EVALUATING IN A DUAL ECONOMY FRAMEWORK THE INDIAN INDUSTRIAL PERFORMANCE DURING 1951-52 TO 1989-90

R. KAVITA RAO

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PREFACE

The completion of this dissertation has left me indebted to many. I would like to take this opportunity to express my gratitude for all the help I recieved.

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Economic Research Unit,
Indian Statistical Institute,
Calcutta.

R. Kavita Rao

Chapter 1

INTRODUCTION

1.1. Objective of the Study

The primary goal of economic development is to achieve high rates of growth of outputs and incomes so as to ensure high per capita income and levels of living in the economy. In India, this was sought to be achieved, to a large extent, through a rapid expansion and growth of the industrial sector, as is evident in the emphasis placed on the industrialisation programmes in her various Five Year Plans. However, the growth of this sector has exhibited considerable ups and downs over the years, belying expectations. Quite expectedly, this has evoked substantial debate on the factors influencing and/or constraining industrial growth in India. This debate has acquired added dimension against the background of the new economic policies of liberalization and privatization being advocated and pursued by the government recently. The fact that the issues raised in this debate have not yet been resolved makes further investigations in this area necessary and worthwhile. The present study is an attempt in this direction. In particular, the purpose of the present study is to analyse industrial growth in India over the last four decades and to explain econometrically the observed growth at a slightly disaggregate level.

Given the professed goals of development, the process of economic development and constraints to such a process have been the subject of intensive study for a long time. While the availability of investible resources has consistently been viewed as a constraint to the expansion of capacity and output, the lack of profitable venues to invest in a developing economy has come to be recognized as another constraining factor. The Nurksian theory of "low level

equilibrium trap" suggested that in such economies the endogenous markets and other economic conditions fail to generate sufficient investible resources and/or to provide profitable investment opportunities. This brought into the picture the big-push theories and the idea of balanced and unbalanced growth. All these theories called for a step up in investment in the economy, such a step up not necessarily being motivated by the existing market conditions. These theories thus assigned a prominent role to be played by the public sector in the growth of such economies.

Further progress in development economics came with the recognition that underdeveloped economies are generally characterised by certain structural rigidites like the existence of imperfections in market conditions, prevalence of traditional production methods, low levels of productivity etc. Such a recognition got crystallised into the notion of a "dual economy", i.e., an economy consisting of two distinct sectors or sub-economies, so to say - a modern sector and a traditional sector - which differ from each other in the forms of organisation of prodution, the levels of technology used, the extent of orientation towards the market, etc.[1]. The term 'dual economy', coined by Sir Arthur Lewis, was used to describe an economy in transition from a traditional or backward state to a modern or an advanced state. A number of models have emerged which sought to capture a wide variety of such rigidities in a dual economy set-up. The traditional sector in such economies is usually identified as agriculture while industry is referred to as the modern sector. Economic development, therefore, gets identified as a process of transformation of a predominantly agrarian economy into an industrial or modern economy. Clearly, rapid growth of the industrial sector is

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[1]Lewis(1954) drew attention to some of these features of a dual economy. In a discussion of the literature on dual economy models, Dixit (1973, pp. 305-326) highlights some of these features of a dual economy.

of prime concern in such models, and these models, therefore, seek to identify the various constraints to industrial growth.

1.2. Plan of the Study

Given the objectives and the variety of the models mentioned above, the dual economy framework appears to be an appropriate framework for analysing the issues to be discussed in the present study. We, therefore, begin our study with a comparative analysis of the existing dual economy models in *Chapter 2*. These models are classified into two broad groups - the supply or resource constrained models and the demand constrained models. This chapter presents the existing dual economy models in terms of a *general system* containing a larger number of variables than equations and derives the different models by specifying alternative sets of equations to close the system. Such a presentation facilitates comparison of results across models in terms of the differences in the model specific assumptions.

Given the variety of these models in the literature, some questions naturally arise : do these models just represent plausible types of economies or can they be understood to characterise different stages in the development of an economy ? Further, is it possible to provide exogenous stimuli to hasten the process of development of a dual economy ? These are the questions that we seek to explore in *Chapter 3*. In order to discuss these issues we consider a modified set-up which allows for the existence of an economically active government and/or the possibility of foreign trade and the inflow of foreign resources. Given the nature of constraints identified in chapter 2, there emerge a number of possible alternatives to stimulate development, some of which involve methods of stepping up the rate of growth of agriculture and some consider means of increasing the rates of growth of output and capacity creation in industry. In this chapter, we seek to identify

the probable features of the growth paths based on these various alternative stimuli to development. In the process we also examine how a supply constrained industry could get transformed into a demand constrained one, implying that the stimulus to growth tends to become exogenous to the economy.

Using this discussion as a backdrop, we turn to the particular case of the Indian industry in *Chapter 4*. The Indian industrial sector has experienced many ups and downs in growth - mid-sixties saw the beginning of a phase of decelerated growth while the eighties are supposed to have witnessed a revival. Both these phenomena have evoked considerable debate regarding the factors responsible for such changes in behaviour. We, therefore, begin our investigation of the growth of the industrial sector in *Chapter 4*, by attempting to identify the timing and features of these two phenomena not only at the aggregate level but at the level of broad groups of industries as well. With these observations in the background, the existing literature on the Indian industry is sought to be reviewed next. Here, in addition to the debates on the factors explaining the deceleration and revival of industrial growth, we attempt a critical appraisal of the various qualitative and econometric studies on the intertemporal behaviour of outputs of the Indian industry.

Our discussion in Chapter 3, by focussing on the distinction between supply and demand constrained economies, brings to the fore the question of the nature of constraints faced by the Indian industry. Is the Indian industry demand determined or supply constrained ? Part of the current debate too concerns itself with this question. In *Chapter 5*, therefore, we try to infer about the nature of these constraints by looking into the time trends of various indicators and related variables. For instance, trends in capacity utilization ratios in the different industry groups are used for assessing the possibility of demand being the constraining factor. On the supply side, trends in a variety of indicators are

examined, taking into account the various supply side factors put forth so far to explain the industrial stagnation and revival in the Indian context. The results obtained here seem to support the view that it is the demand variables which have constituted long term bottlenecks to the industrial growth in India.

Chapter 6 takes up from the results of the earlier chapters and seeks to explain empirically the intertemporal behaviour of industrial outputs in terms of demand side variables. For this purpose, the industrial sector is subdivided as per the use-based classification into three broad groups of industries, viz., consumer goods, intermediate goods and basic and capital goods industries. A small model is first constructed to depict the broad structure of interrelations among the various economic variables and then the reduced form relations of the model are derived which explain output of each industrial group in terms of exogenous and/or pre-determined variables. These reduced form relations have been estimated on the basis of the data from 1951-52 through 1989-90. From the results of the empirical exercise one finds that at a broad level, the demand side factors provide a fairly satisfactory explanation for the variations in outputs of various groups of Indian industries.

Finally, *Chapter 7* summarises the major findings of the study. An attempt is also made in this chapter to derive some implications of the recent changes in policy regime being advocated and implemented by the government. Specifically, in a very broad way we seek to assess, in the light of the results of our study, the possible impact, on the economy, of the recent shift towards more liberal economic policies with respect to both internal and external sectors.

Chapter 2

DUAL ECONOMY MODELS AND CONSTRAINTS TO GROWTH

2.1. Introduction*

The term 'dual economy' is used to describe an economy characterised by the coexistence of two distinctly different subeconomies - different in the levels of technology as well as in the forms of organisation of production, interacting with each other through the market in such a way that their distinguishing characteristics remain unaltered. The modern sector is usually identified as the industrial sector while the agricultural sector is referred to as the backward sector. This term, first coined by Sir Arthur Lewis (1952), is used to describe an economy in transition from a set-up of a predominently agrarian nature to one characterised by a dominant industrial sector. A wide class of models has emerged in the literature which address themselves to characterising the behaviour and development of such economies (Jorgenson, 1961; Fei and Ranis, 1964, 1967; Dixit, 1969; Zarembka, 1970; Marino, 1975; Amano, 1980; Rakshit, 1982; Taylor, 1982; Bose, 1989; etc.). All these models focus on identifying the possible constraints to industrial growth in such economies. In this chapter, we propose to use the dual economy framework to isolate constraints to industrial growth.

The literature on dual economy models can be broadly classified into two groups: the classical and neoclassical models based on the assumption of full utilization of resources, and the demand constrained models which assume underutilization of resources. While the former set of models investigate the possibility of attaining a stable long run growth path, the latter also deal with constraints to growth in the short run. It is evident from the way

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* The results of this chapter have been published as a paper titled 'A Unifying framework for Dual Economy Models', in *The Journal of Quantitative Economics*, Vol.8, No. 2, 1992, pp. 247-64.

the models have been classified that they differ in the identification of the constraining factor(s). These differences can be illustrated well if all the models could be viewed in terms of a generalised framework, with the different models appearing as different closures to the common general system.

The method of analysis we shall adopt, therefore, is as follows : a general system for a dual economy is specified, which admits larger number of variables than equations. Each different way of closing this system is then shown to yield a different model. Such a method of analysis facilitates comparison of results across models. This scheme of analysis owes its origin to Sen (1962) who sought to compare neoclassical and neo-Keynesian theories of distribution. Bell (1978) carried out a similar exercise in the context of a single-good, dual economy. Our interest extends further in that we consider a typical dual economy set-up which allows for the production of two heterogeneous commodities and hence has to incorporate a relative price variable. Relative price being an extremely crucial variable in influencing both private decision making as well as policy considerations, we feel such an extension is an essential step for our analysis.

In what follows, we present slightly generalised versions of the various dual economy models we intend to compare. The short run behaviour of these models would be studied via comparative static exercises. Any difference in results obtained by us when compared with those of the original models are sought to be explained in terms of the specific features of the original models which have been left out in the process of generalising the model. Section 2.2 develops the basic structure of the framework used. Section 2.3 presents the closures corresponding to the individual models along with the results of various comparative static exercises. In addition, the specificities of the original models are also discussed in this section. Section 2.4 rounds up with a discussion on the factors

constraining industrial growth as brought out by these various models.

2.2. The General Framework

Consider an economy comprising of an agricultural sector and an industrial sector, each producing a different good. The structure of the economy is captured in terms of a number of equations, presented in Table 2.1 below. There are four categories of income earners : the agricultural labourers (s), landlords (r), industrial workers (w) and the industrial capitalists (c). It is assumed that each category consumes both the goods and further that the workers spend all their incomes for consumption purposes, while savings in the economy originate only from incomes of landlords and capitalists. The equilibrium condition for the agricultural market (eq. 2) involves the demand for the marketed surplus of the agricultural good where the latter is defined as the agricultural output remaining after fulfilment of consumption demand of the landlords and the agricultural workers; the agricultural output is assumed to be a function of the level of employment (L_1) and the level of technology used (θ) in agriculture(eq. 1). Here, in addition to the demand from the capitalists and industrial workers, we have a demand for inventory accumulation of the agricultural good (I_a), presumably by landlord-cum-traders, which is assumed to be inversely related to p, the relative price of the agricultural good in terms of the industrial good, á lá Rakshit (1982, p. 146-47). Eq. (3) gives the production function for the industrial good, the level of output (X_2) being a function of the level of employment (L_2) and the level of capital stock (K_2) in this sector. Eq. (4) gives the market clearing condition for the industrial sector where the right-hand side describes the demand for this good by the various categories of consumers as well as investors. Eq. (5) stipulates that the wage rate is equalised across sectors.

