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Structural Adjustments and Agriculture

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FOREWORD

Economic Reforms have been ushered in in the Indian economy since July 91. Macro economic reforms in the form of trade and exchange rate policies and controlling the fiscal deficits are affecting all the sectors. The structural reforms in industry are directly affecting the industrial sector, but also having implications for other sectors. What is likely to be the impact of these Macro and Micro Reforms on Indian Agriculture is the subject matter that Dr. Ashok Gulati and Dr. Shashanka Bhide have tried to explore in this paper. They have pointed out the linkages between trade reforms, industrial reforms and their implications for agriculture. They also focus specifically on the Urea segment of Fertiliser Industry. They attempt to delineate broadly the implications of decontrol in the Urea sector (under alternative scenarios). Another interesting point that they take up for analysis is the impact of reforms on private investment in agriculture and thereby on the growth momentum of this important sector of the economy.

I am sure this paper would be useful to researchers and policy makers interested in knowing the implications of the reform process in agriculture.

S. L. Rao
Director-General

Mast-head

The process of economic reforms launched in India about two years back, has affected the trade and industrial sectors more than the others. Agriculture, a major sector in the Indian economy, cannot remain insulated from the reform process for long. In this context, a review of the economic reform process undertaken so far and its implications for agriculture, are important and this paper is an attempt to provide such a review. The paper takes up in greater detail the implications of price decontrol in the case of urea and the role of private sector investment in agriculture under the reforms.

Structural Adjustments and Agriculture*,[1]

SINCE July 1991 India has been engaged in a dramatic turnaround of economic policies, which are going to shape the future of this country in a significantly different way than was envisaged by earlier policies. It appears with a high degree of certainty that the Indian economy will go in a big way for market orientation at home and across borders, with the process of globalisation already initiated in the manufacturing sector. It would be worth asking at this stage as to what is the broad nature of economic reforms initiated so far, and how different sets of policies in the new package are likely to affect agriculture? This paper is a modest attempt to address this major question.

Accordingly, the first two sections of this paper address these two questions. In Section I, the main elements of economic reforms being carried through in different segments of the economy are delineated. In Section II, the likely implications of these policy changes, both in the agricultural and non-agricultural sectors, for agriculture are discussed. This section specifically focusses on the question of fertiliser subsidy and factors influencing the flow of resources into agriculture. In Section III, the conclusions of the analysis are presented.

I. Nature of Economic Reforms (July 1991 to March 1993)

The broad tenor of economic reforms so far has been three fold:

(a) Correcting the overvalued exchange rate of the rupee first by devaluation, followed by the partial convertibility of the rupee, and then making the rupee fully convertible on the current account transactions. This is combined with lowering of tariff walls, which incidentally are the highest in the world, to a maximum of 110 per cent in the last budget, and to a maximum of 85 per cent in the 1993-94 budget (except in the case of passenger baggage or some luxury consumer items). The basic direction is in terms of globalising the economy, particularly the manufacturing sector that needs to change from an inward orientation to an outward looking sector. On capital goods imports the maximum tariff is being gradually reduced to much lower levels, say about 25-30 per cent. The idea is to upgrade the technological status of the

* Thanks are due to D.K. Joshi for his excellent research support in preparing this paper.

[1] An earlier version of this paper was presented at the First National Conference on Agricultural Policy in the Context of New Economic Policy held at Indian Agriculture Research Institute (Delhi) during February 24-25, 1993.

industry to international standards. This hopefully would help in promoting exports, given comparative advantage of cheap skilled labour in this country. This measure also aims at opening up the domestic industrial sector to global competition, thus forcing industry to adopt measures to reduce costs and upgrade the quality of its goods. The policy of globalisation seeks to reverse the process by which the domestic industry has become inefficient (high cost) under the umbrella of protection that was too high and provided for too long a period, perhaps past the stage of infancy.

Fiscal correction in the Central budget which led to a reduction in fiscal deficit from 8.5 per cent of GDP in 1990-91 to 6.5 per cent in 1991-92, to 5.7 per cent in 1992-93 and a target of 4.7 per cent in the coming year. This macro adjustment is carried out primarily with a view to control inflation and to learn to live within the means of the economy. This involves either cutting down government expenditures or raising revenue or optimally making both the efforts.

Reduction in government expenditures, especially on capital formation would require that the private sector should take up the initiative in meeting the new opportunities for investment. To facilitate this growth of private sector, reforms in industrial regulations were essential. Delicensing of most of the industries at home (except a list of 18) was carried out in 1991 Deregulation of domestic industry was necessary to bring about greater competitiveness both within the country and in a global environment. For the manufacturing sector the writing is quite clear on the wall that market forces will play a major role in influencing the decisions of what to produce, how to produce, and where to produce. Government will be more of a monitoring agency to prevent unfair trade practices, rather than the one influencing the allocation of resources. The domestic manufacturers are told in no uncertain terms that gradually they will have to face greater global competition, and therefore they must look outside to decide on their future investments. With the gradual reduction of tariff walls, it has become imperative to revamp the entire domestic tax structure particularly with regard to excise duties and corporate income tax. The 1993-94 budget has lowered the excise rates but corporate taxes are left untouched. This indicates that the process of globalisation does not end at reducing tariff barriers alone, rather it necessitates domestic deregulation and restructuring of entire taxation policies, and also of reorientation of several institutions which lose their significance in the changed environment.

It may be noted that so far the process of economic reforms, more or less, has fined itself to the manufacturing sector. Agriculture has been directly hit primarily

by one policy reform, and that is with regard to the fertiliser subsidy. It may be mentioned here that even in the case of fertiliser subsidy, the compulsion seems to have arisen from the need to make adjustments in the budgetary balance rather than with a view to ushering in reforms in agriculture.

Let us now try to examine the likely consequences of the above set of reforms on agriculture in the short and medium to somewhat long run.

II. Likely Implications of the Reforms Undertaken So Far

(a) Trade and Exchange Rate Policy Changes

The impact of Policy Changes at the macro level, particularly in the trade and exchange rate policies, on agriculture are briefly examined here. Sweeping changes in the external sector ranging from devaluation to abolition of CCS, EXIM scrip, and introduction of partial and now full convertibility have influenced the structure of effective incentives in different sub-sectors of the economy. This is likely to induce reshuffling of resources across different sectors. Viewed from this angle, when the impact of these trade policy changes on incentive structures is examined, it is found that the sectors which have gained most are the ones with lowest import intensity. Agricultural products stand at the top in that ranking, followed by leather products, cement, etc.(Gulati and Debroy, 1992). Thus agriculture should be attracting more resources (primarily from the private sector) on account of exports purely on the basis of its incentive structure. Incidentally, these changes in trade policy (if they are in the right direction) and their impact on incentive structures also indicate that earlier the system was 'discriminating' against agriculture through an overvalued exchange rate and a plethora of other trade policy instruments.

From the angle of export competitiveness, these reforms in trade policy have made most of Indian agricultural commodities (with a notable exception of oilseeds) quite competitive, more so than most of the industrial commodities (Gulati and Pursell, 1992). The major question, however, is whether there are ample surpluses of agricultural commodities or will these exports be at the cost of domestic consumers. One way out may be to export better varieties or processed agricultural commodities fetching higher unit value, while simultaneously allowing imports of low value, coarser varieties for the poor at home. But the real solution seems to lie in enhancing productivity, pumping in greater investments in agriculture, and promoting resource use efficiency.

