The Pakistan Development Review
Vol. XXVII, No. 4 Part I (Winter 1988)

Invited Lecture

Conditions of Agricultural Growth in Developing Countries

HANS-BERND SCHÄFER*

Economic development is hardly possible without an increase in agricultural production. This holds especially true for the development of industry and other non-agricultural sectors. How else should a rapidly increasing population outside the agricultural sector be maintained with necessary agricultural goods? Though this is a simple truth agricultural production, especially food production increase has been far from satisfactory in many developing countries. Between 1974–76 and 1982–84 per capita food production in industrialized countries increased at a much higher rate than in developing countries and in almost 50 developing countries it has even declined during the same period.[1] Many developing countries are now heavily dependent on food imports to sustain their urban population, though they have comparative advantages to produce agricultural products.

How is this defect to be explained? Technical reasons are not prevailing. Though only in Africa and South America unused arable land is available to a large extent but not in Asia, it would be possible to dramatically increase agricultural production by introducing new seed varieties, chemical fertilizer and irrigation. The main factors to hamper agricultural growth are political, social and economic. T. H. Schultz wrote in 1978: "What is needed are many Green Revolutions that would increase agricultural production throughout low income countries. They could be had, but they are presently suppressed by the lack of adequate incentives."[2] In many developing countries the farm sector is exploited by the urban sector and a stream of agricultural surplus is channelled out of the farm sector to feed the non-agricultural population. Very often the prices of farm products are artificially held down. Though this proposition does not hold for countries as important as China or India, it gives a good picture of the development in many African and Latin American and some Asian states. To exploit agriculture in the early phases of industrial development has also been a feature of industrial countries in their early phases

*The author is Professor, Department of Economics, University of Hamburg, West Germany.

[1]World Development Report 1988. Stat. Appendix Table 7.

[2]T. H. Schultz (ed.). Distortion of Agricultural Incentives, 1978, p. 6.

of development such as Mercantilism in 18th century France or the Soviet industrialization during the Thirties or the Japanese industrialization. In all these cases agriculture was squeezed by the more modern sectors. In many cases agriculture was conceptualized to subsidize rapid industrialization. But somtimes the planners of rapid urbanization had to notice that the agricultural hen laid did from starvation before it could lay the industrial egg and that this strategy was not viable.

But still price discrimination operates against the agricultural sector in many developing countries. Farmers make up the majority of the population of most of these countries, but they are often underrepresented politically so that they tend to be passed over in favour of urban groups, such as entrepreneurs, well-organized workers or employees of the public administration and state-owned enterprises, who are better able to promote their own interests. This tendency is further accentuated by the centralist structure of administration in many developing countries. The "urban bias" produces government decisions that discriminate against agriculture by distorting prices and in the allocation of government expenditure. Substantial net transfers of resources from agriculture to non-agricultural sectors often occur.[3]

An important role is ascribed to increase in farm prices as part of the adjustment of agricultural policy required in many developing countries. It should be recognized, however, that substantially raising the level of farm prices also has adverse consequences.

It makes staple foodstuffs more expensive for poor sections of the population, for whom, "cheap bread" is often an effective form of social policy in countries with rather inefficient bureaucracies.

It reduces government revenues, a substantial proportion of which often comes from export duties on agricultural produce or government monopoly trade in agricultural products, since other sources of revenue are poorly developed.

It redistributes income towards the agricultural sector, where the savings ratio is lower than in the rest of the economy. The overall savings ratio is lower than in the rest of the economy. The overall savings ratio therefore also falls, and perhaps the rate of economic growth too.

Finally, raising agricultural prices leads to lagged wage increases in the other sectors of the economy and at least a temporary decline in industrial profits and in the rate of industrial growth.[4]

[3] See H.-B. Schäfer: Landwirtschaftliche Akkumulationslasten und industrielle Entwicklung, Heidelberg 1983; S. Ahmed: Agricultural Taxation and Economic Development in Bangladesh, in: Quarterly Journal of International Agriculture, Vol. 22, 1983, No. 4 pp. 353–367; P. L. Scandizzo, C. Bruce: Methodologies for Measuring Agricultural Price Intervention Effects, World Bank Staff Working Paper No. 394, Washington, D. C. 1980; J. Sharpley: Intersectoral Capital Flows: Evidence from Kenya, Development Discussion Paper No. 32, Harvard Institute for International Development, 1977.

[4] See H.-B. Schäfer, op. cit.

Apart from these repercussions, it must also be borne in mind that farm prices cannot be the only element in a new agricultural policy. They must be one aspect of an economic climate favourable to agriculture and above all they must be accompanied by a package of infrastructural measures in rural areas; without such measures the development of commercialized agriculture does not appear to be even feasible. It is not easy to define the correct combination of price and infrastructural measures, since the connection between farm prices and aggregate agricultural output has not yet been adequately clarified.

Several hundred studies on the estimation of supply elasticities for individual agricultural products have appeared in the last twenty-five years,[5] but until very recently almost nothing had been written about the price response of aggregate agricultural output in developing countries. The results of the estimates for individual products vary, but on balance they arrive at positive values.[6] In the main, these studies refute the claim sometimes made in development literature that price has no influence on the production behaviour of farmers in developing countries. The price mechanism operates when decisions have to be made about the product mix. However, the fact that certain products have positive elasticities indicates nothing about the price elasticity of agricultural production in general or that of the market supply of agricultural products. This would be a fallacy of composition, for high elasticities for individual products are compatible with a low supply elasticity for aggregate farm production, since there is usually scope for switching land from the production of one product to another. In many developing countries it is not primarily a question of changing the product mix – for instance, raising grain prices to increase the production of cereals instead of cash crops or *vice versa* – but one of expanding agricultural production as a whole. Since many countries have forced down most key agricultural prices, it is important to know what impact a general increase in agricultural prices would have and whether this would create adequate production incentives.

