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A METHOD OF DETERMINING MINIMUM SUPPORT PRICES

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The present food crisis and the abnormal increase in agricultural prices in general and in food prices in particular demands a high priority for agricultural development. This is what is sought to be achieved during the Fourth Plan period. The results of such an endeavour would, however, be felt after a lapse of time. In the meanwhile, effective distribution measures are being introduced to ensure equitable distribution of foodgrains at fair prices to the consumers—especially to the vulnerable section of the population. The evaluation of a proper price policy is a pre-requisite for the fruition of both development efforts and distribution measures. An attempt has been made in this paper to suggest a workable procedure, on the basis of available empirical data, for determining that level of food prices which would satisfy the so-called divergent interests of producers and consumers and at the same time, would be in line with the development needs of the country.

In the first place, let us assume that the supply of foodgrains is less than the demand for them. Since prices in the free market will rule at fairly high levels depending on the relative elasticities of supply and demand, this will render sufficient incentives to the agriculturists. However, from the point of view of the impact of high prices on the non-producer consumers and on the development efforts of the country, surely prices cannot be allowed to soar to higher and higher levels. If the gap is too wide, no rational price policy, however meticulously determined, can save people—especially the vulnerable section—from starvation. If the gap is not large, then one of the possible short term solutions in a situation of soaring prices is to consume less by a quantity $\frac{D-S}{N}$, for each individual, where D, S and N stand for demand, supply and the total number of consumers respectively (assuming no import of foodgrains).

We know that the food balance in India is marginally in deficit since import is only about 5 to 8 per cent of our requirements. Let us assume for the sake of simplicity that the total supply in the market is from the internal production only. The producers can be divided into two broad groups. The first group consists of subsistence farmers who cultivate for their own food requirements and does not have any surplus to sell. The second group consists of farmers who cultivate not only for their own requirements but sell the surplus quantity in the market. In our subsequent discussion, we propose to consider the case of the second group of farmers and will term them as producers.

According to the normal economic behaviour, the producer will try to maximize his income. At the same time the consumer will try to minimize his expenditure. Thus, if the price for a cereal is "p" such that

(*i*) income is maximized for the producer and

(*ii*) expenditure is minimized for the consumer.

(It is assumed that there is no change in the consumption habit of the consumer). For all practical purposes, it may be not possible to find a price "p" satisfying the condition (*i*) and (*ii*) above.

So we propose to find a price "p" for a cereal which satisfies the condition given below :—

Minimum possible price acceptable to the producer = Maximum possible price payable by consumer ... ... (1)

As the acceptable price differs from producer to producer and also similarly the payable price from consumer to consumer, we may have to find a price "p" satisfying the conditions,

Minimum possible price acceptable to a maximum number of producers ... ... (2A)

Maximum possible price payable by a maximum number of consumers ... ... (2B)

The above case may be written as follows :

$$P = \int_{0}^{p^*} d\phi(p); \quad Q = 1 - \int_{0}^{p^*} d\Psi(p); \quad \ldots \quad (3)$$

Where ϕ (p) represents the distribution function of the minimum price acceptable to the producers and Ψ (p) represents the distribution function of the maximum price payable by the consumers. Now p^* is so chosen that it satisfies the condition (3) above, so that Y_0 number of producers and X_0 number of consumers are included within the range of integrals, where Y_0 and X_0 are known *a priori.* Here also we face the problem of indetermination, if we want condition (3) to be satisfied for the same or fixed proportion of producers and consumers.

When we cannot find a price p^* where it will satisfy condition (3) for "P" proportion of producers (*i.e.*, Y_0 in number) and Q proportion of consumers (*i.e.*, X_0 in number), we find a substitute price p_0 for p^* in the following manner :—

Let p_1 be the price which is determined by

$$\int_{0}^{p_1} d\phi(p) = P;$$

and similarly a price p_2 is determined by

$$\int_{0}^{p_2} d\Psi(p) = 1 - Q.$$

Then we fix p_0 in such a way, so that,

$$\int_{p_1}^{p_0} d\phi(p) = \lambda P \; ; \text{ and } \int_{p_2}^{p_0} d\Psi(p) = 1 - \lambda Q \quad \ldots \quad (4)$$

Where λ is a fixed constant determined by interpolation.

