Demand Side Factors and India's Industrial Growth

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Using a dual economy framework, wherein the industrial sector is postulated to face an effective demand problem, the paper proposes to explore the extent to which demand side factors served as a constraint to growth of the Indian industrial sector, over the period of 1960-61 to 1989-90. The main factors considered are growth of agricultural output and of autonomous expenditure as indicators of demand side factors. We have also sought to explore the possibility of changes in the nature of the underlying relationships by using dummies, to demarcate the different sub-periods.

I
Introduction

INDUSTRIAL growth in post-independence India has been characterised by significant ups and downs. These have evoked considerable debate regarding factors affecting and/or constraining such growth. The fact that the issues raised in this debate remain unresolved calls for further investigations. The present paper is one such attempt, where we seek to explore the extent to which demand side factors have served as a constraint to India's industrial growth. Such a study becomes all the more relevant in the context of the programmes for structural adjustment and policies of liberalisation and privatisation being pursued in the recent times by the Indian government. While all such corrective policies are expected to relax any existing bottlenecks to supplyside responsiveness, it becomes pertinent to assess the role of the demand factors in her industrial growth so far.

The framework we shall use is a kind of dual economy framework. The growth of an industrial sector is generally looked upon as a part of a wider process of development of the economy, namely, a transformation from a predominantly traditional, agrarian setup to a modern industrial economy. The literature on dual economy models deals with the characterisation of such economies and constraints to industrial growth therein. This literature comprises of broadly two kinds of models. The set of classical and neo-classical models deals with a supply-led industrial sector, where the industrial sector does not face any effective demand problems.[1] The other set of models explicitly considers the problem of effective demand, where savings are not automatically equal to investment/autonomous expenditure and hence there is no guarantee that the profit maximising output of the industrial sector would be demanded. Possible constraints to industrial growth in a labour surplus economy then turn out to be insufficiency of autonomous expenditure, inadequate growth of agriculture, etc.[2] It is this latter set of models that we propose to use in the present paper for analysing the behaviour of industrial output in India during the period from 1960-61 to 1989-90.

A study of the literature on the industrial growth in post-independence India reveals that this entire period can be classified into three sub-periods. After an initial period of rapid industrial growth of almost 8 per cent of per annum on an average, a phase of slow growth set in. This phase, usually referred to as a phase of stagnation, extends from the middle of the 1960s to almost the end of the 1970s during which the average annual rate of growth of industrial output dropped to 4 per cent. During this phase, of course, the economy had gone through two successive droughts in the mid-1960s, another couple of droughts in the early 1970s and a number of oil shocks in the 1970s. Industrial rate of growth, however, picked up in the 1980s when it exceeded 7 per cent per year, on an average. Studies exploring these different phenomena have put considerable emphasis on agriculture-industry linkages on the one hand, and the behaviour of autonomous expenditure on the other.[3] As we shall see later, these two sets of factors also assume vital importance in the present paper. The paper is organised as follows: Section II presents our basic model while Section III reports the empirical results obtained. Some concluding observations are contained in Section IV.

II
The Model

The framework to be adopted is a dual economy framework in which the economy is disaggregated into two broad sectors – agriculture and non-agriculture. Non-agricultural sector includes industrial and tertiary sectors. Services produced by government administration will be a product of the non-agricultural sector and government consumption expenditure is the main item of expenditure on that product. The specification of the model is completed by making a simplifying assumption, namely, that foodgrains is the representative output of the agricultural sector. This assumption may be justified by an appeal to the fact that foodgrains production is important not only quantitatively,[4] but also qualitatively as its output and relative price are the two basic variables in macro models for developing economies.

The consumption demand for manufactured goods (C_m) comes from people engaged in both the sectors. Such demand from a sector depends on the real income originating in that sector and the relative price. If Y_n, X and p are respectively non-agricultural output,[5] foodgrains output and the relative price of foodgrains (i e, the ratio of price of foodgrains to the price of manufactures), C_m may be taken to depend on Y_n and pX. The former is a variable measuring real incomes of capitalists and workers engaged in the non-agricultural sector[6] while the latter gives a measure of income of cultivators. Of course, in the latter case one should consider not output of foodgrains as such, but the marketable or marketed surplus of foodgrains (X^s, say). However, to keep the structure simple and also because of the fact that no time series data on X^s for the country as a whole are available, we shall not introduce a variable like X^s. Instead, we assume that the marketable surplus in terms of manufactured goods (pX^s) is positively related to pX. However, once we recognise that the relevant variable which represents cultivators' real income is pX^s, we have to keep in mind that the marketable surplus (X^s) in a period comes partly from current production (X) and partly from production in the preceding year (X_{-1}). Hence we shall use two variables to represent cultivators' income in the current period, namely pX and pX_{-1}.