While price elasticities for individual products have been estimated regularly since the Fifties, most studies on aggregate elasticities have been written in the last decade, apart from a few pioneering works.

ESTIMATING AGGREGATE ELASTICITIES

The most comprehensive study to date is that by Binswanger *et alia.*[7] It

[5] See in particular H. Askari, J. T. Cummings: Agricultural Supply Response. A Survey of the Econometric Evidence, New York 1976; H.-B. Schäfer, op. cit.: H.-B. Schäfer: Niedrigpreispolitik für Agrarprodukte aus entwicklungstheoretischer Sicht, in: Woll, Glaubitt, Schäfer (eds.): Nationale Entwicklung und internationale Zusammenarbeit, Heidelberg 1983.

[6] See H.-B. Schäfer: Niedrigpreispolitik für Agrarprodukte, op. cit.

[7] See H. P. Binswanger *et al:* Estimates of Agricultural Supply Response from Time Series of Cross-country Data. EPOLS Division Working Paper No. 1985-3, The World Bank, Washington, D.C. 1985.

processes data from 58 countries for the period from 1969 to 1978 and takes as explanatory variables not only agricultural prices but also data reflecting the scale of government activity in rural areas, such as spending on agricultural research, the degree of literacy, life expectancy, the length of the road network and the extent of irrigation. The study estimates low positive price elasticities for the time series analysis and negative values for the cross-country comparison. A pooled regression produced low values with non-significant coefficients. In both cases the greater part of changes in output is explained not by the price variable but by the indicators of government activity. However, this does not lead the authors to conclude that agricultural prices are of no significance for aggregate production, since the elasticities estimated using the Nerlove model[8] cannot depict longterm price influences on the total agricultural capital stock. Such long-term effects depend on the ratio of the return on capital in agriculture to that in the other sectors of the economy, which determines the distribution of investment between agriculture and other uses. Movements of capital out of agriculture triggered by low farm prices must have a substantial impact on agricultural production over the long term, but it cannot be demonstrated using the Nerlove model.

CONFLICTING RESULTS

Binswanger's findings contrast with the study by Peterson,[9] who has obtained very high elasticities for aggregate farm production in a cross-country analysis. The reason for these discrepancies lies mainly in differences in the way they construct an index of real agricultural prices. Peterson deflates farm prices using fertilizer prices as a proxy for the index of production costs, whereas Binswanger rejects this method on the grounds that fertilizer prices are usually subsidized, leading to heavy overdemand and corresponding rationing, so that they are not an appropriate indicator. Another important cause of the differences was the relative paucity of price data at the time when Peterson was writing his work and the failure to take account of distortions in the exchange rates of many developing countries' currencies.

In contrast to the studies by Peterson and Binswanger *et alia,* the other works estimate elasticities only for individual countries or regions. Savant's study[10] covers sixteen Indian districts and examines separately the periods from 1920 to 1941 and from 1950 to 1964. Positive elasticities were obtained in only seven cases and negative values in two, whereas the values for the remaining districts were around

[8] This model is used in most studies for calculating agricultural price elasticities. See H. Askari, J. T. Cummings, op. cit. pp. 38 ff.

[9] W. L. Peterson: Aggregate Supply Response, Manuscript 1979; W.L. Peterson: International Farm Prices and the Social Cost of Cheap Food Policies, in: *American Journal of Agricultural Economics,* Vol. 61, 1982, pp. 202 ff.

[10] S. Savant: Supply Behaviour in Agriculture, Bombay 1978.

zero. It is interesting to note that the highest elasticities were obtained for districts close to urban centres, where price changes are generally accompanied by substantial changes in demand and where the supply of modern consumer goods from the industrial sector is relatively good. It is also noteworthy that positive elasticities were fewer in the period from 1920 to 1941 than after 1950. This supports the view, which had already emerged from the estimation of price elasticities for individual products, that price responsiveness increases with rising commercialization and a decline in subsistence farming. However, in Savant's study too the greater part of the production changes was explained by factors representing the effects of government activity.

An IMF study by Bond[11] examines nine African countries over the period from 1961 to 1969. The only explanatory variables it uses are prices, a weather variable and the trend over time as a "catch-all" variable, and in all cases but one it obtains positive price elasticities of aggregate production with values between 0.11 and 0.54.

Bond concludes that intersectoral terms of trade have a considerable impact on aggregate production. However, his findings should be treated with caution. First, they conflict with those in the more comprehensive study by Binswanger *et alia* and Savant's results for individual districts. Secondly, there are serious doubts about the reliability of the statistical material for the African countries examined, as Bond himself emphasises. The production figures are based largely on rough FAO estimates, and reliable data on producer prices were available for only a few countries. Thirdly, Bond does not attempt to incorporate explicitly the effect of government measures, which in other studies explain a large part of the production changes.

A study by Herdt[12] dating from 1970 is interesting from the point of view of methodology, but its results are difficult to interpret. Whereas it is normal to use a production index of aggregate production and a corresponding price index, Herdt first estimates elasticities and cross price elasticities for all agricultural products and then uses these to calculate a price elasticity for aggregate production. Since this method makes the price of each agricultural product an independent variable in the regression, very long time series are needed to ensure a suitable ratio between the number of variables and the number of observation periods. However, the use of long time series is difficult not only from the point of view of data collection; it is particularly problematic if the economic environment or the basic techniques of agricultural production have changed markedly during the period under examination, since such changes cannot be captured satisfactorily within the model.