Table 2.1 : Equations and Notations

Equations

(1) Marketable surplus of agricultural good :

$$X_1 = Q_1(L_1, \theta) - F_s(p, aL_1) - F_r(p, R)$$

$$= X_1(p, L_1, a, \theta) \; ; \; \frac{\partial Q_1}{\partial L_1} > 0, \; \frac{\partial Q_1}{\partial \theta} > 0, \; \frac{\partial}{\partial \theta} \cdot \frac{\partial Q_1}{\partial L_1} \gtreqless 0.$$

(2) Market clearing of agricultural good :

$$X_1 = F_w(p, mL_2) + F_c\{p, \pi(L_2, K_2)\} + I_a(p).$$

(3) Industrial production function :

$$X_2 = X_2(L_2, K_2); \quad \text{(with usual signs of partial derivatives).}$$

(4) Market clearing for industrial sector :

$$X_2 = M_s(p, aL_1) + M_w(p, mL_2) + M_r\{p, R(L_1, a, \theta)\} + M_c\{p, \pi(L_2, K_2)\} + I$$

(5) Wage rate equalization : $m = a.p.$

Endogenous Variables : X_1, X_2, L_1, L_2, m, a, p. I.

Notations :

Sector 1 : agriculture ; Sector 2 : industry

Q_1 = agricultural output; X_2 = industrial output.

X_1 = marketed surplus of the agricultural good.

L_i = level of employment in sector i (i=1,2).

a, m = product wage rate in sectors 1 and 2, respectively.

θ = indicator of level of technology in sector 1.

R = Rent, i.e., landlord's income, in units of good 1

$= Q_1(L_1, \theta) - aL_1 = R(L_1, a, \theta).$

π = Industrial profits in units of good 2

$= X_2 - mL = \pi(L_2, K_2, m).$

K_2 = capital stock in sector 2 (assumed given in the short run)

I_a = inventory accumulation of the agricultural good.

I = investment demand for good 2.

F_j, M_j = Consumption demand for goods 1 and 2 respectively by the jth group of consumers, (j=s, w, r, c).

p = relative price of good 1 defined in units of good 2.

Before going into the details of the individual closures, let us try to characterise the demand functions of the workers. This is taken up in the following discussion.

Price Elasticities of Workers' Demand for Agricultural and Industrial Goods

An interesting feature of the workers' demand for a good is that its responsiveness to changes in prices is expected to depend on whether the wage rate is fixed in terms of the agricultural good or the industrial good. This is illustrated below.

Let us consider a given group of workers, say, industrial workers. Their budget constraint is given by

$$(a) \qquad p.F_w + M_w = m.L_2$$

where F_w is their demand for the agricultural good and M_w, that for the industrial good. Incomes of the workers can be fixed in units of either the agricultural good or the industrial good. In either case, an increase in p, i.e., a shift in the relative price in favour of the agricultural good, will generate a substitution effect in favour of the industrial good and away from the agricultural good. The income effect, however, will be different in the two cases. We will now consider these two cases separately.

Case A : Real wage rate fixed in units of the industrial good (i.e., $m = \bar{m}$).

In this case, the budget equation of the industrial workers becomes :

$$(b) \qquad p.F_w + M_w = \bar{m}L_2$$

Consider Figure 1 where BD_1 is the budget line and the initial equilibrium is at E_1. Now, an increase in p shifts the budget line inwards to, say, BD_2 with new equilibrium at E_2, i.e., it generates an income effect which discourages consumption of both goods. Hence,

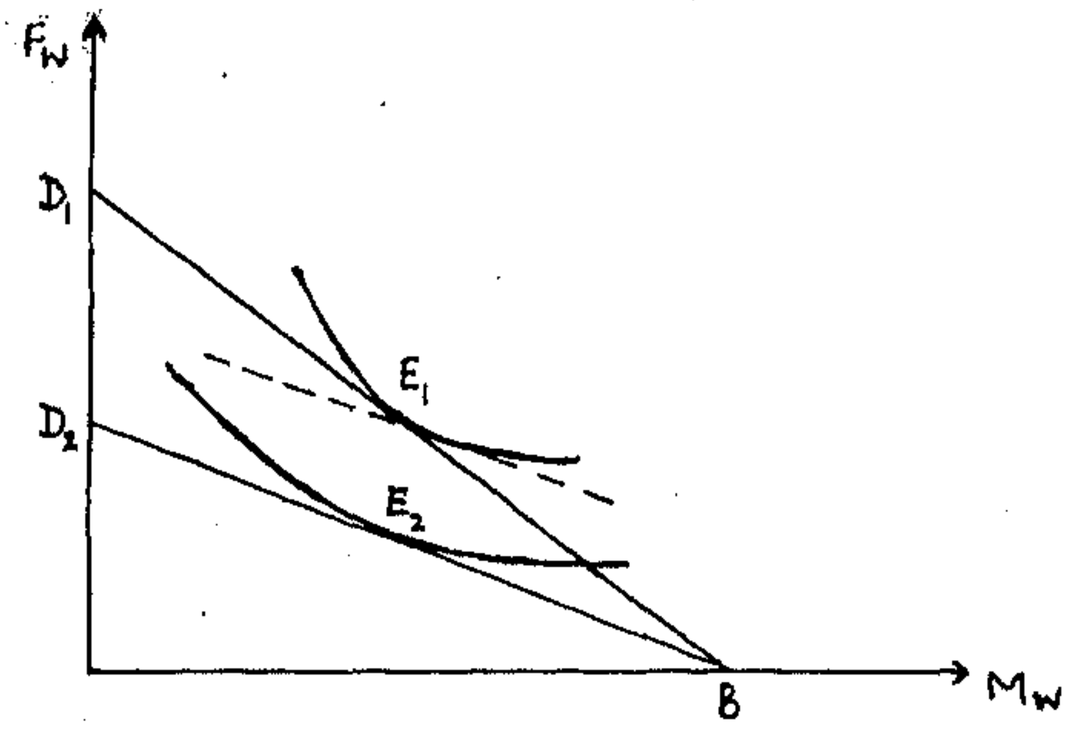

Figure 1

putting income effect and substitution effect together yields a decline in the demand for the agricultural good. To consider the effect on the industrial good, we differentiate the budget equation with respect p so as to get :

$$F_w + p.\frac{\partial F_w}{\partial p} + \frac{\partial M_w}{\partial p} = 0$$

or, multiplying both sides by $(p/\bar{m}L_2)$, the above may written as

$$\frac{p F_w}{\bar{m} L_2} + \frac{p F_w}{\bar{m} L_2} \cdot \frac{p}{F_w} \cdot \frac{\partial F_w}{\partial p} + \frac{\partial M_w}{\partial p} \cdot \frac{p}{M_w} \cdot \frac{M_w}{\bar{m} L_2} = 0.$$

Expressing the relation in terms of elasticities one finally gets :

$$\text{(c)} \qquad \lambda \, . \, (1 + \varepsilon_F) + (1 - \lambda) \, . \, \varepsilon_M = 0$$

where ε_F and ε_M are the price elasticities of demand for the agricultural good and industrial good, respectively and λ is the share of the expenditure on food in labourers' total income (i.e., $\lambda = p.F_w/mL_2$)), while $(1 - \lambda)$ is the share of that on the industrial good. Obviously, given $\varepsilon_F < 0$,

$$\text{(d)} \qquad \varepsilon_M \gtreqless 0, \quad \text{if any only if} \quad \varepsilon_F \lesseqgtr -1.$$

Case B : Real wage rate fixed in units of the agricultural good (i.e., m/p is fixed at, say, $\bar{y}$)

The budget equation of industrial workers is now given by

(e) $\quad F_w + (M_w/p) = \bar{y}.L_2$

Consider Figure 2 where DB_1 is the initial budget line and initial equilibrium is at E_1. An increase in p shifts the budget line outwards to say DB_2, generating an income effect which encourages consumption of both the goods. Putting income and substitution

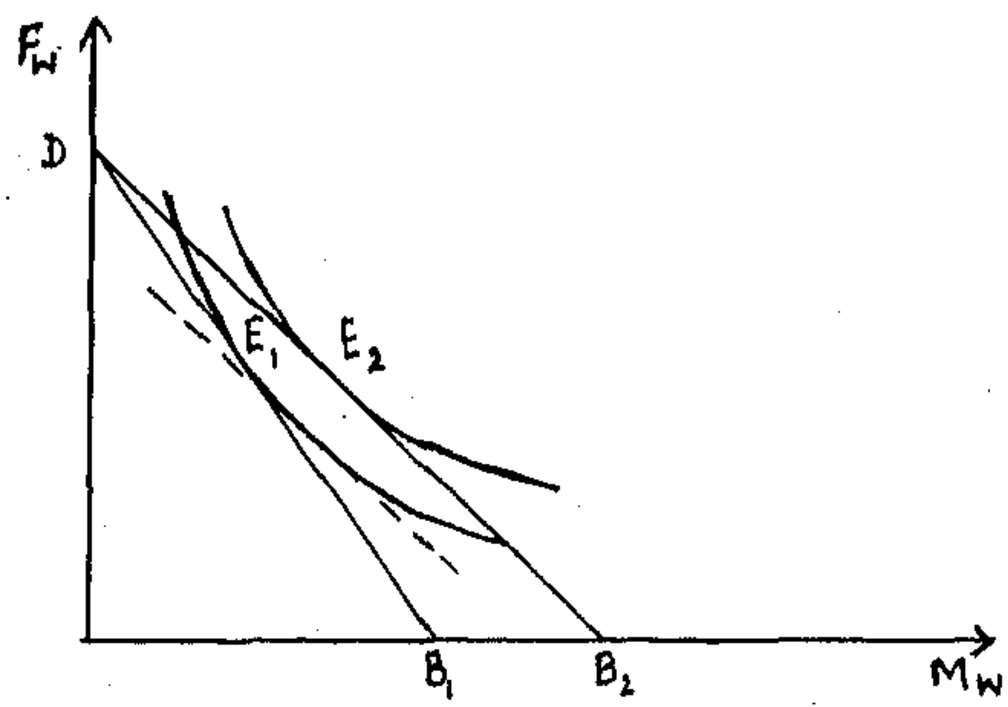

Figure 2

effects together yields an increase in the demand for the industrial good. To consider the effect on the agricultural good, we differentiate the budget equation with respect to p, and express the relation in terms of elasticities to get[1]

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[1]The relation is obtained from the budget equation in the following way:

$$0 = \frac{\partial F_w}{\partial p} + \frac{1}{p}.\frac{\partial M_w}{\partial p} - \frac{M_w}{p^2} = \frac{\partial F_w}{\partial p}.\frac{p}{F_w} + \frac{p}{F_w}.\frac{M_w}{p^2}.\left(\frac{\partial M_w}{\partial p}\frac{p}{M_w} - 1\right)$$

$$= \varepsilon_F + \{(M_w/p)/F_w\}.(\varepsilon_M - 1)$$

$$= \varepsilon_F + \{(1 - \lambda)/\lambda\}\ (\varepsilon_M - 1)\ .$$

(f) $\lambda.\varepsilon_F + (1 - \lambda) . (\varepsilon_M - 1) = 0.$

Thus,

(g) $\varepsilon_M \gtreqless 1$, if and only if, $\varepsilon_F \lesseqgtr 0.$

A similar exercise can be carried out for the agricultural workers, and the results there will be the same. We thus get the following result for any group of labourers :

Proposition 1

For any group of labourers, given the usual assumption that $-1 < \varepsilon_F < 0$, ε_M is *negative* in Case A, but is *positive* (and in fact greater than unity) in Case B.

2.3. Closing Rules and the Individual Models

The unifying framework of our dual economy as set out in Table 1 consists of five equations in eight endogenous variables, viz., X_1, X_2, L_1, L_2, p, a, m, I. (Note that K_2, $\bar{L}$, and α are all taken to be exogenous variables). Therefore, we need three more relations in order to complete the model. Depending on how these equations are specified, the different models emerge. We begin our discussion with the neoclassical model which is followed by the Lewis-Ranis-Fei model (henceforth to be referred to as the LRF model). We then consider two different versions of demand constrained models, namely those by Rakshit (1982) and Bose (1989). In each case, the entire system of equations is reduced to only two relations involving two variables - the relative price of the agricultural good (p) and the level of industrial employment (L_2). The analysis and the results of the comparative statics exercises are presented in terms of these two variables. The stability of equilibrium in such models can be verified. Th technique used in such cases is discussed in Appendix A.