Apart from real income, the other variable which affects C_m is the relative price of foodgrains (p). A *ceteris paribus* rise in p will induce mainly income effect on the demand for industrial consumer goods particularly by those people who are dependent on the markets for their consumption of foodgrains (e g, industrial workers). The reason is simple. Given that their demand for foodgrain is price-inelastic, a *ceteris paribus* rise in p will force them to spend a larger fraction of their income on foodgrains, and hence to reduce their expenditure on industrial consumer goods.[7] Thus one may write

$$C_m = c(Y_n, pX, pX_{-1}, p) \qquad (1)$$

The aggregate demand for industrial goods includes not only consumption demand, but investment demand, export demand and intermediate demand. Some of these demands are autonomous while the rest depend on sectoral outputs. However, so far as investment demand is concerned, private investment (PI) is affected by government investment in infrastructure and other capital goods. We may thus postulate that the aggregate output of the industrial sector (Y_m) depends on the explanatory variables included in equation (1) earlier as well as on the (real) autonomous expenditure on such goods (A_m):

$$Y_m = d(Y_n, pX, pX_{-1}, p, A_m) \qquad (2)$$

The variable A_m may include (real) government investment (GI) and possibly also export of industrial goods (E_m). However, in our empirical exercises the sum of GI and E_m as an autonomous variable has not yielded better results than the one including GI only. Hence, the variable A_m is taken to consist of GI only.

The non-agricultural sector consists of industrial and tertiary sectors, and as mentioned earlier, services produced by government administration are a product of the non-agricultural sector and an autonomous item of expenditure on these services is government consumption expenditure. Thus the demand for the non-agricultural output will be affected by all the variables on the RHS of equation (2) as well as the (real) value of government consumption expenditure (GC):

$$Y_n = f(Y_n, pX, pX_{-1}, p, A_m, GC) \qquad (3)$$

Before we proceed further, let us mention that (3) may be solved for Y_n to express the effective demand for Y_n in terms of other variables as follows:

$$Y_n = E(pX, pX_{-1}, p, A_m, GC) \qquad (3a)$$

We now need only market demand and marketable surplus relations for foodgrains to determine its relative price. There is already a considerable literature on the topic (see, for example, Chakrabarti, 1977). We consider a simple model and postulate that the relative price of foodgrains is related positively to Y_n and negatively to lagged and current outputs of foodgrains:

$$p = h(Y_n, X, X_{-1}) \qquad (4)$$

Equations (3) and (4) are the two basic relations determining equilibrium in the economy. Solving these for the two endogenous variables, Y_n and p, one gets

$$Y_n = F(X, X_{-1}, A_m, GC) \qquad (3R)$$

$$p = H(X, X_{-1}, A_m, GC) \qquad (4R)$$

Substituting the above in equations (1) and (2) one gets the reduced form expressions for C_m and Y_m, the two variables of our interest, as follows:

$$C_m = C(X, X_{-1}, A_m, GC) \qquad (1R)$$

$$Y_m = D(X, X_{-1}, A_m, GC) \qquad (2R)$$

TABLE 1: ESTIMATED LOG-LINEAR REGRESSION EQUATIONS FOR THE OUTPUT OF INDUSTRIAL CONSUMER GOODS (C_m)