[11] M. A. Bond: Agricultural Responses to Prices in Sub-Saharan African Countries, IMF Staff Papers, Vol. 30, 1983, pp. 703 ff.

[12] R. W. Herdt: A Disaggregate Approach to Aggregate Supply, in: *American Journal of Agricultural Economics*. Vol. 52, 1970, No. 4, pp. 512 ff.

Herdt's study relate to twelve districts in the Indian state of Punjab and examines separately the periods from 1907 to 1946 and from 1951 to 1964. As well as prices, he uses a weather index, a trend over time and the extent of irrigation. He obtains positive elasticities with significant coefficients for the first period, the average value for the twelve districts being 0.13. For the second period (from 1951 to 1964) five of the twelve elasticities come out with a negative sign and the average works out at –0.13. This result is in clear contradiction to the findings of Savant, which indicate that supply elasticities increase with rising commercialization. Herdt explains this surprising result as being due to the tremendous change in production (Green Revolution) that occurred in the Punjab during the period under examination.

Bapna, Binswanger and Quizon[13] have estimated elasticities for four Indian states for the period from 1955 to 1973. Apart from prices and the weather, they used other explanatory variables such as the length of the road network, the number of agricultural markets, the extent of irrigation and the usability of high-yielding varieties. The output elasticity for all crops is low (0.09) and not significant. On the other hand, the elasticities for irrigation (0.17) and market density (0.10) are higher. Price elasticities of between 0.29 and 0.36 for individual products were also calculated.

A further study by Bapna[14] examines one district in the Indian state of Punjab over the period from 1956 to 1976. Data on technology are used as variables as well as prices and the weather. The measured elasticity for aggregate production is around 0.27 and is significant. The elasticity for the land area under cultivation is low, but that for the hectare yield comparatively high.

Reca's study of aggregate production in Argentina[15] produced long-term elasticities of between 0.42 and 0.52. This finding contradicts that of a study by Diaz Alejandro[16] on Argentina, whose simple time-lag model produced only a low reading.

THE AUTHOR'S STUDY IN 20 SELECTED INDIAN DISTRICTS

I have just finished a study on price elasticities in 20 Indian districts. I took area, production and productivity as independent variables and various variables on infrastructure like road length, number of regulated markets and irrigated area as shifter variables. Different concepts of prices were also used. The results differ. Here

[13] S. L. Bapna, H. P. Binswanger, J. B. Quizon: Systems Output Supply and Factor Demand, Equations for Semi-arid Tropical India, in: *Indian Journal of Agricultural Economics.* Vol. 39, 1984, pp. 179 ff.

[14] S. L. Bapna: Aggregate Supply Response for Crops in a Developing Region, Delhi 1981

[15] L. R. Reca: Argentina: Country Case Study of Agricultural Prices. Taxes and Subsidies, World Bank Staff Working Paper No. 386, Washington, D.C. 1980.

[16] C. F. Diaz-Alejandro: Essays on the Economic History of the Argentine Republic, New Haven 1970, p. 141.

I would like to make just a few central observations.

The infrastructure variables influence on productivity, land use and production are considerable and significant. This conclusion is rather independent of the model type used, for example logarithmic, short-term or long-term.

A connection between land productivity and real agricultural prices was not ascertainable. Often the coefficients exhibit an unexpected value, and are not, moreover, significant.

A pronounced, albeit minimal dependency was apparent between prices and cultivated land. This was most clearly the case when fertilizer prices were used as deflators for the agricultural prices. There is a considerable correlation between the infrastructure variables and cultivated land, particularly between the variable irrigated land and land as well as between the principal component infrastructure (comprised of number of markets, irrigated land and road length) and area of production.

Production is heavily dependent on infrastructure variables. The coefficients are all positive and significant, and the infrastructural elasticities are all higher than the price elasticities.

An unambiguous connection between prices and production cannot be determined. The number of the verifiable coefficients varies between one and seven, depending on the model used. The number of negative coefficients is in some models greater than that of positive coefficients.

Refinement of the models, for example by successively eliminating insignificant variables, resulted in part in a larger number of verifiable coefficients for the price variable. This does not modify the most important result mentioned above – that there is a connection, and a weak one at that, only between prices and cultivated land.

RESULTS OF THE POOLED REGRESSION

We compiled the pool regression for all districts as well as for the wheat and rice districts separately. To this end, we alternatively used both the dummy variation model and the variance component model to eliminate the time and country effects. A positive influence of prices on production, cultivated land or productivity is not ascertainable with these models. The coefficients are for the most part either negative or positive, but not significant.

The results were the same when the pooled regression related not to all districts together but rather only to relatively homogeneous districts, here the wheat and rice districts. The infrastructural influences remained in these models also largely positive and significant (see Table 1).

