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SAVINGS, INVESTMENT AND ECONOMIC GROWTH

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Introduction

When, after centuries of colonial domination, we resumed control over our own destiny, and embarked on a programme for the country's development, the idea that the main constraint on economic growth was savings needed for capital accumulation was firmly entrenched in the development literature. It followed directly from the "production function approach" of neo-classical economics, according to which the aggregate output of a country was a function (representing technology) of the country's endowment of land, labour and capital. Land was generally fixed in supply, and labour grew exogenously; therefore, the growth of capital was essential for economic growth. Hence, in his great book on development, Arthur Lewis (1955, p.226) proclaimed that "the central problem in the theory of growth is to understand the process by which a community is converted from being a 5 per cent to a 12 per cent saver - with all the changes in attitudes, in institutions and in techniques which accompany this conversion." Strangely enough, this was one issue on which Marxist economics was also in agreement, for Marx had also taught that the driving force behind economic growth was capital accumulation. This view of capital as the main constraint on growth was the basis for international aid from the developed to the less-developed countries but, in the event, the flow of such aid proved to be a mere trickle, especially to large countries like India, which had also adopted a non-aligned position in its international relations with the two super-powers.

It is not surprising, therefore, that the Indian development strategy has all along placed great emphasis on increasing domestic savings. The hard core of India's plans has been an extension of the capital accounts of the traditional annual budget to a five-year period. It has turned out that, considering its desperate poverty and under-development, India was remarkably successful in increasing its rate of investment, starting from only 10 per cent in 1950/51 and reaching as high as 23.7 per cent in 1978/79. However, there was no significant acceleration of economic growth, corresponding to this rise in the rate of investment. Therefore, economists have been engaged in analysing this puzzling feature of Indian experience. The present paper is an attempt to contribute to this discussion.

The Reliability of the Data

The first step in the analysis is to check the reliability of the data. It may well be that the puzzle is mostly due to a progressive upward bias in the estimates of investment or a progressive downward bias in the estimate of national product. The former possibility has been seriously advanced by Rakshit (1982). Arguing from the entirely valid position that "If an item of expenditure is regarded as investment, there should correspond to it some flow of future income (positive or negative)", he has queried a number of items in the CSO estimate of investment. For example, he cites the case of expenditure on capital formation in General Administration, which is included in the estimate of national investment, but the flow of services from this capital is not counted in the estimate of national product, as the entire output of the sector is valued only on the basis of the expenditure on wages and salaries and treated as government

consumption according to the above principle, either the expenditure on investment in this sector should be left out of total investment or an allowance should be made for the services of the capital stock in this sector in the estimate of national product. While the argument is theoretically valid, there is no evidence that the upward bias in the estimate of the above investment relative to that of national product has increased over time sufficiently to be a major part of the explanation of our puzzle.

Another example cited by him is that stocks are measured on particular dates of the year on the basis of corresponding holdings of financial assets by the household sector, and hence there is a tendency for a progressive upward bias in estimates of investment in the form of increases in stocks as a result of increasing intervention in the market by official agencies such as the Food Corporation of India. He has also suggested that there is a significant upward bias in the CSO estimates of the important category of household financial savings. He then makes a rough estimate that these errors may have biased the CSO estimates of investment by as much as 5½ % of net domestic product at market prices in 1978/79. His argument has been examined by other writers and it seems that the bias may not be as high as this figure, and further, that to the extent that there is an upward bias, it may not have increased over time sufficiently to account for the increase in the CSO estimate of the rate of investment, especially in the late seventies.

The CSO estimates of savings and investment have been examined in great detail by the Raj Committee (1982). The Committee concluded that, "On the whole, the improvements thus achieved in the series on gross capital formation and savings over the last two decades, as a part of the

more comprehensive series on national income and expenditure, have made these estimates almost as good as they can be expected to be, given the nature of the economy and the difficulties inherent in securing adequately reliable data. It is doubtful whether the estimates for any other country at a similar stage of development have a much firmer foundation." (p.49). Of course, there is always room for improvements, and the Raj Committee itself has made a number of suggestions. Pending such improvements, the available estimates may be taken as being sufficiently reliable for what they purport to measure within the system of national accounts to be used for the following analysis. This analysis will be largely based on the data which has been most conveniently brought together in a compact form in the report of the Raj Committee.

Trends in Savings and Investment

In the national income accounting approach, savings have to equal investment. Therefore, there are two ways of estimating this figure, and both have been used in the Indian statistics. Table 1 summarises the savings estimates.

Table 1: Domestic Savings as Percentage of GDP at market prices (percentage)

Period	Public Sector	Private Corporate Sector	Household Sector			All Sectors
			Physical	Financial	Total	
1950/51 - 1954/55	1.72	0.96	5.80	1.14	6.94	9.62
1955/56 - 1959/60	1.82	1.18	6.42	3.02	9.44	12.44
1950/51 - 1959/60	1.77	1.07	6.11	2.08	8.19	11.03
1960/61 - 1964/65	3.26	1.90	5.52	3.18	8.70	13.86
1965/66 - 1969/70	2.66	1.42	8.18	3.02	11.20	15.28
1960/61 - 1969/70	2.96	1.66	6.85	3.10	9.95	14.57
1970/71 - 1974/75	3.14	1.72	8.44	4.18	12.62	17.48
1975/76 - 1979/80	4.52	1.50	9.48	6.24	15.72	21.74
1970/71 - 1979/80	3.83	1.61	8.96	5.21	14.17	19.61

These estimates are derived from the financial statements of the various sectors, except for the physical savings of the household sector which is estimated in real terms as the value of the physical capital formation in that sector. These estimates show a considerable rise already from the fifties to the sixties but there was a sharper increase from the sixties to the seventies, and especially from the first half to the second half of the seventies. Of the increase in the saving rate from the fifties to the sixties, about a third occurred in the public sector, a sixth in the private corporate sector, and the remaining half in the household sector, divided equally between the physical and financial forms. For the rise from the sixties to the seventies, there was no contribution from the private corporate sector; one sixth of the rise occurred in the public sector and the rest in the household sector, again divided equally

between the physical and financial forms. It was within the seventies that a high proportion of the rise in household savings was in financial form.

