

Relative Rates of Growth Agriculture and Industry

A V Ramsunder

A Rudra has presented in his article ("Relative Rates of Growth: Agriculture and Industry," The Economic Weekly, November 7, 1964) certain rates of growth of industry which are in balance with specified rates of growth of agriculture. One of his important conclusions was that a 12 per cent annual rate of growth of 'industry' over the decade 1960-61-1970-71 is in balance not with 5 per cent growth of 'agriculture' as is believed but with a 6.9 per cent growth. He also works out the pressures on prices that will be generated in the economy by the imbalanced growth.

In view of its importance it is worthwhile to re-examine the problem keeping in mind two important aspects which did not directly enter Rudra's discussion.

First, we shall relate consumption, savings, taxes, etc. directly to the levels of income generated under alternative assumptions about the rate of growth of 'agriculture'.

Second, we shall explicitly make some assumptions about tax-rates, savings ratios, commodity composition of consumption, etc. We have retained most of Rudra's other assumptions.

The present paper concerns itself only with deriving the rates of growth of 'industry' in balance with alternative rates of growth assumed for 'agriculture'. We have also worked out the changes in the overall direct tax-rate that will have to be made in order to make a 5 per cent growth rate of 'agriculture' balance a 12 per cent growth of 'industry'. Finally we have examined the implications of an alternative value for the savings to disposable income ratio.

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BRIEFLY stated the following conclusions emerge from our analysis:

(1) We find that a 12 per cent rate of growth per annum of 'industry' is in balance with a rate of growth of 'agriculture' in the range 5.7 per cent—5.9 per cent. The term balance is used in this context to mean that there is balance between total supply (including imports) and total demand (including exports) at base year prices. In interpreting this result a number of qualifications need to be kept in mind: (a) The model is defined in terms of broad aggregates. One can

argue that the rates of growth of 5 per cent and 12 per cent widely discussed are not necessarily related to the sectors 'agriculture' and 'industry' as we have defined for this study. It can further be argued that the particular scheme of aggregation adopted may have concealed the extent of imbalances that may be revealed by a more disaggregated study. In this connection it may be mentioned that our sector 'agriculture' includes industries based on agricultural raw materials. Thus if we had treated these industries as a separate sector the results could conceivably have been different.

(b) The limitations of the input-output framework with constant coefficients in the context of an economy undergoing rapid structural change are well known and need not be repeated here. In particular supply response to changes in prices are ignored. (c) A number of simplifying assumptions have been made (see section 2) in arriving at our results.

(2) Direct tax-rate as a proportion of Net National Product will have to be raised from 5 per cent to a value in the range 7.4 per cent—7.9 per cent.

(3) If the ratio of savings to disposable income is raised from 8 per

Table 1: Inter-Industry Transactions for India 1960-61
(In Rs crores at 1959-60 producers' prices)

Output Sector	Input into sectors				Other Industries Consumption	Total Household Consumption	Govt. Consumption	Gross Capital Formation	Exports	Imports	Stocks	Total Final Demand	Gross Output
	(1)	(2)	(3)	(4)									
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Agriculture and industries based on agriculture	2059.7	187.8	21.0	206.6	2475.1	7229.7	104.9		401.1	322.0	197.7	7611.4	10086.5
(2) Mining and industries based on mining (incl. coal)	166.7	1126.4	159.6	147.9	1600.8	509.2	225.1	2002.0	57.9	790.9	33.2	2036.5	3637.3
(3) Coal, electricity, rail and motor transport	199.3	232.3	137.9	276.7	846.2	219.2	4.7		1.8	0.1	0.2	225.8	1072.0
(4) Value added	7420.8	1480.7	748.7										14276.0 ¹
(5) Others + trade and transport margin (incl. indirect taxes)	240.0	610.1	4.6										
Gross Output	10086.5	3837.3	1072.0			11994.6 ²							

¹ total value added

² total household consumption at market prices.

cent to 12 per cent it is seen that the rate of growth of 'agriculture' that is in balance with a 12 per cent of growth of 'industry' is in the range 4.6 per cent—4.8 per cent.

(4) The rates of growth of 'industry' which are in balance with given rates of growth of agriculture are generally seen to be higher than those obtained by Rudra (compare our Table 3 with Rudra's Table 3). In particular, the rate of growth of 'agriculture' which is in balance with a 12 per cent growth of industry is in the range 5.7 per cent—5.9 per cent as against Rudra's 6.9 per cent. Again the magnitude of foreign exchange deficits generated by an imbalanced growth is roughly half of what Rudra has obtained, though the gross capital formation is somewhat lower in our case (compare our Table 4 with Rudra's Table 4). However, in analysing these differences one must keep in mind the differences in the set of assumption made by us and Rudra.