Table 1

Area-elasticities in Selected Indian Districts (1958–78)

District	Short-run Elasticity	Long-run Elasticity
1. Ahmednagar	0.01	0.02
2. Sholapur	–0.09	–0.10
3. Osmanabad	0.05	0.07
4. Jamnagar	0.03	0.08
5. Junadadh	0.10	0.13
6. Jodpur	–0.01	–0.01
7. Nagaur	0.00	–0.00
8. Barmer	0.02	0.02
9. Sagar	0.08	0.09
10. Sehore	0.10	0.11
11. Vidisha	0.01	0.00
12. East Godavary	0.10	0.11
13. West Godavary	0.19	0.19
14. Krishna	0.13	0.13
15. Anantapur	0.14	0.14
16. Chittor	0.05	0.06
17. Kolar	–0.24	–0.21
18. Tumkur	–0.03	–0.01
19. Hassan	0.18	0.18
20. Tanjarvur	–0.06	–0.03

NO CAUSE FOR OPTIMISM

When assessing the studies overall, it must be stressed that the number of works dealing with the price response of aggregate farm production in developing countries is still relatively small. However, the most important works on this subject have only appeared in the last few years. In broad terms, their findings give no cause for optimism (see Table 2). The study by Binswanger *et alia,* which is the most thorough and comprehensive to date, reveals no notable price response on the part of agricultural production. Apart from the Peterson study, the other works estimate elasticities that are mostly very low, rarely exceeding 0.25. More important is the fact that agricultural production evidently reacts more strongly to certain types of government activity in rural areas (road building, establishment of markets, degree of literacy) than to price increases. It would be wrong to claim that farm prices are irrelevant to

Table 2

Price Elasticities of Aggregate Farm Production in Developing Countries

Author	Country	Period Examined	Short-term Elasticity	Long-term Elasticity
Bapna, Binswanger, Quizon (1984)	India, Semi-arid Areas	1955–1973	0.09	
Binswanger, Mundlak, Yang Bowers (1985)	58 Countries	1969–1978	0.0–0.18	0.01–0.23
Peterson (1979)	53 Countries	1968–1970		1.25–1.66
Reca (1980)	Argentina	1950–1974	0.21–0.35	0.42–0.52
Bapna (1981)	India (Punjab)	1956–1976		0.27
Garcia[1] (1981)	Columbia	1950–1976	0.44–0.95	
Swift[2] (1971)	Chile	1942–1964	–0.27[a]	
Bond (1983)	Ghana	1963–1981	0.20	0.34
	Ivory Coast	1969–1978	0.13	0.13
	Kenya	1966–1980	0.10	0.16
	Liberia	1966–1980	0.10	0.11
	Madagascar	1968–1981	0.10	0.14
	Senegal	1970–1979	0.54	0.54
	Tanzania	1972–1981	0.15	0.15
	Uganda	1968–1981	0.05	0.07
	Upper Volta	1964–1981	0.22	0.24
Savant (1978)	India, Various Districts	1950–1964	–0.93–1.21	–0.96–2.81
Herdt (1970)	India (Punjab), Average of 12 Districts	1951–1964	–0.13[b]	
		1907–1946	0.13	

[1] G. J. Garcia: The Effects of Exchange Rates and Commercial Policy on Agricultural Incentives in Columbia 1953–1978, (IFPRI), Washington D.C. 1981.

[2] J. Swift: Agrarian Reform in Chile – An Economic Study, Lexington, Mass., 1971.

[a] Land area elasticity.

[b] Hectare yield elasticity.

aggregate production, but it would be equally wrong to regard them as the most important or even the sole strategic variable for the increase in agricultural production in developing countries.

SCALE OF DISCRIMINATION

Low empirical values for aggregate price elasticity in developing countries should not lead one to conclude that farm price discrimination has a negligible effect on agricultural development. The Nerlove model is an important empirical tool for calculating price elasticities, but its value should not be overestimated. It takes account of time-lags between price formation and the creation of price expectations and between production planning and production and thus enables "long-term" elasticities to be calculated, but it cannot express the complex interrelationships between price discrimination against farmers on the one hand and the loss of skilled labour, the neglect of long-term investment and the transfer of savings away from agriculture on the other. These effects in turn have significant repercussions on agricultural production, which cannot be expressed by estimating a supply curve.

We shall attempt to portray the connection between the many forms of discrimination against agriculture and the growth in agricultural output in around thirty countries (see Table 3). Development literature has been combed for all available information indicating the scale of discrimination against agriculture in the Seventies, especially price discrimination. The accumulated data have been combined to form three discrimination indicators:

A price discrimination indicator showing the scale of intervention in the system of farm prices;
A non-price discrimination index summarising other information on the neglect of agriculture; and
A discrimination index constructed from information on price and other discrimination against the agricultural sector.

The discrimination index is correlated with the rate of growth in agriculture. It is modelled on a study by Agarwala,[17] who examined the link between price distortions and macroeconomic growth in developing countries. He constructed a price distortion index from data on the scale of government interference with important prices such as exchange rates, factor prices and product prices, constructed a discrimination index from this and correlated it with macroeconomic growth rates.

[17] R. Agarwala: Price Distortions and Growth in Developing Countries, World Bank Staff Working Paper No. 595. Management and Development Series No. 2, Washington, D.C. 1983.