Then, there is an independent estimate of investment, based on estimates of types of assets divided into three major categories - construcation, machinery and equipment, and changes in stocks. The relative magnitudes are summarised in Table 2.

Table 2: Investment by Type of Assets: Percentage of GDP at current market prices

Period	Construction	Machinery & Equipment	Changes in Stocks	Total
1950/51 - 1954/55	6.76	2.82	0.76	10.34
1955/56 - 1959/60	8.26	5.02	1.52	14.80
1950/51 - 1959/60	7.51	3.92	1.14	12.57
1960/61 - 1964/65	8.96	6.40	2.10	17.46
1965/66 - 1969/70	9.84	6.48	1.56	17.88
1960/61 - 1969/70	9.40	6.44	1.83	17.67
1970/71 - 1974/75	9.22	6.74	3.14	19.10
1975/76 - 1979/80	10.60	8.54	3.00	22.14
1970/71 - 1979/80	9.91	7.64	3.07	20.62

It will be noted that the investment ratios are higher than the saving ratio in each period, One reason for the difference is that the investment data of Table 2 includes the part financed by foreign savings, while the data of Table 1 refer only to domestic savings. But even allowing for this, there is a difference due to methods of

estimation which make the investment estimates higher than the savings estimates. The CSO has taken the savings estimates as the more reliable and therefore treats this part of the difference as "errors and ommissions", which are used to adjust the investment estimates downward. The unadjusted investment figures are still used to show the composition by type of asset and the allocation by institutional sectors.

Both Tables 1 and 2 show a considerable rise in the rate of investment in the past three decades. However, there are some interesting differences. Table 2 shows that the rise from the fifties to the sixties was greater, and that from the sixties to the seventies as well as that within the seventies, was smaller, than in Table 1. According to type of asset, there was a steady increase in investment in machinery and equipment; construction investment grew relatively rapidly from the fifties to the sixties, while inventory investment was more important in the rise of the investment ratio from the sixties to the seventies.

The ratios of Table 2 are in current prices but in this period, investment goods prices increased (at 6.26% per annum) faster than GDP (at 5.49% per annum). The rise of the investment ratio in real terms has therefore been slower than in current prices, and it is the real trend which is more relevant for explaining the rate of economic growth. The changes in real terms are shown in Table 3.

Table 3: Investment by Type of Assets: Percentage of GDP at 1970/71 Market Prices

Period	Construction	Machinery & Equipment	Changes in stock	GDCF
1950/51 - 1954/55	7.42	4.06	0.78	12.26
1955/56 - 1959/60	8.20	5.92	1.62	15.74
1950/51 - 1959/60	7.81	4.99	1.20	14.00
1960/61 - 1964/65	8.68	6.50	2.10	17.28
1965/66 - 1969/70	10.58	6.70	1.60	18.88
1960/61 - 1969/70	9.63	6.60	1.85	18.08
1970/71 - 1974/75	9.28	7.08	3.10	19.46
1975/76 - 1979/80	9.44	8.00	2.90	20.34
1970/71 - 1979/80	9.36	7.54	3.05	19.90

We now see that the rise in the investment ratio in real terms (6 percentage points) is considerably less than in current prices (8 percentage points); the increase from the fifties to the sixties is even more impressive, while that from the sixties to the seventies, and within the seventies has become less significant.

As for the savings estimates, the capital formation figures collected by type of assets have also been allocated to the three institutional sectors - public, private corporate, and household sectors. The investment in the household sector is taken as being the same as the savings in physical form of that sector as shown in Table 1. The results in current prices are summarised in Table 4.

Table 4: Investment by Institutional Sectors: Percentage of GDP at current market prices

Period	Public Sector	Private corporate Sector	Household Sector	Total
1950/51 - 1954/55	3.12	1.42	5.80	10.34
1955/56 - 1959/60	5.96	2.44	6.40	14.80
1950/51 - 1959/60	4.54	1.93	6.10	12.57
1960/61 - 1965/65	8.02	3.92	5.52	17.46
1965/66 - 1969/70	7.34	2.34	8.20	17.88
1960/61 - 1969/70	7.68	3.13	6.86	17.67
1970/71 - 1974/75	7.68	3.02	8.42	19.10
1975/76 - 1979/80	10.16	2.48	9.50	22.14
1970/71 - 1979/80	8.92	2.74	8.96	20.62

The investment in the public and private corporate sectors is greater than their savings. Part of the difference is statistical due to different methods of estimation. The rest is financed by foreign savings and the financial savings of the household sector. Table 5 shows the investment savings gaps of these two sectors on the basis of Table 1 and 4.

(Table 5)

As the figures stand, the investment-savings gap is much larger in the public sector than in the private corporate sector. It is partly due to the fact that most of the foreign savings flows into the public sector. These foreign savings as a proportion of GDP averaged only 1.3 per cent in the fifties, 2.3 in the sixties, and were very small in the seventies. Therefore, there is some indication that the greater part of household

Table 5: Investment-saving Gaps: Percentage of GDP at current market prices

Period	Public sector	Private Corporate sector
1950/51 - 1954/55	1.40	0.46
1955/56 - 1959/60	4.16	1.26
1950/51 - 1959/60	2.78	0.83
1960/61 - 1964/65	4.76	2.02
1965/66 - 1969/70	4.68	0.92
1960/61 - 1969/70	4.72	1.47
1970/71 - 1974/75	4.54	1.28
1975/76 - 1979/80	5.64	0.98
1970/71 - 1979/80	5.09	1.13

financial savings flowed to the public sector. This accounts for the more rapid rise in investment in the public sector, especially from the fifties to the sixties. However, most of the increase in investment from the sixties to the seventies occurred in the household sector.

