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interest should influence investment behaviour. By and large the reported rate of interest also is lower in our Group I States than in the other States. However the cost of borrowing, in the nature of things, cannot be considered a major determinant of investment. In sum, the correlations between capital formation and other variables observed above do not seem to indicate a one-way causal nexus and do not constitute evidence leading to a rejection of our hypothesis.

VI. SUMMARY AND CONCLUSION

Admittedly, the rate of capital formation in Indian agriculture is low. Superficial observation would attribute this to low savings, absence of integration between saving and investment, lack of entrepreneurship, etc. But on a closer scrutiny these appear to be only proximate causes, if not mere statistical association.

The hypothesis offered here is that capital formation is a function of the level of technology. Traditional agriculture like ours is characterized by backward and stagnant technology. Under the circumstances, the returns to investment in such agriculture are apt to be low, and therefore, the incentive to invest weak. Investment rate will pick up with the appearance on the rural landscape new inputs which embody modern technology. This hypothesis seems to stand the test of reason as well as of empirical verification.

For a proper test of our hypothesis we need time-series data which at present are not available. However, we have attempted to verify the hypothesis on the basis of a cross-section analysis the result of which does not contradict it. Needless to say, such an analysis has severe limitations.

TRENDS IN CAPITAL FORMATION IN TARAI AGRICULTURE

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Introduction

Agriculture in the Tarai region of Nainital and Rampur districts of Uttar Pradesh is relatively new—both in terms of its origin and technology. It was less than 20 years ago that reclamation work was taken up in this area. The access was difficult. Wild animals, tall grasses and malaria were rampant. People were given all types of incentives to settle and farm on this land. These incentives, among other things, included availability of land, at a nominal cost. The enterprising people who took up the challenge included refugees from Pakistan, retired military officers and those agricultural graduates who preferred harder life of a

farmer rather than turning into white collared administrators. They have never regretted their decision because a number of changes for better have taken within these 20 years. There is an excellent network of transport and communication facilities. Land values have gone up to Rs. 6,000-7,000 per acre. Thanks to their progressive and enterprising outlook and the efforts of the U.P. Agricultural University, the Tarai farmers are following the newest technology. They are now even trying the "new" crops like soybeans and sugarbeets. The productivity of agriculture in this region was already quite high because of factors like rich and virgin soil, adequate moisture, etc. Due to settlement and colonization, the average size of holdings is reasonable. A majority of farms are 15 acres or more in size. The supply of labour has never been adequate due to moist climate and other conditions. These factors coupled with better education and greater enterprise of the farmers have been responsible for a greater degree of mechanization in Tarai agriculture from the very beginning, *i.e.*, 1950's. With these farmers, farming has been very much a business proposition rather than just a way of life. The introduction of high-yielding varieties has further accelerated the pace of agricultural development and raised the farm incomes in Tarai.

As a consequence of increased productivity and incomes, the demand of the farmer has increased not only for inputs like fertilizer and improved seeds but also for durable assets like tractors, farm machinery, storage structures and permanent improvements like land levelling, fencing, bunding, installation of tube-wells, construction of drainage and irrigation channels, etc.

Objectives of the Study

The objectives of the study are to estimate (1) the trend and magnitude of capital formation in Tarai agriculture, and (2) the pattern of growth of some important assets of the farmers, *i.e.*, whether the growth has been more or less uniform for all assets or the farmers have a preference for investments in one form of the assets as compared to others.

A study of the pattern of growth of different assets is also of nterest for one more reason. Given the condition that the farmer is rational and, therefore, he would invest more where the marginal productivity of his capital is the maximum, a study of the pattern of investment will also help in getting an idea of the productivity of different forms of capital.

Methodology

This study was conducted in the Tarai region of the Nainital and Rampur districts. Yearwise details of assets and liabilities were collected from a cross-section of farmers for the last five years, *viz.*, 1963-64 to 1968-69. We quite realize the limitation of this study in respect of the period covered. However, we decided to start with 1963-64 as a base because :

(*a*) The information supplied by the farmers for the period going back to more than five years may not be so reliable in case it is given by memory.

(*b*) Introduction of hybrid varieties of maize in 1963-64 marked, if we may say so, the beginning of the era of the use of high-yielding varieties on a large scale in Tarai agriculture.

(*c*) Most farmers were not record-conscious from the time they started farming. Fairly accurate records of assets and liabilities and important investments were available with most farmers for the last 5 - 6 years.

The choice of the base year, therefore, fell on the year 1963-64 and the estimates of trends in capital formation are based on the information relating to the period between 1963-64 to 1968-69.

