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HUMAN CAPITAL FORMATION IN HARYANA AGRICULTURE

BALDEV SINGH*

Department of Economics
Kurukshetra University, Kurukshetra

This paper attempts to measure and compare investments in human capital according to size-groups of farms in Haryana and to discover the factors which determine such investments. The analysis is based on data relating to 1967-68 collected on the basis of a questionnaire designed for a wider survey conducted during October, 1968—January, 1969.

A three-stage stratification design was adopted for the step-by-step selection of blocks, villages and farm households. At the first stage, one block was selected at random from each of the seven districts of Haryana except Hissar, where zonal differences necessitated selection of two blocks. At the second stage, three villages were selected from each block except in Hissar, where two villages were selected from each block. Representative villages were selected in consultation with the Block Development authorities. At the third stage, four farm households in each village were randomly selected from each of the four groups of farms (classified according to size of operational holdings), *viz.*, small (up to 7.5 acres), medium (between 7.5 acres and 15 acres), big (between 15 acres and 30 acres), and large (30 acres and above). In all, a sample of 342 farm households was selected for the study. (10 farms of given sizes did not exist in the selected villages.)

Human capital formation in agriculture, for the purposes of this analysis, is denoted by the additional expenditure incurred by farm families on acquiring formal education, improved farm skills and maintenance and improvement of health.

Investment in formal education was measured by expenditure approach, *i.e.*, by recording the expenditure reported by households. Investment in farm skills (which included consultations with agricultural authorities and progressive farmers and visiting agricultural demonstration farms and agricultural exhibitions) was measured by time-valuation approach, *i.e.*, by recording the reported man-hours spent multiplied by the prevalent wage rate. Investment in health (which included treatment of curable diseases and mishaps and use of tonics, vitamins, etc.) was measured by both the approaches depending upon the memory of the reporting households.

Table I brings out the relationship between human capital formation (as a whole and according to its components) and size of farm households. The table also gives corresponding figures for farm output and family size. Investment in human capital per household increases as we move from smaller to larger households, although the rate of increase is highest between medium and big households. If we now look at such investment per member of households, there is a similar, although a lower rate of increase as we move from medium to larger

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TABLE I—GROSS FARM OUTPUT, FAMILY SIZE AND HUMAN CAPITAL FORMATION PER HOUSEHOLD ACCORDING TO SIZE OF FARM HOUSEHOLDS

(value in Rs.)

Description/Size	Small	Medium	Big	Large
A. Human capital formation ..	237·20 (100)	283·64 (100)	436·46 (100)	651·08 (100)
(i) Investment in health ..	56·94 (24·00)	31·55 (11·1)	47·37 (10·8)	36·75 (5·6)
(ii) Investment in farm skill	7·72 (3·3)	20·03 (7·1)	35·30 (8·1)	96·60 (14·8)
(iii) Investment in education	172·54 (72·7)	232·06 (81·8)	353·79 (81·1)	517·73 (79·6)
B. Size of farm family (Nos.) ..	7·8	9·5	10·2	12·4
C. Gross farm output	4,476·11	7,246·18	12,727·66	27,316·14

Note : Figures in brackets denote respective percentages.

households and, once again, the rate of increase is highest between medium and big households. There is actually a slight decline per member in medium as compared with small households.

It would appear that there is some component of human capital which diminishes in relative importance on large households tending to offset the increase in other components. Also that it is the increase in family size which causes this. The decline (although nominal) per person between small and medium households would indicate that the component in question is very likely of the nature of a compulsive necessity. There is a positive correlation between family size and size of households as well as between farm output and size of households. But the latter is much stronger and actually the rate of increase of family size experiences a decline between medium and big households. There is a presumption that the component which diminishes in relative importance with size of households is health, while components which increase in importance with size of households are education and, particularly, farm skills. This implies that family size is decisive in determining the total human capital formation up to a certain point in the size of households after which farm output becomes the decisive factor. This point seems to lie around big households. This, in essence, gets confirmed from the analysis of the relationship between the components of capital formation and size of households.

Investment in health is highest on small and lowest on medium households. Big households make the next highest investment in health denoting a little over 50 per cent increase over medium households. Investment in health as a proportion of human capital as a whole, ranging between 24 per cent on small and 5.6 per cent on large households, shows a consistent decline as we move from smaller to larger households, the least decline being that between medium and big

households. Investment in farm skills shows a positive correlation with size of households, although the rate of increase experiences a decline between medium and big households. Investment in farm skills as a proportion of investment in human capital as a whole, ranging between 14.8 per cent on large and 3.3 per cent on small households, also shows a positive correlation with size of households and here again the rate of increase is the smallest between medium and big households, the largest increase being that between small and medium households. Investment in education also shows a positive correlation with size of households, although the rate of increase experiences a slight decline between big and large households. The rate of increase is again most prominent between medium and big households. Investment in education as a proportion of investment in human capital as a whole, ranging between 81.8 per cent on medium and 72.7 per cent on small households, does not seem to be significantly different as between the various sizes of households, although the medium, followed by big households have an edge over large and, more so, small households.