2.3.1. Neoclassical Model

The initial version of a neoclassical dual economy model is due to Jorgenson (1961). The model considers an agricultural sector based predominantly on peasant cultivation. This is reflected in the assumption that the average income per peasant, i.e., the wage rate in agriculture, equals the average product of labour there. The product wage rate in industry, on the other hand, equals the marginal product of labour, as the producers in industry are postulated to be profit maximisers. An additional assumption made is that of full employment in the economy. Industrial workers are assumed to demand a fixed quantity of the agricultural good, and to spend the remaining income on the industrial good. Thus, savings in this economy are only out of profits in industrial sector. For such an economy, one can observe a positive relation between the rate of growth of output in agriculture (more appropriately, the rate of technical progress in agriculture) and the rate of growth of output as well as employment in the manufacturing sector. In other words, the performance of the agricultural sector could serve as a crucial constraint to the expansion of output of the manufacturing sector.

This model has been followed by a series of other neoclassical models, each of which focuses on generalising some of the specific features and/or relaxing some of the assumptions of the initial model. Zarembka (1970) generalises the demand function for the agricultural good by introducing non-zero price and income elasticities of demand. Marino (1975), on the other hand, generalises the production functions used. The Cobb-Douglas production functions used by Jorgenson and Zarembka are replaced by generalised production functions satisfying the standard neoclassical assumptions. Both these generalisations preserve the basic results of the model with the agricultural performance being found to have a positive impact on the industrial sector.

In all these models agricultural growth is attributed to, or modelled to be determined, by the exogenous factors. Amano (1980) explicitly introduces capital accumulation in agriculture in order to endogenise agricultural growth. Agriculture is assumed to be organised in the form of tenancy arrangements. The landlord is assumed to sell all his surplus output to the industrial sector and invest his savings - a fixed proportion of rental income - in the agricultural sector. The savings out of profit income, on the other hand, are assumed to be solely invested in the manufacturing sector. This model too confirms the same kind of results - i.e., the rate of growth of the agricultural output, and more particularly, the rate of growth of marketable surplus of the agricultural good emerges as a crucial factor in determining the rate of growth of the industrial output.

All the different versions of the neoclassical model could be accommodated in a single framework by specifying a closure of the following form to the general dual economy framework as spelt out in Table 2.1 :

$$(6N) \qquad a = \alpha . \frac{Q_1 (L_1, \theta)}{L_1} , \qquad 0 < \alpha \leq 1$$

$$(7N) \qquad m = \frac{\partial X_2}{\partial L_2}$$

$$(8N) \qquad L_1 + L_2 = \bar{L} \qquad (\bar{L} \text{ being the total labour available}).$$

(7N) follows from the assumption of profit maximization in industry. The traditional sector, on the other hand, may either be characterised by peasant agriculture or alternatively, there may exist both landlords and agricultural labourers, the distribution of output between the two groups being governed by some given law. In equation (7N), $\alpha = 1$ refers to the former case while a fractional

value of α would imply the prevalence of the latter system[2].

Substituting eqs. (6N) - (8N), (1) and (3) into eq. (2) gives us the agricultural market clearing equation in terms of L_2 and p (eq. (i) below, where substitutions for a, m, etc. are to be made). Similarly, substituting (6N) - (8N) into eq. (5) yields yet another relation, i.e., the relation (ii) below :

$$\text{(i)} \quad X_1(p, L_1, a, \theta) = F_w(p, mL_2) + F_c(p, \pi) + I_a(p)$$

$$\text{(ii)} \quad p.\alpha .Q_1(L_1, \theta)/L_1 = \partial X_2/\partial L_2$$

Consider (i) first. An increase in L_2 (and hence a fall in L_1) raises[3] the demand for the agricultural good and at the same time reduces[4] its marketed surplus. Thus an excess demand situation is created. Given the usual assumption that the excess demand for agricultural good is inversely related to its relative price, clearing the agricultural market requires p to rise. Thus the relation (i), when plotted on the (L_2, p) plane, yields an upward rising curve AA (Figure 3). The relation (ii), on the other hand, gives rise to a downward slopping curve, WW : a rise in L_2 reduces the marginal product of labour in industry (i.e., RHS declines) but alongside, a fall in L_1 raises the average product of labour in

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[2]Jorgenson (1961), Zarembka (1970) and Marino (1975) assume the case of peasant agriculture (α = 1) while Amano considers the second case (α < 1). It may be noted that this latter specification can accomodate even the case of share tenancy, if the tenants are clubbed with the group of agricultural labourers.

[3]Jorgenson (1961) and Marino (1975) assume the price and income elasticities of demand for the agricultural good to be zero, while Zarembka (1970) and Amano (1980) introduce non-zero elasticities of demand.

[4]A fall in L_1 reduces X_1 while a rise in L_2 raises capitalists' profit as well as labourers' income (mL_2) ; the latter follows, if the marginal product of labour is assumed to be inelastic with respect to the industrial employment.

agriculture (i.e., LHS increases) and hence p has to fall for (ii) to hold.

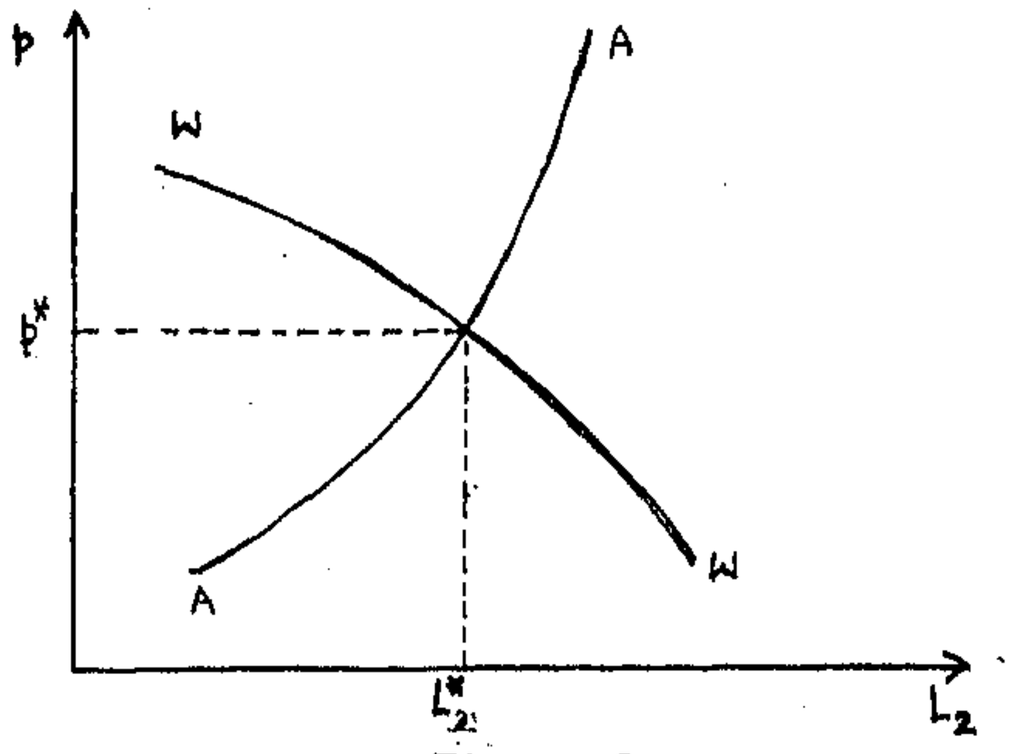

Figure 3

Here, the intersection of WW and AA yields the equilibrium values of L_2 and p; once these are determined, the equilibrium values of the other variables may be easily obtained.

Comparative Statics

(a) *An Increase in α*

An increase in the share of labour in agricultural output, α, has to be matched by a fall in p, in order that industrial profits be maximised at an unchanged L_2 (i.e., for (ii) to hold good). Thus, the WW curve shifts downwards. On the other hand, in (i), an increase in α is most likely to reduce the marketable surplus, since this implies a redistribution of income in favour of the workers, and it may be reasonably assumed that, compared to landlords, workers have a higher marginal propensity to consume the agricultural good. Hence p has to rise, in order to clear the market at the same L_2, i.e., AA curve shifts upwards. Thus, as a result of an increase in α, L_2 declines, while the effect on p cannot be read off the diagram.

(b) *An increase in θ*

Consider advances in the level of technology used in

agriculture. This will be represented by an increase in the value of the parameter θ in the production function of the agricultural sector. Effectively, this means a higher level of agricultural output corresponding to any given level of L_1. Now, given the levels of employment in the two sectors, this would imply an increase in Q_1 and hence in a. For industrial profits to be maximised at a given level of L_2, therefore, p has to fall, i.e., WW shifts downwards. On the other hand, marketable surplus (X_1) rises and hence p has to fall to clear the market at the same L_2, i.e., AA shifts to the right. Thus, at the new equilibrium, we have a lower p, the effect on L_2 being ambiguous.

(c) An increase in K_2

Consider capital accumulation in industry. This would imply an increase in the marginal product of labour, given the levels of p and L_2; hence p would have to rise for (ii) to be fulfilled, i.e., WW shifts to the right. On the other hand, the demand for foodgrains increases, supply remaining unchanged. This implies, once again, an increase in p corresponding to any given L_2, i.e., the AA curve shifts to the left. The new equilibrium would thus have a higher p, the effect on L_2 being ambiguous.

The neoclassical model represents the most generalised version of a dual economy, since here almost all the variables are allowed to adjust in case the economy is subjected to an exogenous shock. However, in general, it is accepted that a dual economy is usually characterised by a variety of structural rigidities and that no meaningful result can be obtained if the existence of such rigidities are ignored completely. Attempts have, therefore, been made to develop alternative models to accommodate some or all of these rigidities. Depending on the way the structural rididities are specified, we get the different models emerging from here. Alongside, one can even argue that the different models characterise, at least partly, the different stages of development of a dual

economy. Let us then begin our analysis with the model of Lewis (1954), the pioneering model in this field. We take for analysis the Ranis - Fei type of formalization of this model.

2.3.2. Lewis-Ranis-Fei Model (LRF model)

This model, in seeking to capture a dual economy in transition, identifies three phases in the development of the economy. We will discuss each of the three phases below.

LRF Model : Phase I

This phase characterises the dual economy in its earliest stage of development. The agricultural sector here has surplus labour, so that any increase in labour employed (or reduction therein) fails to raise (or reduce) the output. Wages in this sector are fixed in terms of the agricultural good. In this phase the main problem is seen as one of underemployment in the agricultural sector, and hence the model explores the possibility of absorbing this surplus labour into the industrial sector.

The other feature of this phase is that wages in industry too are fixed in units of the agricultural good. Clearly, from the wage equalization relation, this implies that p is indeterminate. As Rakshit (1982, pp. 117,141) puts it, this leaves p to be hanging in the air since the demand functions and the market clearing conditions in agriculture are suppressed[5]. Hence, here p is assumed to be determined from outside the system, say, at $p = \bar{p}$; which then replaces (2).

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[5]Lewis model contains a couple of assumptions which help to specify the condition of equilibrium for the agricultural good : (a) landowners and capitalists have zero marginal propensity to consume food, (b) workers in both agriculture and industry have a fixed demand for the agricultural good. However, the model does not outline any economic mechanism through which such an equilibrium is attained.

With surplus labour, agricultural output does not vary with the level of employment in this sector. Hence, output (Q_1) appearing in eq. (i) may be assumed to be fixed at say $\bar{Q}_1$. In addition to the stipulation that $p = \bar{p}$, the closing rules in this model can, therefore, be specified as follows :

$$(6L1) \quad a = \bar{a}$$

$$(7L1) \quad m = \partial X_2/\partial L_2$$

$$(8L1) \quad L_1 + L_2 = \bar{L}$$

Substituting (6L) - (8L) into (5) and assuming p to be flexible, once again one gets an inverse relation between L_2 and p - something like the WW curve in Figure 3 above. The exogenously given value of p (i.e., $p = \bar{p}$, which replaces (eq. 2) here) determines the level of L_2 from the WW curve.