Equation	Explanatory Variables (in Logarithms)													
No	Intercept	A_m	GC	A_n	X	X_{-1}	pX	pX_{-1}	p	D	DA_n	D′	$\bar{R}^2$	DW
1.1	0.277	0.118	0.220		0.101	0.141							0.982	1.88
	(2.16)	(2.72)	(5.01)		(1.59)	(2.01)								
1.2	–0.061			0.343	0.115	0.139							0.981	1.86
	(–0.52)			(8.74)	(1.83)	(1.97)								
1.3	(–0.095)	0.154	0.184				0.139	0.134	–0.221				0.981	1.91
	(–0.17)	(2.76)	(2.790)				(2.05)	(1.63)	(–2.45)					
1.4	–0.465			0.340			0.139	0.138	–0.207				0.982	1.95
	(–1.43)			(8.91)			(2.22)	(1.88)	(–2.36)					
1.5	0.493			0.275	0.119	0.161				–0.830	0.083	–0.036	0.982	2.00
	(1.37)			(4.79)	(1.87)	(2.22)				(–1.32)	(1.36)	(–1.56)		

Notes: R^2 denotes coefficient of determination adjusted for degrees of freedom and DW, the Durbin-Watson statistic.
The figure in parenthesis below an estimated coefficient gives its t-ratio. The same practice is followed for Table 2 also. The dummy variables in Tables 1 and 2 are defined as follows.
In D' = 1, for each year from 1960-61 to 1964-65;
0, for all other years.
In DA_n = In A_n, for each year from 1980-81 to 1989-90;
0, for all other years.
In D = 1, for each year from 1980-81 to 1989-90;
0, for all other years.

TABLE 2: ESTIMATED LOG-LINEAR REGRESSION EQUATIONS FOR THE OUTPUT OF INDUSTRIAL SECTOR (Y_m)

Equation	Explanatory Variables (in Logarithms)													
No	Intercept	A_m	GC	A_n	X	X_{-1}	pX	pX_{-1}	p	D	DA_n	D′	$\bar{R}^2$	DW
2.1	(–4.166)	0.157	0.602		0.214	0.131							0.994	0.98
	(–27.98)	(3.12)	(11.80)		(2.89)	(1.61)								
2.2	–5.107			0.767	0.285	0.135							0.989	0.79
	(–27.54)			(12.43)	(2.89)	(1.22)								
2.3	–4.805	0.206	0.529				0.256	0.187	–0.354				0.995	1.19
	(–8.31)	(3.47)	(7.50)				(3.54)	(2.13)	(–3.68)					
2.4	–6.533			0.716			0.304	0.271	–0.310				0.994	1.40
	(–16.70)			(15.61)			(4.02)	(3.07)	(–2.94)					
2.5	–5.193			0.781			0.310	0.104		–0.047		–0.060	0.992	1.19
	(–13.37)			(11.60)			(3.64)	(1.06)		(–1.39)		(–2.17)		
2.6	–5.534			0.814	0.327	0.089				–1.186	0.0108		0.991	1.34
	(–16.03)			(12.05)	(3.62)	(0.87)				(–1.47)	(1.37)			
2.7	–4.423			0.681	0.331	0.129				–2.296	0.221	–0.096	0.994	1.61
	(–10.66)			(10.30)	(4.51)	(1.53)				(–3.17)	(3.11)	(–3.64)		
2.8*	–4.340			0.672	0.314	0.146				–2.269	0.219	–0.097	0.990	1.88
	(–9.42)			(9.41)	(4.38)	(1.82)				(–2.73)	(2.69)	(–3.31)		

* This equation is obtained by re-estimating eq (2.7) after correcting for first-order autocorrelation of the residuals.

Our final step is to estimate the relations (1R) and (2R). This is discussed in the next section.

III
Empirical Results

In the empirical exercise the two variables C_m and Y_m are represented by the two production indices, viz, the index of production of industrial consumer goods and the general (i e, all commodity) index of industrial production, respectively. We have tried to fit both linear and log-linear regression equations for each variable. In each case log-linear equations have yielded better results and hence only these are reported in Tables 1 and 2. All equations are estimated by the OLS method and by using the annual observations[8] on the variables over the period from 1960-61 through 1989-90.

Output of Industrial Consumer Goods (C_m)

Table 1 reports results for C_m. The first exercise involving A_m, GC and the two series of foodgrains output as regressors yields good results with expected signs and satisfactory t_ratio for all estimated coefficients; $\bar{R}^2$ is quite high and DW statistic is satisfactory (eq 1.1 in Table 1). If A_m and GC are lumped together to form a single variable, A_n, the total autonomous expenditure on non-agricultural output (i e, $A_n = A_m + GC$), the result remains almost the same (eq 1.2) and the estimated coefficient of A_n turns out to be just equal to the sum of those of A_m and GC in eq (1.1). Henceforth, we shall report results involving mainly the total autonomous expenditure, A_n. It may be of some interest to inquire how equation (1) will look empirically when Y_n is replaced by the expression (3a). Equations (1.3) and (1.4) of Table 1 show results of such exercises.[9] The results are very good and all coefficients including that of p are of expected signs and have high t-ratios.

