Farmers' Response to Price Movements

Case of Rape and Mustardseed

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Whether cultivators in developing countries respond to price changes in a definite way has been a subject of controversy.

There are authors who have argued that cultivators do respond to price changes and found empirical evidence to support their argument.

There are also those who hold that the price elasticity of supply of agricultural commodities is zero or negative.

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This article discusses farmers' response to price movement. Rape and mustardseed are the crops studied.

THIS paper deals with farmers' response to price movement. Rape and mustardseed are the crops studied. It is necessary to point out here that this is not the supply function. I would rather call it an output response function, in which farmers' decision about how much to produce at a given price is being investigated. In Indian conditions, where it is believed that the farmer produces primarily for home consumption and not for the market, the distinction between supply function and output response function should be considered important. However behaviour of supply would certainly depend on the nature of this function.

Whether cultivators in underdeveloped areas respond to price changes in a definite way has been a subject of controversy. There are authors [1] who have argued and found empirical evidence that cultivators do respond positively to price changes. There are also others [2] who believe in zero or negative price elasticities of supply of agricultural products.

In India not many studies have focused on this problem. Of those that have, the ones by Raj Krishna [1], Dharm Narain [3], Acharya and Sengupta [4] attract immediate attention. The methodology followed by Dharm Narain is purely graphical. One is inclined to have some reservations about drawing firm conclusions on the basis of similar movements of acreage and price alone, when there might be other factors as well influencing the acreage. Raj Krishna and Acharya and Sengupta follow a standard regression analysis.

Formulation

In Raj Krishna's formulation the observed acreage x_t at time t is taken as a linear function of (i) relative price of last year (ii) acreage of last year and other shifter variables. The introduction of lagged acreage is a consequence of the Nerlovian [5] adjustment model. A similar type of estimating equation can follow from an expectation model as well, introducing an inherent difficulty in the interpretation of the equations. The adjustment model can be used to distinguish between the long-run and the short-run effects. But the expectational model cannot interpret the equation in that convenient way and in fact the role of the term x_{t-1} appears to be only to represent the distributed lag effect, except that of last year's price. From this point of view the introduction of x_{t-1} appears a little artifical, particularly if one wants to raise doubt about the effect of price itself. The introduction of x_{t-1} as an independent variable in the regression model would generally increase the value of R^2 particularly when we are considering economic time series, and thus is open to question.

Acharya and Sengupta also have taken a similar formulation. But in this case they have taken the ratio of the acreages of two competing crops (jute and paddy) at the year t as a linear function of the same ratio of the preceding year and lagged price ratio (of the two competing crops).

From the above consideration I have decided not to take previous year's acreage as an explanatory variable. Further one would expect that in general the farmers' behaviour is dominated by a craving for foodgrain self-sufficiency and uncertainty minimisation. If he produces foodgrains for his own needs he runs the risk of a poor crop anyway, but if he produces cash crop and leaves a part of his food needs uncovered he still runs the risk of losing both ways. Foodgrains price may become unfavourable to him when he goes to buy and at the same time the price of cash crop may have fallen when he is forced to sell. Hence, under a very unstable price, for a small farmer the risk increases with the proportion of the consumption needs that have to be purchased. Consequently the farmers continue to grow foodgrains and low risk crops.

If the preceding describes the situation reasonably well then the following hypothesis can be formulated about the price response of the farmers:

> "Cash crop-foodgrains acreage substitution effect in response to price changes is likely to be of small magnitude. On the other hand if the farmers' expectation about yield of foodgrain is high then he is likely to release a greater part of his land to cash crop if prices are not unfavourable."

Thus from the foregoing the following formulation of estimating equation would result

$$x_t = a_0 + a_1 p_{t-1} + a_2 RFY_{t-1} + a_3 t \quad \dots (1)$$

where x_t is a measure of output of rape and mustardseed at time t

p_t = relative price (Rapeseed/competing crop) at time t

RFY_t = competing Rabi foodgrain yield/acre at time t

t = the time variable

Results*

I have analysed the output response of rape and mustardseed for the whole of India where annual index of production for the period 1951-52 to 1963-64 was taken as the measure of output. Consequently the current yield/acre of rapeseed (RY_t) is taken as another

* Standard errors are shown below each estimated co-efficient Along with R^2, F, d the Durbin-Watson Statistics is also given in each case.

explanatory variable. Average wholesale prices of rape and mustardseed at three centres (Calcutta, Bombay and Kanpur as available in *Agricultural Situation in India*), arrived at in two alternative ways (viz, by a weighted average with notional weights of 20, 65, 15 for Bombay, Kanpur and Calcutta respectively and by simple average price of the three centres), have been taken to start with as the representative price of rape and mustardseed. The competing foodgrains in this case are Rabi cereals and pulses. The index of yield/acre of Rabi foodgrains was arrived at as a weighted average of the indices for Rabi cereals and that of pulses (weights being those given in *Agricultural Situation in India* along with these figures). Since wholesale prices for Rabi foodgrains are not available separately, the index of wholesale prices for foodgrains (from the *Bulletin of Food Statistics*, Directorate of Economics and Statistics, Ministry of Food and Agriculture) were used. To avoid serial correlation the regression was fitted to the first differences.