All these increases in the investment rates of the various sectors in current prices become reduced when calculated in constant 1970/71 prices, as shown in Table 6.

To summarise, the shares of the various sectors in total investment in the different types of assets are shown in Table 7. The three figures in each cell of the table show the decade average for the fifties, the sixties and the seventies respectively.

Table 6: Gross Investment by Sectors: Percentage of GDP at 1970/71 market prices

Period	Public Sector	Private Corporate Sector	Household Sector	Total
1950/51 - 1954/55	3.64	1.70	6.92	12.26
1955/56 - 1959/60	6.36	2.62	6.76	15.74
1950/51 - 1959/60	5.00	2.16	6.84	14.00
1960/61 - 1964/65	7.98	3.84	5.46	17.28
1965/66 - 1969/70	7.76	2.48	8.66	18.88
1960/61 - 1969/70	7.87	3.16	7.06	18.08
1970/71 - 1974/75	7.76	3.08	8.62	19.46
1975/76 - 1979/80	9.26	2.30	8.78	20.34
1970/71 - 1979/80	8.51	2.69	8.70	19.90

Table 7: Percentage of Total Investment in Each Type of Asset and Each Sector (Decade Average for fifties, sixties and seventies)

Type of Assets	Public Sector	Private Corporate Sector	Household Sector	Total
Construction	25.4	2.1	31.8	59.3
	26.4	2.7	24.7	53.8
	21.8	1.4	24.5	47.7
Machinery and Equipment	8.8	8.3	14.5	31.6
	13.4	8.5	14.5	36.4
	16.4	7.1	14.1	37.6
Changes in Stocks	2.8	4.9	1.4	9.1
	2.8	5.2	1.8	9.8
	5.8	4.3	4.6	14.7
Total	37.0	15.3	47.7	100.0
	42.6	16.4	41.0	100.0
	44.0	12.8	43.2	100.0

The investment of the public and household sectors is rather heavily concentrated in construction, while a large part of machinary and equipment is invested in the small private corporate sector. The private corporate sector also has a disproportionate share of inventory investments.

Relationship with Growth of Output

We turn now to consider the relationship of investment to rates of economic growth. These rates are summarised in Table 8.

Table 8: Rates of Economic Growth (Average of annual rates at 1970/71 prices)

Table 8: Rates of Economic Growth

Period	GDP	NDP
1950/51 - 1954/55	3.92	3.92
1955/56 - 1959/60	3.76	3.70
1950/51 - 1959/60	3.83	3.81
1960/61 - 1964/65	5.23	5.14
1965/66 - 1969/70	2.81	2.66
1960/61 - 1969/70	4.02	3.90
1970/71 - 1974/75	2.24	2.24
1975/76 - 1979/80	4.34	4.28
1970/71 - 1979/80	3.29	3.26

There has not been any significant rise in these rates of growth corresponding to the rise in the investment ratio. There was a slight increase from the fifties to the sixties, and then a decline in the seventies.

However, there was a rise from the first half to the second half of the seventies.

The usual way of relating economic growth to the rates of investment is by calculating incremental capital-output ratios (ICORs). A rough indication of the trend in these ratios is given in Table 9. One measure, denoted as (a) is derived by dividing the sum of net domestic capital formation (NDCF) inclusive of inventory changes by the increase in net domestic product (NDP). However, it is more relevant to consider the investment in fixed capital. Therefore, a time series of the stock of such capital was derived (as explained in the Appendix). From these, a second estimate of ICORs, denoted as (b) has been derived by dividing the increase in the stock of fixed capital in each period by the increase in the NDP in that period. These ratios are marginal ratios. As we have some estimate of capital stock, we have also calculated the average capital-output ratios, denoted as (c); these are quinquennial averages of annual ratios.

Table 9: Capital-Output Ratios (Rs.crores at 1970/71 prices)

Period	Increase in NDP	Sum of NDCF	Increase in Capital Stock	Capital-output Ratios		
				(a)	(b)	(c)
1950/51 - 1955/56	3715	7566	6374	2.04	1.72	2.03
1955/56 - 1960/61	4571	13746	11014	3.01	2.41	2.03
1960/61 - 1965/66	4245	17229	13151	4.06	3.10	2.05
1965/66 - 1970/71	7811	22016	17990	2.82	2.30	2.27
1970/71 - 1975/76	6036	27363	19441	4.53	3.22	2.36
1975/76 - 1979/80	4992	28120	20932	5.63	4.19	2.38

The first point to note is that, by both (a) and (b) estimates, the ICOR has been increasing steadily, not just in the late seventies, but throughout the period. This trend is also apparent, though at a slower rate, in the average capital-output ratio. However, the trend in these ratios was interrupted in the sixties, mainly because of the disastrous fall of agricultural output in 1965/66 which reduced the rate of output growth in the early sixties and raised the ICOR, but increased the rate of output growth in the late sixties and reduced the ICOR.

This clearly shows the need to consider the various sectors individually because they differ so much in their ICORs. Table 10 shows these individual ratios for the period 1970/71 to 1978/79 based on unofficial estimates of fixed capital stock prepared by CSO for the Raj Committee.