As we have mentioned earlier, the two widely debated issues in the context of India's industrial growth are those of industrial stagnation and revival which are supposed to have occurred around the mid-1960s and during the period of the 1980s, respectively. We have sought to investigate these issues in an indirect way, namely, by examining whether the structure of relations postulated in (1R) and (2R) would exhibit shifts across different periods. For this purpose, we consider a number of dummy variables – two intercept dummies (D′ and D) for the two periods, viz, the first half of the 1960s and the 1980s and a slope dummy for autonomous expenditure (DA_n) for the 1980s. The best result is obtained when all the dummies are present (eq 1.5). We find that all dummies have coefficients higher than unity, DW statistic is 2 and the slope dummy DA_n has a small positive coefficient. Although $\bar{R}^2$ remains the same as in equation (1.2), we choose equation (1.5).

Aggregate Output of Manufacturing Sector (Y_m)

With two series of foodgrains output and A_m and GC separately or their aggregate A_n as regressors, the estimated equations turn out to be quite good, except for the low value of the DW statistic and low t-value of the coefficient of X_{-1} (equations (2.1) and (2.2) of Table 2). Once again, one may be interested to know the empirical counterpart of equation (2) when Y_n is replaced by the expression (3a). The results for such partial reduced form expressions, given in equations (2.3) and (2.4) of Table 2, show that all coefficients have expected signs and are also highly significant. Interestingly, comparing eq (2.3) with eq (2.1) or eq (2.4) with eq (2.2), one finds that estimated coefficients of a given regressor are very close in the two equations.[10]

In order to investigate whether the relation involving these variables has undergone any shifts over time we introduce, as before, the three dummy variables, D , DA_n and D′. Regression results involving alternative combinations of these dummies are shown in equations (2.5) – (2.7) of Table 2. We observe that coefficients of all the dummies are significant along with those of other explanatory variables.[11] However, values of DW statistic for these equations are low, except that for equation (2.7), which falls in the inconclusive range. For the equation (2.7), the first-order autocorrelation coefficient (ρ), based on the regression residuals, is estimated to be 0.1935. Using this estimate of ρ, the equation (2.7) is re-estimated after correcting for first-order autocorrelation and (2.8) gives this re-estimated equation. We observe that DW statistic has improved substantially and magnitudes as well as t-ratios of all coefficients have remained more or less

TABLE 3: DATA ON SELECTED MACRO VARIABLES OF THE INDIAN ECONOMY

Year	Index of Industrial Production (Base 1980-81 = 100)		Relative Price of Foodgrains (Base 1981-82 = 100)	Foodgrains Output* (Million Tonnes)	Government Final Expenditures at 1980-81 Prices (in Rs Crore)	
	Consumer goods C_m	General Y_m	P	X	Investment A_m	Consumption GC
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1960-61	63.2	36.2	94.5	72.0	5151	3573
1961-62	64.7	39.2	91.9	72.1	5102	3836
1962-63	64.2	42.9	92.7	70.3	5873	4629
1963-64	68.5	46.9	95.9	70.6	6611	5733
1964-65	72.9	51.0	114.1	78.2	7411	5939
1965-66	73.8	53.8	114.5	63.3	7798	6516
1966-67	73.4	54.1	120.8	65.0	6777	6572
1967-68	69.5	54.7	135.6	83.2	6237	6705
1968-69	76.0	58.5	119.2	82.3	6312	7073
1969-70	79.5	62.9	123.3	87.1	6179	7764
1970-71	80.1	65.4	113.8	94.9	6335	8492
1971-72	81.4	69.1	107.9	92.0	7006	9369
1972-73	84.5	71.8	111.8	84.9	8316	9402
1973-74	84.6	72.4	115.9	91.6	8137	9305
1974-75	88.3	74.7	132.2	87.4	6957	8875
1975-76	86.9	79.6	115.8	105.9	8201	9799
1976-77	89.5	87.3	99.4	97.3	10144	10576
1977-78	92.2	90.6	108.5	110.6	10806	10898
1978-79	99.7	97.5	109.7	115.4	10843	11706
1979-80	94.4	96.2	98.0	96.0	11142	12424
1980-81	100.0	100.0	96.0	113.4	11693	13084
1981-82	106.0	109.3	100.0	116.6	13152	13663
1982-83	103.4	112.8	105.5	113.3	15247	15075
1983-84	108.1	120.4	108.7	133.3	15551	15718
1984-85	114.0	130.7	99.7	127.4	16433	16983
1985-86	122.6	142.1	100.1	131.6	17080	18924
1986-87	127.2	155.1	100.2	125.5	19231	20849
1987-88	126.0	166.4	102.0	122.8	18660	22660
1988-89	127.5	180.9	106.7	148.7	19490	23877
1989-90	132.9	196.4	97.9	149.7	20042	25337