II

The Model

We have used the inter-industrial set up to study the dependence of agriculture on industry. The economy has been divided into four sectors.

- (1) Agriculture and industries based on agriculture.
- (2) Mining (excluding coal) and industries based on mining.
- (3) Coal, electricity, railways and motor transport.
- (4) Residual sector, including commerce and services.

Table 1 gives the inter-industrial transactions for the base year 1960-61, drawn up at 1959-60 producer's prices and Table 2 gives the matrix of coefficients, including the coefficients of value added for the three sectors.

The model consists of the following feasibility condition to be satisfied by the output levels x_{it} ($i=1, 2, 3$) of the three sectors. The equations may be written as follows:

$$\begin{aligned} (1) & \begin{matrix} x_{11} & -a_{11} & x_{12} & -a_{12} & x_{13} & -a_{13} & x_{14} & =h_{11} \\ x_{21} & -a_{21} & x_{22} & -a_{22} & x_{23} & -a_{23} & x_{24} & =h_{21} \\ x_{31} & -a_{31} & x_{32} & -a_{32} & x_{33} & -a_{33} & x_{34} & =h_{31} \end{matrix} + \begin{matrix} +g & +s & +o & +e & -m \\ i_1 & i_2 & i_3 & i_4 & i_1 \end{matrix} \\ (2) & \begin{matrix} x_{11} & -a_{11} & x_{12} & -a_{12} & x_{13} & -a_{13} & x_{14} & =h_{11} \\ x_{21} & -a_{21} & x_{22} & -a_{22} & x_{23} & -a_{23} & x_{24} & =h_{21} \\ x_{31} & -a_{31} & x_{32} & -a_{32} & x_{33} & -a_{33} & x_{34} & =h_{31} \end{matrix} + \begin{matrix} +g & +s & +o & +e & -m & +k \\ i_1 & i_2 & i_3 & i_4 & i_1 & i_1 \end{matrix} \\ (3) & \begin{matrix} x_{11} & -a_{11} & x_{12} & -a_{12} & x_{13} & -a_{13} & x_{14} & =h_{11} \\ x_{21} & -a_{21} & x_{22} & -a_{22} & x_{23} & -a_{23} & x_{24} & =h_{21} \\ x_{31} & -a_{31} & x_{32} & -a_{32} & x_{33} & -a_{33} & x_{34} & =h_{31} \end{matrix} + \begin{matrix} +g & +s & +o \\ i_1 & i_2 & i_3 \end{matrix} \end{aligned}$$

where s_{it} are the input coefficients, h_{it} is the household consumption of commodity i in year t , g_{it} government consumption, e_{it} its export, m_{it} the import, s_{it} the addition to stocks and o_{it} is the intermediate consumption of the residual sector. k_{it} stands for capital formation consisting of two parts k_{it} financed by domestic savings

and k_{it} financed by external assistance. The sectors are so defined that all the fixed capital formation takes place in the second sector and the third sector has neither imports nor exports. In addition to the above three conditions we make use of the following identity:

$$(4) \quad y_t = v_{1t} x_{1t} + v_{2t} x_{2t} + v_{3t} x_{3t} + y_{4t}$$

where y_t is the gross national product measured in producer's prices of 1959-60, v_{it} is the value added per unit of output in sector i and y_{4t} is the total value added in the residual sector.

In order to study the mutual relations between the rates of growth of the output x_{it} and available supply for net exports of agriculture ($e_{it} - m_{it}$) we eliminate R_{it} , s_{it} and o_{it} by making suitable assumptions about them and k_{it} and h_{it} by relating them to the gross national product y_t .

III

The Assumptions

(1) The coefficients a_{ij} and v_{it} are taken from the 1960-61 inter-industry table and are assumed to remain constant over the decade. Rudra, however, has assumed a zero value for some of the coefficients, where the corresponding flow constitutes less than 5 per cent of the total flow. Again, he has raised the input of industrial raw materials into agriculture "to take care of likely technological changes in the latter".

(2) Government consumption is treated as exogenously given, taking the following numerical values (for $t = 1970-71$) (same as Rudra's).

$$g_{1t} = \text{Rs } 250 \text{ crores, } g_{2t} = \text{Rs } 560 \text{ crores, } g_{3t} = 10 \text{ crores.}$$

(3) We treat $s_{it} + o_{it}$ as proportional to the level of outputs x_{it} .