(This we can always write without any loss of generality when p_0 lies between p_1 and p_2).

Appreciating the difficulties of observing directly the behaviour of the variables : "minimum acceptable price to producers" and "maximum payable price by consumers," we confront the case of finding a method which will enable us to find the distribution functions of both. Actually these two variables are the outcome of the joint effect of some other variables. In this case, we approach with the object of finding a price which will give incentive to the producers and more or less, will be acceptable by the consumers. Here we assume that both producers and consumers can be divided into homogeneous groups in respect of their consumption patterns, *i.e.*, according to the different utility functions. It is also assumed that the consumption pattern of an individual depends on his per capita income and remains unchanged within a particular income group in which he is placed. We also assume that every individual has the same objective of improving his economic position, *i.e.*, the utility function of a particular individual is tending towards the utility function of a par next higher income group. The use of per capita income is necessary since the price payable or acceptable depends not only on the total income of the family but also on the number of individuals to be maintained on that income.

Let the producers be divided into n groups, according to the different utility functions and let the central value of the per capita income be, $I^\circ_1, I^\circ_2, \ldots\ldots\ldots\ldots I^\circ_n$.

Let n'_i be the number of producer's family in the ith group with I°_i as the central value of the per capita income.

Let the cost of production per unit weight for these individuals be given by,

$$c_i = \begin{bmatrix} c_{i1} \\ c_{i2} \\ \vdots \\ c_{in'i} \end{bmatrix}$$

which is considered as the average of "t" years (say 3 years). The cost considered here is the total operational cost and the imputed value of the family labour and bullock labour. Let the corresponding average price received by the producer's family over the same "t" years be,

$$p_i = \begin{bmatrix} p_{i1} \\ p_{i2} \\ \vdots \\ p_{in'i} \end{bmatrix}$$

And the corresponding average surplus amount of foodgrains sold for the above "t" years be

$$s_i = \begin{bmatrix} s_{i1} \\ s_{i2} \\ \vdots \\ s_{in'i} \end{bmatrix}$$

The proportion of income from the particular grain in respect to total income is given by ν_1 depending on the same "t" years average, be

$$\nu_i = \begin{bmatrix} \nu_{i1} \\ \nu_{i2} \\ \vdots \\ \nu_{in'i} \end{bmatrix}$$

i, varies from 1 to n, in all the cases.

As one of the purposes of the price policy is to provide an incentive to the cultivators, the cost of production (as already defined) is to be derived from the results of the experiments conducted by the agricultural research stations. Let the cost of production be C° per unit weight. Of course, this cost will be higher than the normal cost incurred by producers. But it is assumed that the cultivator will invest any extra income for increasing the total product during the first few years.

Let the minimum acceptable price by the producers be as

$$p'_i = \begin{bmatrix} p'_{i1} \\ p'_{i2} \\ \vdots \\ p'_{in'i} \end{bmatrix}$$

where elements of p'_i is determined in the following manners.

Let the jth element of p'_i be p_{ij} determined by the relation,

$$p'_{ij}\, s_{ij} - C^\circ s_{ij} = \nu_{ij}\, [\, I_{ij} - \xi\, (I^\circ_{i+1} - I^\circ_i\,)\,]$$

where $O < \xi \leqslant 1$ and depends on the difference $(\, I^\circ_{i+1} - I^\circ_i\,)$

where I_{ij} is the total income of the j^{th} individual of the i^{th} group. Extra incentive in the form of $\xi\, (I^\circ_{i+1} - I^\circ_i)$ is given to the producers so that they can move to the next higher group, which is already discussed. As I_{ij} was not observed earlier we can reduce (A) as,

$$s_{ij}\, (p'_{ij} - p_{ij}) + (C_{ij} - C^\circ)\, s_{ij} = \nu_{ij}\, (I^\circ_{i+1} - I^\circ_i)\, \xi.$$

Thus we can find $\sum_{i=1}^{n} n'_i = N_0$ number of observation for the minimum price acceptable to the producers from p'_is, where, $i=1, 2, \ldots\ldots\ldots\ldots n$.