Table 3

Average Nominal Protection Coefficients for the Agricultural Sector

Country	NPC of the Agricultural Sector	NPC up to 0.80	Per Capita Rate of Growth in Agricultural Output	NPC Over 0.80	Per Capita Rate of Growth in Agricultural Output
1. Egypt	0.89			0.89	–1.00
2. Ivory Coast	0.85			0.85	1.26
3. Ghana	0.60	0.60	–3.70		
4. Kenya	0.90			0.90	–1.13
5. Malawi	1.00			1.00	–0.13
6.	0.80	0.80	0.73		
7. Nigeria	0.70	0.70	–0.40		
8. Upper Volta	1.00			1.00	1.00
9. Zambia	0.70	0.70	–2.07		
10. Senegal	0.70	0.70	–1.90		
11. Sudan	0.75	0.75	–1.19		
12. Togo	0.50	0.50	–0.21		
13. Tanzania	0.70	0.70	–1.72		
14. Argentina	0.85[2]			0.85	2.36
15. Brazil	0.76[2]	.76	1.31		
16. Bolivia	1.46			1.46	–0.33
17. Chile	0.95[1]			0.95	1.04
18. Columbia	1.29[1]			1.29	2.01
19. Mexico	0.98[1]			0.98	–0.12
20. Peru	1.49			1.49	–2.33
21. Uruguay	–	–	–	–	–
22. Bangladesh	0.85[2]			0.85	0.25
23. Burma	0.88[2]			0.88	0.79
24. China	–	–	–	–	–
25. India	0.96[2]			0.96	0.56
26. Indonesia	0.95[2]			0.95	2.14
27. Philippines	1.18[1]			1.18	2.08
28. Pakistan	0.70[1]	0.70	0.33		
29. Thailand	0.93[1]			0.93	2.09
30. Turkey	1.40[1]			1.40	0.89
	Group Averages	0.69	–0.88	1.05	0.61

[1]EPC = effective protection coefficient for the agricultural sector at a given point in time.

[2]NPC = nominal protection coefficient, calculated as an average of the NPCs for individual agricultural products. In all other cases. NPC for the agricultural sector for the period 1970–80.

In order to carry out a comparable study of the agricultural sector, we put together a number of indicators for as many countries as possible from the available literature on development. Once these have been presented briefly, three alternative procedures will be used to construct discrimination indices for price discrimination, non-price discrimination and overall discrimination. A regression will then be calculated between these indices and the average annual rate of growth in agricultural production between 1971 and 1982.

NOMINAL RATE OF PROTECTION IN AGRICULTURE

A frequently used indicator for price discrimination against agriculture in developing countries is the nominal rate of protection for agricultural products, defined as the ratio between producer prices and import prices on a cif basis. As far as possible, this ratio has been calculated as an average for the period from 1970 to 1981, by averaging the values for individual agricultural products and using the result as an indicator. In addition, the average rates of growth in per capita agricultural production have been calculated for a group of countries with high price discrimination and one with low discrimination. Countries with nominal protection coefficients of 0.8 or less are regarded as high discrimination countries while those above that level are treated as low. High discrimination countries showed an average fall of 0.88 percent a year in per capita agricultural production between 1971 and 1982, whereas low discrimination countries recorded an annual per capita increase of 0.61 percent (see Table 3).

This finding is noteworthy, since it indicates that prices have a considerable influence on aggregate farm production. It therefore contradicts those studies that attempted to estimate price elasticities for the entire agricultural sector and generally arrived at very low aggregate values. Nevertheless, it is obvious that this method can provide only a rough indication.

Changes in the terms of trade between agricultural and industrial products are another important factor. Of course, a deterioration in terms of trade between the agricultural and the industrial sector cannot simply be equated with discrimination, for they may express changes in factor productivities. However, often protective tariff policies lead to the emergence of monopolistic market power and scope for price increases that work to the detriment of the agricultural sector. One problem with determining the terms of trade is that of finding a suitable indicator for the prices of industrial goods. The most suitable would be a price index that encompassed all industrial goods contained in the demand of farming households, consumer goods as well as producer goods. The terms of trade calculations used here, which are drawn from the relevant literature, are based on widely differing price indices and relate to different periods. The average change in the terms of trade in the Seventies has been calculated for the purposes of this paper.

EFFECTIVE RATE OF PROTECTION FOR INDUSTRIAL PRODUCTS

A further possible factor of price discrimination against agriculture is the effective protection coefficient of industry, defined as the ratio of value added at domestic prices to value added at world market prices. The higher the tariff protection for industrial products, the higher the prices farmers have to pay for such goods and the worse their terms of trade. This value is possibly more appropriate for depicting the extent of discrimination than changes in the intersectoral terms of trade, for which the available data are not easily compared.

Despite the considerable effort involved in calculating the effective protection coefficient for a country's industry as a whole, it has been possible to assemble data for more than thirty countries. Most of the studies relate to a single year and some of them date back to the Sixties, but since the effective rate of protection reflects the overall stance of foreign trade policy, which generally does not change abruptly over time, it nevertheless seems to be a usable measure for analysing periods of several years.

ORGANIZATION OF AGRICULTURAL MARKETS

Not only is interference with the price mechanism of agricultural markets widespread in developing countries, but the nature of the markets is often also subject to government edicts and prohibitions; in extreme cases, trade in agricultural products is a complete state monopoly. It is true that the scale of official intervention cannot be equated with discrimination, as the example of the European Community shows, but in most developing countries it is an indication of the "urban bias" of agricultural policy. In most countries the prices of agricultural products are set by the government. In some countries government regulations compel the use of land to produce certain agricultural products whose prices are held artificially low. Restrictions are often imposed on the volume of agricultural exports. In many instances there is substantial excess demand for agricultural inputs and capital goods, because subsidies keep prices low but the resulting demand cannot be met, so that a system of rationing is necessary, often arranged according to political expediency and to create a political clientele. This reduces the efficiency of resource utilization. Finally, in a number of countries state monopolies handle all agricultural trade and the storage of agricultural products.

