastic types of agricultural commodities that a price support program might concentrate on the latter commodities. Unfortunately, the more income elastic commodities tend to be those which are relatively perishable.

and hence pose immense problems for the operation of a support program. Presumably, the most effective means by which government policy can improve prices for these commodities is through improved marketing facilities

It is proposed that the level of support be determined by an estimate of the equilibrium price under the expected supply and demand conditions of the approaching year. Demand estimates may be based on projections of population and per capita income, estimates of income elasticity of demand and a measure of inflationary factors such as the money supply. Supply may be estimated either by simple observation or through projections taking into account changes in technology, inputs and weather. From such information a moderately reliable price estimating equation can be developed. As indicated above, estimates of support price will have to be coordinated with national trade policy, requiring comparison of estimated support prices with estimated international prices and study of the likely effects of any discrepancy between the two.

If government capacity to support prices is weak and weather fluctuations large, it will be important to make the estimate close to harvest time. The weaker the government support power, the wider the level should be between buying and selling prices and the greater the allowance for seasonal price increases. If weather fluctuations are unimportant or capacity to support great, little will be lost by setting prices even in advance of planting, and the greater the risks that can be taken in setting prices close to estimated levels. The proposal suggested here is complex and requires substantial numbers of trained personnel for its operation. It may fail for that reason alone. In leveling this criticism it should be noted that the objectives and the mechanisms are much less complex than price policies generally recommended. Any price stabilization program should be entered only after careful thought, full recognition of the problems, the probabilities of failure and the implications of failure.

Cost of production should not be an explicit basis for determining the support level partly because the context assumed is one of improving technology and hence declining unit costs. The basic incentive for expanding production is provided by declining unit costs and not by rising prices. For similar reasons input subsidies are not recommended, except perhaps in early stages of innovation.

The objective of the policy stated is not a constant level of agricultural prices. When favorable weather has provided a large crop, prices would be lower than when unfavorable weather has provided a small crop. In low income countries, the scope to expand consumption, even of basic food grains, through lower prices is greater than in high income countries. Further, real incomes of farmers tend to be higher with a large supply than with a small supply. That is, of course, the opposite of the relationship expected in high income countries. The reasons for this reverse relationship are (1) demand is much less inelastic with

respect to price in low income countries, and (2) a substantial proportion of basic food commodities are retained for home consumption and are not affected by a price decline incident to greater production. Of course, if demand is inelastic, those producers who sell practically all of what they produce may experience income changes inverse to level of production.

If the objective of price supports is to protect farmers from market imperfections that drive prices below the supply-demand balance price, then the support price should be moderately below that price in order to allow the market to operate within reasonable bounds and to increase the probability that the policy can be administered. There is a naive assumption here that economists set agricultural support prices. In practice political processes may dominate. This argues for caution in initiating price support programs and for thoroughly considering other devices for achieving the same ends. Certainly, programs of improved transport and market reporting should be studied as supplements and alternatives to price policy for dealing with market imperfections.

There are two basic considerations in deciding how much below the supply-demand balance price supports should be set. First is the financial, and administrative capacity to make support purchases, and second, the degree of precision with which the appropriate price can be estimated. The lesser the capacity to make support purchases and the lesser the capacity to estimate the normal supply-demand equilibrium price, the greater the discount to be set for the support price. The greater the discount for the support price the less helpful it will be to farmers. On the other hand, if the support is set so high that it cannot be maintained, confidence in the government's ability to support prices will be destroyed and susceptibility to sharp price decline increased.

Announcement of the support level just prior to harvest season has the advantage of allowing more accurate appraisal of the supply situation, particularly with respect to weather. For most farmers in low income countries a constant price irrespective of weather effects on crop size will increase fluctuations in real incomes as compared to basic supply-demand equilibrium prices. Thus, a policy of setting prices prior to planting would normally provide less real income stability for the farmer than would setting them just prior to harvest. The converse is the case for consumer real incomes.

Announcing the support level prior to planting is necessary if the objective is to cause an immediate reallocation of resources towards specified crops. This is unlikely to be the objective with respect to the basic food grains in a context of economic development and technological change in agriculture.