(b) Of Fiscal Correction

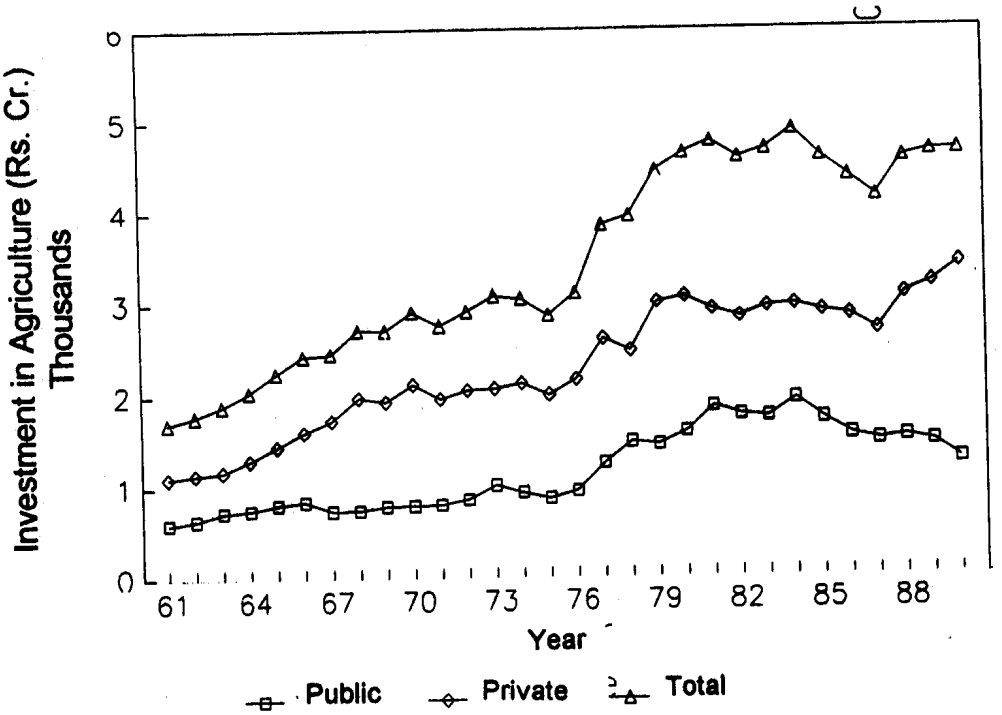
As far as the question of fiscal correction is concerned, the main issue is to explore how the government can reduce its deficit. Although it is perhaps too early

to say much about this, so far the indications are that it is not cutting down its non-developmental expenditure in any significant way. If there is any sign, it is more of decline in the developmental expenditure. If it is really so, and if further adjustments are likely to be in the same direction, this is likely to have an adverse impact on the growth of the economy. Agriculture is a state subject, and one will have to examine more carefully the state budgets also. Cursory scanning of budgets of selected states somewhat confirmed apprehensions that investment in agricultural infrastructure and in irrigation is either constant or marginally declining in real terms for 1992-93. This is somewhat an alarming feature, given the need to increase foodgrain production to 210 million tonnes by the end of the Eighth Plan. However, there also have been some welcome steps in the previous budget for agriculture, such as, small farmers' agro-business consortium, and now in the 1993-94 budget the allocation for plan schemes of the Ministry of Agriculture including Animal Husbandry and Dairying is being increased by 12.7% over the revised estimates of the previous budget. Plan schemes of rural development are up by 39 per cent [from Rs. 3500.12 crores (RE) in 1992-93 to Rs. 5010 crore (BE) in 1993-94]; of water resources by 33.5 percent (from Rs. 216.44 crores to Rs. 289 crores) (See *Expenditure Budget 1993-94*, Vol. I). Further, the allocation for food processing has been raised from Rs. 25 crores in the previous plan to Rs. 1000 crores in the Eighth Plan.[1] This can help in adding value to Indian agriculture, and if spent properly on the desired infrastructure for food processing with an eye on exports, it can fetch a significant amount of foreign exchange.

In the context of reductions in government expenditure, the dependence of agriculture on public investment merits careful examination. The government investment in agriculture has taken primarily the form of works relating to irrigation. Investment in medium and large irrigation projects has raised the productivity of the crop area by enabling the adoption of high yielding varieties, intensive use of fertilisers and raising the intensity of cropping. The proportion of government investment in the gross fixed investment in agriculture averaged 32.3% for the period 1985-86 to 1989-90. Out of an average gross fixed investment of Rs.4481 crores at 1980-81 prices, public investment was Rs.1447 crores, for the period 1985-86 to 1989-90. Thus, public investment, though not predominant, is a critical component of total investment in agriculture.

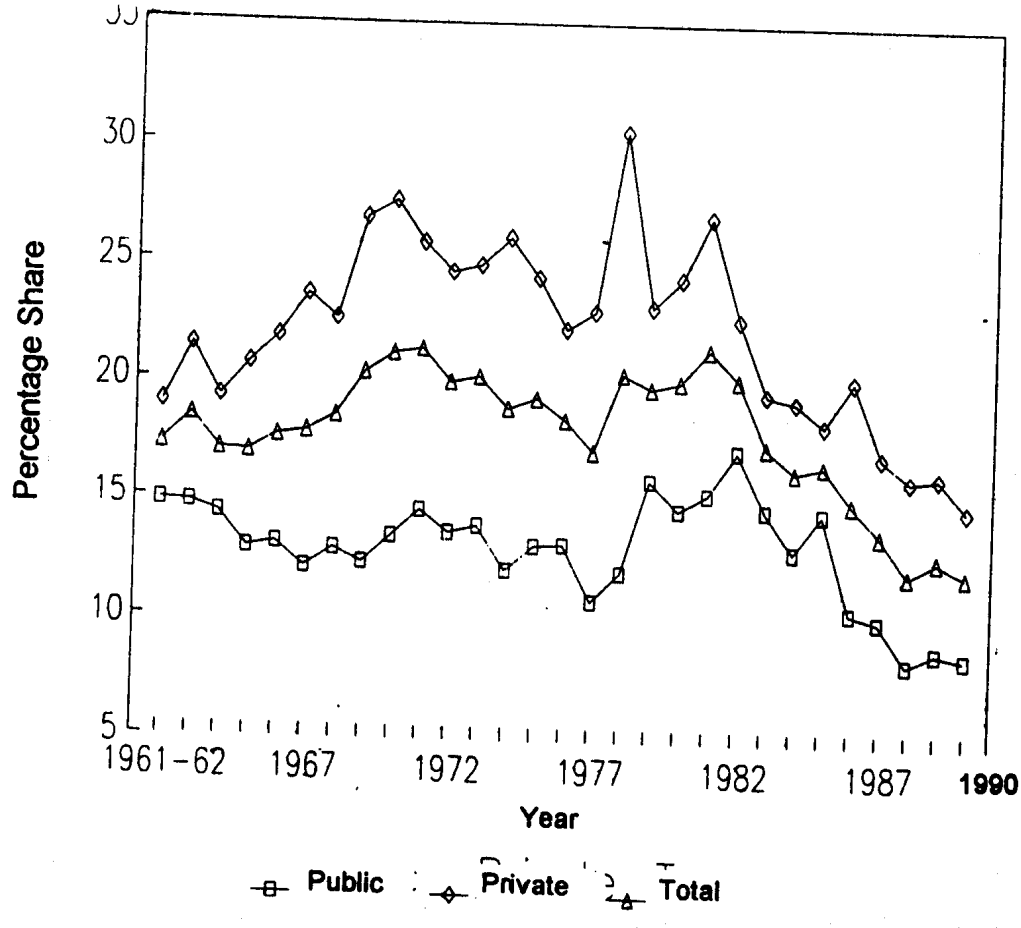
As *Figure 1* shows, trends in investment in agriculture do not show any increase during the period of the 1980s. For the public sector, there in fact appears to be a declining trend. The private sector investment has not been rising sufficiently to make up the decrease in the level of public investment. The average rate of growth of investment in agriculture has declined for public, private and total investment for the 1980s as compared to the 1970s.

