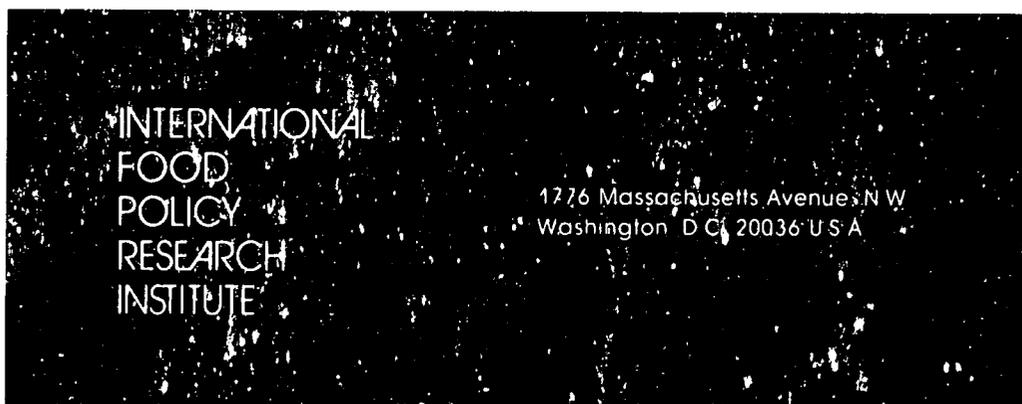


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Structure and Dynamics of Fertilizer Subsidy: The Case of Bangladesh

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Structure and dynamics of fertilizer subsidy

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Economists often proceed with impact studies of fertilizer subsidy without first making an examination of the structure and dynamics of subsidy. This may lead to misleading focus and to seeking solutions generally in adjustment of administered prices. Substantial gains in efficiency can be realized by looking into structural questions of subsidy. The case of Bangladesh provides an example of how a proper procedure of accounting can shift the onus of correcting numerous distortions that arise from current practices, from farmers to industries. The case study also shows that farmers receive less subsidy than usually claimed and the hidden subsidy to industries is passed on to farmers. The Bangladesh case may represent developing countries in a general manner.

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¹K. Subbarao, *Incentive Policies and India's Agricultural Development: Some Aspects of Regional and Social Equity*, Institute of Economic Growth, New Delhi, India, 1984.

²International Food Policy Research Institute and the Bangladesh Institute of Development Studies, *Fertilizer Pricing Policy and Foodgrain Production Strategy in Bangladesh*, Vol I & II, a joint study for the Ministry of Agriculture, Dhaka, Bangladesh, 1985.

³In the course of a joint study by IFPRI and BIDS (*ibid*) the nature of such questions was unfolded to the researchers by various policy makers and analysts.

This article addresses the issues concerning the structure of fertilizer subsidy and the dynamic forces that mould this structure over time. It does not go into the question of whether the policy of subsidization is socially good or bad. Any analysis of the latter is dependent upon and must be preceded by a proper assessment of the former. The subject matter in the paper is treated within the context of Bangladesh.

Although the empirical content of the article is limited to Bangladesh, the issues are quite common in most developing countries. Most countries in Asia and Africa have been employing input subsidy as a pricing instrument for accelerating domestic food production. Thus, India spent Rs 5053 million (equivalent to \$421.0 million) in 1983/84 on fertilizer subsidy.¹ Similarly, Bangladesh provided a budgetary subsidy of Tk 1426 million for fertilizers – about 14% of the total public development expenditure in agriculture in 1983/84.² Pressures from donors and even from finance ministries of national governments are increasingly intense for elimination of subsidies.

Policy debates around the issue of elimination of subsidy include a number of substantive questions.³ Is the subsidy on fertilizer really a subsidy to farmers or to manufacturers of fertilizers? If the subsidy transfer is received by manufacturers, does it go to local or foreign industries? What is the nature of dynamic elements (ie quantity, sources of supply, world price, foreign exchange, management of procurement, distribution, stock and domestic pricing regimes) that influence the extent of subsidy? What does the structure of subsidy look like? Is the extent of subsidy by types of fertilizers and sources of supply the same? These questions are important, particularly at the operational levels, even though most economic analyses of subsidy tend to bypass them, assuming them to be trivial, and focus on the growth and distributional impact of subsidy.

Methods and estimates of subsidy

For rapid expansion in the use of modern inputs in agriculture, a public

parastatal – the Bangladesh Agricultural Development Corporation (BADC) – was created in 1962/63. BADC assumed the task of procuring and distributing fertilizers through development of a network of publicly operated distribution centres throughout the country. Only from 1979/80 has the sphere of BADC gradually been reduced – decentralizing the functions of retail and wholesale trades in fertilizers to the private sector. BADC still retains the responsibility of procuring fertilizers from abroad and maintaining required stock at about 95 primary distribution points and central warehouses. This mechanism of supply resulted in a rapid growth in fertilizer consumption in the country. Growth rates in fertilizer sale were 23% per annum during 1962–70, 14% per annum during 1970–77, and a little over 7% during 1978–84. Before complete decentralization, the retail price was fixed by the government on a panterritorial basis and the government provided the difference between BADC's cost price and sale price as subsidy. Currently, traders can sell fertilizers at any price at retail levels, but they receive from primary distribution points at a fixed price. Subsidy on fertilizers now reflects the difference between cost price and sale price at the level of primary distribution points.