Table 10: ICORs by sector: 1970/71 to 1978/79

Sector	Increase in fixed capital stock ΔK	Increase in Net Value Added ΔY	ICOR $\Delta K/\Delta Y$
1. Agriculture, forestry, fishing	6562	3074	2.13
2. Mining and quarrying	1225	115	10.65
3. Manufacturing	6925	2710	2.56
(a) registered	4065	1775	2.29
(b) unregistered	2860	935	3.06
4. Construction	128	559	0.23
5. Electricity, gas, water supply	4750	294	16.16
6. Transport and communications	4119	953	4.32
(a) Railway	1378	209	6.59
(b) Other transport	2153	602	3.58
(c) Communications	588	142	4.14
7. Trade etc.	779	2076	0.38
8. Banking and insurance	177	646	0.27
9. Real estate	3809	292	13.04
10. Public Administration	4688	1118	4.19
11. Others	789	357	2.21
Total	33951	12194	2.78

Much of the intersectoral variation in ICORs is as may be expected but there are some puzzling features. They may be due to the roughness of the estimates but still they have to be examined more deeply with better data. One is the rather high ICOR for agriculture, nearly as high as for manufacturing. Another puzzling feature is that, within manufacturing, the ICOR for unregistered enterprises is higher than for the registered sector, country to the general opinion. The high ICOR for the electricity and related sector is acoording to expectation, but the high value for the real estate sector may be much influenced by the prices at which the output is valued. Finally, both investment and output values have to be examined closely for public administration , which absorbed nearly 14% of total investment but whose output increase has been valued at only 9% of the increase in total output.

To study the trends in more detail, we first divide the economy into the agricultural and non-agricultural sectors. Because the agricultural sector is so heavily influenced by weather conditions, we consider the ICORs over fairly long periods and omit the period 1961/61 - 1965/66 which was particularly affected by weather. The results are shown in Table 11.

The long-period ICOR has been fairly stable in the agricultural sector but increased sharply from the first to the second decade considered in the non-agricultural sector. The effect on the ICOR for the economy as a whole, was accentuated by the fact that the allocation of investment to the more capital-intensive non-agricultural sector increased in this period. It may be interesting to quantify the roles of the two factors; for this purpose,

Table 11: Broad Trends in ICORs (Rs. crores at 1970/71 prices)

Item	Agricultural Sector	non-agricultural sector	Total
1951/52 - 1961/62			
1. Increase in GDP	3199 (38.3)	5148 (61.7)	8347 (100,0)
2. Sum of GDCF	7365 (22.7)	25095 (77.3)	32460 (100,0)
3. ICOR	2.30	4.87	3.89
4. Marginal output-capital Ratio	.4344	.2051	.2571
1966/67 - 1976/77			
1. Increase in GDP	5553 (39.3)	8591 (60.7)	14144 (100.0)
2. Sum of GDCF	12882 (17.6)	60434 (82.4)	73316 (100.0)
3. ICOR	2.32	7.03	5.18
4. Marginal output-capital ratio	.4311	.1422	.1929

Note: Figures in brackets are percentages to total.

it is more convenient to account for the fall in the marginal output-capital ratio, using the formula

$$\Sigma pr - \Sigma PR = \Sigma \frac{(r+R)}{2}(p-P) + \Sigma \frac{(p+P)}{2}(r-R) \quad 1)$$

where due to change in investment allocation; due to change in capital intensity within sectors

where p_i and P_i are the initial and final investment shares of sector i, and r_i and R_i are the corresponding marginal output-capital ratios.

Applying this formula, we find that about 20% of the decline in the aggregate output-capital ratio was due to the change in investment allocation, and the rest to the change in capital-intensity within sectors.

This analysis can now be applied to the individual non-agricultural sectors. For this purpose, the period is divided at the years 1951/52, 1956/57, 1961/62, 1966/67, 1971/72 and 1976/77, the intervals between them being described as periods I, II, III, IV, and V. The investments made in each sector in these periods are shown as percentages of total investment in Table 12.

Table 12: Relative Share of Investment (GDCF) in Individual non-agricultural sectors

Sector	Periods I	II	III	IV	V
Manufacturing	24.9	29.9	30.7	32.9	33.6
Electricity, gas and water	5.5	5.0	10.3	9.8	9.8
Transport and Communication	16.0	18.1	19.3	13.0	13.9
Trade	7.3	[illegible]	2.6	6.3	10.4
Real Estate	27.7	18.4	14.5	22.4	14.4
Public Administration	9.8	13.9	11.6	8.1	10.2
Others	8.8	8.0	10.6	7.8	7.7
Total	100.0	100.0	100.0	100.0	100.0

The next step is to calculate the increase in output in each of these sectors. As there was considerable year-to-year fluctuation, these output increases were derived from three-year averages centred at the years dividing the five periods. On the basis of these figures, the marginal output-capital ratios were found to be as shown in Table 13.

Table 13: Marginal Output-Capital Ratios in non-agricultural sectors

Sector	Periods				
	I	II	III	IV	V
Manufacturing	.2936	.2052	.1527	.1080	.1137
Electricity etc.	.0661	.0774	.0567	.0612	.0539
Transport and Communication	.1272	.1102	.0916	.1158	.1231
Trade	.6333	.7310	1.3620	.4737	.2886
Real Estate	.0380	.0430	.0819	.0397	.0442
Public Administration	.1242	.1164	.1648	.2406	.1798
Others	.6030	.5673	.3752	.3190	.3910
Total non-agricultural sector	.2193	.1972	.1774	.1382	.1452

Formula (1) can again be used to decompose the changes in the marginal output-capital ratios into two components due to the change in the allocation of investment and due to change in the intra-sectoral marginal output-capital ratios; the results are shown in Table 14.