Fig. 1: Real Investment in Agriculture*



* Gross Fixed Capital Formation

Fig. 2 : Share of Agricultural Investment to Total Investment*



* Gross Fixed Capital Formation at 1980-81 Prices

Note :
Public = (Public sector investment in agriculture / Total public sector investment)
Private = (Private sector investment in agriculture / Total private sector investment)
Total = (Total investment in agriculture / Total investment)

The rates of growth estimated using a semi-log functional form for the various periods are as follows:

	1960s	1970s	1980s
(a) Real Gross Fixed Capital Formation in Agriculture	6.28	5.15	-0.90
(b) Public Sector	2.40	7.30	-3.27
(c) Private Sector	8.07	4.16	0.30

The declining trend is more obvious if we consider the share of agriculture in total investment, as shown in *Figure 2*. The share of agriculture in total real investment has declined from a peak of over 20% in 1980-81 to about 12% in 1989-90. The trends are similar for both public and private investment. The data are provided in Annexure Tables A-1 and A-2. While in the case of public investment, one may argue that there was a policy shift in favour of non-agricultural investment in the case of private investment, the explanation for the decline in the share of agriculture should lie in declining profitability of investment, as well as its complementarity with public sector investment.[2]

However, the major issue concerning agriculture in the Central budget remains that of fertiliser subsidy. We all know that during the last two years fundamental changes have taken place in the pricing policy of fertilisers.

(c) The Issue of Fertiliser Pricing

The Joint Parliamentary Committee on Fertiliser Pricing in its report submitted in August 1992 recommended decontrol of phosphatic and potassic fertilisers with respect to prices and movement. It recommended that the urea prices be lowered. These recommendations and a few other measures designed to improve the competitive position of domestic production of phosphatic fertilisers were implemented by the government in August and September of 1992. The price and movement control on phosphatic and potassic fertilisers were removed (in effect, RPS for these fertilisers was abolished), urea price was lowered by 10% (to Rs.2754 per tonne at farm-level), import duty on phosphoric acid was abolished and import of raw materials and intermediates for DAP and complex fertilisers were made at official rates of exchange. Railway freight for phosphatic and potassic fertilisers were brought down. The low analysis nitrogenous fertilisers were brought back under RPS which were decontrolled in July 1991. Following the sharp rise in phosphatic and potassic fertilisers when the controls on price and movement were removed, a special subsidy for Rabi 1992 on DAP and MOP at Rs.1000 per tonne and on complex fertilisers at corresponding rates was announced.

These changes represent steps aimed at reduction of fertiliser subsidies but they also have led to changes in relative prices of phosphatic and potassic fertilisers vis-a-vis nitrogenous because of subsidy on nitrogenous fertilisers. In 1991-92, imported fertilisers accounted for a subsidy of Rs.1300 crores which were primarily phosphatic and potassic fertilisers. The domestic fertilisers accounted for Rs.3500 crore subsidy, part of which was on indigenously produced phosphatic fertiliser and the rest on nitrogenous fertilisers. Thus, the total subsidy on phosphatic and potassic fertilisers may be about Rs.1500 crores. In 1992-93, the price decontrol of phosphatic and potassic fertilisers, therefore, could have saved about half of Rs. 1500 crores on subsidies as the decontrol affected only the rabi applications. The flat rate subsidy of Rs.1000 per tonne for DAP, MOP and corresponding subsidy for complex fertilisers, however, again pushed the subsidy bill higher. Further, increase in subsidy for urea also pushed the subsidy bill up. The subsidy for domestic fertilisers in 1992-93 is estimated at Rs.4800 crores and for imported fertilisers at Rs.1000 crores, thus, higher particularly for indigenously produced fertilisers. In 1993-94, the budget provision for subsidy on indigenous fertilisers is Rs. 3000 crores and for imported fertilisers, Rs.500 crores. This budgeted subsidy of Rs. 3500 crores would turn out to be too insufficient unless appropriate steps are taken to increase indigenously produced nitrogenous fertiliser prices. Even if Rs. 1000/tonne subsidy on DAP and MOP, which was introduced in 1992-93, automatically stands withdrawn in 1993-94, it cannot bring down the subsidy bill to Rs. 3500 crores. This unbridged gap points towards the possibility of 15 to 20 per cent rise in urea prices and/or dismantling of RPS for urea, and substituting it by a flat rate subsidy.[3]

The decontrol of phosphatic and potassic fertilisers led to an initial rise of more than 100% in their prices. Subsequently government introduced Rs. 1000/tonne subsidy on DAP and MOP and tried to control the 'free market' prices. As a result, DAP prices settled at Rs. 7000/tonne. This meant an increase of over 90 per cent in the case of DAP. In the case of MOP, the price subsequent to decontrol reached Rs. 4700 to 5000 per tonne inclusive of subsidy. This development when considered with the fact that there is a reduction in the price of urea, is leading to a distortion in the balanced use of nutrients. The proportion of phosphatic and potassic fertilisers will go down in relation to nitrogen if the present situation continues. The offtake of phosphatic and potassic fertilisers in 1992 rabi season is reported to have decreased by 30 and 50 per cent respectively over the 1991 rabi season. On the other hand, offtake of urea increased by more than 20 per cent, and was sold at a premium in some states.[4]

The need to correct prices now, thus, moves on to the case of urea or nitrogen prices. The Retention Price Scheme (RPS) today covers all the nitrogenous

fertilisers. Nearly all the urea requirements of Indian agriculture are met by domestic production. Urea is the main source of nitrogen supplied through chemical fertilisers in the country. Therefore, changes in urea prices would have significant implications for domestic industry as well as for agriculture. There may be more than one way to go about reducing fertiliser subsidies. For instance, there can be a fixed subsidy per tonne such that the overall subsidy bill is smaller; there can be an increase in prices paid by the farmers coupled with a flat rate subsidy; and there can be a price decontrol. It is this last option and its likely implications that we are investigating in this paper now.

