I AM thankful to Amartya Kumar Sen for his comments (The Economic Weekly May 2, 1964) on my note (April 11, 1964) on his article (Annual Number 1964) on the inverse relation between size of farms and productivity per acre. However, I feel that the problem deserves further study and I could add a few more comments.

Sen thinks that there is an a priori ground for expecting that the smaller farms are more fertile than the larger ones. "If farms of the same size to start with have different degrees of natural fertility, the more fertile farms will tend to subdivide faster due to greater income (and the consequent tendency of the size of the families to expand faster). Thus a correlation may be indirectly established between smallness of size and natural fertility." I still think that this implies a parallel tendency towards income equalisation and since there does not seem to be any such tendency in fact, Sen's argument is wrong by the principle of reductio ad absurdum. Let me spell out the details of the process as I see it.

Sen's process implies not merely that

\[ \text{(1)} \quad \frac{dN}{dY} > 0 \quad \text{(where N is the size of the farm household and Y its income)} \]

but also that the larger the family the smaller will be the size of the farm in subsequent generation. In symbols,

\[ \frac{dS}{dN} < 0 \quad \text{(2)} \]

Moreover, it is obvious that as the size of the farm is reduced, income from that farm is also reduced. That is,

\[ \frac{dY}{dS} > 0 \]

Again, combining (2) and (3) we have,

\[ \frac{dY}{dN} < 0 \quad \text{(4)} \]

It is the combined operation of (1) and (2) that lies at the basis of Sen's argument and it is the combined operation of (1) and (4) that lies at the basis of my assertion that if Sen's argument were correct, there should have been a tendency towards income equalisation. So far as I can see, if (1)+(2) operate, (1)+(4) should operate as well.

The above analysis can be very much clarified with the help of the diagram below. In the diagram N(Y) shows that as the income of the farm increases, size of the family increases. No is the standard size of the family beyond which there will be subdivision of the family and of the farm. Let us suppose that at the beginning all the farms are of the same size but of different degrees of natural fertility. They have different levels of income \( Y_1 < Y_2 < Y_3 \ldots \) Now \( Y_3 \) income will lead to the family size \( N_3 \). This will lead to subdivision of the farm in the next generation when the standard family will be left with the income \( Y_0 \). This process will be repeated in subsequent generations and income of this group of farms will tend to move as \( Y_3 \rightarrow Y_2 \rightarrow \ldots \rightarrow Y_0 \). The extent of subdivision and the size of the farm at any time will depend upon the number of times the farm has been subdivided and the number of family members amongst whom it was being divided. A farm with lesser fertility and income, say, \( Y \), will be subjected to less severe subdivisions and fewer number of subdivisions. Thus there will be a tendency for smaller farms to be more fertile. However, this tendency operates only as a long run force. In the short run there are many factors to thwart its operation. In that long sense, it seems that along with the tendency towards fertility differentials there is a tendency towards income equalisation.

I agree with Sen's explanation as to why labour input is greater in family farms. But I am not sure whether one can attribute the greater productivity of smaller farms to their greater labour input. The problem arises because there are many (including Sen) who believe that the marginal product of labour in agriculture of the Indian type might be zero. The suspicion is strengthened when one finds that according to the Farm Management Surveys, the smaller farms have greater inputs not only of labour but also of bullock labour, seed, manure, fertiliser etc. It is, of course, a difficult task to disentangle the effects of labour and other factors in this case. However, we may apply the standard technique of multiple regression to see if it throws some light on the problem.

I have carried out one such exercise and the results are as follows:

We take the data from Farm Management Surveys (1955-56) for UP and Punjab. All costs other than labour are aggregated into one item-non-labour costs. The data are in money terms but since we are taking cross-section data for one year, it may not matter very much. There are only five size-groups in each place so that if we apply regression analysis to each of them separately we are left with

\* See his "Choice of Techniques", P 15.
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too few degrees of freedom. Therefore, I apply a dummy variable for place (UP=1; Punjab=0) and another for technique of survey (Cost Accounting data=1; Sample Survey=0). The regression equation that we obtain is:

\[ P = 100.1013 - 0.962020 (21.15384) + 0.7149933 (0.1230489) + 6.433386 \]

The coefficients of dummy variables are not significantly different from zero in the statistical sense. Therefore, rejecting the dummy variable, we carry out the regression again and obtain the following equation:

\[ P = 107.7277 + 0.20594297L + 1.058031 K \]

Regarding Agarwala's second point, I would only like to point out that there is nothing inconsistent in assuming that there is "disguised unemployment" in Indian agriculture, and that at the same time, in the large farms based on wage labour, marginal product of labour is positive. The proposition that a withdrawal of working people from Indian agriculture will leave output unchanged assumes that the withdrawal takes place from the family farms, and not from the wage farms. Agarwala's statistics are interesting, but does he intend to conclude from this that marginal product of labour is zero even for those farms that are run on wage labour? If so, how can this be made consistent with rational behaviour and profit maximization? If not, how can Agarwala deny that greater labour input per acre in the family farms compared with that in the wage farms contribute towards greater productivity per acre of the former? Thus, Agarwala's estimation of the marginal product of labour in Indian agriculture up to eight decimal points does not make me inclined to withdraw the labour-based explanation of the productivity difference.

Reply

Amartya Kumar Sen

I AM glad that the difference between Agarwala and myself has now narrowed down from four points to two. In fact I would like to suggest that it is even narrower, for the points he makes in the preceding note, interesting in themselves, do not contradict anything I have asserted.

Agarwala's presentation of the first point is somewhat obscured by a problem of normalisation. Y in inequality (1) refers to income per farm before subdivision, and Y in inequality (3), and therefore in inequality (4), that per subdivided farm. The juxtaposition of (1) and (4), with the two Y's being interpreted as the same is thus misleading. Even after this is put right, however, there is no doubt that the process of subdivision will demonstrably yield a tendency towards income equalisation, as Agarwala asserts in this note. The question is whether it will eventually yield equality, as Agarwala suggested in the last note. Nothing in the inequalities put together by Agarwala guarantees this. If one tries to get such a result, one would have to make stronger assumptions, e.g., the Malthusian ones, where the process of population expansion does not come to rest until every family enjoys subsistence income. This requires the assumption that (a) the size of the family expands whenever income per head exceeds the subsistence level, and that (b) there are diminishing returns to expansion of labour force (both at a point of time and over time). Both the assumptions are dubious, but what is more relevant here is to note that neither assumption is made by the four inequalities under discussion. Inequality (1) is much more general than assumption (a); and inequality (3) or (4) represents the process of subdivision and the corresponding process of income decline per family, and it has foot nothing to do with Malthusian diminishing returns, i.e., with assumption (b).

There is, thus, nothing in Agarwala's arguments which contradicts the simultaneous assumption of: (i) smaller farms being more fertile, and (ii) income per head varying from one farm household to another. Therefore, the empirical observation of (ii) does not in any way cast doubts on (i).

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