Current procedure

Stating simply that the current procedure of estimating subsidy is to measure the cost price and deduct sale price from it in order to arrive at an estimate of subsidy, is a true but not a revealing statement. It is the acquisition cost of fertilizers that is the principal source of most disputes on the estimate of subsidy.

Cost of production

Three broad categories of costs are involved in the total cost of fertilizers: a) procurement cost of imported fertilizers, b) procurement cost of domestic fertilizers, and c) distribution cost. Bangladesh normally imports about 10% of its annual consumption of urea, about 75% of the consumption of phosphatic fertilizers (mostly TSP) and 100% of its potassic fertilizers (in the form of murate of potash). Domestic production is therefore an important source of supply. All domestic production is undertaken in publicly-owned factories under the Bangladesh Chemical Industries Corporation (BCIC). The cost of production of domestic fertilizers in 1983/84 is shown in Table 1. This is the cost which BCIC estimates on the basis of its actual outlays which in turn constitute the basis for pricing fertilizers delivered to BADC. Year to year variation of this estimate normally occurs due to changes in capacity utilization, although over a number of years inflationary forces increase this nominal cost of production.

The first question that generally arises from this practice of cost pricing is whether the actual outlays to BCIC cover all costs, or whether this cost properly reflects cost of the resources to the society? The principal cost component that seems relevant in this context is the interest cost of capital. Fertilizer production is a capital intensive venture. The factories were established with capital from three main sources: interest bearing borrowed capital from donors; outright grant from certain donors; and governments' own capital. Interest bearing borrowed capital from IDA (International Development Agency of the World Bank) and credit from China and a number of other countries

Table 1. Cost of production of fertilizers in Bangladesh, 1983/84.

Cost Items	Fenchuganj Urea		Ghorasal Urea		Ashuganj Urea		Chittagong TSP	
	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)
Cost of raw materials	1 122	40.2	898	50.5	768	20.1	4 539	71.2
Management charges	323	11.6	139	7.8	96	2.5	286	4.5
Interest charges	321	11.5	43	2.4	1 525	39.9	211	3.3
Depreciation	322	11.5	166	9.3	1 167	30.5	236	3.7
Labour	300	10.8	95	5.3	37	0.01	147	2.3
Energy	-	-	152	8.5	22	0.01	588	9.2
Other overheads	402	14.4	205	16.0	206	5.4	371	5.8
Total cost	2 790	100.0	1 778	100.0	3 821	100.0	6 378	100.0
Ratio of cost of production to fob price of fertilizer		0.71		0.5		0.98		1.41
Capacity utilization (%)		83		75		71		53
Rate of depreciation (%)		7		8		6		8

Source: Bangladesh Chemical Industries Corporation, 1984.

involved soft loans with low interest rates (generally 2–5% with a grace period of 10 years). If all capital costs are evaluated at interest rates in international financial markets, the real cost of capital would definitely be higher than shown in Table 1. The table shows the interest cost ranging from 2.4% to 39.9% of total average cost. Excluding the Ashuganj factory, the range of interest cost in other factories is from 2.4% in Ghorasal to 11.5% in Fenchuganj. Capital cost of most factories in India ranges from 40–70% of the average cost of production.⁴ Government economists including some professionals in Bangladesh argued that the opportunity cost of soft loans received from outside would not be different from stipulated interest rates. The fungibility of such funds is considered to be limited. The portion of capital contributed by the government would definitely earn a rate of return in other public investments which may not be as high as the rate in international financial markets.

Depreciation of capital equipment is calculated on the basis of a flat rate (6–8%) on the original investment cost. Would this accumulation of depreciation fund be enough to replace the machineries when they run out of life? The answer is clearly negative unless the rate is realistic and the accumulated fund earns enough interest income to counter-balance the inflationary effect on cost of investment in fertilizer industries. Fertilizer factories have occasionally been remodelled with considerable additional investment cost. This makes the calculation of depreciation on the basis of a flat rate on original investment an obsolete procedure. Moreover, management of depreciation funds was far from what would be required for a steady growth of funds sufficient to cover replacement costs. One particular aspect of future replacement costs of factories that never enters into most imaginations is the future exchange rates of local currency *vis-à-vis* foreign currencies. Because depreciation funds are generally maintained in local currency, the real value of such funds may depreciate because of future adjustment in exchange rates from current overvaluation. This effect would be additional to inflationary forces on world prices of equipment for fertilizer factories. Because the share of foreign exchange in total investment cost is generally very high (60–80%) in fertilizer production, this impact of exchange rate could be substantial.

The third important element of cost is the raw materials. All urea

⁴World Bank, *A Survey of the Fertilizer Sector in India*, Staff Working Paper No 331. Washington, DC, USA, 1979.

factories in Bangladesh are based on domestic natural gas, but the TSP (triple super-phosphate) factory at Chittagong is based entirely on imported rock phosphate as the raw material. How does one price natural gas for use in fertilizer factories? Should it be based on cost of production, prices charged to other uses, or value in other uses including the net value in exporting liquefied gas rather than using gas domestically? A study by the Bangladesh Planning Commission shows that the price of natural gas supplied to fertilizer industries is underpriced by about 63% of its true economic value.⁵ Even though this study does not seem to provide convincing evidence to the precise extent of underpricing, the fact that underpricing is involved is clear enough.