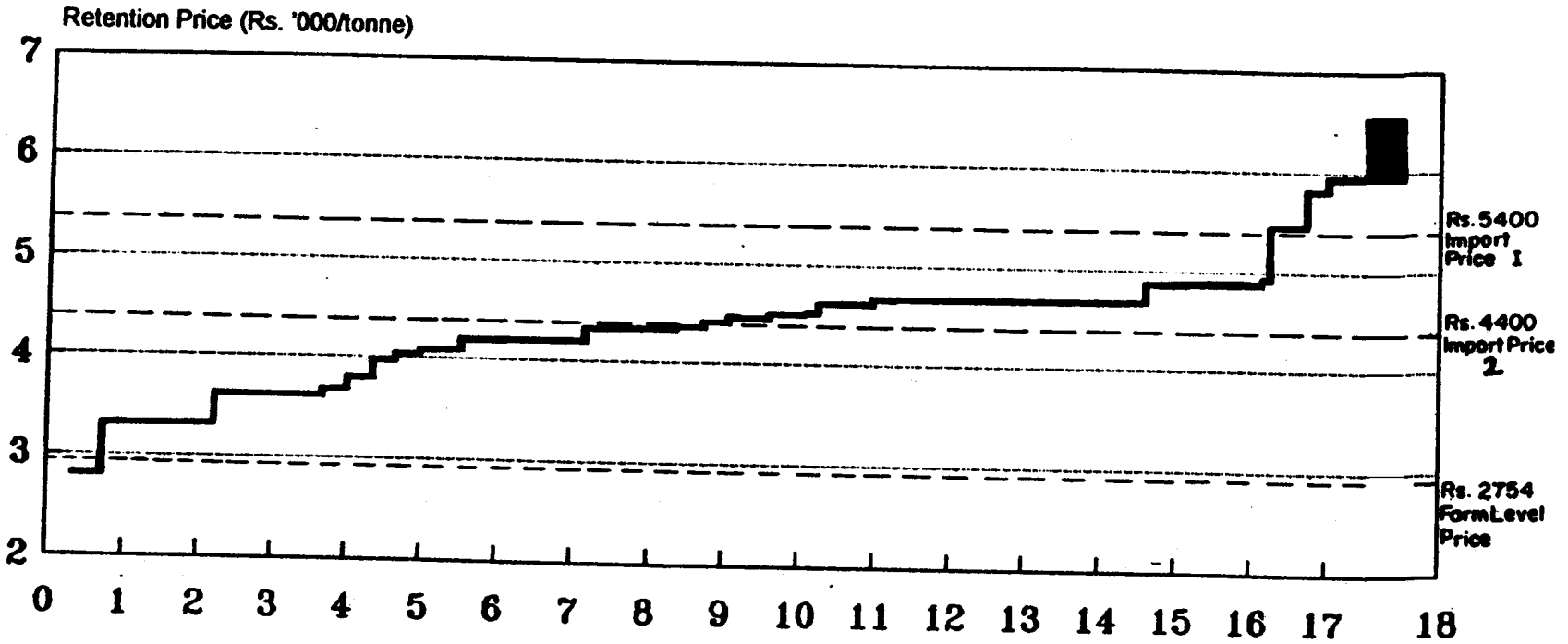
To analyse the impact of decontrol of the fertiliser pricing in the case of urea, we have utilised the data on retention prices for plants across the country (Annexure Table A-3) and alternative estimates of elasticity of demand for fertilisers with respect to price. The analysis is distinct from many other analysis of the issues relating to fertiliser subsidy as it incorporates a supply curve for the industry, specifically. The supply curve for 1991-92 is shown in *Figure 3*.[5]

In *Figure 3*, we have also shown the import price of urea at Rs.5400 and Rs. 4400 per tonne, including the freight and distribution cost. Only 8% of domestic capacity would be unable to stand the competition from imports at an import parity price of Rs. 5400, but when import price is Rs.4400 per tonne, 50% of the capacity will not be able to cover the cost of production.

In a regime of price decontrol and freedom to import, the import price would form a ceiling on price. The retention prices provide the marginal cost of production. On this basis the likely changes in the fertiliser consumption and price in a decontrolled scenario are obtained. The framework used is one of supply-demand equilibrium. The supply curve is simulated by retention prices and a fixed distribution cost with the supply curve flattening at an import parity price of Rs. 5400 per tonne. An import price of Rs.5400 per tonne is used to take into account the fact that India's entry into the international market as a buyer may raise the price of urea. However, in order to assess the sensitivity of the results to alternative levels of import prices, we have used the price of imported urea inclusive of distribution cost at Rs. 5000 and Rs. 4400 per tonne. The demand curve is simulated for a range of price elasticity of demand between -0.15 and -0.50 and the observed point of farm-level price and consumption in 1990-91.[6] The retention prices used for the simulations were for 1991-92. The results, therefore, are representative for 1991-92 on the cost side.[7]

Using the supply-demand framework noted above two sets of simulations were carried out and the results are given in Tables 1 and 2. In *Simulation 1*, the equilibrium price and quantity were obtained in a price decontrol scenario for urea where all other factors influencing fertiliser demand or supply are held constant. In

Fig. 3: Fertiliser Supply Graph



Price* (91-92)

* Retention price is inclusive of freight and distribution margin

Simulation 2, along with urea price decontrol, crop output prices are increased by 10% and irrigated area is assumed to increase by 2%. To capture the effect of increase in irrigated area, an elasticity of fertiliser consumption with respect to gross irrigated area, 1.5 is used.[8] The impact of higher crop output price is to decrease the relative price of fertiliser by an equivalent percentage.

Table 1 presents the results for both the scenarios with production levels for various urea plants at the 1990-91 level as indicators of supplies. This may understate the supply if 1990-91 was a difficult year for specific plants on account of breakdowns or other production disruptions. If no additional supplies from such plants are likely in the short run, then the 1990-91 production levels may be adequate proxies for supply. However, to provide for a range of supply response, in Table 2, we present the results for the two simulations when production capacity for each plant is taken as its supply. Thus, the two tables provide a range of results under different levels of supply responses.

The main difference between Table 1 and Table 2 may be noted first. Table 1 relates to actual production as a proxy for supply for each plant and Table 2 relates to capacity. In terms of a supply curve, the curve of Table 2 is to the right of such a curve for Table 1. That is, for the same level of retention price, the same or larger level of supply is given by the Table 2 curve than the curve of Table 1. Secondly, the difference between the two simulations represents a shift in demand curve for urea under *Simulation 2* as compared to *Simulation 1*. As irrigated area increases and crop prices increase, the demand curve for urea shifts to the right. The results need to be interpreted in this context.

In Table 1a, we find that when import price of urea is inclusive of distribution cost @ Rs.400 per tonne, at Rs.5000 per tonne or higher (Rs.5400 per tonne), the equilibrium price settles between Rs.4645 and Rs.4881 per tonne for the price elasticity of demand between -0.15 and -0.50. This is the farm level price and represents an increase of 69% to 77% over the level of Rs.2754 prevailing today. For these prices, consumption is estimated to fall by 1.34 to 3.25 million tonnes over the level of 13 million tonnes observed in 1991-92. When import price is Rs.4400 per tonne (inclusive of distribution cost), the fall in consumption in comparison to 1991-92 level is somewhat lower as imports take up the slack between domestic supply and demand when the import price falls below the domestic cost of production for additional output. The equilibrium price is the import price in this case which is the ceiling on urea price if imports are allowed freely. The price increase is, thus, 60% over the prevailing level and reduction in consumption is about 1 to 3 million tonnes.