Table 14: Decomposition of change in Marginal Output-Capital Ratio of non-Agricultural Sectors

Periods	Change in marginal output-capital ratio	Due to Change in allocation of investment	Due to change in sectoral marginal ratio
I to II	- .0221	- .0133	-.0088
II to III	- .0198	- .0176	-.0022
III to IV	- .0392	+ .0144	-.0536
IV to V	+ .0070	+ .0191	-.0121

In three of the four periods, the marginal output-capital ratios declined, i.e. the ICOR increased, especially from period III to IV. On the average

the intra-sectoral marginal output-capital ratio declined in all periods. The effect of the changing allocation of investment has been to reduce the marginal output-capital ratio of the non-agricultural sectors as a whole in the first two intervals (i.e. to increase the average ICOR) and to increase it in the last two intervals (i.e. to reduce the average ICOR). In other words, the changes in the allocation of investment has been biased in favour of the more capital-intensive industries in the first two intervals and against them in the last two intervals. In the last interval, the latter effect was slightly stronger than the former, so that there was a net increase in the marginal output-capital ratio of the non-agricultural sector as a whole.

In view of the large share (an average of 44% in the last decade) of the public sector in gross investment, it is worth considering the sectoral allocation of investment in the public and private sectors in more detail. This is done in Table 13.

Table 13: Composition of Investment in Public and Private Sectors (%): 1970/71 - 1978/79

Sector	Composition of Investment			Share of
	Public Sector	Private Sector	All Sectors	Public Sector
Agriculture	12.7	24.3	19.1	29.4
Mining	5.9	0.8	3.0	85.8
Manufacturing	21.2	30.9	26.6	35.2
Construction	0.9	2.7	1.9	20.7
Electricity etc.	19.8	0.4	9.9	97.2
Transport & Communications	15.8	6.6	10.7	65.5
Trade	5.7	11.0	8.7	29.2
Real Estate	-	22.3	12.4	-
Public Administration	14.6	-	6.4	100.0
Banking	0.6	0.3	0.5	63.2
Other services	2.9	0.7	1.7	77.3
All Sectors	100.0	100.0	100.0	44.3

From the point of view of promoting economic growth, the share of public administration in public sector investment seems uncomfortably large. Considering the vital importance of the agricultural sector for increasing food supply for relaxing the constraints on growth in the other sectors, and for raising the incomes of the poor mostly located in the agricultural sector, the share of that sector in public investment is too low. The large share of the public sector in manufacturing has also to be examined to see if it is mostly confined to the capital goods needed to promote growth elsewhere. In the private sector, we have to consider whether the large flow of investment to real estate can be diverted to more productive purposes.

Growth of Capital Stock

We started with the question why a considerable rise in the investment ratio has not accelerated economic growth in India. This is a puzzle, when viewed against the standard Harrod-Domar model:

$$g = cs \qquad (2)$$

where g is the rate of growth of output, c is the marginal output-capital ratio and s is the savings (or investment) rate. Of course, as an ex post relationship, this is an identity. The fact that s has increased but g has not implies arithmetically that c has increased. That is what we found in general, the sharpest increase occurring in the manufacturing sector. But as a causal theory, the Harrod-Domar model assumes that c is fairly stable. The Indian experience is puzzling only when viewed against this expectation.

This theory is the standard one in the theory of growth as it has evolved in the context of the DCs. Much has been written on the alleged stability of the capital-output ratio in these countries. But there is no reason to expect that the ratio should also be stable in the early stages of development of LDCs like India. In fact, in the only significant historical study of the problem, Bicanic (1961) has argued that, starting from a low ICOR in the first phase, it rises sharply in the second phase, and then declines to a stable medium value in the third phase which has characterised the recent experience of the DCs. Bicanic associated the rise in ICOR in the second phase with the building up of capital-intensive infrastructure. It is in this respect that there seems to be a difference in the Indian case, where an increasing share of investment was allocated to the manufacturing sector (Table 12), which also showed the sharpest rise in ICOR (Table 13).

There are a number of possible explanations for the declining productivity of investment in general and in the manufacturing sector in particular. One reason may be the composition of output within the manufacturing sector, where there may be a trend towards more capital-intensive products increasingly demanded by the upper income groups whose incomes are rising more rapidly than for other groups. Then, there is the question of the absorptive capacity for capital. According to this approach, at any given time, a country can only absorb a limited amount of capital productively. An attempt to increase capital stock beyond this limit will lead to rapidly diminishing returns. Over time, a country's absorptive capacity depends on the skill of its labour force, as influenced by education and training. Therefore, one possible explanation of the Indian

puzzle may be that the growth of physical capital has outstripped that of human capital. A third possible explanation is that the growth of capital is not being used efficiently because of the country's economic institutions, especially those affecting the working of the labour and capital markets in allocating and utilising these factors efficiently. Fourthly, the increase in the country's productive capacity due to rising investment ratios may not be matched by a corresponding increase in demand. This should be reflected in growing under-utilisation of capital. Unfortunately, the data on capacity utilisation available at present are not quite adequate to show any trend. Finally, we must also consider the possibility of a progressive under-estimation of output, especially in the last few years; if so, there may well have been an acceleration of economic growth corresponding to the rise in the investment ratio. This aspect of the statistical record has not been examined as closely as the estimates of savings and investment.

So far, we have been studying the relationship between investment and economic growth by means of ICORs. This approach is designed to study short-period relationships especially in developed economies. In LDCs like India, the short-term relationship is greatly disturbed by many factors, especially the role of weather in agriculture and its transmission to other sectors. At the same time, the major problem in India is the persistence of a low rate of growth for a long time, not just in the past few years. Therefore, it is necessary to supplement the above analysis with a longer term approach. From this point of view, the concentration of the Harrod-Domar model on investment as a ratio of national income is misleading. Even a rise in this ratio when the national income itself

is growing slowly, especially given the tendency for c to fall in the early stages of development pointed out by Bicanic, means a slow growth of the capital stock. It is more useful therefore to consider the rate of growth of the capital stock directly.