Perhaps the most sensitive factor relating cost of fertilizer production and management efficiency is the capacity utilization. Utilization of full engineering capacity will probably never be possible on a sustained basis. But a 90% level can be achieved under efficient management. Maintenance of machineries, handling of labour relations, management of cash flow, and capacity and motivation of resident managers to initiate action without waiting for central approval are the four fundamental ingredients necessary for best capacity utilization. The fertilizer factories under the public sector in Bangladesh suffer from deficiencies on all these accounts; the result is irregular and moderate capacity utilization in most factories.

An attempt is made to develop a cost estimate correcting, at least partly, for the factors described above. Readers are cautioned that this correction is based on a somewhat imperfect knowledge and inadequate analysis of the detailed cost structure. Nevertheless, it is my judgement that the estimate would be very close to what would be found if detailed analysis were conducted. The modification in cost of production is made with the following changes. Interest cost is assumed at 12% per annum on capital cost disregarding the sources of financing but allowing grace period, if any. Natural gas is assumed to be currently underpriced by 25% and is corrected for this underpricing. Depreciation cost is re-estimated on the basis of the replacement requirement. In this regard it is assumed that the world price of fertilizer factory equipment will increase annually by 10% and the exchange rate would move from Tk 25 per US dollar in 1983/84 to Tk 40 per US dollar at the time of replacement. The depreciation fund is assumed to earn an interest rate of 10% annually. This corrected cost of production of fertilizers is shown in Table 2.

A comparison of Tables 1 and 2 reveals a number of glaring facts which bear immense implications for price policy. Cost of production on the basis of real costs of raw materials and capital is found to exceed average production cost based on actual outlays of BCIC by 26–100%, depending on factories. Compared with the *FOB* prices of fertilizer, average costs of production in all but the Ghorasal urea factory are substantially higher on a full costing basis. Under the current costing procedure, the average costs are lower than the *FOB* prices in all factories except the TSP plant at Chittagong. The Chittagong TSP plant involves a raw materials cost (imported) which alone is almost equal to the *FOB* price of the final product. Fenchuganj and Ghorasal urea factories appear to be more inefficient in conversion of natural gas into urea than the Ashuganj factory which is claimed to be the most modern. But, then, the capital cost of the Ashuganj factory is 38–78% higher than the

⁵A. Rab, *Possibilities of Increasing Domestic Financial Resource Mobilization for the Second Five-Year Plan*, Bangladesh Planning Commission, Dhaka, 1981.

Table 2. Corrected cost of production of fertilizers in Bangladesh, 1983/84.

Cost items	Fenchuganj Urea		Ghorasal Urea		Ashuganj Urea		Chittagong TSP	
	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)	Cost (Tk/ton)	Share (%)
Cost of raw materials	1 403	28.6	1 120	31.1	960	17.6	4 539	56.3
Management charges	323	6.6	139	3.9	96	1.8	286	3.5
Interest charges	2 015	41.2	1 560	43.4	2 780	50.8	1 790	22.2
Depreciation	457	9.3	246	6.8	1 360	24.9	345	4.3
Labour	300	6.1	95	2.6	37	0.7	147	1.8
Energy	—	—	152	4.3	22	0.4	588	7.3
Other overheads	402	8.2	285	7.9	206	3.8	371	4.6
Total cost	4 900	100.0	3 597	100.0	5 461	100.0	6 378	100.0
Ratio of cost of production to <i>lob</i> price of fertilizer		1.25		0.92		1.39		1.78
Ratio of corrected cost to reported cost in Table 1		1.76		2.02		1.43		1.28
Capacity utilization (%)		83		75		71		53

Source: Estimatec with information from Bangladesh Chemical Industries Corporation.

other two. It is clear that improvement in management that can contribute to higher capacity utilization will bear a higher pay-off in the Ashuganj than other factories. The scope of reducing the average cost of production through a higher capacity utilization is large in all factories, particularly in Ashuganj, Ghorasal and Chittagong TSP.

Cost of import

Bangladesh imports some fertilizers under various types of financing arrangements; foreign aid constitutes the main source of such financing. The differentials in free market and tied-aid market prices of fertilizers are shown in Table 3. Although the prices represent 1983/84, it is a stable pattern valid for other recent years as well. It is clear that purchases by cash foreign exchange from free international markets cost about 10–30% less than the imports under tied aid. Donors have a tendency to overprice fertilizers supplied under concessionary arrangements. Even if some donors give fertilizers on grant, they enjoy a bloated satisfaction by quoting a high price in the invoice. The implication of this practice on farm level prices will be discussed later.

Distribution cost

The structure of fertilizer distribution cost can be gleaned from the data

Table 3. Comparison of free market world prices and prices of fertilizers under tied aid in Bangladesh, 1983/84.