Note: * The value of X for 1959-60 is 67.5.
See Rao (1993) for the sources and method of computation of these data.

unchanged. One may, therefore, choose either equation (2.7) or equation (2.8).

IV
Conclusion

Our empirical results show that policy variables like government consumption and investment expenditures have played a crucial role in influencing the industrial production in India during the last three decades. These are all demand variables. Another factor is also found to have been important, viz, the growth of the agricultural output – perhaps a mixed variable representing both demand pressures and supply of wage goods. These are in fact the variables which are supposed to play vital roles in process of industrialisation in the various dual economy models.

An interesting observation of the study is that the elasticity of industrial output with respect to a given explanatory variable has varied across different periods. As the positive coefficients of the slope dummy DA_n in the two tables indicate, a one per cent increase in autonomous expenditure (A_n) is observed to induce a larger increase in both the aggregate industrial output and output of the industrial conmsumer goods in the 1980s than in the preceding period. Some plausible explanations may be advanced for such an increase in the value(s) of multiplier corresponding to autonomous expenditure in the 1980s. The marginal propensity to invest might have been higher in the 1980s; also the marginal propensity to consume the industrial good might have been larger in the 1980s, presumably owing to some shifts in the distribution of personal disposable income in this period towards groups having higher propensity to consume the industrial good. Another contributory factor seems to be the change in the pattern of expenditures and revenues of the government in the 1980s. While the tax rates are found to be more or less stable in the 1980s [Sen Gupta 1993; Kelkar et al 1991], transfer as a percentage of total expenditure and presumably as a proportion of GDP has increased [Rao and Tulsidhar 1991:19]. This might have increased the multiplier effect associated with a given increase in autonomous expenditure in the 1980s than in the past.

Notes

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1 The pioneering models in this group are Lewis (1954), Jorgenson (1961) and Fei-Ranis (1964). A survey of some of these models can be found in Dixit (1973).

2 Rakshit (1982) builds up formal macro models involving demand constrained industrial sector. A survey of all the different types of models can be found in Rao (1992).

3 See, for example, the studies by Ahluwalia (1985, 1991), Bagchi (1970), Chakravarty (1979), Lahiri et al (1984), Nagraj (1992), Rangarajan (1982). A critical analysis of the various studies on behaviour of industrial output can be found in Rao (1993).

4 For instance, foodgrains output has a weight of 68.1 per cent in the index numbers of India's agricultural production with the triennium ending 1969-70 = 100 as the base.

5 This may be interpreted as the value of outputs of non-agricultural goods at constant prices.

6 A rise in Y_n is expected to raise the income of the workers. Further, if the outputs are demand-constrained, producers produce less than their profit maximising levels of output and hence a rise in output will raise their profits also [Rakshit 1982:19].

7 A clear exposition of such effects of p on C_m is given in Rao (1992). See also Bose (1993).

8 The data are given in Table 3. The sources and the methods of construction of these series are discussed in Rao (1993).

9 Since pX and pX_{-1} appear as regressors, these equations may be called partial reduced form equations. Given that these equations contain an endogenous variable p and that we are using OLS, these particular estimates may suffer from simultaneous equation bias.

10 This may imply that coefficients in equations (2.3) and (2.4) are not very much affected by simultaneous equation bias.

11 We have also tried with a slope dummy for A_n for the period of the first half of the 1960s, but its coefficient has not turned out to be significant.

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