The general experience of fast growing countries elsewhere has been that the growth of factor inputs, such as labour and capital, is not sufficient to account for observed rates of growth. There is left a considerable part of economic growth due to rising productivity of factor inputs, often just called the "residual" and identified with the rate of technological progress. The usual method of identifying various sources of growth is by the formula:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + b\,\frac{\dot{L}}{L} + c\,\frac{\dot{K}}{K} \qquad (3)$$

where Y is national income, A is level of technology, L is labour, K is capital, a dot over a variable refers to the change in it during any given period, and b and c are the elasticities of output with respect to labour and capital respectively, identified with the respective factor shares on the assumption of constant returns to scale. This is not entirely satisfactory for a number of reasons, such as the assumption of constant returns to scale, the assumption of efficiently working and competitive factor markets, and the neglect of the close interaction between technological progress and capital accumulation highlighted in the "learning by doing" theory of Arrow, and the technical progress function of Kaldor. However, it may serve as a first approximation.

A recent estimate (Chen, 1979) of these sources of growth in some fast growing Asian countries for the period 1955 to 1970 (1957 to 1970 for Singapore) is given in Table 16.

Table 16: Accounting for Growth in Fast growing Asian countries: 1955-70

Country	Rate of Growth: Output	Labour	Capital	Technology
Hong Kong	9.31	3.10	7.80	4.33
Japan	10.12	1.40	9.27	6.36
Singapore	6.56	2.50	3.60	3.62
South Korea	8.84	2.88	5.30	4.99
Taiwan	8.02	2.87	5.00	4.30

For these estimates, the elasticities of output with respect to labour and capital were taken as 0.6 and 0.4 (0.7 and 0.3 for Japan). On the average, technological progress as a proportion of output growth for these countries averaged 55%; the corresponding proportion for DCs generally was even higher at 64%.

To apply this model to India, we have made some estimates of the growth of capital stock for the economy and some major sectors; they are shown with the method of estimation in the Appendix. The long term rates of growth of these estimates of capital stock and of GDP (derived by fitting an exponential trend by least squares) are shown in Table 17.

Table 17: Accounting for Growth: India, 1950/51 - 1978/79

Sector	Rates of Growth			
	Output	Capital	Labour	Technology
The Economy	3.62	4.47	2.2	0.29
Agricultural sector	2.23	3.33	2.1	- 0.49
Non-agricultural sector	5.10	4.31	2.5	1.70
Manufacturing sector	5.42	6.17	3.5	0.59
Other non-agricultural sector	4.98	3.96	2.3	1.85

A very rough estimate of the rates of growth of labour is also shown in the table. From these rates of growth, an estimate of the rate of technological progress is derived, assuming both factor elasticities to be 0.5 (following I.J.Ahluwalia's estimate for the manufacturing sector).

These estimates are derived from the most recent calculations but still are very rough. They differ considerably from some other estimates which have been made, for example, the growth of capital stock shown here for the manufacturing sector is much lower than the estimate by I.J. Ahluwalia. Other estimates of technological progress have generally been even lower. These estimates have been compiled to stimulate more work to improve them. Pending further revisions, they may help to direct our attention to more important parameters of analysis and policy.

Of course, the accounting for growth approach can be translated into the Harrod-Domar approach in a formal arithmetical form. For example, in the above accounting for growth approach, if the addition to capital stock is, say 10% of net national product (which corresponds to a gross

investment rate of near 20%) in 1978/79, capital stock will increase by 4.14%, and, with a growth of labour at 2% and no technological progress, will result in output growth at 3.17%. The same result follows also from the Harrod_Domar equation with s = 10% and c = .317 (corresponding to an ICOR of 3.15). But there may be an advantage in the accounting for growth approach which has a place for the role of labour and technological progress.

As the figures stand, the first conclusion that emerges is the low rate of technological progress, considering the great scope for improvement that exists in the low level of technology from which we started, and the emphasis given to this source of growth in our development strategy. It is even more surprising that the contribution of technological progress in the important agricultural sector is negative. In the light of these results, we might as well say that the real puzzle of Indian experience is why there has been so little technological progress. This can only be explained by the relative neglect of human capital in the form of the education and training of the people.

At the same time, the rate of growth of capital stock is still low compared with fast growing countries. The rate of growth of capital is important not just as a way of augmenting the quantum of productive factors but also as a vehicle of technological progress. The two factors have been separated in the above model only for convenience of analysis but in fact they are highly interrelated.

We are therefore driven to the conclusion that an adequate growth of output in India requires a faster growth of capital than we have achieved so far. The formidable nature of this problem, the problem of 'primitive

accumulation'. is, of course, well known, and there has been much discussion of possible solutions. But in view of the persistence of slow growth even after the rise in the investment ratio achieved so far, it seems worth while re-examining at least some aspects of the problem further.

One of the ways of increasing investment is to bring in foreign capital. Most fast-growing countries have had the advantage of foreign capital at a crucial stage of their development. The central point of Rosenstein-Rodan's (1961) theory was that such capital was, in fact, needed to raise domestic rates of saving to a level adequate for self-sustaining growth. The experience of the fast growing Asian countries shows, in retrospect, that, provided foreign capital flows in sufficient quantities, the period of dependence on it is surprisingly short.

There are a number of forms in which foreign capital flows into a country. We first consider the case of borrowing. Obviously, there are many aspects of such borrowing concerning the terms and conditions attached which have to be considered very carefully and have in fact been widely discussed in India. We shall, however, consider only one aspect, namely the tendency for both lenders and borrowers to adjust the amount of loans so that the debt-service ratio remains below a conventional limit. In the case of a country like India, with a relatively small foreign trade sector, this limit is reached very quickly. It is true that some large borrowers, especially in Latin America, have landed themselves in acute debt-servicing problems but as Lewis (1978) has pointed out, the conventional limits were far exceeded in the past experience of many countries. Countries like South Korea have deliberately promoted their exports as a way of justifying large scale borrowing. Ultimately, the amounts that a country can borrow

safely depends in the productivity with which borrowed capital is invested and on the terms on which it is supplied rather than on arbitrary limits set on the debt-servicing ratio.