Fertilizer	Source	Cif price under tied aid (US \$/ton)	Free market cif price (US \$/ton)	Difference (%) ^a
Urea	USAID credit	210.25	185.00	13.65
	SAUDI grant	205.00	185.00	10.81
	USAID grant	242.34	185.00	31.00
	Cash foreign exchange	183.00	185.00	-1.08
TSP	NORAD grant	198.72	175.00	13.55
	UK grant	199.74	175.00	14.14
	ADB credit	188.74	175.00	7.85
	IFAD credit	192.76	175.00	10.18
	Dutch grant	182.34	175.00	4.19
	Danish grant	203.30	175.00	18.17
	KFW grant	174.39	175.00	—
	Dutch grant (bulk)	190.15	175.00	8.66
	Rumania barter	192.00	175.00	9.71
MP	CIDA grant	141.30	120.00	17.75

Note: ^aPercentage difference is *cif* price under tied aid minus free market price divided by free market price times 100.

Source: Import data from Bangladesh Agricultural Development Corporation. Free market data from World Bank, *Commodity Trade and Price Trends*, World Bank, Washington, DC, 1982 and 1983 editions; and recent unpublished information from the World Bank.

in Table 4. It should be noted that dealers' commission is included as an item of distribution cost, reflecting the fact that government sets farm level price and dealers are expected to accommodate their cost and profit within the margin of dealers' commission.⁶

Dealers' commission is a decision variable, and as such has been shown separately. The real distribution cost items indicate that the total distribution cost (excluding dealers' commission) is only about 9.4% of the full value (14.8% including dealers' commission) of fertilizers (at primary distribution points) in 1983/84. This estimate was about 13.2% in 1981/82. Distribution cost has been brought down by about 19% (in nominal terms) between 1980/81 and 1983/84. In real terms the reduction in distribution cost would be larger.

This downward trend in distribution cost is primarily attributable to the shifting of cost to dealers (on to farmers) through the introduction of a new marketing system mentioned earlier. However, part of the reduction is due also to an improvement in BADC's performance, which may have been indirectly caused by the pressure generated from the new system.

Scope of further reduction in distribution may exist in items like movement and handling, overhead, and pay and allowances (staff strength remains the same even though *Thana* sales centres have been closed). On the other hand, the depreciation and capital costs of public warehouses is not included in the cost.

Estimate of budget subsidy

A discussion of fertilizer costing for the purpose of budgetary subsidy has been presented. The estimate of subsidy based on these costs is now presented in Table 5.

It can be seen that the budgetary subsidy was about 25% of costs in 1983/84. There were tremendous variations in the subsidy rates among various types of fertilizer and among various sources of supply of a given type. Thus, the subsidy rates on urea, TSP, DAP and MP were 11.4%,

⁶It is somewhat odd that dealers' commission is still included in the distribution cost, since from the beginning of 1983/84 the government has deregulated retail prices of fertilizers, implying that dealers can sell at any price they can get.

Table 4. Internal distribution cost of fertilizers in Bangladesh, 1980/81 to 1983/84.

Cost items	1980/81		1981/82		1982/83		1983/84	
	Cost (Tk/ton)	Share (%)						
Movement and handlings	280	47.5	428	63.4	361	52.9	288	60.1
Staff pay and allowances	44	7.5	43	6.4	56	8.2	48	10.0
Establishment cost and repair maintenance	13	2.2	16	2.4	12	1.8	11	2.3
Overhead	85	14.4	104	15.4	92	13.5	75	15.8
Warehouse rent	18	3.1	12	1.8	16	2.3	3	0.6
Physical verification, bagging and dunnage	6	1.0	7	1.0	1	0.1	1	0.2
Stock loss	49	8.3	19	2.8	19	2.8	11	2.3
Publicity, promotion and training	1	0.1	1	0.1	2	0.3	3	0.8
Interest on working capital	87	14.8	26	3.9	101	14.8	16	3.3
Marine insurance	6	1.0	19	2.8	23	3.4	22	4.6
Sub-total	589	(100.0)	675	(100.0)	683	(100.0)	476	(100.0)
Dealers' commission	180		241		275		275	
Total	769		916		958		751	
Quantity distributed (tonnes × 10 ³)	875.2		829.3		968.4		1 220.0	

Source: Bangladesh Agricultural Development Corporation.

Table 5. Estimated full budget subsidy on fertilizers distributed in 1983/84 (on the basis of procurement price as in Table 4).