Information from a variety of sources on the extent of agricultural price controls, compulsory sales of agricultural products to the state, the extent of land use regulations, the availability of agricultural inputs and the rural structure was evaluated and allocated the value 0 or 1, depending on whether the criterion was largely met or not. For econometric purposes these indicators can be used as dummy variables.

RESOURCE UTILIZATION

Discrimination against agriculture is also evident in the utilization of productive resources, especially capital and labour. According to the theory, discrimination must reduce both the quantity and the quality of resources used in agriculture. By way of example, a number of data on resource utilization that are available for a larger number of countries were gathered, such as the ratio of the number of students of agricultural science to the population or the illiteracy rate in the countryside as a measure of the quality of the labour force. Here too, it is clear that discrimination against agriculture is not the only factor determining resource utilization; for example, the illiteracy rate in rural areas also depends on the country's general level of development.

Sooner or later, discrimination against agriculture has characteristic repercussions on foreign trade. Food imports rise, because discrimination holds back self-sufficiency. Imports of agricultural products often rise faster than exports, countries become increasingly dependent on food aid from western industrial countries and the food problem increasingly dominates the balance-of-payments situation. These effects of discrimination were portrayed by using two indicators, namely food aid per head of population and the ratio of agricultural imports to total exports. The rates of growth of food imports and total exports were also compared.

Development aid for agriculture in US dollars per head was used as a further indicator, although in this case it is not clear whether a high value indicates discrimination or promotion of agriculture; both interpretations are possible in principle. Discrimination can have the effect of greatly increasing the need for development aid for agriculture, so that a high level of agricultural aid can be regarded as an indication of discrimination.

The opposite interpretation is also conceivable, however, namely that a high degree of discrimination has the effect that the bulk of development assistance is also channelled to sectors other than agriculture. Nevertheless, simple correlation between per capita rates of growth in agricultural production in thirty developing countries and per capita development aid shows a clear positive relationship between the two, so that a high value for development aid to agriculture is more likely to be a sign of non-discrimination.

DISCRIMINATION VERSUS GROWTH?

Let us now examine whether there is a statistical connection between agricultural discrimination and the growth in agricultural production. For this, the individual indicator values for price discrimination were first standardized to obtain values with an average of zero and a variance of one. The following indicators of price discrimination were used: nominal protection coefficient for agriculture (–), change in intersectoral terms of trade (–), effective protection coefficient for

industry (+), scale of farm price controls (+), compulsory sales to government agencies (+), availability of agricultural inputs (+) and the organization of the agricultural market (+).

Using the same procedure, values were constructed for the indicators of non-pride discrimination: direct taxes paid by agriculture (+), official development assistance (+), students of agricultural science (–), illiteracy rate in agriculture (+), food aid (+) and the ratio of agricultural imports to exports (–). Three different methods were used to generate discrimination indicators from these values.

Unweighted addition (substraction) of the standardized values: values that indicate discrimination, such as the level of the effective industrial protection coefficient, were added and others, such as the level of the agricultural protection coefficient, were substracted. This produced a price discrimination indicator, a non-price discrimination indicator and an overall indicator encompassing the values of both price and non-price discrimination.

Weighted addition of the standardized values: for this purpose a multiple regression between the growth rates of agricultural production in thirty countries between 1971 and 1982 and the corresponding standardized indicator values was carried out. The resultant coefficients of the regression equation were then used as weights for aggregating the standardized values to create a discrimination indicator.

Creation of a principal component from the individual values describing discrimination: this procedure is based on the notion that discrimination against agriculture is a many-sided syndrome affecting a number of quantifiable variables equally. It is assumed that the individual discrimination values are interlinked in a linear manner and can be expressed by other values (principal components). The first principal component was interpreted as a discrimination index. In this way a total of three discrimination indicators were generated for price, non-price and overall discrimination.

The discrimination indicators for thirty countries were then correlated with these countries' average annual rates of growth in agricultural production and per capita agricultural production over the period from 1971 to 1982.

The results are shown in Table 4 and partially in Figure 1. The calculated statistical relationships are strongest in the case of weighted addition of the standardized indicators. Moreover, the link appears stronger if the per capita growth rate is used as the dependent variable instead of the growth rate. The principal component procedure appears to be the least rewarding; regression of the principal component "discrimination" with growth rates produces relatively low determination coefficients (see Table 4). Moreover, the principal component explains only a small proportion (around 30 percent) of the variances of the individual values. It is worth noting that the estimated coefficients are all significant and do not differ markedly from one another, however, the discrimination index is constructed (see Table 4).