The trends of growth in the total assets and the net worth of the farmer have been calculated. We have also computed the trends of investments in bullock power, farm machinery, irrigation and land improvements because they form a major portion of the farmer's assets, excluding land.

From the collected information, two time-series A and B were prepared for values of bullocks, farm machinery, irrigation, land improvements, total assets and net worth. Simple linear regression model was fitted to these series.

Series A : The series was obtained by computing the values of different assets per acre at current prices and per acre increase in the value of assets was expressed as a function of time :

$$Y_A = a_A + b_A t \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

where

Y_A is the value of assets in rupees per acre,

b_A is the additional annual increase per acre in assets, and

t is the number of years beyond 1963-64. Thus t = 1, 2, 3..... for years 1964-65, 1965-66, 1966-67..... respectively.

Series B : It relates to simple rate of change in the asset values. These are quite similar to those used in an earlier study conducted by Tara Shukla.[1]

$$Y_B = a_B + b_B t \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

where

Y_B is the index of the value of an asset computed from the series of indices when the value of an asset in 1963-64 is taken to be equal to unity and the values of that asset in subsequent years are indexed to this value,

b_B is the annual simple rate of change in an asset,

t is the same as above.

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1. Tara Shukla : Capital Formation in Indian Agriculture, Vora & Co., Bombay, 1965.

Trends of Farm Investments (per acre) : Series A

Bullocks :	$Y_A = 174.93 - 20.09\ t$	(iii)
Farm machinery :	$Y_A = 193.08 + 146.06\ t$	(iv)
Irrigation :	$Y_A = 156.10 + 49.50\ t$	(v)
Land improvement :	$Y_A = 8.25 + 4.39\ t$	(vi)
Total assets :	$Y_A = 2629.90 + 291.10\ t$	(vii)
Net worth :	$Y_A = 2421.80 + 127.00\ t$	(viii)

Simple Rate of Change of Various Forms of Investments : Series B

Bullocks :	$Y_B = 1.014 - .122\ t$	(ix)
Farm machinery:	$Y_B = .681 + .393\ t$	(x)
Irrigation :	$Y_B = .864 + .276\ t$	(xi)
Land improvement :	$Y_B = .507 + .269\ t$	(xii)
Total assets :	$Y_B = .817 + .091\ t$	(xiii)
Net worth :	$Y_B = .881 + .047\ t$	(xiv)

The simple rates of change in various forms of investments as obtained in (ix), (x), (xi), (xii), (xiii) and (xiv) have been given in Figure 1.

The above exercise reveals the following :

(1) Except for bullocks, all other forms of assets studied here have increased.

(2) The value of assets in the form of bullocks is declining, the annual decrease being nearly Rs. 20 per acre. As we shall see, this is largely due to the substitution of bullocks by tractors.

(3) Per acre investment in farm machinery, irrigation facilities and land improvements, has increased during the last five years. The magnitude of annual increase in the value of assets per acre is the maximum for farm machinery, coming to about Rs. 146. Irrigation comes next with an increase of about Rs. 50 per acre per year. Land improvements account for about Rs. 4.39 per acre of additional annual investments. The large increase in farm machinery partly explains the decrease in bullocks. However, all increase in farm machinery is not only due to substitution of bullocks by tractor because investment in farm machinery also includes investment in bullock drawn implements.