Comparative Statics

(a) An increase[6] *in* $\bar{a}$

This shifts the WW curve downwards and given $\bar{p}$ we now have a lower L_2.

(b) An increase in θ

Advances in the level of technology used in agriculture, are likely to yield a higher level of marketable surplus of good 1, and hence disturb the existing equilibrium in the system. However, the assumption of the constancy of both 'p' and 'a' impedes any process of adjustment to a new equilibrium and hence needs to be modified. As is fairly obvious, in such a case, one would expect p to fall.

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[6]That the real wage rate in agriculture is fixed in this model is quite consistent with the phenomenon of surplus labour in agriculture and could very well be interpreted as the subsistence wage rate. An increase in $\bar{a}$, thus, could be looked upon as a policy-induced change, e.g., through the minimum wage laws. Given the existence of rents in the model, such a redistribution of income is feasible.

However, such a change must imply the existence of a market clearing relation for the agricultural good. This really takes us to the second phase of the LRF model, where such a market clearing relation is argued to have emerged. A discussion of the effects of the technological progress in agriculture, therefore, is postphoned to the next subsection.

(c) An increase in K_2

As shown in the neoclassical model, a rise in K_2 would increase the marginal product of labour in industry, i.e., an upward shift of the WW curve. Given the level of p, clearly, this would imply a higher L_2.

An *economy* which conforms to the above description is expected to experience a growth of its industrial sector, as long as there exists surplus labour in the agricultural sector and the savings of the capitalists are sufficient to ensure positive net investment which is essential for sustaining the process of absorption of this labour in the industrial sector. In this phase of development of the economy constraints to the growth of the industrial sector are perceived to be mainly in the form of feasible rates of growth of capital stock and of the level of savings in the capitalist sector. This phase would last as long as the marginal product of labour in the agricultural sector remains zero or insignificant. When the marginal product of labour in the subsistence sector gets pulled up through migration, technological improvements etc., the functioning of the economy also undergoes a change. This stage of development of a dual economy is described by the second phase of the LRF model.

LRF Model : Phase II

Any withdrawal of labour from the agricultural sector functioning with a positive marginal product for labour would imply a decline in the absolute level of output, implying a possible decline

in the quantity of the agricultural good available to industrial workers, on an average. In such an economy it would be difficult to justify an assumption of the relative price being fixed exogenously and remaining constant. Instead, it may be reasonable to suppose that the economy transforms into one where the relative price varies in order to clear the market for the agricultural good. So we drop the assumption of $p = \bar{p}$ and reinstate eq. (2). In terms of the diagram, this implies superimposing the corresponding curve (denoted by AA in figure 3) on the WW curve of Figure 3. The intersection of these two curves yields the equilibrium levels of L_2 and p.

Comparative Statics

(a) An increase in $\bar{a}$

This has to be matched by a fall in p for profits to be maximised at the same L_2, i.e., WW curve shifts downwards. On the other hand, this change redistributes income in favour of the workers and given their higher propensity to consume food compared to that of landlords, the marketable surplus declines. Hence, p has to rise in order to clear the market at the same L_2, i.e., AA curve shifts upwards. At the new equilibrium we have, once again, a lower L_2. The effect on p, however, is ambiguous.

(b) An increase in θ

As long as technological progress in agriculture leaves $\bar{a}$ unaffected, WW curve does not shift. However, an increase in Q_1 raises X_1[7], and hence AA curve shifts to the right, yielding a new equilibrium at a higher L_2 and a lower p.

(c) An increase in K_2

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[7]Since the marginal propensity to consume the agricultural good of the landlords is less than one, technological advances in agriculture - wherein the entire increase in agricultural output accrues to the landlords - would result in a higher level of marketable surplus.

Once again, as in the neoclassical model, the AA curve shifts to the left, suggesting a higher p at the new equilibrium, the impact on L_2 being ambiguous.

In this phase of development of the economy, agricultural sector does prove to be a major hurdle to the growth of the industrial sector. Raising productivity in the agricultural sector either through technological improvements or through capital accumulation clearly provides a stimulus to the industrial growth (provided, of course, the agricultural wage rate remains unchanged inspite of growth in productivity).

LRF Model : Phase III

In the second phase, the economy is characterised by wages in the agricultural sector being fixed in terms of foodgrains. However, further outmigration from this sector would ultimately lead to the emergence of a situation where the wage rate in agriculture is equated to the marginal product of labour in this sector as well. This is the third phase of development of the dual economy as visualised in the LRF model. The closures for this model are as follows :

$$(6L3) \quad a = \partial Q_1 / \partial L_1$$
$$(7L3) \quad m = \partial X_2 / \partial L_2$$
$$(8L3) \quad L_1 + L_2 = \bar{L} .$$

Substituting eqs. (6L3)-(8L3) into eq. (5) we get the wage equalization relation, which when plotted on the L_2-p plane yields the WW curve as in Figure 3. An increase in p here would require a decline in L_2 for the equality to hold, i.e., the WW curve will be downward sloping. On the other hand, substituting these relations along with eqs. (1) and (3) into eq. (2), we get the AA curve in this case. An increase in L_2 would lead to an increase in demand for the agricultural good while the supply, i.e., the marketable surplus,

declines. For this market to clear, p would have to increase implying an upward sloping AA curve (as in the earlier figure), the intersection of these two curves defining equilibrium.

Comparative Statics

(a) An increase in θ

Technological progress in agriculture, in this phase, can have two kinds of effects depending on the nature of technical advance, i.e, depending on how it affects the marginal product of labour in agriculture ($\partial Q_1/\partial L_1$) *at a given level of* L_1. There are two possible cases : (i) a situation where advances in technology leave the marginal product unchanged, and (ii) a situation where the marginal product of labour rises as well, implying an increase in the agricultural wage rate. The outcome in each case is discussed below.

Case (i) : In this case, the WW curve remains unaffected while the AA curve shifts downwards, as an increase in the rental income by increasing the supply of foodgrains, would call for a decline in p for this market to clear. At the new equilibrium, therefore, we have a lower p and a higher L_2.

Case (ii) : In addition to the effect mentioned above, in this case, the WW curve too shifts downwards since with an increase in the wage rate in agriculture, p has to register a decline for the wage equalization relation to hold at the same L_2. At the new equilibrium, therefore, we have a lower p, the effect on L_2 being ambiguous. However, if the nature of the technological progress is such as to increase the marginal product only marginally and the fruits of such advance accrue mainly to landlords, the (horizontal) shift of the WW curve would be smaller than that of the AA curve so that L_2 would rise.

(b) An increase in K_2

Capital accumulation in industry in this phase would lead to an increase in the product wage rate in industry. For the wage rates in both sectors to be equated at the same L_2, p has to rise, i.e.,

the WW curve shifts to the right. On the other hand, the demand for foodgrains increases, requiring an increase in p to clear the market. Thus the AA curve too shifts upward. At the new equilibrium, we have a higher p, once again the effect on L_2 being ambiguous.

The LRF model focuses its attention on the question of development of the dual economy where the capacity in the industrial sector constitutes a major bottleneck. Here it should be pointed out that given the existence of two kinds of constraints to the growth of the industrial sector in these economies, relaxation of any one of them does not obviously lead to an increase in the level of economic activity. The ambiguity in the results obtained may be attributed to this phenomenon. The same holds in the case of the neoclassical model as well.

One major limitation of both the neoclassical model and the LRF model is that these do not conceive of any problem of effective demand. However, as capital accumulation takes place, the capacity in the industrial sector can outgrow the size of domestic demand. And once this stage is reached, the industrial sector in the economy could face effective demand problems. This consideration then brings us to the demand constrained dual economy models. The concern now shifts to examining the possibilities of unemployment within the industrial sector itself. However, since the agricultural good still commands a predominant proportion of expenditure out of wage income, it would be sensible to continue to specify the industrial wage rate in terms of the agricultural good. A model which characterises this stage of development of a dual economy is the demand constrained model[8] of Rakshit (1982).

2.3.3. Rakshit's Model

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[8]Rakshit (1982, ch. 7) also considers an opposite version of this model which he calls a supply constrained equilibrium. This is similar to phase II of the LRF model discussed earlier.

This model uses a different notion of surplus labour as compared to all the models discussed earlier. The functioning of the model in the short run is such that there is no possibility of migration of labour across sectors. The quantum of marketable surplus of agricultural good is assumed to be determined exogenously. In terms of our framework this is equivalent to assuming that the employment in agriculture is given exogenously. In this context, surplus labour is assumed to exist in the industrial sector itself; the existence of surplus labour in the economy manifests itself in the assumption that the wage rate in industry is fixed exogenously in units of the agricultural good. (It may be pointed out that an assumption of a fixed wage rate is justified only when there are excess supplies of labour at the going wage rate.)

That the present model recognises the importance of effective demand is indicated by the fact that the level of output in the industrial sector is determined not by the marginal productivity condition but by the aggregate demand for the good. The level of investment demand in this model is assumed to be fixed in units of the industrial good[9]. Therefore, the closures to Rakshit's model are as follows :

(6R) $a = \bar{a}$

(7R) $I = \bar{I}$

(8R) L_1 is exogenously fixed.

Substituting (6R), (8R) and (1) into eq. (2) gives the combinations of L_2 and p which clear the food market (AA schedule in Figure 4). On the other hand, substituting (6R) - (8R) and (3) into eq.(4) gives us combinations of L_2 and p which clear the industrial

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[9]It may be noted that Rakshit considers two separate cases, viz., one in which the investment demand is autonomous and the other where it is determined by the level of profits. We are considering the former case here.

market (MM schedule in Figure 4).

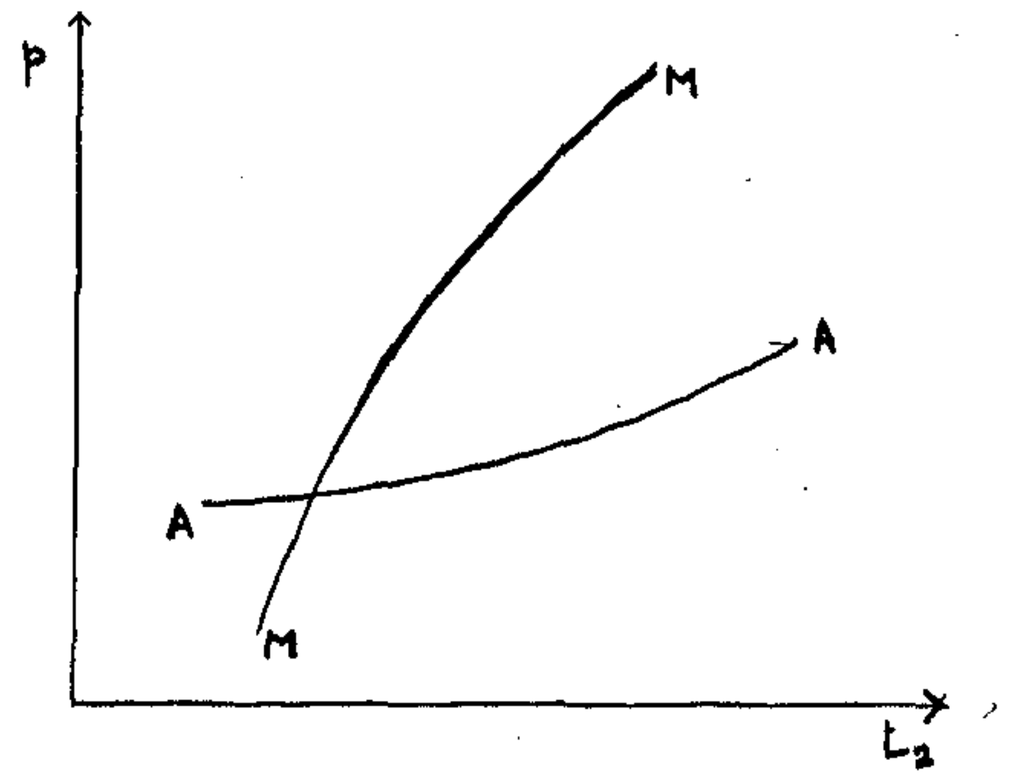

Figure 4

To explain the slopes of these curves, an increase in L_2 increases demand for X_1 and hence p has to rise to clear the agricultural market (AA will be upward sloping). An increase in p, on the other hand, raises M_s and M_w. (This follows from the result corresponding to the case B of Proposition 1 as wage rates are here fixed in terms of the agricultural good). M_r also increases, however, M_c falls. Here, Rakshit (1982, p. 147) assumes the consumption propensity of landlords to be large than that of capitalists. *In addition,* M_s *and* M_w *also rise.* So the aggregate demand for the industrial good rises, requiring a rise in L_2 so as to clear the industrial goods market (MM schedule is upward sloping). Finally, as has been argued by Rakshit (1982, p. 150), the stability of the equilibrium requires the MM curve to be steeper (with respect to the L_2 axis) than the AA curve.