When demand for fertiliser can be pushed up through factors such as output price and irrigation (Table 1b), we find that the equilibrium prices, when import price

Table 1a

Results of Simulation 1 where urea prices are decontrolled, with production as quantity supplied

Price Elasticity of Demand	IMPP = Rs 4400/Te				IMPP = Rs 5000/Te				IMPP = Rs 5400/Te			
	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP
-0.15	11.96	7.58	4.38	4400	11.66	11.66	-	4881	11.66	11.66	-	4881
-0.20	11.68	7.58	4.10	4400	11.31	11.31	-	4838	11.31	11.31	-	4838
-0.30	11.12	7.58	3.54	4400	10.63	10.63	-	4790	10.63	10.63	-	4790
-0.40	10.56	7.58	2.98	4400	10.09	10.09	-	4677	10.09	10.09	-	4677
-0.50	10.00	7.58	2.42	4400	9.48	9.48	-	4645	9.48	9.48	-	4645

Table 1b

Results of Simulation 2 with production as quantity supplied

Price Elasticity of Demand	IMPP = Rs 4400/Te				IMPP = Rs 5000/Te				IMPP = Rs 5400/Te			
	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP
-0.15	12.50	7.58	4.92	4400	12.17	12.17	-	4898	12.17	12.17	-	4898
-0.20	12.26	7.58	4.68	4400	11.83	11.83	-	4898	11.83	11.83	-	4898
-0.30	11.79	7.58	4.21	4400	11.22	11.22	-	4826	11.22	11.22	-	4826
-0.40	11.30	7.58	3.72	4400	10.63	10.63	-	4773	10.63	10.63	-	4773
-0.50	10.80	7.58	3.22	4400	10.17	10.17	-	4677	10.17	10.17	-	4677

Note:

TOTQ = Total Consumption of urea in million tonnes

DOMQ = Consumption of urea from domestic supply in million tonnes

IMPQ = Consumption of urea from imports in million tonnes

EP = Equilibrium Price (Rs/Tonne)

IMPP = Price of imported urea at farm gate level

Table 2a

Results of Simulation 1 where urea prices are decontrolled with capacity as quantity supplied

Price Elasticity of Demand	IMPP = Rs 4400/Te				IMPP = Rs 5000/Te				IMPP = Rs 5400/Te			
	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP
-0.15	11.96	7.70	4.26	4400	11.68	11.68	-	4838	11.68	11.68	-	4838
-0.20	11.68	7.70	3.98	4400	11.33	11.33	-	4819	11.33	11.33	-	4819
-0.30	11.12	7.70	3.42	4400	10.74	10.74	-	4702	10.74	10.74	-	4702
-0.40	10.56	7.70	2.59	4400	10.09	10.09	-	4677	10.09	10.09	-	4677
-0.50	10.00	7.70	2.30	4400	9.48	9.48	-	4645	9.48	9.48	-	4645

Table 2b

Results of Simulation 2 with capacity as quantity supplied

Price Elasticity of Demand	IMPP = Rs 4400/Te				IMPP = Rs 5000/Te				IMPP = Rs 5400/Te			
	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP	TOTQ	DOMQ	IMPQ	EP
-0.15	12.50	7.70	4.80	4400	12.17	12.17	-	4898	12.17	12.17	-	4898
-0.20	12.26	7.70	4.50	4400	11.88	11.88	-	4838	11.88	11.88	-	4838
-0.30	11.79	7.70	4.09	4400	11.23	11.23	-	4819	11.23	11.23	-	4819
-0.40	11.30	7.70	3.60	4400	10.76	10.76	-	4702	10.76	10.76	-	4702
-0.50	10.80	7.70	3.10	4400	10.17	10.17	-	4677	10.17	10.17	-	4677

Note:

TOTQ = Total Consumption of urea in million tonnes

DOMQ = Consumption of urea from domestic supply in million tonnes

IMPQ = Consumption of urea from imports in million tonnes

EP = Equilibrium Price (Rs/Tonne)

IMPP = Price of imported urea at farm gate level

is above Rs.5000 per tonne, are higher and consumption levels also are larger in comparison to the case presented in Table 1a. The reduction in consumption of urea when prices are decontrolled would be 0.8 to 2.8 million tonnes in this case and there will be no imports. Equilibrium prices are higher by 70 to 78% over the present farm level prices. When we consider lower import prices, the consumption levels are higher but imports play a major role in providing the supplies. For the domestic industry, as much as 3-4 million tonnes production would have to be reduced from those units which produce urea at a cost above Rs.4000 per tonne.

The results given in Table 2a and 2b basically provide the same scenario as discussed above, with the difference that the equilibrium prices would be lower as greater supply becomes available from almost all the plants than before. In some cases production may indeed exceed capacity as some plants are running above 100% capacity. These changes are not likely to cause major differences to the results as we already have provided a wide range for the basic parameters. One may infer, based on these results that, if there is decontrol, urea prices would increase and this increase will be between 60 and 78% over the prevailing level. There would be an impact on the level of consumption of urea which will have to be minimised through adjustments in output prices and factors such as larger investments in irrigation.

In the short-run, it is clear that there would be a drop in the consumption of urea when its price is decontrolled and the price rises. The aim of decontrol is to eliminate subsidies and enable the industry to grow on the basis of competitiveness. The resources saved from subsidy removal could be ploughed back into agriculture to raise the use of yield enhancing inputs such as fertiliser. This route, therefore, is still open to raise agricultural production. The process of price decontrol, therefore, could be implemented in phases where a flat per tonne subsidy could be applied and the resources saved could be invested in building infrastructure for agriculture.

(d) Domestic and External Liberalisation of Industry

Metaphorically, the straw that broke the camel's back in the case of India's economic management was the external payments crisis of 1991. The foreign exchange reserves had plummeted to less than the requirements of one month's import bill by June 1991. Confidence of the international financial community had dropped. The situation had warranted a series of measures which would provide both the short term finances and sustained exports growth to meet the import needs in the longer term.

The lowering of tariff walls in the manufacturing sector combined with invitation to foreign investors, and delicensing at home should promote greater competition, and finally lead to reduction in production costs. If this happens, the

industrial goods are likely to be available at lower prices (real) than was the case earlier. This should automatically act towards correction of terms of trade in favour of agriculture, arresting the outflow of resources from agriculture. This is likely to be a major gain to agriculture even if no structural reforms are ushered in in the agricultural sector. The high protection that was accorded to the manufacturing sector (NPC=1.4 in mid 1980s compared to only 0.87 for agriculture, Gulati and Pursell, 1992) acted as an indirect 'tax' on agriculture. Such a situation in most of the developing countries has been said to be responsible for the slow growth of agriculture in these countries. For example, Krueger, Schiff and Valdes (1992), in their most comprehensive study of 18 developing countries on the Political Economy of Agricultural Pricing Policy, show that the growth of their agricultural sectors was lower by 90 per cent compared to what it could have been if this 'indirect taxation' was absent. The empirical results of protection as reported in Gulati and Pursell (1992) clearly indicate that India is also one of such typical cases where trade policies have inflicted a 'hidden' tax of a significant size on its agricultural sector. With the lowering of protection to the manufacturing sector, as envisaged in the NEP, the 'indirect tax' on agriculture will automatically be reduced, and therefore, this sector will invite more resources purely on grounds of efficiency.