It is hardly surprising that investment in health is highest on small households. The fact that big households make the next highest investment in health means that the compulsive nature of investment in health gets replaced by the attributes of improvement in health made permissibe by a higher level of income. The fact that medium households make a lower rate of investment in health than investment in human capital compared with small households is because the compulsive attribute is less acute owing perhaps to greater immunity made possible by better diet, etc.[1] The picture gets further strengthened when we note that investment in health is a decreasing proportion of human capital as we move to larger households, where the least decline in the proportion is that between medium and big households.

When we take up farm skills and education our inference gets further strengthened. The fact that there is a decline in the rate of increase in the investment in farm skills between medium and big households simply means that the big households are not in as advantageous a position (note the rate of increase in farm output) as medium households are compared with small households. The same factor explains the smallest rate of increase in investment in farm skills as a proportion of investment in human capital as a whole. The fact that big households experience the highest rate of increase and that there is a slight decline in the rate of increase when we move from big to large households simply means that big households do not have as high a relative edge (whether in terms of income or education or both) as big households have over medium households. This is further strengthened by the fact that investment in education as a proportion of investment in human capital as a whole is not significantly different as between sizes of households.

We shall now make use of the linear regression model and the second order exponential form of parabolic equations[2] to show that our conclusion regarding the relationship between human capital formation and size of households is reasonably dependable.

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1. We have to remember that our data ignore differences in diet as between different sizes of households.

2. Correlation, regressions and exponential parabolic equations were calculated on the basis of districtwise average of 28 sub-samples representing the four groups of farm households.

Zero order correlation coefficients between investment in human capital and family size (0.70734) as also between investment in human capital and farm output (0.56541) were found to be significant at 1 per cent level, there being insignificant correlation (0.07275) between family size and farm output.

Fitting the linear regression model :

$$I = a + b\,F + c\,G$$

we found that

$$I = -417.10 + 66.27\,F + 0.012228\,G.^{3}$$

Where I = Investment in human capital,
F = Family size,
G = Farm output, and
a, b, c are parametric constants.

Squared coefficient of multiple correlation for this relationship came to 0.88 while the squared partial correlation coefficients were 0.90 for family size and 0.85 for farm output. Thus 88 per cent of the variations in investment in human capital can be associated with variations in family size and farm output; and family size can remove 90 per cent of the variation not already associated with farm output while, if family size is considered first, farm output is associated with 85 per cent of the residual variation in investment in human capital.

To bring out the relative contribution of family size and farm output, explaining 88 per cent of variation in investment in human capital, a second order exponential form of parabolic equation was fitted.[4] Basic equation was of the following form :

$$I = a\,b^{x}\,c^{x^2} \text{ or}$$
$$\text{Log } I = \text{Log } a + X \text{ Log } b + X^2 \text{ Log } c.$$

Where X is an explanatory variable, *viz.*, family size or farm output.

Fitted equation, with family size (F) as explanatory variable, was

$$\text{Log } I = 2.8134 - (0.0021948)\,F - (0.0024264)\,F^2$$

and with farm output (G), it was

$$\text{Log } I = 2.7827 - (0.0031019)\,G + (0.0010615)\,G^2$$

While the former equation shows that the rate of investment in human capital declines in geometric progression with increase in family size, the latter equation

3. Standard errors of corresponding regression coefficients (b and c) being 2·07 and 0·0004964 respectively.

4. This equation was selected as the second order differences of log polynomial were almost constant and the third order differences were negligible.

shows that the rate increases with increase in farm output. Further, these equations, when fitted with the respective values of explanatory variables, show that investment in human capital explained by family size as a percentage of that explained by farm output declines as one moves from small (72.7 per cent) to medium (57.3 per cent) to big (42.1 per cent) and to large households (8.4 per cent). This agrees with our conclusion that the role of family size in determining investment in human capital is taken over around big households by farm output.

SAVING ELASTICITIES AND STRATEGIES FOR CAPITAL FORMATION—A MICRO ANALYSIS

V. RAJAGOPALAN AND S. KRISHNAMOORTHY

Agricultural College and Research Institute, Coimbatore-3

Capital in the developing economies is the crucial factor which sets the pace and pattern of economic growth. The touch of capital on all other factors is too obvious and it becomes the basic theme of the parables of growth economists. Implicit in the modern concept of capital is that its embodiment in land productivity, in differential labour efficiency and varied managerial efficiency. Technology determines such embodiment and therefore, capital and technology are so interlinked that tardiness in any one would affect the other. Capital provides for activities of identifying and augmenting technology which in turn and in conjunction with capital resources, generates capital formation through output expansion and increase in savings and new investment.

In development economies agriculture is said to be the least efficient sector characterised by low resource productivity and subsistence level of income. Capital investment is necessary for land resource development through reclamation for provision of irrigation inputs, for increasing soil fertility and for improving labour efficiency and managerial skills by formal, vocational and extension education. The demand for capital for developing agriculture is motivated by the aspiration for higher income levels conditioned by cultural and other extra economic factors.

CAPITAL STRUCTURE

It would appear that a formal definition of capital structure and capital formation would be useful for understanding the discussions on savings and investments that follow.

Capital formation *per se* is the flow of capital services per unit of time. Implied in this definition is that the rate of capital formation is determined not only by saving but also by initial capital stocks. For a typical developing agriculture the capital structure necessary for dynamic output expansion and growth, can be summarised as in Figure 1. There are two ways by which capital, both physical

N.B.: Figures in bracket denote to the literature cited under 'References' at the end of the paper.