Comparative Statics

(a) An increase in $\bar{a}$

The redistribution of income in favour of agricultural workers reduces X_1; on the other hand, income of workers in industry rises while that of industrialists falls. However, workers are

supposed to have a larger marginal propensity to consume food compared to capitalists. So the demand for X_1 rises; hence p has to increase in order that the agricultural market clears at the same L_2, i.e., AA schedule shifts upwards. On the other hand, among the different components of demand for the industrial good, M_s and M_w rise, while M_r and M_c fall; one may assume the marginal propensities to consume the industrial good of the industrialists and landlords to be larger than those of the workers in either sector. This would imply that the demand falls and hence L_2 falls i.e., MM shifts to the left. At the new equilibrium, however, one can not read out the effect on either L_2 or p from the diagram..

(b) An increase in θ

If this technological progress leaves $\bar{a}$ unaltered, then X_1 increases and hence AA shifts downwards. On the other hand, a rise in Q_1 raises R and hence M_r, i.e., the MM schedule shifts to the right. The effect on L_2 and p at the new equilibrium are both ambiguous. It can, however, be shown that L_2 increases, if the fall in the demand for X_2 resulting from a fall in p needed to clear the food market is smaller than the rise in the demand for X_2 consequent upon an increase in Q_1.

(c) An increase in K_2

The very fact that the industrial sector is demand constrained obviously indicates that an increase in K_2, i.e., capacity output in industry, would not have any impact on the economy. Instead, in these models we will examine the effects of an increase in $\bar{I}$, the autonomous investment expenditure.

(d) An increase in $\bar{I}$

This increases the demand for X_2 and hence MM schedule shifts to the right. At the new equilibrium, we have a higher L_2 and a higher p.

It may be pointed out that Rakshit's results remain unchanged

even under the alternative assumption of investment demand being endogenous to the system. In this model, as opposed to the earlier models, agricultural production does not appear as an immediate constraint to the industrial growth. On the other hand, the size of demand which gets reflected in the quantum of investment demand, becomes a crucial variable affecting industrial output.

With increases in real incomes accruing to workers and a greater diversification of the industrial structure, the predominance of the share of food in the total wage income reduces, and we come to the next stage of development of a dual economy, where wage rates in industry are fixed in money terms. Excess capacity in the industrial sector leads to the price of the industrial good being fixed on a markup basis. But this implies that the product wage rate in industry depends on such factors as might affect the mark-up rate and hence may be taken to be fixed, at least in the short-run. Thus, in this case, real wage rate in industry is fixed in terms of the industrial good, rather than in terms of the agricultural good as in Rakshit (1982). The model by Bose (1989) captures precisely this set-up.

2.3.4. Bose's Model

While discussing this model, we will ignore the distribution of income in the agricultural sector. Marketable surplus comes from two sources, the group of agricultural workers and small farmers (X_{1s}) and the landlords (X_{1r}). In addition, Bose assumes that the former do not have access to the open market for the agricultural good and hence they sell their surplus agricultural product to the landlords, at a fixed price '$\bar{q}$' (fixed in terms of the industrial good). Thus the difference $(p - \bar{q}).X_{1s}$ accrues to the landlords. The income accruing to the landlords and industrialists may be put together to define a total income, in units of the industrial good, y, as follows :

$$y' = \pi + pR + (p - \bar{q}).X_{1s}$$

$$= \pi + R^{*}, \qquad \text{where,} \quad R^{*} = pR + (P - \bar{q}).X_{1s}$$

Since they are assumed to satisfy their demand for food first, their income remaining after fulfillment of food demand is given by

$$y = y' - p.(F_r + F_c)$$

It may also be assumed that they have identical demand functions for the industrial good. The aggregate demand for the industrial good from the landlords and capitalists is thus assumed to be given by :

$$C = C(y)$$

Since all savings in the system come from the landlords and the capitalists' income, the savings - investment equilibrium implies :

$$y = C(y) + \bar{I}$$

This then implies that y is determined by $\bar{I}$ as in a simple multiplier model :

$$y = f(\bar{I}), \quad \text{where } f' > 0.$$

and hence,

$$C(y) + \bar{I} = y = f(\bar{I}), \quad f' > 0.$$

We thus have the remarkable result of Bose, viz., that once the level of investment is given, the volume of demand for the industrial good coming from this section of income earners as well as their real income are determined.

In terms of our framework and notations the model can be represented as follows :

(1B) $X_1 = X_{1s}(q, L_1, \theta) + X_{1r}(p, L_1, \theta)$

(2B) $X_1 = F_w(p, mL_2) + F_c(p, \Pi) + I_\alpha(p)$

(3B) $X_2 = \gamma.L_2$, (for X_2 below full capacity output[10]).

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[10]For levels of production below full capacity output, the industrial sector is assumed to function with a fixed coefficient

(4B) $X_2 = q.X_{1s}(q, L_1, \theta) + M_w(p, mL_2) + f(I)$

(5B) $q = \bar{q}$

(6B) $m = \bar{m}$

(7B) $I = \bar{I}$

(8B) L_1 is fixed exogenously.

Substituting (1B), (3B), (5B), (6B) and (8B) into (2B), we get the agricultural market clearing equation - a relation in L_2 and p. A rise in L_2 raises demand for X_1 and hence p has to increase, i.e., this relation, when plotted on the L_2-p plane, is upward sloping

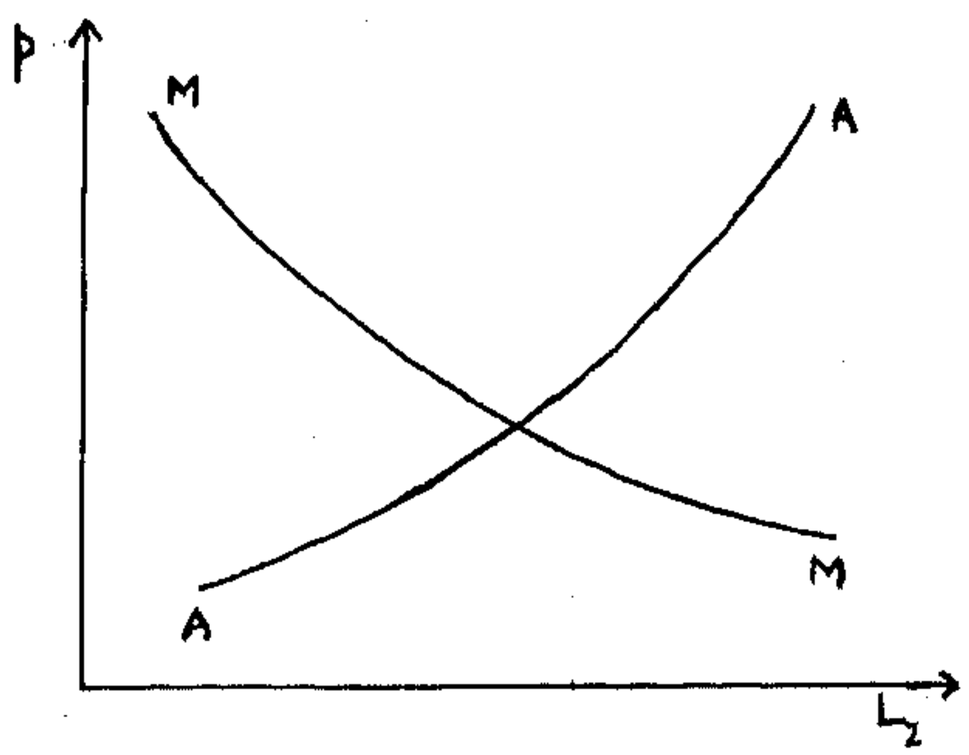

Figure 5

(AA schedule in Fig.5). Substituting (3B), (5B) - (8B) into (4B), gives us the market clearing equation for the industrial good in terms of L_2 and p. Here an increase in p reduces M_w, since F_w is price inelastic. (This follows from the Case A of our Proposition 1, as the wage rate is now fixed in terms of the industrial good.) Hence, L_2 has to fall. This relation, on the L_2-p plane, is a downward sloping curve (MM schedule in Fig. 5).

Comparative Statics

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production function where γ denotes the labour requirement per unit of output produced.

(a) An increase in q

X_{1s} is negatively related to q; therefore, a rise in the parameter 'q' reduces X_{1s} and hence, X_1 reduces. This shifts the AA schedule to the left. However, if X_{1s} is inelastic with respect to q, $q.X_{1s}$ rises and hence, demand for X_2 rises, shifting the MM schedule to the right. At the new equilibrium, p increases; the effect on L_2 cannot be read off the diagram.

(b) An increase in θ

The effect of a technological progress in agriculture on the system depends on, to whom the increase in output accrues. Two extreme cases may be considered :

Case (i) : All the increase accrues to the workers, i.e., X_{1s} increases, X_{1r} remains unchanged. This increases X_1 and hence AA shifts to the right. On the other hand, the above induce an increase in demand for the industrial good and hence MM shifts to the right and we have a new equilibrium at a higher L_2, effect on p being ambiguous.

Case (ii) : All the increase accrues to the landlords : X_{1r} increases and hence, X_1 increases - AA shifts to the right. MM curve is not affected. Hence, at the new equilibrium, we have a higher L_2 and a lower p.

(c) An increase in $\bar{I}$

This increases demand for X_2 and hence, MM shifts to the right. At the new equilibrium, we have a higher L_2 and a higher p.

2.4. Conclusion

In this chapter we have sought to study the constraints to the development of a dual economy through the growth of the industrial sector. For this purpose, we consider a unifying framework for dual economy models, the different models existing in

the literature having been obtained by specifying alternative 'closures' to a general system of equations characterising a dual economy[11]. Each of the models considered here has been reduced to a system of two equations in two variables and presented in terms of a two- variable diagram[12].

The comparative static results of various models have then been compared through this simple apparatus. A comparison of these results illustrates the obvious point that these results depend on the way the various closures are specified, and that the differences in closures are closely related to differences in modes of specification of wage rates in these models.

Table 2 summarises the results of the comparative static exercises. For the sake of illustration, let us consider the effect of a technological progress in agriculture, i.e., an increase in θ, in each model. While the second phase as well as the third phase of the LRF model gives us the most commonly anticipated result of a decline in p and an increase in L_2, the neoclassical model does not assure us of an increase in L_2. The difference between these two models lies in the differences in the ways of wage specification in agriculture. While in the former, the wage rate is fixed in terms of food, in the latter it equals either the whole or a part of the

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[11]There exist a number of other models in the literature, which have not been considered by us, e.g., that of Taylor (1982). Needless to say, Taylor's model could also be accomodated into our framework. In fact, this model belongs to the category of demand constrained models and some of the closing rules here are similar to those in Bose (1987), e.g., $m = \bar{m}$, $I = \bar{I}$ etc. However, Taylor brings in explicitly the role of capital stock in agriculture and in his model, agricultural output is determined by this capital stock. Given a fixed labour- output ratio in this sector, agricultural employment in the short run is thus given.

[12]It may be pointed out that Rakshit (1982) also uses a similar diagram to discuss the results under a dual economy setup.