Next is the case of foreign investment. The advantage of this form of foreign capital inflow is that it is usually accompanied by foreign technology. However, the terms on which such investment is generally made, especially by multinational companies, are usually so severe and the sectors in which it is usually located of such low priority that this may not be the most useful way of stimulating investment.

But there is a stronger case for seeking and taking more aid, i.e. capital on concessional terms. India has received far less than its fair share of aid, partly because of its size and partly because of its non-aligned posture in international relations. But these considerations affecting India's share of aid stem directly from the role of aid as an instrument of foreign policy. The case has to be made more strongly against aid as a transaction between governments and in favour of aid as a transaction between peoples in which governments are only intermediaries. What is needed is to demonstrate that a larger flow of aid will be used to relieve absolute poverty, as eloquently argued by Dr.I.G.Patel (1970); it is likely then that the case for aid will receive a significant humanitarian response among the people of the rich countries.

We next turn to measures to increase investment with domestic resources. The standard theory in Indian planning seems to be that the level of investment should be fixed at the level of savings and that if investment exceeds savings, there will be inflation. This follows largely

from a tendency to think of these problems largely in financial terms, an approach that was criticised by Kaldor (1958) in connection with the preparation of the Third Five Year Plan. He pointed out that, arguing in real terms, any inflation resulting from investment in excess of savings will be self-liquidating in the short run, if the investment is made in quick yielding projects which abound, especially in the agricultural sector (see also Lewis, 1954). On the other hand, keeping investment at the level of expected savings will not guarantee monetary stability. As Raj (1966) has shown, one of the most potent causes of inflation in LDCs like India is a shortfall of basic wage goods, especially food. Even if it was the case that an excess of investment over savings leads to inflation, we have to choose between the real objective of rapid growth and the monetary objective of price stability. Kaldor ( ) has recently argued for the importance of the real over the monetary objectives in Britain; this argument is even more valid for a country like India.

The appropriate strategy for India is, therefore, one of pressing all productive avenues of investment as far as the real resources of the economy permit, and then increasing savings as far as possible to this level in order to moderate its inflationary impact, i.e. the savings effort should be used as an instrument for controlling inflation rather than to determine the investment target. The great challenge to development strategy is the use of labour to create capital, an important theme of development economics, highlighted, for example, by Nurkse (1953). It has been an important source of investment in countries such as China, Japan and Indonesia, especially as a result of co-operative action for the common good, which Professor Ishikawa (1978) has described as the "community

principle". This approach has been much less evident in India for reasons which lie deep in the institutional conditions of the country. In the absence of the community principle, the same idea is also involved in policies such as the Employment Guarantee Schemes, but the resources channelled to this scheme have not been adequate to make a significant impact.

On the question of how much savings is available, it has become apparent in recent years that the rate of savings is not a simple function of income. It depends on other factors as well, such as the distribution of income and the terms of trade between the agricultural and non-agricultural sectors (see, for example, K.Krishnamurthy and Saibaba, 1982). The method of estimating the propensity to save that is commonly used and recommended in standard textbooks is to regress savings in real terms on income in real terms. But ex post figures for savings are (except for foreign capital inflow) the same as the figures for investment. Therefore, such a regression will only reflect the relationship between growth of income and the growth of investment, whether financed by voluntary or by forced savings; it will not reflect the rate of voluntary savings. For savings to be used to control inflation, they must be voluntary. Then, the propensity for voluntary savings is better reflected by regressing nominal savings on nominal income. During periods of inflation, the propensity to save shown by the nominal analysis will be lower than that shown by the real analysis, because the latter includes forced savings as well.

We next consider the division of investment between the public and private sectors. In the last decade, the average share of the public sector in gross investment (at 1970/71 prices) was 44%. This is a large share.

This does not mean that the public sector is investing too much, it is more likely that the private sector is not investing enough. Initially, one of the objectives of the investment licensing apparatus was in fact to limit private sector investment in order to ration out limited supplies of strategic materials such as steel and cement. Perhaps the control system has now outlived this purpose. Now that the public sector is in control of the 'commanding heights' of the economy, it may be possible that a relaxation of the constraints due to a few strategic materials may increase investment to a much greater extent. It is now widely recognised that private sector investment is ultimately determined by profitability, in turn based on technology and the state of demand, rather than by prior savings. If investment can be stimulated by technological progress and a wider spread of effective demand, the corresponding savings will be forthcoming.

Finally we consider public sector investment. The need for increasing such investment by exercising the utmost economy in government expenditure (already constituting a third of national income) and using such investment to bring about fundamental changes in the economy is, of course, widely recognised. But there is one aspect which needs stressing, namely the great extent of fluctuation in public investment. As Dr.Chitre (1981, p.93) pointed out, "The fluctuations in the public sector investment in fixed capital and stocks have been quite sharp in India over the past twenty five years of planning, and they seem to have accentuated rather than mitigated the fluctuations arising out of the other causes." Partly as a result of such fluctuations, the rate of growth of public sector investment declined

from 9.8% in the period 1956/57 to 1965/66 to 6.4% in the period 1966/67 to 1978/79 (I.J.Ahluwalia, 1982, Table XXI, p.95).

There is a close relationship between fluctuations in the non-agricultural sectors and those in agricultural production. This may be due to the role of demand. But increasingly, scholars studying the matter have come to the conclusion that one of the most important links in the chain of causation is public sector investment (see e.g. Srinivasan and Narayana, 1977; Nayyar, 1978; Rangarajan, 1981, 1982). While demand factors may be important in the link between agricultural fluctuations and the fluctuations in private sector non-agricultural activity, there are no strong reasons, as far as real resources are concerned for public sector investment to fluctuate so strongly in sympathy with agricultural conditions. The main reason seems to lie in a monetary policy which is perhaps excessively concerned to control inflationary pressures arising from agricultural shortfalls. A reconsideration of such a policy may help to insulate the rest of the economy from the agricultural fluctuations and thus set the stage for faster growth in the economy as a whole.