$y_{it} + o_{it} = b_{it} x_{it}$ where b_{it} are assumed to have the following base

Depreciation is assumed to be 6 per cent of the G.N.P. This gives the net national product:

$$Y_{4t} = 0.94 y_t.$$

Direct taxes and surplus of public enterprises are each assumed to be 5 per cent of the M.N.P. Subtracting these two from the N.N.P. we get the disposable income.

$$y_{4t} = 0.94 y_t - 2(0.05 \times 0.94 y_t) = 0.846 y_t.$$

The total private savings (personal + corporate) are assumed to be 8 per cent of the disposable income. So that we get total private savings at 0.06768 y_{4t} and total household consumption at market prices $C_t = 0.77332 y_{4t}$.

It is assumed that the domestic consumption at producer's prices of the output of the three sectors retains to C_t the same proportion in the terminal year as in the base year. In the base year this ratio is seen to be 0.6635. Further it is assumed that 85 per cent of this consumption at producer's prices is from the output of the first sector, 10 per cent from the second and 5 per cent from the third. In contrast to the consumption vector used by Rudra, which he has derived by a modified application of the Linear Expenditure System, our vector has fixed proportions in the three sectors.

To arrive at total domestic savings used for financing fixed investment we have to add government savings to private savings and subtract the net increase in inventories during the fiscal year.

For evaluating total Government savings the receipts are assumed to be 18.8 per cent of the G.N.P. (direct taxes 4.7 per cent, government current surplus 4.7 per cent and indirect taxes 9.4 per cent of the G.N.P.). We have assumed the total Government expenditure to be Rs 2800 crores, in 1970-71. Thus the total savings is 0.1885 \times 2800. The net increase in inventories in the final year is assumed to be 1.5 per cent of the G.N.P. Thus the total gross domestic savings devoted to fixed investment in the final year is 0.067, $+ 0.06768 y_{4t} + 0.1885 y_{4t} - 0.015 y_{4t} - 2800 = 0.3006 y_{4t} - 2800$. There are two sources of financing.

Table 2: Coefficient Matrix

Input Sectors	Output sectors		
	(1)	(2)	(3)
(1)	0.204	0.052	0.020
(2)	0.017	0.310	0.149
(3)	0.020	0.064	0.123
Value added	0.736	0.407	0.698
Gross output	1.000	1.000	1.000

total investment. The first is through domestic savings. The second source is through foreign trade deficit covered by external assistance. The figures we use for this second component are already in producer's prices. We need the counterpart of gross domestic savings in terms of output of the second sector in producer's prices. It would have been nice if we had a deflator for this domestic savings component. What we have is a deflator 1.43 (source: Central Statistical Organisation) for equipment part of investment and 1.00 for construction. We, therefore, made the following two alternative assumptions to arrive at an overall deflator for domestic savings component of fixed investment.

A: 80 per cent of gross domestic savings used for fixed investment is devoted to financing construction. The overall deflator in this case is

$$1 \div \left(\frac{0.8 + 0.2}{1.00 + 1.43} \right) = 1.064$$

B: 70 per cent of gross domestic savings is devoted to construction. The overall deflator in this case is

$$1 \div \left(\frac{0.7 + 0.3}{1.00 + 1.43} \right) = 1.099.$$

The part of capital formation financed by external assistance is treated as equal to the surplus of imports over export earnings.

Thus $k_1 = m_1 + m_2 - e_1 - e_2$
 — e_1 where e_1 is the net invisible earnings plus domestic trade and transport margin on exports.

For m_1 , we have assumed that the non-competitive import is $0.01 x_{11}$ and the competitive import varies for balanced growth. As to m_2 , the non-competitive part is assumed to equal $0.085 x_{21}$, and the competitive import is assumed to be zero.

For e_{11} , the exports of 'agriculture' sector, we have assumed a given proportion of Rs 570 crores and for e_{21} a value of Rs 220 crores. The way the sectors have been defined with all the investment goods producing industries put in sector 2 and with only the sectors, 1 and 2 engaging in foreign trade no assumption about the export of the second sector is relevant to the calculation.

Table 3: Balanced Relative Rates of Growth

Assumption A					Assumption B				
Sector 1	Sector 2	Sector 3	Value Added in Residual	GNP	Sector 1	Sector 2	Sector 3	Value Added in Residual	GNP
2.0	5.6	5.9	2.3	2.8	2.0	5.4	5.8	2.5	2.8
3.0	7.5	7.2	3.1	3.8	3.0	7.2	7.2	3.3	3.8
4.0	9.2	8.5	3.9	4.9	4.0	8.9	8.4	4.1	4.9
5.0	10.8	9.8	4.7	6.0	5.0	10.6	9.7	5.0	6.0
5.7	12.0	10.8	5.3	6.8	5.9	12.0	10.9	5.7	6.9

Assumption A: 80 per cent of gross domestic savings used for fixed investment is devoted to financing construction.