Naturally, from these observations we can find the distribution function ϕ (p) defined in (3).

So our next proposition is that of finding Ψ (p). Here also we proceed in the same manner as we have considered in finding the distribution ϕ (p). First, we divide the consumers in m groups according to the different utility functions and let the central value of the per capita income be, $I'_1, I'_2, \ldots\ldots\ldots\ldots I'_m$.

Let m'_j be the number of consumers family in the jth group with I'_j be the central value of the per capita income. Let the average price paid per unit weight by the consumers for the last "t" years be,

$$\theta_j = \begin{bmatrix} \theta_{j1} \\ \theta_{j2} \\ \vdots \\ \theta_{jm'j} \end{bmatrix}$$

Let the average quantity of grain consumed by these m'_j consumers for the last "t" years be,

$$s'_j = \begin{bmatrix} s'_{j1} \\ s'_{j2} \\ \vdots \\ s'_{jm'j} \end{bmatrix}$$

And the average proportion of income spent on particular foodgrains during the last "t" years, be

$$\mu_j = \begin{bmatrix} \mu_{j1} \\ \mu_{j2} \\ \vdots \\ \mu_{jm'j} \end{bmatrix}$$

j varies from 1 to m in all the above cases.

Now for determining the maximum price payable by the consumers we assume, that

$$\mu_1 < \mu_2 < \ldots\ldots < \mu_{k-1} < \mu_k > \mu_{k+1} > \mu_{k+2} \ldots\ldots > \mu_m.$$

This we can assume without any loss of generality, as we know from the past surveys that the expenditure on food is proportionately more in the lower income groups. But it is assumed here that even among the lower income groups we may find that the proportional expenditure is first increasing upto k groups and then decreasing. According to the same logic as before, the consumers of one group is tending to incur expenditure on that particular grain in the same proportion as that by those in the next higher income group, which is true upto (k—1) groups, kth group being the border one remains unchanged in its expenditure pattern. Then the (k+1) th group and onwards will be ready to spend the proportion of the next below group. Thus we find the maximum price payable by the consumers as :

$$\theta'_j = \begin{bmatrix} \theta'_{j1} \\ \theta'_{j2} \\ \vdots \\ \theta'_{jm'j} \end{bmatrix} \qquad \text{..............(B)}$$

Such that, $\theta'_{jl}\, s'_{jl} = \mu_{j+1,\,l}\, I'_{jl}$; for $j=1, 2, \ldots\ldots\ldots\ldots (k-1)$.

We can also write this,

$$(\theta'_{jl} - \theta_{jl})\, s'_{jl} = \mu_{j+1,\,l}\, I'_{jl} - \mu_{jl}\, I'_{jl} = I'_{jl}\, (\mu_{j+1,\,l} - \mu_{jl}).$$

If the difference $I'_{j+1} - I'_j$ is not very large for all j, we can assume $I'_{jl}=I'_j$ In finding (B) we confront three cases for matching, first,

$$m'_j > m'_{j+1}$$

then we make correspondance upto $\mu_{j+1},\ m'_{j+1}$

and for the rest take $\mu_{j+1},\ m'_{j+1}$ as the standard proportion. Second, $m'_j < m'_{j+1}$ there consider only first m'_j component of μ_{j+1} and the rest are ignored. But when $m'_j = m'_{j+1}$ we don't have any problem of adjustment.

When $j > k$ we find, (B) with the relation $\theta'_{jl}\, s'_{jl} = \mu_{j-1,\,l}\, I'_{jl}$

where $j = (k+1), (k+2)\ldots\ldots\ldots\ldots m$. Thus from (B) we find,

$$\sum_{j=1}^{m} m'_j = M_0 \text{ ; number of observation}$$

for finding out the distribution function $\Psi(p)$ for the maximum price payable by the consumers.