Table 2.2. Results of Comparative Static Exercises in Various Models

Effects on L_2 and p

Model	Initial stimulus	Increase in $\bar{a}$	Increase in θ	Increase in K_2	Increase in $\bar{I}$
Neo-classical Model		p ambiguous; L_2 ↓	p ↓; L_2 ambiguous	p ↑; L_2 ambiguous	
LRF Model Phase 1		given $\bar{p}$, L_2 ↓	no change	given $\bar{p}$, L_2 ↑	
LRF Model Phase 2		p ambiguous L_2 ↓	p ↓; L_2 ↑	p ↑; L_2 ambiguous	
LRF Model Phase 3			p ↓; L_2 ↑	p ↑; L_2 ambiguous	
Rakshit's Model		both ambiguous	both ambiguous		p ↑; L_2 ↑
Bose's Model		p ↓ if X_{1r} increases; L_2 ↑	p ↓ if X_{1r} increases; L_2 ↑		L_2 ↑; p ↑

average product of labour in agriculture. Again, when we consider the demand constrained models, the differences between the two models turn out to be those basically in the specification of wages. As far as the results of the comparative static exercises are concerned, in one case (i.e., Rakshit's model) L_2 can actually even decline. On the other hand, in Bose's model, we get a clear increase in L_2; alongside, p can also be shown to decline in one case (i.e., the case when the entire increase in output accrues to the landlords).

Chapter 3

ALTERNATIVE WAYS OF STIMULATING GROWTH IN A DUAL ECONOMY SET-UP

3.1. Introduction

The development of a dual economy involves the transformation of a dual economy into a predominantly modern economy. Broadly, there can be two ways of achieving this goal, viz., through rapid growth of the modern sector, or through a direct transformation of the traditional sector itself into a modern one. A precise characterisation of the traditional and modern sectors here is important to understand this process of transformation. Differences in the objective functions of producers in the two sector forms one such basis of distinction. In this case, the modern sector is characterised as one where production as well as investment decisions would be determined on the basis of the profit motive. The traditional sector, on the other hand, is broadly characterised as one where such decisions are not necessarily guided by profit signals. In the existing literature on dual economy models, the traditional and modern sectors have been identified as agriculture and industry, respectively[1]. Our discussion in the last chapter was centered around the growth of a dual economy through the first kind of approach mentioned above.

The analysis in Chapter 2 distinguished between two different kinds of models, which can be called the supply determined models

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[1]It should be pointed out that the distinction along these lines refers to differences in organisation of production - production and investment in agriculture being modelled as being independent of profits/returns accruing there.

and the demand constrained models (the LRF and the neoclassical models fall in the first category while Rakshit's model and Bose's model are examples of the second category). In each of these models, two factors have emerged as potential constraints to industrial growth - the growth of agricultural output and the growth of investment expenditure. In the supply determined economies, i.e., the resource constrained economies, the former constrains the levels of employment and output in industry. The latter, being determined as a residual variable, does not affect the current production, but through its effect on capacity creation, constrains the volume of potential output in future. On the other hand, in the demand constrained models, it is the level of investment which constrains the current level of industrial output. A slow growth, implying a possible shortage of agricultural output here would impose a limit on the maximum attainable level of industrial output.

The models studied in Chapter 2, however, consider a closed economy with no government and study growth endogenous to the system. A question that naturally arises is - are there any means of stepping up the rate of transformation of the dual economy ? It is this question that the present chapter is addressed to. Here we would try to explore the alternative paths available and the possible constraints to growth along these paths. To this end, we would, wherever appropriate, consider an open economy and introduce the government as well. However, before coming to these questions, it would be of use to clearly set down what we mean by the terms - supply constrained industry and demand constrained industry, considering that one would find repeated usage of these terms in this and the following chapters.

At an elementary level, an equilibrium would be characterised as a supply constrained equilibrium, if producers are producing at the level at which they would have produced if there were no demand

problem, i.e., if producers are operating on their supply function. To clarify, a supply function defines the level of output that would maximise profits corresponding to the levels of prices of outputs and inputs, given technology. Any change in the vector of prices would induce a change in the profit maximising level of output, i.e., a movement along the supply function to the new profit maximising point. Now, consider a constraint in the availability of some input, in the form of quantity rationing, say. (The input prices here do not clear the market.) The supply function would exhibit a shift - i.e., corresponding to the given level of prices, a smaller quantity of output would now be forthcoming[2]. Clearly, such a constraint could be imposed either by the variable inputs or by the so-called fixed inputs in the short run. One such case would involve a constraint imposed by the level of capital stock. While the variable inputs can have a flexible supply, i.e., they can be incorporated into production immediately, capital stock is usually assumed to involve a time lag in getting incorporated (gestation lag). Thus, a constraint on the levels of production can easily arise from the quantum of capital stock and the industry would then be operating so as to maximise profits, given the level of capital stock. An increase in capital stock clearly brings about an outward shift in the supply curve, implying a higher level of output corresponding to any particular price vector.

Thus in response to a change in the price vector and/or supply/demand situation, there appear two possible responses - movement along the supply function and a shift in the supply function. Corresponding to these, one can identify two forms of supply constraint - constraints to movement along a supply function

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[2]The supply function could in fact, become discontinuous. As long as the quantity constraint is not binding, the function would remain at its earlier levels; however, once the constraint becomes binding, the supply function would experience a shift.

and constraints to the outward shifts of the supply function[3]. The various forms of supply side bottlenecks and the various characterisations of a supply constrained industry can be shown to be captured by such a definition of a supply constrained equilibrium. For instance, Rakshit (1982, pp. 166-67) characterises a supply constrained equilibrium as one where the market for the industrial good experiences excess demand, and yet relative prices do not change to clear the market. The situation being referred to here appears to be a manifestation of some bottlenecks to shifts along the supply curve. In the present context, the bottleneck is attributed to a shortage in supply of agricultural goods as well as to the shortage in productive capacity in the non-agricultural sector (Rakshit, 1982, p. 149).

On the other hand, let us consider a demand constrained equilibrium. Here, the level of demand would impose limits on the level of production, i.e., given the vector of prices, profit maximization in industry would dictate a level of production higher than the current level of demand. The case refers to that of underutilization of existing capacities. An expansion in demand in this case, would step up production, provided agricultural outputs were not a constraint, (since an insufficient supply of the latter could result in the building up of inflationary pressures in the system, and even eliminate the initial stimulus provided by the increased demand). Given these notions of demand and supply constrained equilibria, we will try to explore the various

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[3]Here it should be pointed out that in addition to the relaxation of constraints in supply of various inputs and factors of production, there can exist alternative ways of introducing shifts in the supply function. If, for instance, one considers the various components of the Schumpeterian notion of development, three of the sources of development discussed would constitute contributions to the outward shift of the supply function - introduction of a new method of production, conquest of a new source of supply of raw materials or semi-manufactured goods and introduction of new good.

alternative means of stepping up the rate of transformation of a dual economy, and examine the nature of potential constraints in these cases.

Consider a dual economy at the very initial stage of development, conforming, say, to a Lewis-Ranis-Fei type of structure. In such an economy, industrial growth is constrained by the quantum of capital stock (the case of a resource bottleneck to growth). Alongside, current production may also be constrained by the level of agricultural production, especially by the marketable surplus of food. This is particularly the case in the neoclassical model where the constraint to the industrial growth is determined by the rate of release of labour from agriculture (Dixit, 1973, p. 346). Clearly, any means of stepping up the rate of growth of capacity would enhance growth in industry. Two alternative sources of such investment are - government investment and private investment. Similarly, growth could be stimulated by stepping up rate of growth of agricultural output, thus making investment in industry, as well as flow of resources to this sector more feasible. In this chapter we would explore each of these alternatives. The plan of the chapter is as follows. We take up the latter aspect first in Section 3.2. Section 3.3 examines the various issues in connection with the strategy of expansion of investment. The final section presents some broad conclusions.

3.2. Growth of the Agricultural Sector

In all the models discussed in the preceding chapter, supply of agricultural output has figured as a constraint to the growth of industrial output. In the supply constrained models, supply of agricultural output, through its impact on the product wage rate in industry, constrains the level of activity in the industrial sector, while in the demand constrained models, scarcity of agricultural

output exposes the system to inflationary pressures, with accompanying depressing effects on demand. A relaxation of this bottleneck, therefore, constitutes an essential element of any strategy for transformation of a dual economy. Capital accumulation in agriculture could relax such a bottleneck. This could be achieved in two alternative ways - through exogenous capital investment and/or introduction of new technology in agriculture, or through transformation of the traditional agricultural sector so that investment decisions become endogenous to the sector. In other words, in the latter approach, one seeks to endogenise the decisions regarding capital formation in the traditional sector. Let us take up each of these approaches separately.

Investment in agriculture and/or introduction of new technology by an outside agent (say, the government) would contribute to enhancing the rate of growth of output in the industrial sector. A number of dual economy models of the neoclassical type emphasize the importance of the growth of agricultural output for achieving a sustained growth of the modern sector[4] (Amano, 1980; Marino, 1975). These models, however, talk of an exogenously specified rate of growth of agricultural output. Amano introduces capital accumulation in agriculture. But such accumulation is not taken to respond to market signals, etc., i.e., capital accumulation remains some what exogenous to the functioning of the system. The third stage of the LRF model too emphasizes on the importance of agricultural growth, as investment then is found to respond positively to an increase in agricultural production. The rate of transformation of such economies is therefore, hastened with the stepping up of the rate of growth of agricultural output. The industrial sector in these models, however, remains supply constrained, with the level of

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[4]Investment in industry in these models is found to increase with an increase in agricultural production. The result, however, is dependent on the assumptions regarding consumption demand.

production being constrained by the level of capital stock.

On the other hand, in the case of a demand constrained industry, the direct impact of an increase in agricultural production works through the relative price, encouraging consumer demand. A reduction in the relative price of food also has an indirect impact, viz., by reducing the inflationary potential of any increase in investment, it makes feasible a step up in investment expenditure, which provides a further boost to the total demand. Thus, both consumer demand as well as investment demand for the industrial good would be stimulated. With increase in the exogenous investment expenditure, endogenous investment would also be encouraged (through the increase in demand), suggesting that the industrial sector would continue to be demand determined.

The growth in the agricultural output outlined above is based on exogenous stimuli. However, such a process of growth logically, may not be self sustaining and hence may require frequent renewal of stimulus. The possibility of sustained growth then calls for endogenising the investment and technology decisions in the agricultural sector.

The distinction between the traditional and modern sectors in the dual economy models has been drawn in terms of differences in the objective functions of producers therein. The modern sector is characterised as being guided by the profit motive, which is not the propelling force in the case of the traditional sector. The agricultural sector is identified with the traditional sector in that investment decisions in agriculture have been argued to be non-responsive to the profit motive. There exists a substantial amount of literature which seeks to trace the reasons for this lack of responsiveness to the prevailing institutional structure (Bhaduri, 1961; Newbery, 1975; Rakshit, 1982; Basu, 1993). Tenancy - whether

it be share tenancy or fixed rent tenancy - has been argued to be a hindrance to the growth of agriculture. Land reforms, therefore, appear as a solution, the emphasis being on 'creation' of owner cultivators, and not so much on tenancy reforms[5]. To quote Rakshit (1982, pp. 285/86), "...an economic system that is a half-way house between a fully exploitative one and a society where land is owned by the actual tillers may contribute significantly to the stagnation of the economy, even when investible funds are no bottleneck.... There may thus be much economic sense in the stand taken by those critics of land reforms who argue that mere legal provisions for protecting the rights of the tenants cannot effect - in fact, may well stand in the way of - growth of the agricultural sector of the economy". Clearly, the emphasis here is on the transformation of the traditional sector into a sector more capable of responding to the profit motive. Such a transformation, by removing the wedge between the investor and those to whom the fruits of investment accrue, can endogenise investment decisions as well as decisions to innovate within the agricultural sector.