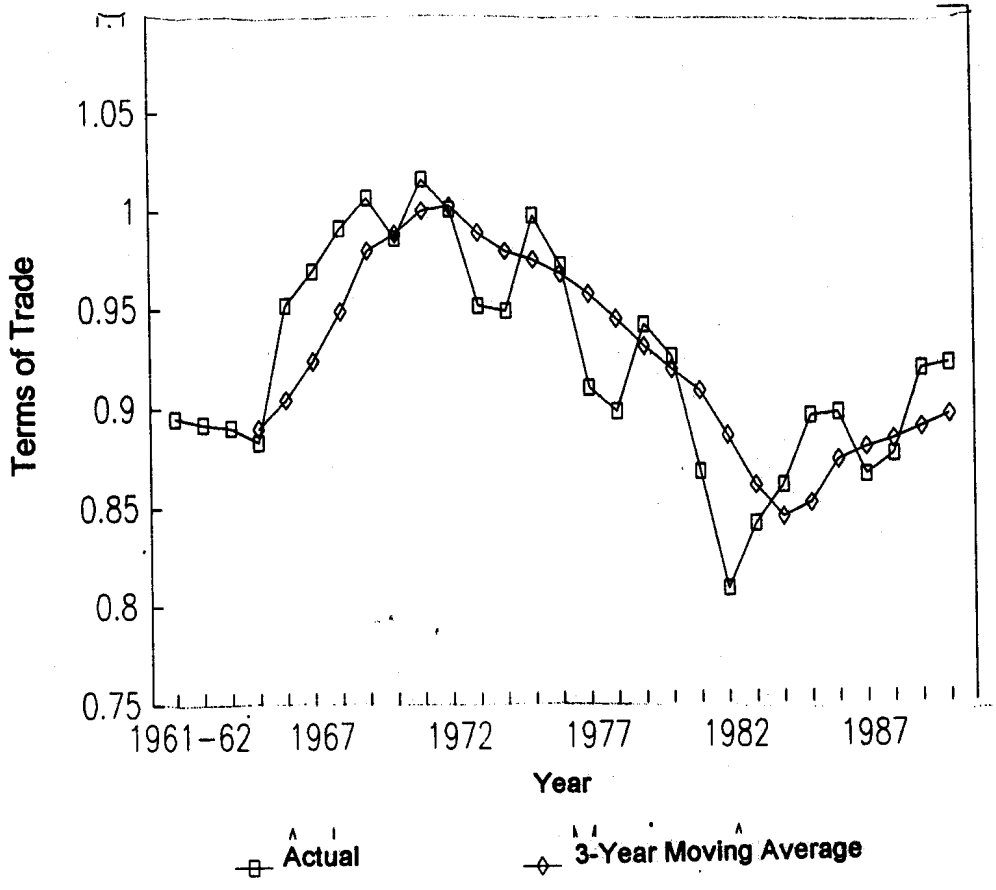
(e) Resource Flow into Agriculture

It was pointed out earlier that there has been a consistent decline in the proportion of investment in agriculture out of total investment. The fall in real public investment in agriculture has not been fully compensated by the rise in private investment observed in the late1980s. The causes which have restrained the flow of private sector resources into agriculture may be several. But profitability of investment in agriculture vis-a-vis other sectors is surely an important one amongst these factors.

One of the major variables affecting profitability of investment is the terms of trade between agriculture and the other sectors. *Figure 4* tracks the terms of trade, defined as the ratio of WPI for agricultural products and overall WPI.[9] The variable has declined steadily throughout the 1970s and the rising trend since the trough of 1981-82 has not been sufficient to take it to the relative position of 1970-71.

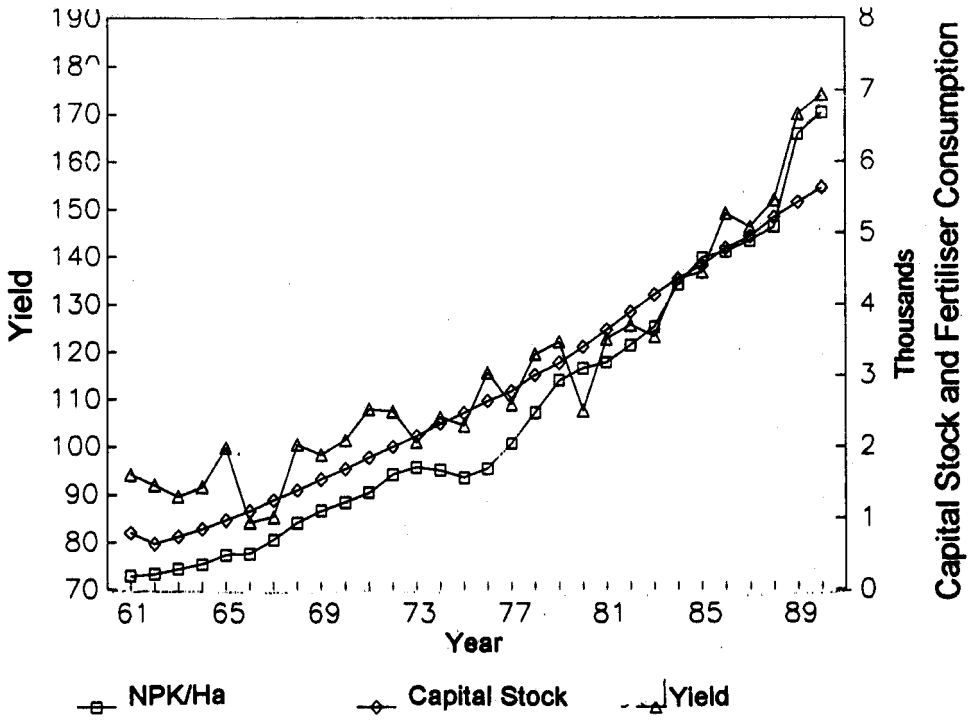
It is hypothesised that private investment responds to variables such as terms of trade between agriculture and other sectors, growth of agricultural income relative to non-agricultural income and the level of public investment in agriculture. The factors such as availability of credit to agriculture are also found to have an important influence on private investment in agriculture (Gandhi , 1990 and Kumar, 1992). The terms of trade were not favourable to agriculture in the 1970s or 1980s — though there

Fig. 4 : Terms of Trade*



* Ratio of WPI for Agricultural Commodities to Overall WPI

Fig.5 : Crop Yield, Capital Stock and Fertiliser Consumption Per Ha*



Crop Yield = Index for all crops (TE 69-70=0)
Capital Stock = Cumulative capital formation at 1980-81 prices *divided by* gross cropped area (Rs/Ha)
NPK/Ha = $N + P_2O_5 + K_2O$ in Kilogram per hectare of gross cropped area

appears to be a beginning of a reversal of the trend. Non-agricultural GDP grew faster than agricultural and public investment in agriculture declined in the 1980s.

While the causal factors overlap, it is clear that the mix of factors was not favourable to agricultural investment. The rate of investment, *per se*, is obviously not an end in itself. But in the case of agriculture, it needs to be pointed out that the capital-output ratio is lower than in the other sectors and higher agricultural output is associated with more equitable distribution of income and lower incidence of poverty. Therefore, stepping up the rate of investment in agriculture should be a matter of urgency for the Indian economy.