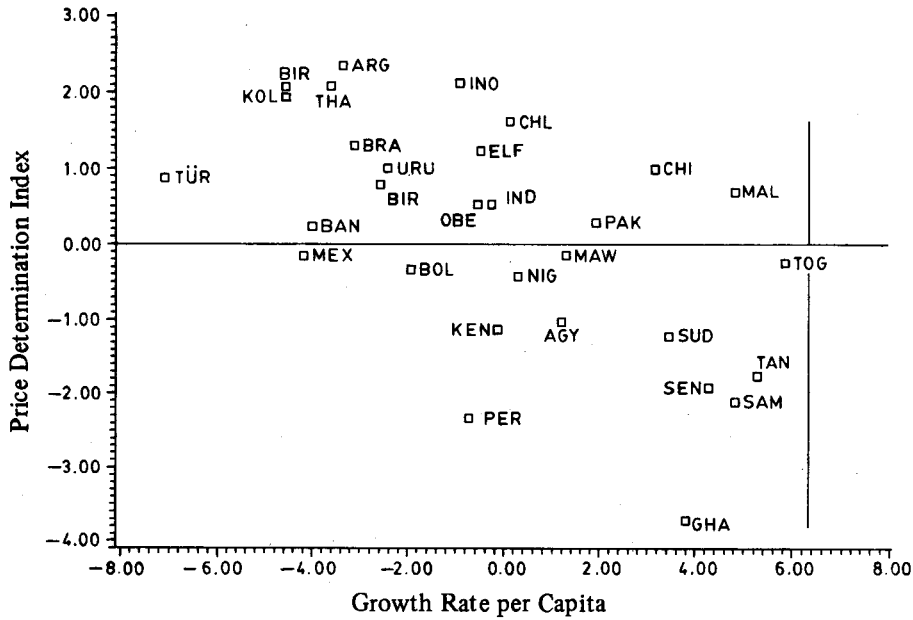
Table 4

Average Rate of Growth in per Capita Agricultural Production (1971–82)

	Rate of Growth of Agricultural Production in 30 Developing Countries			Rate of Growth of per Capita Agricultural Production in 30 Developing Countries		
	R^2	a_0	a_1	R^2	a_0	a_1
Principal Component						
1. Price Discrimination Explained Variance: 29,9 percent	0.26	2.52[b]	−0.66[b]	0.35	−0.05	−0.84[b]
2. Non-price Discrimination Explained Variance: 35,4 percent	0.19	2.52[b]	−0.56[a]	0.45	−0.05	−0.96[b]
3. Discrimination, All Indicators	0.29	2.52[b]	−0.69[b]	0.50	−0.05	−1.01[b]
Unweighted Addition of Standardized Indicators						
1. Price Discrimination	0.37	2.52[b]	−0.78[b]	0.42	−0.05	−0.93[b]
2. Non-price Discrimination	0.19	2.52[b]	−0.56[b]	0.44	−0.05	−0.95[b]
3. Discrimination, All Indicators	0.33	2.52[b]	−0.73[b]	0.52	−0.05	−1.03[b]
Weighted Addition of Standardized Indicators						
1. Price Discrimination	0.61	2.52[b]	−1.31[b]	0.55	−0.05	−1.46[b]
2. Non-price Discrimination	0.38	2.52[b]	−1.28[b]	0.52	−0.05	−1.44
3. Discrimination, All Indicators	0.68	2.52[b]	−1.31[b]	0.69	−0.05	−1.45[b]

[a] Significant with less than 5 percent probability of error.
[b] Significant with less than 1 percent probability of error.

Step-by-step regression with all the indicators produces an interesting result, in that just three indicators determine 60 percent of the per capita rate of growth of agricultural production in the sample of thirty countries. They are the following:



AGY :	Egypt	IND :	India	PER :	Peru
ARG :	Argentina	INO :	Indonesia	PHI :	Philippine
BAN :	Bangladesh	KEN :	Kenya	SEN :	Senegal
BIR :	Burma	KOL :	Colombia	SAM :	Zambia
BOL :	Bolivia	MAL :	Mali	SUD :	Sudan
BRA :	Brazil	MAW :	Malawi	TAN :	Tanzania
CHI :	China	MEX :	Mexico	TOG :	Togo
CHL :	Chile	NIG :	Nigeria	THA :	Thailand
ELF :	Ivory Coast	OBE :	Upper Volta	TUR :	Turkey
GHA :	Ghana	PAK :	Pakistan	URU :	Uruguay

Fig. 1. Average per Capita Agricultural Growth Rate and Index of Price Discrimination (1971–1982).

	R^2	$a_0 = -0.06$
1 The Illiteracy Rate	0.36	$a_1 = -0.54$*
2. Plus the Organization of the Agricultural Markets (Market Economy versus State-controlled Economy)	0.53	$a_2 = -0.76$**
3. Plus Changes in Intersectoral Terms of Trade	0.60	$a_3 = -0.44$*

* Significant with less than 1 percent probability of error.
** Significant with less than 5 percent probability of error.

All the other indicators either increase the determination coefficient only marginally or have non-significant coefficients when additionally introduced into the regression equation.

The studies that have been made so far into aggregate price elasticities for agricultural production in developing countries give no cause for optimism about elasticity. Some of the studies estimate elasticities close to zero, but even the other elasticity estimates leave one with no option but to conclude that substantial price increases are needed to bring about a discernible increase in agricultural production in developing countries.

The impact of price factors is more evident, however, if rates of growth in agricultural production over a ten-year period are calculated and a connection established between these and various measures reflecting price discrimination against agriculture. It then becomes clear that price discrimination against agriculture leads to a significant reduction in the rate of growth of agricultural production and per capita agricultural production. In this respect it is not just producer prices that are relevant, however, but a range of prices that can influence agricultural production.

There are many factors besides prices that affect the possibility of exploiting the development potential of agriculture. These range from government policies on investment, health and education to institutional factors such as the organization of the agricultural markets. There are many indications that increases in producer prices can be effective only when combined with the reduction of general discrimination against the hinterland in developing countries. Agricultural prices cannot be the sole factor of a new agricultural policy in developing countries. The prices must be set in an economic environment that is favourable to the agricultural sector. This must be accompanied in particular by a package of infrastructure measures in rural areas. Without this the development of commercialized farming in which prices achieve a larger influence does not appear at all possible.