3.3. Increase in rate of capacity creation in industry

A dual economy in its earliest stages of development is likely to be constrained by the quantum of available resources (i.e., a case of supply constraint). A plausible way of speeding up the transformation of this economy requires stepping up of the rate of capacity creation (i.e., of investment expenditure) in the non-agricultural sector. Two possible sources of such investment are

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[5]The objective here is to ensure that returns due to each factor of production actually accrue to it, so that the existence of scarcity gets properly reflected in factor prices in question and invokes a response. Tenancy reforms, by altering the rates of return to the different factors would introduce distortions in the functioning of markets and the transmission of market signals.

government investment and private foreign investment. Growth in a closed dual economy with no government would necessarily be based on private investment. However, such investments would be guided by current market signals and also constrained by the domestic resource availability. Any source of investment not affected by these two limiting characteristics, would make feasible higher levels of investment in the economy - as is the case both with government investment and private foreign investment.

A. Public Investment as a strategy for growth

The rationale for public investment in a developing economy is mainly the following. The lumpiness of investment and the long gestation lags of projects, in addition to the standard problems associated with the production of public goods and social goods, do not provide sufficient incentives for private investment in certain areas. In such situations, public investment is argued to be desirable or even essential. Clearly, public investment is not expected to respond to the standard market signals. In fact, given the importance of planning in a mixed economy, public investment is sometimes necessary in order to cater to the anticipated demand smoothly. This could often result in investment decisions considerably divergent from what the current market signals indicate. An obvious implication of such kinds of investment is the possibility of creation of capacities in excess of current demand - a possibility which may ultimately create a demand constrained industrial sector.

In a supply constrained industry, resources being the bottleneck to growth, the level of investment is expected to be constrained by the quantum of resources available. If the government has access to alternative sources of investible funds such as foreign aid, this constraint too could be relaxed, making possible higher rates of capacity creation. However, in the absence of such alternatives, paucity of resources is likely to induce an adverse

impact on private investment, given the control of government over resources. In both these cases, one is likely to observe emergence of underutilized capacities at least in some industry groups in the economy, which could get further reinforced due to the slow rate of capacity creation elsewhere. The emergence of such excess capacities may ultimately enforce a decline in public investment. This, in turn, would raise and/or reinforce demand problems for the industrial sector, adversely affecting the incentives for private investment as well. In other words, these trends would reinforce the tendency for underutilization of capacity.

As a special case, consider a situation where public investment is geared towards capacity creation in the capital goods sector while private investment takes place in the consumer goods sector only. The foregoing analysis suggests that at a given time one might witness the existence of excess capacities in the capital goods sector. In response to this, public investment might fall, which would imply a decline in effective demand, thus reducing the private incentive to invest. Bhaduri (1985) talks precisely of such a scenario, when he discusses the possibility of a divergence between "realisation proportion" and "historical proportion" in analysing how sustained excess capacities could exist in a sector[6]. Any divergence between these proportions rules out full utilization of capacities in both sectors.

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[6]Given the rules of distribution of income in an economy with two sectors (viz., capital goods and consumer goods) and given the marginal propensities to save, there is a unique "realisation proportion", i.e., the proportion in which outputs of the two sectors are produced such that expected profits are realised with each market clearing without any excess demand or supply. In contrast, "historical proportion" is defined by the existing capacities inherited from the past (Bhaduri, 1985, pp. 63-65).

In such a state, corrective adjustments require changes in the distribution of income in these sectors such that the discrepancy between these two proportions narrows down. However, since investment decisions are expected to be based on expectations regarding future values of variables, even when these proportions are equated in physical terms, expectations are not likely to settle, thus ruling out the possibility of a convergence to equilibrium[7]. In other words, an imbalance once created, is not easily amenable to correction[8].

So far we have assumed that the supply of agricultural output does not constitute a bottleneck to the expansion of investment or production in industry. The existence of such a bottleneck, however, could generate inflationary pressures in the economy. Either of the two processes, viz., an emergence of significant excess capacities or inflationary pressures, would necessitate a reduction of the rate of growth of public investment. This would, in turn, lead to a further decline in degrees of capacity utilization even with inflation being controlled. In other words, one has a demand constrained industry, with the problem being further aggravated by a decline in public

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[7]The process of adjustment of the realisation and historical proportions could lead to 'overshooting' in the opposite direction, because of the pressure of expectations.

[8]There may exist another problem in the working of the above mentioned adjustment mechanism. This mechanism works through a change in real wage, which would have two contradictory effects : potential profits per unit of sale would increase but effective demand could fall because of a fall in real wage. Unless this decline in demand were compensated for by increase in investment (say, induced by higher potential profits), capacity could remain underutilised.

investment[9].

To summarise the arguments presented in this section, in an economy faced with a supply bottleneck, large scale public investment might lead to the emergence of excess capacities in industry, thereby transforming a supply constrained industry into a demand constrained one. Whether domestic resources are supplemented by the inflow of foreign resources or not does not change the picture qualitatively. Finally, an insufficient supply of foodgrains imposes a constraint on the expansion of public investment.

B. Foreign Investment-led Growth

Foreign investment would provide another source of augmenting investment in the domestic economy. Foreign investment can take two alternative forms - one, involving inflow of investible resources, thereby generating demand for domestic capital goods industries and, the other, involving inflow of foreign capital goods.

If the industrial sector is strictly supply constrained, i.e., producers are maximising profits at the given level of prices, production will not respond to the increased demand for capital goods resulting from a relaxation of the resource bottlenecks, i.e., through inflow of investible resources. It is the second form of foreign investment, i.e., inflow of foreign capital goods, which would step up rate of capacity creation in this case.

Decisions of a private foreign investor would be guided not

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[9]In response to potential inflationary pressures, public investment could be directed towards agriculture so as to relax the bottleneck there. Such a process of growth or transformation would depend on public investment being continuously reallocated in response to the most pressing constraints, i.e., a process of shifting from the correction of one bottleneck to the other.

simply by domestic market signals, but by the international market conditions. Hence, capacity creation would not be strictly in response to domestic demand and could very well exceed such demand. Thus, two factors could contribute towards the creation of excess capacities in a dual economy open to foreign investment : the possibility of investment decisions of these firms being unrelated to domestic market conditions, and the import of capital goods promted by foreign investment. Once excess capacities develop, the economy, initially a supply constrained one, gets transformed into a demand constrained one. A sustained growth as well as the transformation of the dual economy would now be contingent on the growth of demand for industrial output.

Alternative ways of boosting up demand for the domestic industry are limited in number. It could be achieved through either higher exports or higher public expenditure. Export of industrial output is less amenable to manipulation due to the element of exogeneity associated with it. Provided foreign investment is geared towards international market signals, this could be a viable alternative. The other alternative, i.e., growth in public expenditure, would stimulate demand in the domestic economy, and facilitate better utilization of existing capacities. This might make further investment profitable. However, supply of agricultural output may pose a constraint in cases where economic growth is fostered by foreign investment or public investment. It should be pointed out here that, since public investment is likely to be more sensitive to inflationary pressures than foreign investment, inflationary pressures and its impact are expected to get intensified in the latter case.

To summarise, foreign investment in the domestic economy, while influencing the pace of capacity creation and transformation of the domestic economy, also induces another parallel transformation -

that from a supply constrained one to a demand constrained one. Industrial growth then becomes contingent on the growth of demand. In this particular case, exports as a source of demand come to occupy a prime place - both in terms of relaxing bottlenecks to growth as well as providing additional stimuli to growth. Any other form of demand for industrial goods is likely to confront the agricultural bottleneck faster, unless, of course, foreign investment takes place in agriculture itself.

3.4. Concluding Remarks

The discussion in this chapter, has centred around four alternative approaches to the problem of transformation of a dual economy into a predominantly modern economy. Two of these approaches put emphasis on the growth of the agricultural sector itself - one through exogenous stimuli and the other through a direct transformation of the traditional sector itself. The former approach does not emerge as suitable for initiating self-sustained growth, while the latter suggests the possibility of endogenous growth. In neither case, does one witness any change in regime. The other set of alternatives involves rapid expansion of the industrial sector itself. In this case, whatever be the guiding force (i.e., either growth in public investment or that in foreign investment), a change in regime is likely to take place where a supply constrained industry gets transformed into a demand constrained one. Such a change in regime makes growth of the industrial output contingent on sustained growth of autonomous sources of demand.

Chapter 4

SURVEY OF LITERATURE

4.1. Introduction

In the preceding chapters we have made an attempt to examine theoretically, in the light of the various dual economy models, the nature of possible constraints to the growth of the industrial sector. In the context of the Indian industrial sector, a large number of studies - theoretical as well as empirical - have addressed broadly the same set of issues. We propose to review this literature in the present chapter.

The growth process of the Indian industrial sector since the fifties has displayed many ups and downs. One can identify broadly *three* distinct *phases.* The first phase is one of rapid growth which is supposed to have lasted for a decade and a half. This is followed by a phase of slow growth, usually referred to as a phase of stagnation or deceleration in industrial growth. This second phase is argued to have commenced around the mid-sixties. Although the end *of this phase is* a debated issue, there appears to exist some concensus that it lasted till the late seventies. Finally, it is maintained that the eighties have witnessed some revival in growth, and hence may be referred to as the third phase.

The literature on the growth of the Indian industrial sector can be divided into *three broad groups* depending on the nature of the issues addressed. First, there are studies which seek to explain the stagnation of or deceleration in the growth of Indian industries from the mid-sixties. Secondly, some recent studies focus on identifying the factors responsible for the revival of industrial growth in the eighties. Thirdly, there are econometric studies which seek to

explain mainly the intertemporal behaviour of industrial outputs. We shall discuss each of these groups of studies separately.

The chapter is organised as follows. In order to understand the phenomena of stagnation and revival in industrial growth, we examine first the characteristics of the growth of the industrial sector over the last four decades. This is taken up in Section 4.2. Section 4.3 presents a of review the literature on stagnation in growth of Indian industry. It may be mentioned that both demand side explanations and supply side explanations have been advanced for this phenomenon. So far as demand side explanations are concerned, discussions have centred around the three main components of demand, viz., the exhaustion of import substitution possibilities, factors affecting the consumption demand and the behaviour of the investment demand. Similarly, supply side explanations include bottlenecks experienced in the availability of inputs as well as in the expansion of capacity and the presence of inefficiency in resource use. These explanations on either side will be examined in Section 4.3. Section 4.4 analyses the factors supposed to have been responsible for the revival of growth in the eighties. Section 4.5 reviews the econometric studies on the behaviour of industrial outputs. Finally, some concluding observations are noted in Section 4.6.

4.2. Trends in Behaviour of Industrial Outputs in India

In order to obtain a broad view of the industrial growth in India, let us look at the time series of general index of industrial production (IPG). Figure 4.1 depicts the logarithm of this index against time[1], while column (2) of Table 4.1, shows average annual

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[1]Consider the following linear relation :

$$\log x_t = \alpha + \beta t.$$

The slope of this line, i.e., β, gives the (proportional) rate of growth of x_t. That explains the plotting of $\log x_t$ against t.

rates of growth of this index over successive five year periods. From the Figure and the Table it appears that the period under consideration comprises of three different phases across which industrial growth rates are found to have differed. The first phase showing high growth rates ends in the mid-sixties and the following two quinquinnia witness lower growth rates. An upward trend in these growth rates is discernable from the second half of the seventies, although a complete revival is in evidence only in the eighties.