Estimated equations were

(Estimated equations are presented separately for weighted average price and simple average price. There is practically no difference between the two sets of estimates. This would indicate that some difference in the weighting scheme would not affect our estimates to any great extent.)

(i) $dx_t = 1.515 + 0.134\, dp_{t-1}$
(1.851) (0.127)
$+ 1.630\, dRY_t + 1.185\, dRFY_{t-1}$
(0.148) (0.268)

when simple average price was used.
$d = 1.668$ inconclusive, $R^2 = 0.941$,
$F_{(3,14)} = 42.309$ significant at 0.1 p level.

(ii) $dx_t = 1.537 + 0.141\, dp_{t-1}$
(1.849) (0.132)
$+ 1.631\, dRY_t + 1.184\, dRFY_{t-1}$
(0.148) (0.268)

when weighted average price is used.
$d = 1.693$ inconclusive. $R^2 = 0.941$,
$F_{(3,14)} = 42.427$ significant at 0.1 p c level

$RY_t =$ the index of yield/acre of rape and mustardseed at time t.

The above shows that the price variable is rather unimportant.

The foregoing suffers from two limitation. First, the decision of the farmers primarily relates to acreage allotment and hence acreage of rape and mustardseed should be analysed and second, Rabi foodgrains prices should be taken into consideration. Index of acreage given to rape and mustardseed is available from official series published in *Agricultural Situation in India*. Index of wholesale price for Rabi foodgrains was arrived at by weighted average of the index of wholesale prices of wheat, gram, barley and other pulses, given in *Bulletin of Food Statistics*. These indices are given in calendar years. To get indices of corresponding agricultural years (July-June) simple average of two consecutive indices were taken.

Now the estimated equations turn out to be

(i) $x_t = 61.655 + 0.095 p_{t-1}$
(37.992) (0.175)
$+ 0.618 RFY_{t-1} + 2.630t$
(0.322) (0.626)

in the case of weighted average price.
$d = 1.121$ inconclusive, $R^2 = 0.799$,
$F_{(3,11)} = 14.567$ significant at 0.1 p c level.

(ii) $x_t = 64.369 + 0.066 p_{t-1}$
(37.856) (0.172)
$+ 0.618 RFY_{t-1} + 2.657t$
(0.325) (0.653)

in the case of simple average.
$d = 1.104$ inconclusive, $R^2 = 0.796$,
$F_{(3,11)} = 14.334$ significant at 0.1 p c level.

In the above x_t = Index of acreage of rape and mustardseed at time t
p_t = Index of ratio of wholesale prices (rape and mustardseed / Rabi foodgrains) at time t
RFY_t = same as before.

Here also wholesale price turns out not to be very effective in acreage allocation.

An alternative fit was tried with ratio of average prices between April and September, to take into account the price variations in between the last harvest and the next sowing season. Month end indices of wholesale prices are available in the *Bulletin of Food Statistics* for the relevant crops and from there index of ratio of average wholesale prices (rape and mustardseed/Rabi foodgrains) for the period April to September in a year was constructed and the resulting estimated equations are:

(i) $x_t = 61.882 + 0.086 p_t$
(35.030) (0.161)
$+ 0.615 RFY_{t-1} + 1.368t$
(0.311) (0.272)

In the case of weighted average price.
$d = 1.277$ inconclusive, $R^2 = 0.832$,
$F_{(3,12)} = 19.742$ significant at 0.1 p c level.

(ii) $x_t = 61.097 + 0.093 p_t$
(35.092) (0.161)
$+ 0.616 RFY_{t-1} + 1.372t$
(0.310) (0.266)

in the case of simple average price.
$d = 1.257$ inconclusive, $R^2 = 0.832$,
$F_{(3,12)} = 19.846$ significant at 0.1 p c level.

In this case also price turns out not to be important.

In all the above estimated equations the fit is quite good. All of them are still subject to some limitations. One might argue that the farmers would react, not so much to what the level of wholesale prices would be, but to the prices that he would get in his village after the harvest or in some nearby market. Farm prices were not used in these analyses because sufficiently long time series are not available on a uniform basis.

The satisfactory fit presented above encouraged us to carry out the same type of analysis with relative average farm prices, for India as a whole and also for the States where rape and mustardseed is important. The States of Assam, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan and Punjab were selected on this basis. Assam had to be left out because farm price data were not available. Except for all-India and Rajasthan, we have not observed a good fit. Hence we are not presenting these results till a more detailed analysis is completed.

References

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