Fertilizer	Source	Quantity (tonnes × 10 ³)	Average cost ^a (Tk/ton)	Sale price (Tk/ton)	Total cost (Tk × 10 ⁶)	Total receipt (Tk × 10 ⁶)	Total subsidy (Tk × 10 ⁶)	Rate of subsidy (%)
Urea	All Domestic	635.687	4 274.7	3 966.4	2 717.36	2 521.39	195.97	7.2
	Import Saudi	7.900	5 801.00	3 966.4	45.83	31.33	14.50	31.6
	Import USAID	24.237	6 074.17	3 966.4	147.22	96.13	51.09	34.7
	Import Saudi	14.051	5 821.00	3 966.4	81.79	55.73	26.06	31.9
	Import USAID	26.195	6 866.69	3 966.4	179.87	103.90	75.97	42.2
	All import	72.383	6 282.00	3 966.4	454.71	287.09	167.62	36.9
	All urea	708.070	4 479.88	3 966.4	3 172.07	2 808.48	363.59	11.4
TSP	Domestic ^b	74.631 ^b (55.467p)	6 616.00	2 948.00p 3 752.00g	493.76	235.42	258.34	52.3
	Import Danish	10.065	6 768.92	3 752.00g	68.13	37.76	30.37	44.6
	Import Dutch	52.458	5 400.42	3 752.00g	283.30	196.82	86.48	30.5
	Import Japan	8.805	7 674.94	3 752.00g	67.58	33.04	34.54	51.1
	Import NORAD	17.443	5 789.38	3 752.00g	100.98	65.45	35.53	35.2
	Import UK	5.000	5 814.48	3 752.00g	29.07	18.76	10.31	35.5
	Import ADB	8.580	5 520.72	3 752.00g	47.37	32.19	15.18	32.0
	Import IFAD	8.400	5 620.03	3 752.00g	47.21	31.52	15.69	33.2
	Import Dutch	30.100	5 455.37	3 752.00g	164.21	112.94	51.27	31.2
	Import Danish	45.248	5 982.39	3 752.00g	270.69	169.77	100.92	37.3
	All import	186.099	5 795.52	3 752.00	1 078.54	698.25	380.29	35.3
	All TSP	260.730	6 030.38	3 580.98	1 572.30	933.67	638.63	40.6
	DAF	Import USAID	1.923	6 330.2	3 966.4	12.17	7.63	4.54
Import USAID		15.488	8 559.8		132.57	61.43	71.14	53.7
Import USAID		24.990	8 444.63	3 966.4	211.03	99.12	111.91	53.0
Import Bulgaria barter		24.553	7 518.30	3 966.4	184.60	97.39	87.21	47.2
Import Czech barter		20.997	7 518.30	3 966.4	157.86	83.28	74.58	47.2
Import NORAD		5.880	6 618.40		38.92	23.32	15.60	40.1
All import		93.831	7 856.15	3 966.4	737.15	372.17	364.98	49.5
MP	Import CIDA	13.222	4 532.84	2 948.0	59.93	38.98	20.95	35.0
	Import CIDA	50.000	4 413.40	2 948.0	220.67	147.40	73.27	33.2
	All import	63.222	4 438.33	2 948.0	280.60	186.38	94.22	33.6
Other minor elements		3.207	7 779.72	6 325.98	24.95	20.29	4.66	18.7
All fertilizers		1 129.060	5 125.56	3 827.06	5 787.07	4 320.99	1 466.08	25.3

Notes: ^aAverage cost consists of pooled procurement cost plus distribution cost. Cost rates in this table differ slightly from previous tables due to adjustment made for various factors which cannot be elaborated here. ^bLocal TSP consists of 55 467 tons of powdered and 19 164 tons of granular (g) TSP. Powdered (p) TSP is sold at a lower price.

Source: Compiled from information from Bangladesh Agricultural Development Corporation.

40.6%, 49.5% and 33.6% respectively. Urea from domestic sources was incurring a subsidy of 7.2%. Subsidy on imported urea ranged from about 32% to 42%.

Unlike domestic urea, domestic TSP was incurring a subsidy of the highest order, 52.3%, compared to rates ranging from 30% to 50% for imported TSP. This is partially attributable to the poor quality of domestic TSP (powdered rather than granular) which caused it to sell for a lower price.

Most revealing is the fact the prices of the same variety of imported fertilizer differed so widely among sources of supply. Discussion with BADC and BCIC (Bangladesh Chemical Industries Corporation) indicated that the price differences were not caused by reasons of quality differences, as content of nutrient, acid and particle size are similar and consistent with standard specifications. Rather price differences are caused primarily by conditions of tied aid.

Even though the 25% subsidy rate is what the government terms as budgetary subsidy to farmers, it does not mean that government actually

transfers this amount to BADC. Fertilizers received on credit and through donor grants are valued at the full price quoted in the aid invoice and this value is receivable by government. The cash-flow impact on the government's budget is in fact positive. In 1983/84 the government budget received a net transfer of Tk 218 million from fertilizer account, even though on paper it showed a budgetary subsidy of Tk 1466 million. Like food aid, fertilizer aid has become another source of generating public revenue.

Some implications of the procedure

The implications of the current procedure should be brought out within the context of questions raised in the introduction. A number of such implications are in fact quite serious.

First, if the cost of production of domestic fertilizers continues to be one of the bases for pricing fertilizers to farmers, farmers may be forced to subsidize industries which are inefficient. At present this pressure is not great because, under the current procedure of estimating the cost of production, the factories are allowed to eat away capital received on concessionary terms and deplete natural gas available domestically. When industries are forced to accommodate the full cost of capital and natural gas in their cost (as in Table 2) – and pressure for such a change is already quite intense – the case of farmers subsidizing industries would be a real one. Conversely, if fertilizer industries can improve efficiency, they should not be forced to pass on the benefit to farmers in the form of subsidy. This would take away the incentives for improving the efficiency of industries.

Second, the current cost estimates of domestic fertilizer production do not include full costs. However, industries are allowed to export fertilizers in a competitive world market. During 1982–84, fertilizer industries exported 127 000 tons of urea at an average price of \$145.25/ton which was about 7% lower than the import price under cash payment by the BADC. This is definitely tantamount to a case where domestic industries are subsidizing foreign farmers at a time when the government is making all efforts to eliminate subsidy to domestic farmers. Without a correct approach to pricing of domestic fertilizers, this anomaly will persist.