(We can use $\Psi(p)$ for the variable θ', as both θ' and p are measured in the same scale).

After finding the functions, $\phi(p)$ and $\Psi(p)$ it is possible to find a price acceptable to all interests, in the manner as already discussed earlier.

Requirement of Data and Merit of this Approach

The data on cost of production for different types of foodgrains are already available though not for a long period continuously. Even then, it may be possible with the help of the data collected in routine manner in agriculture research stations and in special enquiries to build up a time-series of cost of production data. The family budget data are available from the various rounds of the National Sample Survey and also from the special enquiries conducted from time to time. It may not be difficult, therefore to build up a time-series of family budget data. Both the series have to be built on income groups or possibly, on expenditure groups.

Apart from the above two types of data, it will be preferable to get information on the expenditure incurred by the progressive farmers on improved practices of agriculture. Finally the adoption of this approach will be greatly facilitated if data on marketed surplus are available, at least for a few years and for important markets. Such data are being compiled by the Directorate of Economics and Statistics, Ministry of Food and Agriculture.

One of the important merits of this approach is that it attempts to indicate a price level which will not only satisfy the condition of acceptability and payability on the part of a maximum number of producers and consumers, it also takes into account the following :—

(*i*) a strive to maximizing utility function by all vulnerable parts;

(*ii*) a conscious attempt to development by investment on improved practices;

(*iii*) a basis though indirectly to evaluate the effect of developments measures in the field of agriculture.

It has not been possible to discuss the above merits in details in this paper. The author hopes to examine them later on in the light of discussion and comments that may be offered to the basic approach followed in this paper.

Some Additional Merits of the Procedure

The primary advantage of this method lies in its self-controlled formulae with the control variable ξ, and partly C°, the cost incurred per unit by the research station. Judicious application of this method will also enable one to decide whether the support price is at all required to the producers. This will also enable one to find out whether the price is required to be fixed in the interest of the consumer.

Advantages cited above will be clear from the discussion below :

$\phi(p)$ is the distribution function of minimum acceptable price by the producer defined over the range (π_1, π_2), this is so considered as the distribution $\phi(p)$ in the range (O, π_1) is null. Similarly, the distribution function $\Psi(p)$ of maximum payable price by the consumers be defined in the ranges (π'_1, π'_2).

Case : I

Let (π_1, π_2) and (π'_1, π'_2) are not overlapping and,

(*a*) $\pi_2 < \pi'_1$, then the price π'_1, should be considered as the support price, which satisfy all the consumers and the producers of fixed proportion.

(*b*) When, $\pi'_2 < \pi_1$, then the support price is not at all necessary for producers with the value of the ξ considered in finding out $\phi(p)$. If ξ was considered greater than zero, it should be first made zero, and reconsider $\phi(p)$, thus determined. Even after putting $\xi = O$, if we find that the relation $\pi'_2 < \pi_1$, is still satisfied, we must lower the value of C°. Even after putting C° to the existing average cost of production, if we find $\pi'_2 < \pi_1$, it is clear that no support price is necessary for the producers. On the contrary price support should be given to the consumers.

Case : II

Let (π_1, π_2) and (π'_1, π'_2) are overlapping.

(*a*) $\pi_1 < \pi'_1 < \pi_2$

Support price should be determined in the same manner as shown in the equation (3) and (4) of the paper.

(*b*) $\pi'_1 < \pi_1 < \pi'_2 < \pi_2$

First minimising ξ, and then if required minimising C°

We must consider the price as in Case I(b).

(*c*) $\pi_1 < \pi'_1 < \pi_2 < \pi'_2$

Then we decide in the same manner as in the Case II(a) above.

Another particular advantage of this method is that it can be applied to unclassified data very conveniently, only by putting single sample in each group.