RATE OF GROWTH OF SELECTED ASSETS

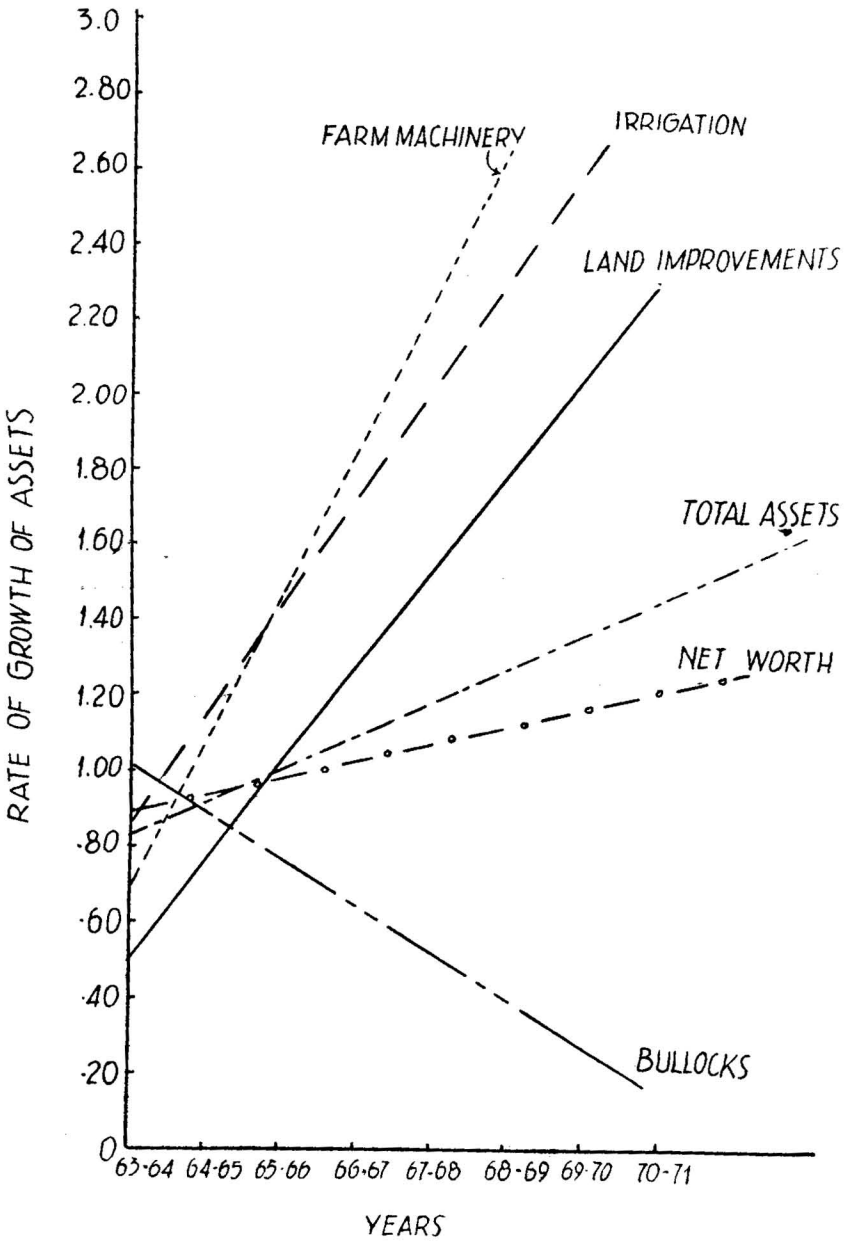

Figure 1

(4) Farmer's total assets in Tarai have grown at an annual rate of Rs. 291 per acre whereas his net worth has increased by Rs. 127 per acre per year.

(5) The rate of change of investments in bullocks is negative. This is —.122 or —12.2 per cent per annum.

(6) The rate of growth of farm machinery is quite high being nearly 40 per cent per year. Most of this increase has come about only during 1966-68, largely due to the introduction of high-yielding varieties and more favourable prices during this period.

(7) The rates of growth of investment in irrigation and land improvements are nearly the same, being 27.6 per cent and 26.9 per cent respectively.

(8) The rates of growth of total assets and net worth are 9.12 per cent and 4.7 per cent per annum.

Conclusions

The process of capital formation in Tarai agriculture shows a very healthy trend. The rates of growth are probably higher for this region than for the country as a whole. This high degree of capital formation is because of the ecological conditions obtaining in the area, progressive outlook of the farmers and high potential of land productivity. The rate of growth of farm assets in Tarai has been higher than that in several other industries. Of course, a lot of this has come only in the last 2 - 3 years. It is for this reason that our figures of rates of growth may be biased upwards. We feel that this boom of investment in Tarai agriculture shall last for another 5 - 7 years and then the rate of investment would, somewhat, slow down.

The rate of growth has been the maximum in the case of farm machinery. This increase in the use of and consequently investments in farm machinery has been possible through higher yields, improved practices and higher returns, both per acre and per rupee.

Irrigation and land levelling are next on the farmer's list of important items of investment. From the trends it appears that, practically, all land in Tarai region of Nainital and Rampur districts would be irrigated in another decade or so. Land levelling and further land reclamation would also be taken up on a large scale.

The decrease in investment in bullocks has been, particularly great during the last 2 - 3 years when the farmers of this region were going for farm mechanization in a big way. On the basis of the linear trend derived for bullocks, additional annual investment in bullocks may become practically zero in another 3 - 4 years. This may look to be too strong a conclusion but it appears that, at least on farms of 15 acres or more, the additional investment in bullocks may be almost negligible because of the feasibility and economy in the use of tractors on these holdings. The same cannot be said for holdings of 10 acres or less. Bullocks shall continue to be the chief source of power on these holdings, at least in the near foreseeable future.