Appendix

Estimates of the Growth of Capital Stock in India

We have now a number of estimates of annual investment which have been brought together by CSO in real terms, for example, in 1970/71 prices. To convert these to time series of capital stock, we need a bench mark estimate. Some authors have made such a bench mark estimate for a particular year and used it to derive a time series (e.g. Dholakia, 1974). However, there is a problem in deriving time series of capital stock from a bench mark for a single year, namely the problem that the annual investment figures may not be quite commensurable with the capital stock figures, such as that involved in the bench mark estimates. The most important problem is to allow for the component of depreciation in gross investment figures, but the problem persists even when we have estimates of net capital formation. Therefore, we must have some correction factors to apply to the annual investment figures. Such a correction factor can be derived if we have bench mark estimates of capital stock not just for one year but for two years with a sufficient interval between them on a comparable basis.

Such estimates have at last become available. They are the unofficial estimates of fixed capital stock for 1970/71 and 1978/79 prepared by CSO specially for the Raj Committee. They show that fixed capital stock increased between these two years by Rs.36,720 crores in 1970/71 prices. But the total net domestic fixed capital formation (NDFCF) between these years amounted to Rs.39,411 crores also in 1970/71 prices. Therefore, these NDCF figures must be multiplied by a correction factor of .9317 to reconcile them with the two bench mark estimates of capital stock. This correction factor has therefore been applied to the annual NDFCF figures to estimate annual capital stock figures between the two bench mark years and also to work backwards year by year to 1950/51. The results are shown in the second column of the Appendix Table.

It is useful to estimate capital stock in particular sectors, especially in the agricultural and non-agricultural sectors. But, unfortunately, estimates are not published for NDFCF figures for these sectors in 1970/71 prices. Therefore, a different approach has to be used based on GDCF figures for these sectors which are available in 1970/71 prices. Thus, in the agricultural sector, the increase in fixed capital stock between the two bench mark years was Rs.7,161 crores in 1970/71 prices, while the sum of GDCF in that sector between those years was Rs.13,578 also in 1970/71 prices, so that the GDCF figures must be multiplied by a correction factor of .5274 to reconcile them with the bench mark figures of capital stock in agriculture. This correction was therefore used to derive a time series for fixed capital stock in agriculture, shown in the third column of the Appendix Table.

It may be objected that the period between the two bench mark years was one in which there were significant inventory changes, especially in agriculture. Therefore it is necessary to check if the ratio of NDFCF to GDCF in the two years for which data are available in published sources was fairly uniform. It turns out that, rather surprisingly this is indeed the case, as shown below:

Capital Formation in Agriculture

Investment	1970/71	1978/79
GDCF	1365	2533
NDFCF	717	1316
Ratio	.5253	.5195

For this calculation, the GDCF figures were taken from CSO National Accounts Statistics, and the NDFCF figures from the unofficial estimates prepared by CSO specially for the Raj Committee.

The method used for the agricultural sector were then applied to the non-agricultural sectors as a whole. In these sectors, the increase in fixed capital stock between the bench mark years was Rs.29,559 crores

at 1970/71 prices, while the sum of GDCF during the period was Rs.57,380 crores also at 1970/71 prices, giving a correction factor of .5151, which was used to compile the time series of capital stock for the non-agricultural sectors shown in the fourth column of the Appendix Table. These estimates are less reliable, as there was a greater variation of the ratio of NDFCF to GDCF from .4591 in 1970/71 to .5283 in 1978/79. These estimates of capital stock in the agricultural and non-agricultural sectors do not add up to that for the economy as a whole, as it was derived by a different method which is probably more reliable. The method for the agricultural and non-agricultural sectors was also applied to the manufacturing and and other non-agricultural sectors, with results shown in the fifth and sixth columns of the Appendix Table.

Appendix Table

Estimates of Capital Stock (beginning of year)

(Rs.crores in 1970/71 prices)

Year	The Economy	Agricultural sector	Non-Agricultural sector	Manufacturing	Other non-agricultural sectors
1950/51	35997	10129	29893	3980	25611
1951/52	37215	10410	30845	4108	26482
1952/53	38760	10788	31921	4378	27291
1953/54	39810	11109	32555	4545	27757
1954/55	41113	11478	33291	4661	28407
1955/56	42371	11774	34219	4761	29290
1956/57	44330	12206	35509	5027	30341
1957/58	46909	12655	37270	5467	31669
1958/59	49289	13113	38929	5893	32903
1959/60	51386	13543	40251	6082	34098
1960/61	53385	13881	41848	6500	35276
1961/62	55789	14296	43773	6982	36726
1962/63	58028	14669	45541	7430	38051
1963/64	60583	15092	47605	7925	39635
1964/65	63388	15531	49793	8388	41401
1965/66	66536	16056	52155	8967	43198
1966/67	70317	16689	54715	9641	45081
1967/68	74071	17226	57629	10502	47093
1968/69	77444	17758	60272	11166	49080
1969/70	80825	18346	62664	11694	50981
1970/71	84526	19003	65462	12416	53057
1971/72	88179	19723	68456	13221	55235
1972/73	91896	20457	71627	14047	57578
1973/74	95853	21255	74492	14723	59794
1974/75	100465	22096	78344	15721	62649
1975/76	103967	22780	81903	16857	64987
1976/77	107745	23466	85572	17811	67702
1977/78	112569	24463	89318	18610	70716
1978/79	118427	25549	93297	19597	73725
1979/80	124899	26884	98015	20886	77129

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