Comments on "Conditions of Agricultural Growth in Developing Countries"

Professor Hans-Bernd Schäfer discusses two major issues in this paper. The first issue has to do with the question "Do prices matter?" in expanding agricultural production in underdeveloped countries. His survey of a number of studies, including his own in some districts of India, shows that "an unambiguous connection between prices and production cannot be determined". There are two problems here. First, a price change is likely to affect not the level of production but the area of a crop. Production level depends on factors related to the allocation of resources and level of efficiency rather than the price of output. However, price changes will affect the marketable surplus. Therefore, in most studies we find a strong relationship of price changes to the crop area and the marketable surplus in agriculture. The second problem involves the estimation of short- and long-run price elasticities. The author should have looked at the difference between the single-crop price elasticities and the cross-price elasticities to determine the crop mix and the level of aggregate agricultural output. The relative price change between crops affects not only the crop mix but also the level of productivity of each crop.

The second issue is the more interesting, because it focuses on the effects of public policies that "discriminate" against agriculture. These policies include price and non-price measures. Professor Schäfer discusses the relationship of the "discriminating indicators" with the rates of agricultural growth in several underdeveloped countries. These indicators are (a) the nominal and effective protection coefficients (or the domestic to international price ratios), (b) domestic terms of trade between agriculture and industry, (c) organization agricultural markets or the degree of intervention by the government in trade, etc., and (d) provision of resources to the agriculture sector (like physical infrastructure, education, etc.). There is no doubt that all of these seem to play a part in determining the rates and structure of growth of agriculture. The problem, however, is that one cannot establish a "cause and effect" relationship between these indicators – or of a composite "discrimination index" however developed – and the rates of agricultural growth.

This brings us to Professor Schäfer's exercise in the last section "Discrimination versus Growth" and the results in Table 4. There can be no disagreement on the point that discrimination against agriculture is a "many-sided syndrome", even if one agrees with the notion of discrimination. The problems really reside in the estimation methods. The principal-component approach has obviously not been very successful

in explaining the relationship either way. Why should one assume that the individual discrimination values are linearly linked? Why does the apparent link between the discrimination index and the growth rate turn out to be stronger on a per capita than aggregate basis? Professor Schäfer makes no attempt to enlighten us on these questions.

I wish the author had dealt more fully with the larger issue of the need for transfer of resources from agriculture to the rest of the economy (its historical role) and the problem of maintaining incentives to increase agricultural production and productivity. Evidently some countries have found the necessary balance, but many others have not? The popularly accepted idea of "urban bias" as an explanation for failure in agriculture of many underdeveloped countries is neither necessary nor adequate.

Mahmood Hasan Khan

Simon Fraser University,
Canada

Comments on "Conditions of Agricultural Growth in Developing Countries"

The author has done an excellent job bringing at one place the literature on supply response in developing countries. The construction of an index of discrimination faced by agriculture in Third World Countries is also an important contribution made by the author. I intend to evaluate the major concern of the paper relating to the determinants of agricultural growth and an analysis of public policies that discriminate against agriculture. From this perspective, I would indicate the policy options that policy-makers need to seriously consider for increasing the rate of agricultural growth.

First, it is important to note that there are a host of factors that determine the rate of agricultural growth in any country. Prices, institutional development, supply of adequate inputs or infrastructural facilities are some of the factors that easily come to mind. Since agricultural production is an integrated process, no factor by itself can be a sufficient condition for agriculture growth. In any meaningful analysis, it is important to attach priorities to determining factors for obtaining additional agricultural output in any specific case. Professor Schäfer's analysis is of a general nature and is of limited usefulness for devising policy insights, without further analysis.

Second, the limited policy usefulness of the type of analysis conducted by the author can be illustrated by his answer to the issue of 'Do prices matter?'. The absence of an unambiguous connection between prices and agricultural production in no way can be construed to imply that governments in developing countries should ignore the important issue of price policies. For one thing, almost all empirical studies on supply response show that there is some positive response to relative prices of agricultural and manufacturing goods and that agricultural output is positively related to prices. A minority of studies show that prices and output are not related. The overall conclusion of the studies, however, is that the extent of responsiveness of aggregate output to relative prices is very small even when positive. If we keep this finding in view, then manipulation of relative prices of agricultural and manufacturing prices by itself would not be a very effective policy tool to use to obtain additional agricultural output in developing countries. The reason is simple. To sustain the rate of growth of the economy at about 6 percent, we need to ensure that the agricultural sector grows annually at least 5 percent a year if undue

inflating pressures are to be avoided. Since the supply responsiveness, even when positive, is very small, the kind of price change in agricultural prices required would be of such an order that no government in the developing countries would be able to live with. Given the knowledge about the aggregate responsiveness, relying on price policy alone is therefore, not a very effective policy instrument to use.

Third, another price policy issue, by and large ignored by the author, relates to the inter-crop price determination by the Third World governments. Evidence of considerable price responsiveness exists when farmers decide about which crops they should devote their resources to. Distortion of prices between different crops results in misallocation of resources.

Fourth, Professor Schäfer's point that non-price factors are critical determinants of agricultural production is well taken. Financing investments require mobilization of resources. In this context too, high agricultural prices and/or input subsidies may turn out to be a drain on resources and ultimately result in underfunding of programmes for agricultural development.

Last but not least, there is a need to rethink about the overall development strategy adopted in most developing countries. In most developing countries, in the past, the development strategy has been such that it has suppressed effective demand for agricultural goods. Given the supply of agricultural goods, it has resulted in low agricultural prices. A strategy aimed at increasing effective demand for agricultural goods results in improved incentives for agricultural producers.

Sarfraz Khan Qureshi

Pakistan Institute of
Development Economics,
Islamabad.