Supports announced prior to planting followed by unexpectedly large acreage planted or unusually good weather may place burdens on the government which it is not able to sustain. With a resultant sharp price

decline, farmers would be even less willing to plan on the basis of government supports in the future. Recognition of this problem may require that supports established prior to planting be set at a level lower than would be justified by later information. This could form part of a useful two-stage setting of supports--a conservatively low level prior to planting and a potentially higher level prior to harvest. It is, however, doubtful that the preplanting price would have sufficient credibility to be useful. It is also doubtful that political processes would allow this degree of fine tuning.

The price policy set forth here has the modest objective of protecting farmers from excessive price instability. It is put forth for a context in which price instability may increase due to the very processes of development themselves. It has the further advantage, which should receive increasing emphasis as production and particularly as marketings increase with the development process, that the increased price stability will encourage greater capital investment in marketing and processing facilities for agricultural commodities. Thus modernization of rice milling, for example, will be encouraged, providing more efficient milling, greater total outturn, better working of the price system and smaller margins between the farmer and consumer. It will also encourage development of the feed consuming livestock industry as feed prices become somewhat more stabilized and that in turn will give further encouragement to the various agricultural industries which process livestock products. Increased price stability will encourage increased entry and competition into various parts of the marketing channels, again providing greater competition and relatively lower margins. Thus, although the objectives and the mechanisms of price policy suggested here are modest, the effects on the total development process may be substantial. They will certainly be more substantial and useful than a much less modest set of proposals for price policy which prove to be inoperable because of underlying economic conflicts and lack of administrative resources.

## VII. Summary

This study places agricultural prices in the broad context of their contribution to total economic growth. This broader prospective constrains the role of agricultural price policy to a limited but still important role.

Price policy for agricultural development has generally over-emphasized (a) raising the average level of agricultural prices relative to other prices and (b) the role of agricultural price stabilization in stimulating agricultural production. Insufficient attention has been given to the role of agricultural prices in (a) stimulating modern agricultural processing industries and a politically stable and economically expanding urban population and (b) facilitating more rapid growth in production of agricultural commodities which have greater rates of growth of demand and greater employment creating potential than the basic food grains.

Agricultural prices must perform a multiplicity of often conflicting functions which include: (a) allocation of resources between agricultural and nonagricultural sectors; (b) allocation of resources within agriculture; (c) facilitating higher rates of savings and investment; and (d) distribution of income amongst regions, sectors and income groups.

Measures which raise agricultural prices do so by transferring resources from other sectors and hence retarding growth in those sectors. Thus the gross gains of such policy in agriculture must be compared with the losses in other sectors.

In general, rising agricultural prices signal a relative failure of agricultural development policies. Ideally agricultural price policy should supplement basic policies for facilitating technological change for agriculture -- particularly those which generate research results and provide ample quantities of production inputs. In those circumstances price stabilization may accelerate diffusion of technology at times when other forces may be particularly destabilizing to prices.

Administrative and financial restraints normally limit price policy to measures for stabilizing prices within a relatively broad range determined by underlying supply-demand relations. Price stabilization programs of the type recommended in this report will also facilitate development of modern agricultural processing industries which currently represent one of the most important links in the marketing system.

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VIII. List of Publications

A. Occasional Papers

Cornell University - USAID Prices Research Contract  
Department of Agricultural Economics, Cornell University  
John W. Mellor

A series of studies of topics relating to agricultural prices and economic development is being carried on at Cornell University as part of a USAID financed contract. The Director of the project is John W. Mellor. The program of study covers three major areas of inquiry: (1) the role of prices in intersectoral income and capital transfers; (2) the effect of price relationships on agricultural production and marketings; and (3) the factors affecting urban prices of agricultural commodities. Thus, in total, these studies are concerned with the effects of agricultural prices on the nonagricultural sectors of the economy, with their effects on the agricultural sector and with the manner in which agricultural prices are determined. Over the course of the contract a substantial number of studies are being carried on in various countries and dealing with various aspects of the processes.

A basic objective of the contract with USAID for the conduct of this research is not only to produce useful research results, but also to provide structured research experience to research persons so as to enlarge the pool of trained manpower for the analysis of such problems. For this purpose the research on this project is accomplished primarily through the use of Ph.D. candidates at Cornell University who use the specific studies conducted as Ph.D. dissertations. The definition of the overall project has purposefully been kept broad and flexible to facilitate the attainment of this additional objective.