Growth of agricultural output requires stepped up investment in this sector. As the potential for further increases in crop area is nearly exhausted, the need to focus on productivity increase is obvious. Productivity growth in turn is related to capital stock per hectare and the use of yield enhancing inputs per hectare. The evidence on this matter is that capital stock per hectare of gross cropped area has increased steadily over the years, particularly since the growth in area is low. The intensity of use of variable inputs such as fertilisers has also risen over the years. These two factors, along with the index of yield of crops per hectare are shown in *Figure 5*. The graph shows close association of the three factors.

A simple model to illustrate some points is given below. Time period for the data used in estimation of equation coefficients is 1965-66 to 1989-90.

(1) *Private investment in agriculture (share)*

$$\ln (PVINVA/PVINVT) = -1.7787 + 0.0118 \underset{(0.14)}{\ln (GDPA/GDPT)_{-1}} + 0.9612 \underset{(1.95)}{\ln TT_{-1}} + 0.0516 \underset{(1.18)}{T} - 0.0537 \underset{(5.18)}{T*D1} + 4.2577 \underset{(4.89)}{D1}$$

OLS $\quad RHO = -0.07 \quad R^2 = 0.88$

(2) *Fertiliser consumption per hectare (NPK)*

$$\ln FPH = 4.9697 - \underset{(0.77)}{0.2779}\ D1 + \underset{(13.31)}{1.3498}\ Ln\ KSPH$$

$$+ \underset{(0.78)}{0.5505}\ Ln\ TT_{-1} + \underset{(0.86)}{0.2896}\ D1 * Ln\ KSPH$$

AUTO $\qquad R^2 = 0.9897$

(3) *Yield equation*

$$Ln\ Yld = 4.0674 + \underset{(8.16)}{0.2287}\ Ln\ FPH$$

AUTO $\qquad R^2 = 0.8745$

(Figures within parenthesis are the t-ratios of coefficients)

where,

PVINVA	=	Private Investment in Agriculture (Gross Fixed Capital Formation at 1980-81 prices).
PVINVT	=	Total Private Investment (Gross Fixed Capital Formation at 1980-81 prices).
GDPA	=	Gross Domestic Product in Agriculture.
GDPT	=	Total Gross Domestic Product.
TT_{-1}	=	Average Terms of Trade with a 1 period lag. Average terms of trade has been defined as a ratio of moving average (3-year) of WPI in agriculture to the moving average (3-year) of overall WPI.
T	=	Time Period (Year).
D1	=	Dummy variable with value = 1 from 1980-81 onwards.
FPH	=	Fertiliser Consumption ($N + P_2O_5 + K_2O$) per hectare of Gross Cropped Area.
KSPH	=	Cumulative Capital Formation at 1980-81 prices *devided by* Gross Cropped Area.
Yld	=	Index number of yield for all crops with base 1969-70=100.
Ln	=	Stands for natural logarithm.
AUTO	=	Indicates adjusted for autocorrelation.

A few points should be noted at the outset. We have chosen a recursive model to enable the use of single equations. The equations capture the basic logic of the argument that terms of trade and pattern of past investments (reflected in the GDP from Agriculture relative to total GDP) influence the share of agriculture in total

private investment; intensity of use of yield enhancing inputs in agriculture is a function of increased level of capital stock per hectare and terms of trade; and finally, productivity of agricultural sector (yield per hectare) is determined by the intensity of fertiliser use per hectare. The model, admittedly is simplistic.[10] But the results are within the range of results provided by more complex models. It may also be noted that the above specification captures the effect of changes in terms of trade which is not captured in the usual Nerlovian models of supply response, i.e., the impact of variations in terms of trade, via investment, on supply is not indicated in the Nerlovian models of supply response.

The estimated coefficients show that, a 10% improvement in terms of trade in favour of agriculture would raise the share of agriculture in private investment by 9.6%. A 10% increase in capital stock per hectare would increase the crop yield by 3.1% and a 10% increase in terms of trade in favour of agriculture would additionally raise the productivity by more than 1.3%. What these estimates show is that improvement in terms of trade in favour of agriculture would raise the productivity of the sector not only by making more intensive use of inputs profitable directly but also by making investments in agriculture more attractive.

Thus the structural adjustment policies being followed up to now have important implications for agriculture. They would mean raising overall productivity of the sector by improving terms of trade in favour of agriculture. And if it is complemented by stepping up public investment in agriculture, the results would be even more encouraging. Resources tied up in subsidising input prices can be invested to create production potential. Even the simple model estimated above shows that rising capital stock per hectare has a greater influence on intensity of use of variable inputs per hectare than mere changes in terms of trade. In other words, government investment in agriculture appears to be a better proposition than short-term measures such as subsidies. Secondly, improvement in terms of trade in favour of agriculture can lead to the much needed investments in this area from the private sector.

III. Concluding Remarks

The broad feature of the policy reforms undertaken in the last two years in the management of India's economy point to the primacy given to measures which aim at raising the efficiency of resources. The effort also clearly aims at reducing the distortions in market signals arising out of government interventions in resource allocation. The wide ranging reforms embracing the industry, trade and fiscal policies have economywide impact and agriculture would not remain insulated from such far reaching policy changes. Firstly, the measures which go towards achieving the macro balance with respect to government budget, would imply a reduction in subsidies and

perhaps also in government investment. Agriculture in India, as in nearly all the countries, accounts for a large proportion of subsidies in the economy. There is considerable attention being paid to fertiliser subsidies today. There is also a concern that investment in agriculture has been declining and that this will have an adverse impact on the economy in the years to come. The squeeze on government expenditures arising from the need to bring about the "macro balance" may have an adverse impact on agriculture. The 1993-94 budget seeks to restore some of the plan expenditures in the agriculture sector. There is an increase of 12.7% in the 1993-94 budgeted plan expenditures for agriculture including animal husbandry over the 1992-93 revised estimates.

The second aspect of the policy reforms relates to improving the efficiency of resource use in the economy by opening up the economy to market forces both within and outside the country's borders. This may help agricultural growth when the protected industrial sector begins to adjust its structure and prices in a competitive environment.

In the present study while reviewing the broad aspects of economic reforms of the last two years, we have focussed on their implications to agriculture. Specifically the issues relating to fertiliser pricing and investment in agriculture are discussed in greater detail. On fertiliser pricing, the case of urea in a price decontrol scenario is examined and we find that under such a scenario, prices would rise upto Rs. 4784 per tonne from the present level of Rs. 2754 per tonne, if imported urea price, inclusive of freight and distribution is above Rs. 5000 per tonne, when the price elasticity of demand for fertilisers is -0.30. Results were obtained under alternative assumptions of price elasticity and price of imported urea. In the case of investment in agriculture, we find that supply response to terms of trade arises not only through its (the latter's) impact on the use of variable inputs but also on investment. It is also hypothesised that the relative decline in investment in agriculture witnessed in the 1980s is partly due to the adverse terms of trade for agriculture. The results support such a hypothesis but further analysis of this issue is warranted.

Endnotes

1. This was stated by the Minister of Agriculture in a workshop on Agricultural Policy Resolution held at Federation House on Jan. 18, 1993 (Delhi).

2. One may argue that the observed declining share of GDP from agriculture in total GDP also is a reflection of declining share of agricultural investment in total investment.