B: 70 per cent of gross domestic savings used for fixed investment is devoted to financing construction.

Table 4: Foreign Exchange Deficits Resulting from Unbalanced Growth

Assumption A					Assumption B				
Rates of Growth of	Competitive Agricultural Imports	Foreign Exchange Deficit	Fixed Capital Formation	Rates of Growth of	Competitive Agricultural Imports	Foreign Exchange Deficit	Fixed Capital Formation		
2.0	10.0	1148	1083	2.0	10.0	1208	1143	5177	
3.0	10.0	711	658	3.0	10.0	778	725	4947	
4.5	10.0	243	204	4.5	10.0	316	277	4699	
5.0	10.0	-285	-309	5.0	10.0	-204	-228		
5.0	12.0	392	527	5.0	12.0	480	615	6019	
5.7	12.0	—	147	5.9	12.0	—	149	5805	

Table 5

	Assumption A		Assumption B	
	Agriculture 5.7%	Agriculture 5%	Agriculture 5.9%	Agriculture 5%
Proportion of direct taxes to N N P	.050	.074	.050	.079
Proportion of Govt. revenue to G N P	.188	.211	.188	.215
G N P (Rs crores)	27438	26005	27903	26155
Agricultural output (Rs crores)	17639	16431	17906	16431
Direct taxes (Rs crores)	1290	1829	1311	1819
Govt revenue (Rs crores)	5158	5487	5246	5623

Table 6: Balanced Relative Rates of Growth with Savings Ratio 12 per cent

Assumption A					Assumption B				
Sector 1	Sector 2	Sector 3	Value Added in Residual	GNP	Sector 1	Sector 2	Sector 3	Value Added in Residual	GNP
1	2	3			1	2	3		
2.0	7.6	6.6	2.4	3.1	2.0	7.4	6.5	2.6	3.1
3.0	9.4	7.9	3.2	4.2	3.0	9.1	7.8	3.4	4.2
4.0	11.0	9.2	4.0	5.3	4.0	10.7	9.1	4.2	5.3
4.6	12.0	10.0	4.5	5.9	4.8	12.0	10.1	4.9	6.1
5.0	12.6	10.5	4.8	6.3	5.0	12.3	10.4	5.1	6.3

IV

Results

Dropping the subscript *t* the relations (1) to (4) can be written under assumption A, as follows:

$$(5) 0.796x_1 - 0.052x_2 - 0.020x_3 = 0.43896y + 0.04x_1 + a_1 - m_1 + 250$$

$$(6) -0.017x_1 + 0.490x_2 - 0.149x_3 = 0.051647y + 0.30068y - 2800$$

$$-220 + 0.05x_1 + 560 - (e_1 - m_1)$$

$$(7) -0.020x_1 - 0.064x_2 + 0.871x_3 = 0.02582y + 0.27x_1 + 10$$

$$(8) y = 0.7357x_1 + 0.4071x_2 + 0.6989x_3 + y_1$$

To arrive at the rates of growth of 'industry' which are in balance with specified rates of growth of agriculture, we have to express x_1 and x_2 as functions of x_3 . This is achieved by substituting 570 for e_1 and 0.01x₁ for m_1 in the above and eliminating y_1 between equations (3), (6) and (7). This leads to the following sets of equations under the two assumptions: Assumption A:

$$(9) x_1 = 0.9379x_2 - 5246.5$$

$$(10) x_1 = 0.2030x_2 - 594.4$$

$$(11) y_1 = 0.3654x_2 + 1331.5$$

$$(12) y_1 = 1.6247x_2 - 1219.5$$

Assumption B:

$$(13) x_1 = 0.9159x_2 - 5103.9$$

$$(14) x_1 = 0.2007x_2 - 580.0$$

$$(15) y_1 = 0.3786x_2 + 1261.4$$

$$(16) y_1 = 1.6274x_2 - 1237.0$$

Substituting the values for x_1 for 2 per cent, 3 per cent, 4 per cent and 5 per cent growth of 'agriculture' the rates of growth of x_1 , x_2 , y_1 and y_2 are worked out. These are presented in Table 3. Again the rate of growth of 'agriculture' which is in balance with 12 per cent rate of growth of x_1 has also been worked out by making use of relations (9) and (13).