The following is a list of Occasional Papers so far completed as part of this program of research. In a number of cases, papers have been republished in journals. The specifics of such publication are given below.

<u>Paper No.</u>	<u>Date Month Year</u>	<u>Title</u>	
1.	Oct. 1967	"Change in Relative Prices of Agricultural Commodities, India, 1952-53 to 1964-65" (Published in <u>Agricultural Situation in India</u> , January, 1968)	John W. Mellor and Ashok Dar
2.	Oct. 1967	"Notes on Foodgrains Prices, India, 1967-68 to 1968-69"	John W. Mellor
3.	Dec. 1967	"Determinants and Development Implications of Foodgrains Prices, India, 1949-50 to 1963-64" (Published in <u>The American Journal of Agricultural Economics</u> , Vol. 50, No. 4, Nov. 1968)	John W. Mellor and Ashok Dar
4.	Nov. 1967	"Domestic Terms of Trade and Economic Development of India, 1952-53 to 1964-65" (Cornell International Agricultural Development Bulletin #12)	Ashok Dar
5.	Jan. 1968	"Note on Agricultural Price Policy - 1968 Indian Wheat Price Support"	John W. Mellor
6.	Jan.- March 1968	"The Functions of Agricultural Prices in Economic Development" (Published in the <u>Indian Journal of Agricultural Economics</u> , Vol. XXIII, No. 1, Jan.-March, 1968)	John W. Mellor
7.	Jan. 1968	"Review of George Blyn, <u>Agricultural Trends in India, 1891-1967 Output, Availability, and Productivity</u> " (Published in the <u>Economic Development and Cultural Change</u> , Vol. 16, No. 3, April 1968)	John W. Mellor
8.	Jan. 1968	"Farm Management Extension in a Modernizing Agriculture" (Published in <u>Netherlands Journal of Agricultural Science</u> , 16, No. 4, 1968)	John W. Mellor
9.	Apr. 1968	"Opportunities and Problems Associated with Wheat Production, Marketing and Pricing in the Kathmandu Valley"	John W. Mellor

<u>Paper No.</u>	<u>Date Month Year</u>	<u>Title</u>	<u>Author</u>
10.	Apr. 1968	"Wheat Production and Utilization as a Leading Edge for Development in the Kathmandu Valley"	John W. Mellor
11.	Sept. 1968	"Statistical Tables, Methodology, Data Sources and Conclusions Regarding Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960"	Teng-hui Lee
12.	Dec. 1968	"Working of Grain Markets in Selected States India, 1955-56 to 1964-65"	Uma J. Lele
13.	June 1968	"A Study of Movement in Prices of Selected Items of Foodgrains and Industrial Raw Materials in India 1939 to 1967-68"	M. B. Mathur
14.	Jan. 1969	"Increasing Fertilizer Use in Indian Agriculture"	Gunvant M. Desai
15.	Jan. 1969	"A Note on the Distribution Effects of Chilean Agricultural Price Policies"	Roberto Echeverria
16.	Jan. 1969	"Economic Analysis of Well Irrigation, Aligarh District, India"	T. V. Moorti
17.	Apr. 1969	"The Modernization Decision in Indian Urban Fluid Milk Markets"	Ray W. Nightingale
<u>Papers 18 through 23 are basic data papers only already out of print but available on a short-term loan basis only.</u>			
18.	Mar. 1969	Summary Tables. Average costs and returns for two years, June 1967 through June 1968 for 139 farmers in Tambon Kungsamphaov, Thachanuan and Hangnam-sakhon, Amphoe Manorom, Changwat Chainat	Brook A. Greene & Jerachone Sriswasdilek
19.	Mar. 1969	Summary Tables: Average costs and returns for two years, June 1968 through June 1969 for 128 farmers in Tambon Kungsamphaov, Thachanuan and Hangnam-sakhon, Amphoe Manorom, Changwat Chainat	Brook A. Greene & Jerachone Sriswasdilek