Third, generating public revenue through fertilizer aid may not be offensive, but the practice of taking invoice prices straight as they are in costing imported fertilizer implies a transfer of burden to farmers to the extent that these invoice prices exceed free market prices by 10–30%. In effect, farmers receive less than what is claimed to be given to them as subsidy on account of aided fertilizers.

Fourth, the practice of pooling costs among factories to arrive at average costs of production of domestic fertilizers masks considerable inefficiencies in certain factories. This implies cross-subsidy among fertilizer factories and does not bode well for improving efficiencies of individual factories.

Finally, there are tremendous differences in the rate of subsidy among various types of fertilizers. These rates are best adjusted on the basis of marginal productivity of each type rather than doing so arbitrarily.

An appropriate approach to pricing fertilizers

It has been made sufficiently clear that the current procedure of pricing

fertilizers creates serious distortions. What is the alternative available to the Bangladesh government? It is suggested that an economic approach based on the world price as a reference for pricing can correct prevailing confusions. Currently there is a phobia against this principle; but it need not be so. The use of the world price for accounting purposes does not necessarily imply an immediate concession to pressure groups asking for elimination of subsidy.

In this approach, the fertilizers are priced at their world levels (border prices), following the principle of economic pricing. Some implications of this approach for estimation of subsidy are shown in Figure 1.

These illustrations are based on linear cost and revenue assumptions. In the diagrams, Q_D^* and Q_M^* are the quantities procured and distributed respectively from domestic sources and import.

- SP = Sale price to farmers
- EP = Economic price (*FOB* price plus distribution cost for import)
- AC = Average cost of procurement and distribution cost to BADC
- ACF = Average cost in terms of actual cash flow cost
- CP = Cost of production of domestic fertilizers plus distribution cost (all in per ton basis)

It is assumed that quantity procured is also distributed. The diagram for domestic fertilizer reflects closely the situation of Ashuganj urea and Chittagong TSP, if the cost of production is adjusted for natural gas and capital cost underpricing. In this case the total economic subsidy is $Q_D^* (EP-SP)$, ie quantity times the difference between economic and sales price. Of this amount of economic subsidy, $Q_D^* (AC-SP)$ is the budgetary subsidy coming from government treasury and $Q_D^* (EP-AC)$ is the part being subsidized by industry, even though the industry has a hidden subsidy equivalent to $Q_D^* (CP-EP)$.

In the case of imported fertilizers the diagram reflects the cases of imports under tied aid. The total economic subsidy is measured by $Q_M^* (EP-SP)$, which is smaller than the total budgetary subsidy of $Q_M^* (AC-SP)$. The difference between the two, ie $Q_M^* (AC-EP)$, is the part of budgetary subsidy that is attributed to overpricing of tied aid, but attributed to subsidy to farmers under current price. (See Table 3 for price differences.) $Q_M^* (SP-ACF)$ is the net resource generation due to fertilizers received under grant and credit arrangements.

On the basis of economic prices, the subsidy for fertilizers distributed in 1983/84 is calculated and shown in Table 6. In doing this, the exchange rate used is the official exchange rate, and the distribution cost

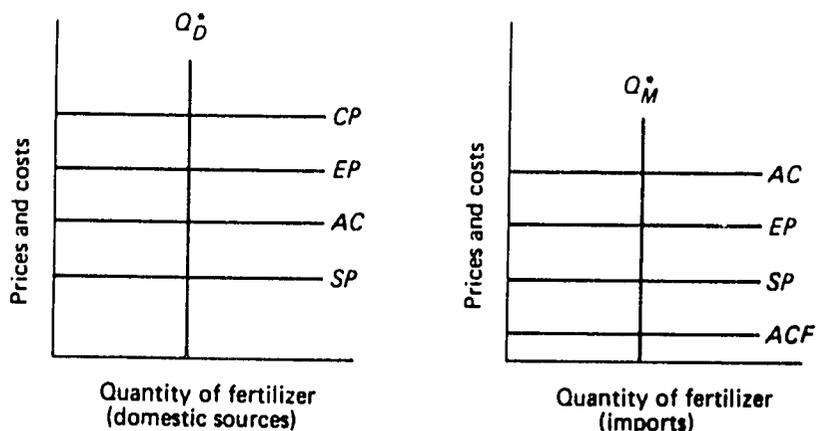


Figure 1. Implications of the economic approach for estimation of subsidies.

Structure and dynamics of fertilizer subsidy

Table 6. Full economic subsidy on fertilizers, 1983/84.