Now to work the foreign exchange deficit engendered by unbalanced growth, equations (5) and (6) have been solved for $e_1 - m_1$ and y_1 . These give

$$A: (17) y_1 - m_1 = 0.3365x_1 - 0.3858x_2 + 0.0739x_3 - 1409.0$$

$$(18) y_1 = 0.9558x_1 + 0.7605x_2 - 0.2186x_3 + 2640.4$$

$$B: (19) e_1 - m_1 = 0.3315x_1 - 0.3898x_2 + 0.0771x_3 - 1394.6$$

$$(20) y_1 = 0.9670x_1 + 0.7694x_2 - 0.221x_3 + 2561.9$$

By substituting 570 for e_1 and putting $m_1 = m_1^* + 0.01x_1$, where m_1^* stands for competitive agricultural im-

ports, equations (17) and (19) are used to evaluate m_1^* for given rates of growth of 'agriculture' and 'industry'.

The values of m_1^* and the corresponding foreign exchange deficits,

$D = m_1^* + 0.01x_1 + 0.085x_2 - 990$ are presented in Table 4, for 2 per cent, 3 per cent, 4 per cent and 5 per cent annual growth rates of 'agriculture' and 10 per cent growth of 'industry'. The results for combination of 5 per cent growth of 'agriculture' and 12 per cent of 'industry' as well as the balanced rates with 'industry' growing at 12 per cent are also presented.

The table also gives the gross investment calculated as follows: gross fixed investment = $0.30068y - 2800 + 1.43(m_1 + m_2 - e_1 - e_2 - e_3)$

As we have seen above 'agriculture' must grow at 5.7 per cent (under assumption A) to be in balance with a 12 per cent growth rate of 'industry'. If, however, agriculture grows only at 5 per cent the demand at base year prices for agricultural products will exceed their supply. The supply demand balance can be restored through a rise in relative prices of agricultural products, leaving money incomes unchanged. Balance can also be restored without change in relative prices by a reduction in total consumption, expenditure. We now examine the extent to which direct taxes will have to be raised to bring down consumption expenditure to the appropriate level.

Denoting the proportion of direct taxes to the Net National Product by 'd' and retaining the assumption about government current surplus and indirect taxes as before, we get:

$$\text{Private savings} = (0.0714 - 0.0752d)y \\ \text{Gross Domestic Savings} = (0.2574 + 0.8648d)y - 2800$$

Consumption at producer's prices of the output of the three sectors = $(0.5451 - 0.5738d)y$.

The first two equations of our system (under assumption A) can now be written as:

$$-0.766x_1 - 0.052x_2 - 0.020x_3 = (0.4634 - 0.48777d)y + 820$$

$$-0.027x_1 + 0.640x_2 - 0.149x_3 = (0.0545 - 0.0574d)y$$

$$+ (0.2574 + 0.8648d)y - 2800 \\ 1.064$$

Substituting the values for x_1 , x_2 , x_3 obtained by assuming the annual growth rates of 5 per cent of agriculture and 12 per cent of industry for the decade 1960-61 to 1970-71, the first

equation gives

$$y = \frac{11112.102}{0.4634 - 0.4877d}$$

Substituting this value of y and the values of x_1 , x_2 and x_3 as before in the second equation we get the value of d . Under the two assumptions A and B the values of d are 0.074 and 0.079, respectively. The implications of this increased tax rate on the Gross National Product and on the volume of direct taxes and total government revenue are presented in Table 5.

We have worked out and presented in Table 6 the balanced relative rates of growth obtained under an alternative assumption about the savings ratio. We have assumed the total private savings (personal + corporate) to be 12 per cent of the disposable income. This rate is nearer the rate of savings implicit in the PPD's notes on 'Perspective of Development' than our earlier assumption of 8 per cent. The increased savings results in a lowering of consumption and consequently a growth rate of 4.8 per cent of 'agriculture' is seen to be adequate to balance a 12 per cent growth rate of 'industry'.

Notes

1. In computing this we are ignoring the effects changes in direct taxes may have on the savings ratio as well as on the commodity composition of consumption.

2. 'Notes on Perspective of Development, India 1960-61 - 1975-76', Perspective Planning Division, Planning Commission.

Sankey Wheels

SATISFACTORY progress has been made by Sankey Wheels in the second year of its existence. Having completed the construction of factory buildings and installation of the truck wheel plant, the company began trial production runs in the latter half of 1964 and initial sales of truck wheels were also recorded before the year ended. The car wheel plant continued to be operated by Guest, Keen, Williams but from the beginning of the current year this plant was transferred to Durgapur where production of wheels for car, jeep and slow-moving vehicles is now in full swing. During the 53-week period ended January 2, last, the company incurred a loss of Rs 18.76 lakhs, after providing Rs 12.47 lakhs for depreciation. Together with the brought-forward loss, the total loss of Rs 23.45 lakhs is carried to the balance sheet.