<u>Paper No.</u>	<u>Date Month Year</u>	<u>Title</u>	<u>Author</u>
20.	Mar. 1969	Summary Tables of the Kasetsart-Cornell Agricultural Economics Research Project, Amphoe Manorom Social, Tractor, Waterpump, Insecticide and other Chemicals, Fertilizer	Brook A. Greene & Jerachone Sriswasdilek
21.	Feb. 1969	Summary Tables for Rice Double Cropping (Dry Season 1967) and Vegetable Production (Dry Season 1968) Tambon Kungsamphaow and Thachanuan, Amphoe Manorom, Changwat Chainat	Brook A. Greene & Jerachone Sriswasdilek
22.	Mar. 1969	Summary Tables of the Kasetsart-Cornell Agricultural Economics Research Project, Amphoe Manorom, 1968 Crop Year	Brook A. Greene & Jerachone Sriswasdilek
23.	Dec. 1968	Summary Tables of the Kasetsart-Cornell Agricultural Economics Research Project, Amphoe Manorom, 1967 Crop Year	Brook A. Greene & Jerachone Sriswasdilek
24.	July 1969	"Growth of Fertilizer Use in Indian Agriculture"	Gunvant M. Desai
25.	Aug. 1969	"The Relationship Between Agricultural Production and Industrial Capital Formation in India, 1951-52 to 1964-65"	U. S. Bawa
26.	Oct. 1969	"An Economic Analysis of Resource Use in Farming, Jabalpur District, Madhya Pradesh, India, 1967-68"	V. P. Shukla
27.	Aug. 1969	"Agricultural Price Policy in the Context of Economic Development"	John W. Mellor
28.	Sept. 1969	"Stability for Primary Products: Means to What Ends?"	W. G. Tomelk
29.	March 1970	"A Comparative Study of Well Irrigation in Aligarh District, India"	T. V. Moorti
30.	June 1970	"Intersectoral Transfers of Income and Relative Prices in Chile: History and Policy"	Roberto Echeverria
31.	June 1970	"The Structure and Performance of the Rice Marketing System in East Pakistan"	M. O. Farruk

<u>Paper No.</u>	<u>Date Month Year</u>	<u>Title</u>	<u>Author</u>
32.	June 1970	"The Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal"	Mark C. W. Schroeder & Daniel G. Sisler
33.	June 1970	"Agricultural Contribution and Agricultural Development: A Brief Review of Resource Transfer Experience in Japan, England and France"	Uma J. Lele
34.	June 1970	"Technological Change in Agriculture and Intersectoral Resource Flows"	John W. Mellor
35.	May 1970	"A Brief Bibliographical Sketch on Intersectoral Capital Transfers in Japan"	Shigemochi Hirashima
36.	June 1970	"Fertilizer Adoption and Use in Amphoe Manorom, Thailand, 1967-69"	Brook A. Greene
37.	June 1970	"An Analysis of Modernization of the Rice Milling Industry in India"	Uma J. Lele
38.	June 1970	"Elements of a Food Marketing Policy"	John W. Mellor

Papers as of June 30, 1970

B. Cornell International Agricultural Development  
Publication Bulletins Related to this Project

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<u>No.</u>	<u>Title</u>	<u>Author</u>
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6	Estimates and Projections of Milk Production and the Use of Concentrate Feeds, India, 1951-1976	John W. Mellor & Bruno C. de Ponteves
10	Irrigation Evaluation Under Monsoon Rainfall Patterns: A Case Study for Raipur District, Madhya Pradesh, India	Thomas F. Weaver
✓ 12	Domestic Terms of Trade and Economic Development of India, 1952-53 to 1964-65	Ashok K. Dar
✓ 15	The Modernization Decision in Indian Urban Fluid Milk Markets	Ray W. Nightingale
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18	Growth of Fertilizer Use in Indian Agriculture -- Past Trends and Future Demand	Gunvant M. Desai
✓ 19	A Comparative Study of Well Irrigation in Aligarh District, India	T. V. Moorti
20	The Interaction of Technological Change and Irrigation in Determining Farm Resource Use, Jabalpur District, India, 1967-68	Vishnoo Prasad Shukla
✓ 21	The Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal	Mark C. W. Schroeder & Daniel G. Sisler