Fertilizer	Source	Quantity (tonnes × 10 ⁶)	Average cost (Tk/ton)	Sale price (Tk/ton)	Total cost (Tk × 10 ⁶)	Total receipt (Tk × 10 ⁶)	Total subsidy (Tk × 10 ⁶)	Rate of subsidy (%)
Urea	Domestic	279.642	4 740	3 966.4	1 325.5	1 109.17	216.33	16.3
	Domestic	356.045	4 740	3 966.4	1 687.7	1 412.22	275.48	16.3
	All Domestic	635.687	4 740		3 013.2	2 521.39	491.81	16.3
	Import Saudi	7.900	5 525	3 966.4	43.65	31.33	12.32	28.2
	Import USAID	24.237	5 525	3 966.4	133.91	96.13	37.78	28.2
	Import Saudi	14.051	5 525	3 966.4	77.63	55.73	21.90	28.2
	Import USAID	26.195	5 525	3 966.4	144.73	103.90	40.83	28.2
	All import	72.383	5 525	3 966.4	399.92	287.09	112.83	28.2
	All urea	708.070	4 820.3	3 966.4	3 413.12	2 808.48	604.64	17.7
TSP	Domestic	74.631 (55.467p)	4 532.00	2 448.00p 3 752.00g	338.23	235.42	102.81	30.4
	Import Danish	10.065	5 275.00	3 752.00g	53.09	37.76	15.33	28.9
	Import Dutch	52.458	5 275.00	3 752.00g	276.72	196.82	77.90	28.9
	Import Japan	8.805	5 275.00	3 752.00g	46.45	33.04	13.41	28.9
	Import NORAD	17.443	5 275.00	3 752.00g	92.01	65.45	26.56	28.9
	Import UK	5.000	5 275.00	3 752.00g	26.34	18.76	7.58	28.9
	Import ADB	8.580	5 275.00	3 752.00g	45.26	32.19	13.07	28.9
	Import IFAD	8.400	5 275.00	3 752.00g	44.31	31.52	12.79	28.9
	Import Dutch	30.100	5 275.00	3 752.00g	158.78	112.94	45.84	28.9
	Import Danish	45.248	5 275.00	3 752.00g	238.68	169.77	68.91	28.9
	All Import	186.099	5 275.00	3 752.00	981.67	698.25	283.42	28.9
	All TSP	260.730			1 319.90	933.67	386.23	29.3
	DAP	Import USAID	1.923	6 575.00	3 966.4	12.64	7.63	5.01
Import USAID		15.488	6 575.00	3 966.4	101.83	61.43	40.40	39.7
Import USAID		24.990	6 575.00	3 966.4	164.31	99.12	65.19	39.7
Import Bulgaria barter		24.553	6 575.00	3 966.4	161.44	97.39	64.05	39.7
Import Czech barter		20.997	6 575.00	3 966.4	138.06	83.28	54.78	39.7
Import NORAD		5.880	6 575.00	3 966.4	38.66	23.32	15.34	39.7
All import		93.831	6 575.00		616.94	372.17	244.77	39.7
MP	Import CIDA	13.222	3 900.00	2 948.0	51.57	38.98	12.59	24.4
	Import CIDA	50.000	3 900.00	2 948.0	195.00	147.40	47.60	24.4
All fertilizers		1 125.853	5 006.35	3 819.95	5 596.53	4 300.70	1 295.83	23.1

Source: Estimated with information from Bangladesh Agricultural Development Corporation.

is Tk 900 per ton. For a number of reasons no attempt has been made to use a shadow price for exchange rate. For one thing, considerable controversy seems to exist around the question of an appropriate rate of exchange. More substantively, the partial approach taken here (partial in the sense that we are dealing only with one commodity – fertilizer) dictates that exchange rate controversy be left to macroeconomic management, and it does not dilute our effort to bring home some other basic issues on fertilizer subsidy. The distribution cost has a number of elements where hidden subsidy may exist. No attempt is made to identify or correct this mostly non-tradable component of cost, even though it has elements with import content. However, the distribution cost has been adjusted slightly upwards (from Tk 881 to Tk 900) to accommodate an apparent storage cost element.

The important point to note in Table 6 is that the economic subsidy (Tk 1296 million) is smaller than the budgetary subsidy shown in Table 5 (Tk 1466 million). This implies that farmers received 170 million taka less than the subsidy they are accounted to have received in 1983/84.

The estimate of economic subsidy in Table 6 is based on the *FOB* price of domestic urea, at US \$153.60 per ton. This is an average (1982/83/84) export price BCIC received for export of about 127 000 tons. The *FOB*

price of domestic TSP was assumed at US \$145.25 per ton. This price is slightly higher than the ex-Gulf and ex-West European *fob* prices.

For imported fertilizers, the *cif* price for urea was assumed to be \$185, for TSP \$175, DAP \$227 and MP \$120.⁷ The government imported some urea in 1984 on cash foreign exchange financing. The *cif* price of this urea was \$183.

The *cif* and *fob* prices are adjusted with appropriate distribution costs to arrive at border prices. This approach of adopting border prices as opportunity costs of resources has been questioned by some people in Bangladesh, particularly for fertilizers received under grants and credit. Their arguments tend to imply that donors have no option than to supply fertilizers on grants and credit – as if grants and credits are sought by the donors, rather than the government of Bangladesh.

This position appears to be neither true nor tenable as an argument for a zero price for fertilizers received under grant. Fertilizer aid is simply a mechanism of resource transfer and a balance of payment support to Bangladesh. Given Bangladesh's food problem, response function and price environment for using fertilizers, the country would probably import fertilizer by cutting imports somewhere else if aids for fertilizers were not forthcoming.