3. The reduction in the provision for subsidy on indigenously produced fertilisers from Rs. 4800 crores in 1992-93 to Rs 3500 crores in 1993-94 can be taken to reflect primarily the impact of price decontrol of phosphatic and potassic fertilisers. The amount of subsidy on phosphatic and potassic fertilisers under RPS as well as under special subsidy scheme in 1992-93 may not be as much as the difference of Rs. 1300 crores noted here between 1993-94 and 1992-93. Further, from the fact that a price reduction for nitrogenous fertilisers took place in 1992-93, which became effective mainly in the rabi reason, and the expectation of rise in the consumption of urea in 1993-94 , it would appear that the subsidy on nitrogenous fertilisers under RPS is certain to rise in 1993-94 closer to the level of 1992-93.

4. The move to full convertibility in 1993-94 will push the prices of imported raw materials for phosphatic fertilisers and also the finished fertiliser material imports up. Fertiliser Association of India (1993) estimates that such increase in the price of DAP which is produced in India may be about Rs. 1300 per tonne.

5. The supply curve here corresponds to capacities of different plants, although one can also use actual production levels.

6. Two points in this context may be noted. First, the price elasticity of fertiliser demand as estimated by various researchers has varied widely not only when considered at the disaggregated level of regions or crops but also at the overall or aggregate level. We have chosen a broad range but believe that the elasticity would be around -0.3 within this broad range. Secondly, in order to simulate the demand curve, we need a point on the curve given by

$$F = A(PF/PY)^b$$

where F is the consumption of fertiliser, PF is the price of fertiliser, PY is the price of output and A is the scaling factor. b is the price elasticity. We have used the observed values of F, PF and PY of 1991-92 to determine A for a given value of b. Once we know the values of A and b, for different values of (PF/PY), the value of F can be calculated to simulate the demand curve for fertilisers.

7. Another point to note in the context of the supply curve is the fact that the costs are based on prices charged for inputs in fertiliser production. The input subsidies to the fertiliser industry on prices paid by it in comparison to the prices paid by other consumers are not adequately addressed by this procedure. On Naptha and fuel oil the prices paid by the fertilser industry are lower than by other consumers. In the case of gas, it may be noted that the price paid by the fertiliser plants are lower than those recommended by the Kelkar Committee on Gas Pricing.

8. The impact of irrigation and crop output price can be considered in terms of the following demand function for fertilisers:

$$F = A(PF/PY)^bIA^c$$

where F, PF, PY, A and b are as defined previously. The variable IA refers to gross irrigated area and can be taken as 1 for which A was computed. The parameter c is the elasticity of fertiliser consumption with respect to irrigated area. A number of elasticity estimates are available in the literature. We have used 1.5.

9. It would be more appropriate to define terms of trade as a ratio of index of prices received by farmers to an index of prices paid. Sidhu (1993) gives a series for the period 1970-71 to 1991-92. However, as we lose many past observations when we use this series, we have not utilised this index.

10. In the case of private investment equation, a variable often used among the explanatory variables is the public investment in agriculture. In the present case, however, as we are using proportion of agriculture in total private investment as the dependent variable, the role of public investment in agriculture in this equation is less prominent.

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Annexure Tables A-1 to A-3

Table A-1

Gross Fixed Capital Formation in Crop Agriculture

(Rs. Crore in 1980-81 Prices)

Year	Public	Private	Total
1960-61	559.7	1025.3	1585.0
62	598.2	1066.8	1665.0
63	677.5	1126.5	1804.0
64	702.9	1236.1	1939.0
65	756.0	1347.0	2103.0
66	780.7	1477.3	2258.0
67	686.2	1626.8	2313.0
68	685.6	1894.4	2580.0
69	735.9	1822.1	2558.0
70	743.4	2010.6	2754.0
71	751.0	1874.0	2625.0
72	805.3	1961.7	2767.0
73	969.2	1968.8	2938.0
74	898.3	2003.7	2902.0
75	836.8	1872.2	2709.0
76	901.8	2033.2	2935.0
77	1179.9	2466.1	3646.0
78	1410.1	2333.9	3744.0
79	1373.5	2872.5	4246.0
80	1508.7	2931.3	4440.0
81	1758.6	2778.4	4537.0
82	1671.4	2674.6	4346.0
83	1625.1	2783.9	4409.0
84	1811.8	2782.2	4594.0
85	1577.8	2709.2	4287.0
86	1428.8	2639.2	4068.0
87	1354.9	2443.1	3798.0
88	1397.1	2821.9	4219.0
89	1337.0	2920.0	4257.0
1989-90	1149.5	3108.5	4258.0

SOURCE: Various issues of *National Accounts Statistics*.

Table A-2

Share of Agriculture in Total Investment by Sectors

(Percentage)

Year	Public	Private	Total
1961-62	18.99	14.84	17.30
1963	21.43	14.79	18.47
1964	19.27	14.39	17.07
1965	20.70	12.95	16.99
1966	21.83	13.16	17.67
1967	23.60	12.17	17.85
1968	22.61	12.96	18.51
1969	26.84	12.38	20.37
1970	27.53	13.48	21.17
1971	25.81	14.58	21.35
1972	24.57	13.67	19.97
1973	24.87	13.97	20.22
1974	26.03	12.10	18.88
1975	24.36	13.15	19.33
1976	22.23	13.20	18.41
1977	22.97	10.85	17.13
1978	30.51	12.04	20.39
1979	23.18	15.92	19.80
1980	24.37	14.69	20.06
1981	26.95	15.36	21.43
1982	22.67	17.20	20.18
1983	19.57	14.71	17.37
1984	19.26	13.02	16.35
1985	18.29	14.59	16.62
1986	20.19	10.53	15.04
1987	17.04	10.16	13.76
1988	16.04	8.39	12.11
1989	16.22	8.92	12.77
1989-90	14.84	8.68	12.14

SOURCE: Derived from various issues of *National Accounts Statistics*.

Table A-3

Retention Price of Urea by Plants for 1991-92

Sl. No.	Year of Commis-sioning	Capacity ('000 Tonnes)	Retention Price (Rs/tonne)	Production ('000 tonnes)
1	1969	330	2276	146.4
2	1975	396	2853	372.6
3	1985	1485	3081	1385.2
4	1986	1452	3078	1717.7
5	1987	330	3266	108.6
6	1982	330	3476	291.7
7	1978	330	3681	292.2
8	1969	330	3719	369.4
9	1973	340	3656	348.7
10	1982	594	3724	607.3
11	1988	726	3733	849.5
12	1973	330	3927	222.8
13	1988	726	3951	868.4
14	1979	511	4099	472.4
15	1976	340	4001	256.7
16	1979	330	4108	230.5
17	1975	512	4030	570.0
18	1979	511	4245	403.9
19	1979	152	4302	101.5
20	1988	726	4277	923.4
21	1971	292	4357	90.3
22	1969	675	4498	663.3
23	1981	495	4419	590.0
24	1974	330	4557	75.8
25	1967	367	4438	438.0
26	1976	330	4637	114.1
27	1965	99	4947	59.0
28	1980	495	5484	78.3
29	1976	285	5605	25.3
30	1980	495	6169	158.9

SOURCE: Deptt. of Fertilisers (GOI)