One serious handicap in following the economic pricing principle for fertilizer is the wide fluctuation in world prices for most fertilizers. Fertilizer prices in the world market, as published and available from the World Bank, show wide fluctuations. If domestic sale prices of fertilizer are allowed to fluctuate with world prices, they may create severe instability in agriculture. The economic principle may, therefore, be adopted only with the additional provision that domestic prices can be stabilized around the world price following a pricing formula based on average or moving-average world prices rather than the price of a particular year.⁸

Such a procedure will require the operation of a fund for price stabilization. If actual procurement prices were below this trend price the fund would be conserving resources, but when actual procurement prices were above it the fund would be giving out money.

Dynamic factors influencing subsidy

In most developing countries, procurement and distribution of fertilizers are done publicly. So long as a government remains in this business, and subsidy on fertilizers has to be maintained within a limit, the tasks should be managed as a business. A number of dynamic factors critically influence subsidy.

1) Prices of fertilizers should be changed on a regular basis in a gradual order. Like most administrative prices, fertilizer prices remain constant for a considerable period and then rise suddenly and occasionally sharply in one shot. For example, little change in the sale prices of fertilizers occurred in Bangladesh between April 1974 and July 1979, but prices were raised by about 65% between October 1980 and December 1982. Farmers become accustomed to a price that endures a long time and therefore resent a sudden large increase. The inherent inflexibility of administrative prices is a potent consideration for decentralizing marketing of fertilizers.

2) The exchange rate between domestic and foreign currencies has a powerful impact on fertilizer prices in countries which are dependent

⁷These prices are consistent with the world market price quoted and published in International Bank for Reconstruction and Development/World Bank, *Commodity Trade and Price Trends*, (World Bank, Washington, DC, 1983) and recent unpublished data from the same source.

⁸A simulation exercise with 1975/76 through 1982/83 situations indicates that moving average rather than simple average technique provides a better guide for pricing with close matchings of deficits and surpluses. Simple average technique leads to increasing deficits in the stabilization fund.

on imports or which follow the economic pricing principle even for domestically produced fertilizers. To facilitate a quick rough estimation of the required change in sale price for changes in exchange rate, the elasticity of sale price with respect to devaluation of exchange rate was calculated for Bangladesh on the basis of current information. These estimates indicate that for every one percent devaluation, the sale price of urea will have to rise by 1.57%, that of TSP by 2.35% and MP by 1.96%. It is true that exchange rate is a macroeconomic management issue but its implication for agriculture is nevertheless quite severe.

3) Where public parastatals are responsible for marketing of fertilizers, the task of planning quantities and composition of fertilizers to be distributed in advance of actual use is a critical responsibility. The assessment of future demand and setting of sale targets are generally based on a set of very uncertain assumptions and imperfect information. This may result either in inadequate or excessive stock availability at the time of peak demand. An excessive stock level implies an increased cost whereas inadequate stock may result in scarcity of supply leading to numerous distortions in farm level prices and application of fertilizers. While the need of professionalism in planning targets and composition of fertilizers cannot be denied, even with the best planning serious shortage may occur in growing stages of fertilizer demand. A liberal stock policy is the answer to such problems in most developing countries. Very often a conservative stock policy entails purchases of fertilizers in the international markets when prices are not favourable. This aspect of cost related to a liberal stock policy that allows to avail of best market situations seldom enters into consideration when formulation of optimum stock policy is attempted.

4) Regional distribution of a given aggregate stock determines the overall effectiveness of stock policies. In a growing stage of fertilizer demand, assessment of the locational demand for fertilizers becomes a crucial but risky task. Imbalance in regional supply and demand is the primary source of excessive cross-shipment and consequent cost escalation in marketing of fertilizers. Professional analysis of regional demand thus becomes unavoidable.

Concluding observations

The risk of conducting economic analysis designed to find out the impact of fertilizer subsidy, without first examining who is subsidizing whom and on what type of fertilizers, has been brought out. It is misleading to trace the impact of subsidy in agriculture alone, if subsidy is going to industries in a hidden manner. The dynamic factors influencing subsidy need greater attention than is generally paid, if subsidy management is to be more efficient. The general practice has always been to focus on administrative prices alone in adjustment of subsidy. Examination of the structure and dynamics of fertilizer subsidy is therefore a prerequisite before measuring the impact of changing subsidy.

The case of Bangladesh demonstrates that fertilizer production cost as a basis for determining subsidy introduces numerous distortions. Particularly, it enhances the chance of shifting subsidy in industries on to farmers. Although this has not yet become a reality in Bangladesh because of current costing procedures which imply depletion of foreign-aided capital and domestic natural gas, the situation is moving

rapidly towards that reality. In relation to fertilizer imported under loan and grant, the donors' invoices generally overstate prices by 10–30%, which are then passed down to farmers. Like food-aid, fertilizer-aid has become a mechanism for generation of public revenue. Thus, even though the budgetary subsidy on fertilizers was accounted to be 25% (Tk 1466 million) in 1983/84, the government received a surplus of about Tk 218 million in that year from fertilizer.

A suggested rational solution to the distortions and anomalies created by the current procedure of estimating subsidy is the adoption of the economic approach to pricing fertilizers on the basis of world prices. This does not necessarily imply a complete elimination of subsidy. The prominent fear of relating the approach with elimination of subsidy is ill-founded. This approach, in due time, will shift the onus of correcting distortions from farmers to industries. Because fertilizer industries are under the public sector in Bangladesh, the assessment of production cost in individual factories would however continue to be an important basis for monitoring efficiencies of factories.