TABLE 4.1. Average Annual Rates of Growth of Indices of Industrial Production over Various Quinquennial Periods : 1951-52 to 1989-90

(per cent)

Period	Indices of Industrial Production			
	General index (IPG)	Consumer goods (IPC)	Basic and Capital goods (IPK)	Intermediate goods (IPI)
(1)	(2)	(3)	(4)	(5)
1951-52 to 1954-55	6.40	3.86	10.83	4.62
1955-56 to 1959-60	7.19	3.51	7.38	7.79
1960-61 to 1964-65	9.37	3.33	12.99	7.53
1965-66 to 1969-70	4.33	1.87	2.65	5.57
1970-71 to 1974-75	3.51	2.13	3.38	4.70
1975-76 to 1979-80	5.26	1.45	4.99	6.92
1980-81 to 1984-85	6.35	3.90	6.84	7.31
1985-86 to 1989-90	8.49	3.16	8.72	9.20

In order to ascertain whether this feature was observed at the aggregate level alone or it characterised most of the individual industries as well, we consider a breakup of the industrial sector on lines similar to the use-based classification of industries. Industry groups as per the 2-digit classification are reclassified into three broad groups - consumer goods, intermediate goods and

Figure 4.2

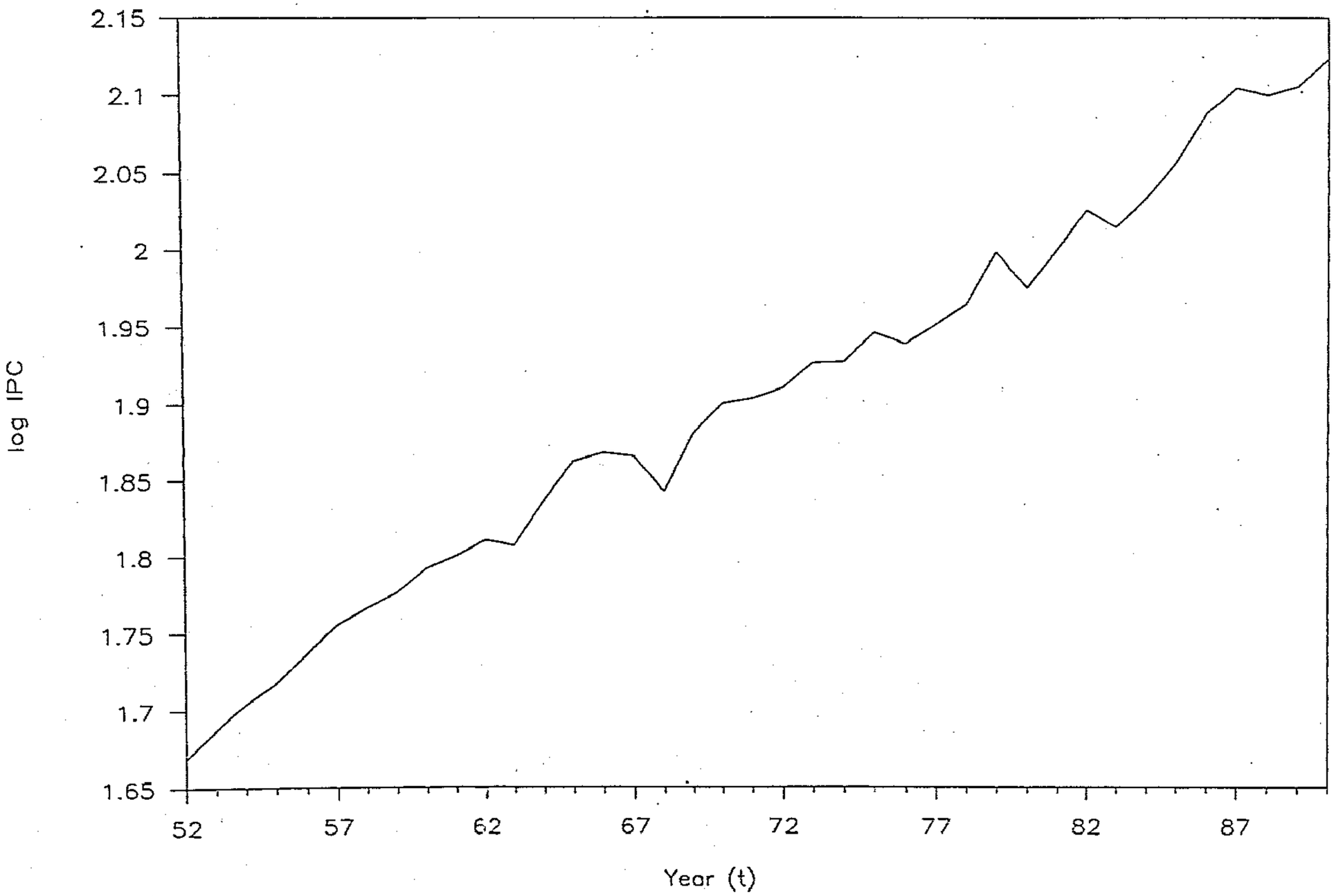

2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.7
1.65
log IPC
52
57
62
67
72
77
82
87
Year (t)

Figure 4.3

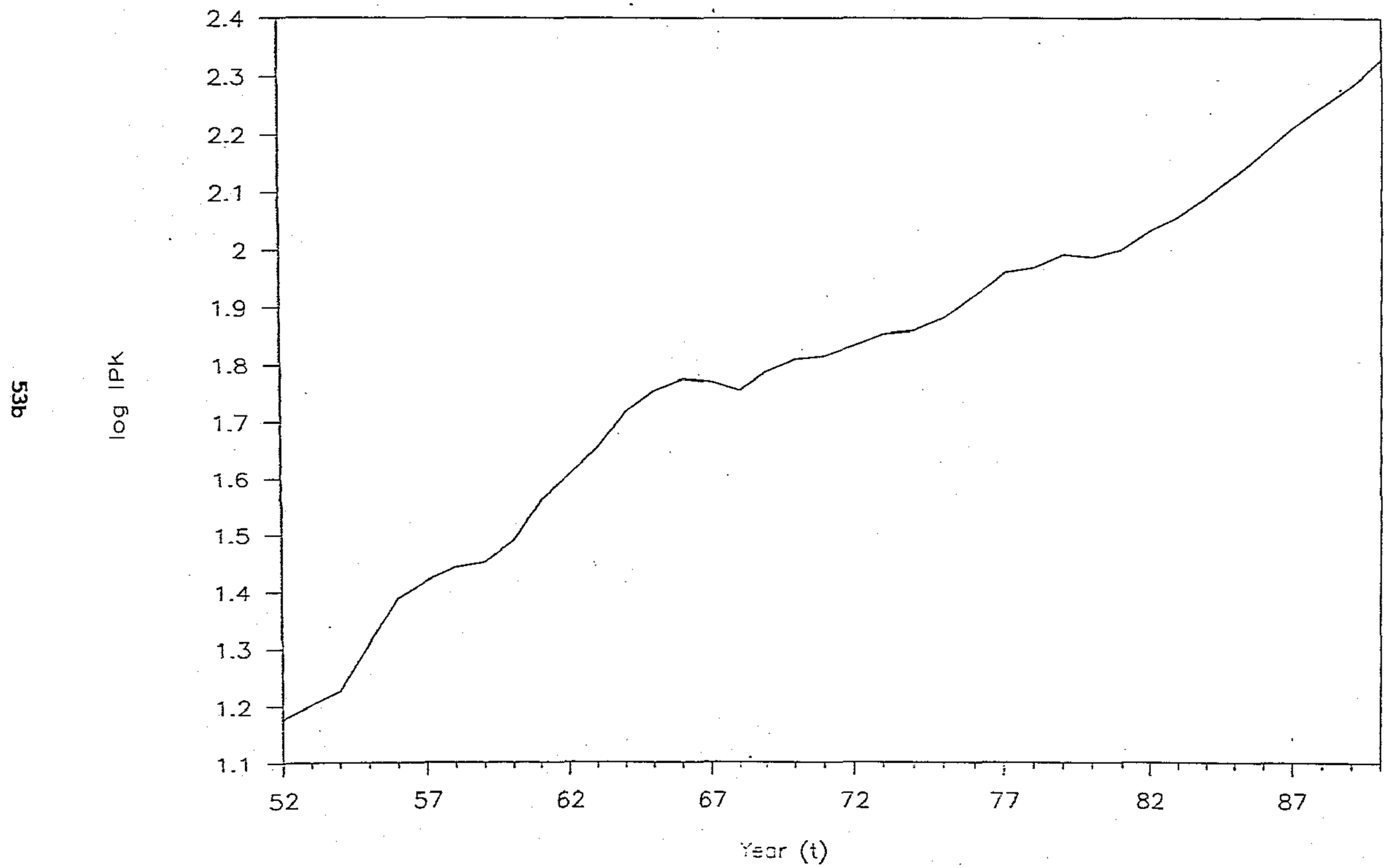

log IPk
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
52
57
62
67
72
77
82
87
Year (t)

Figure 4.4

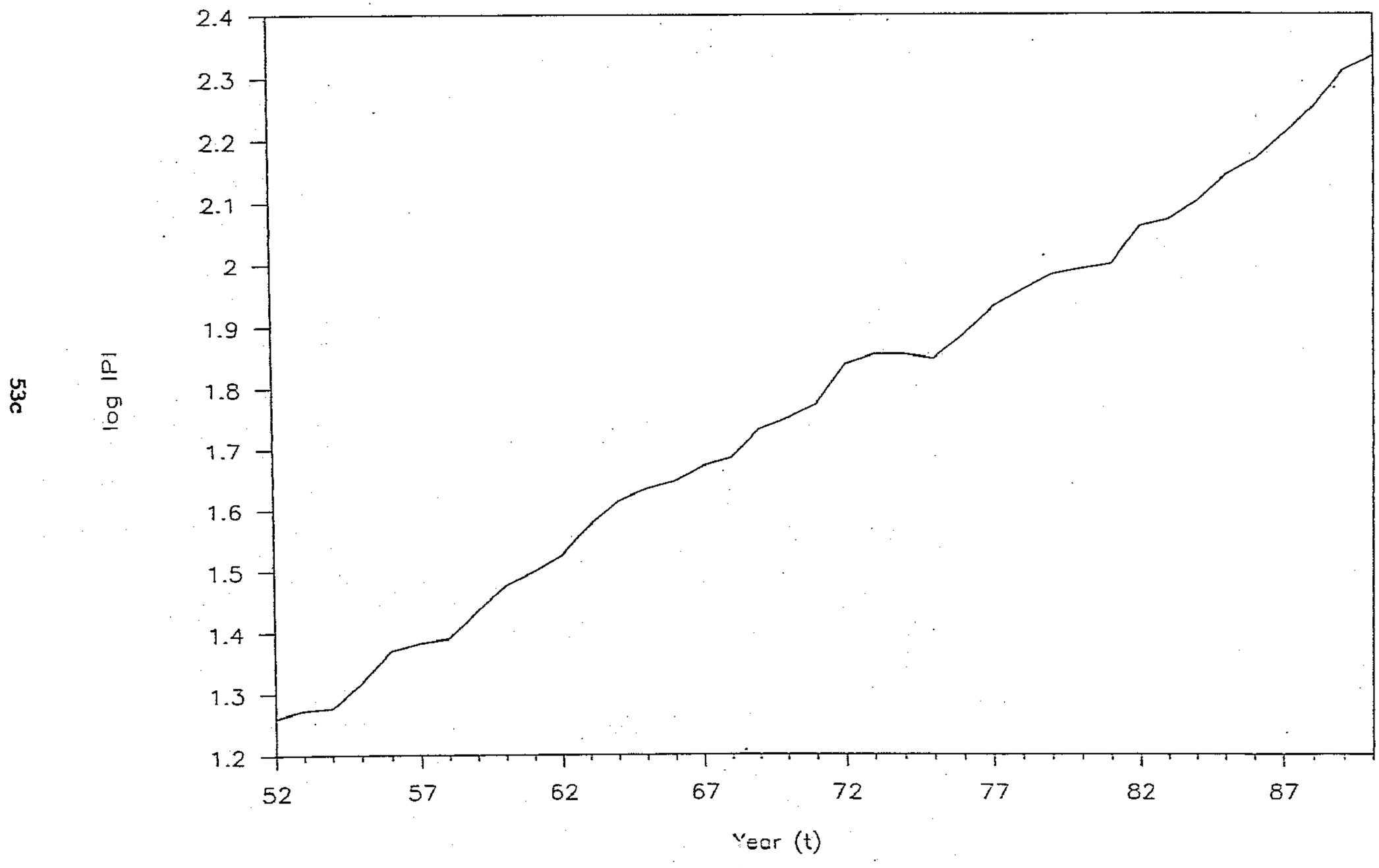
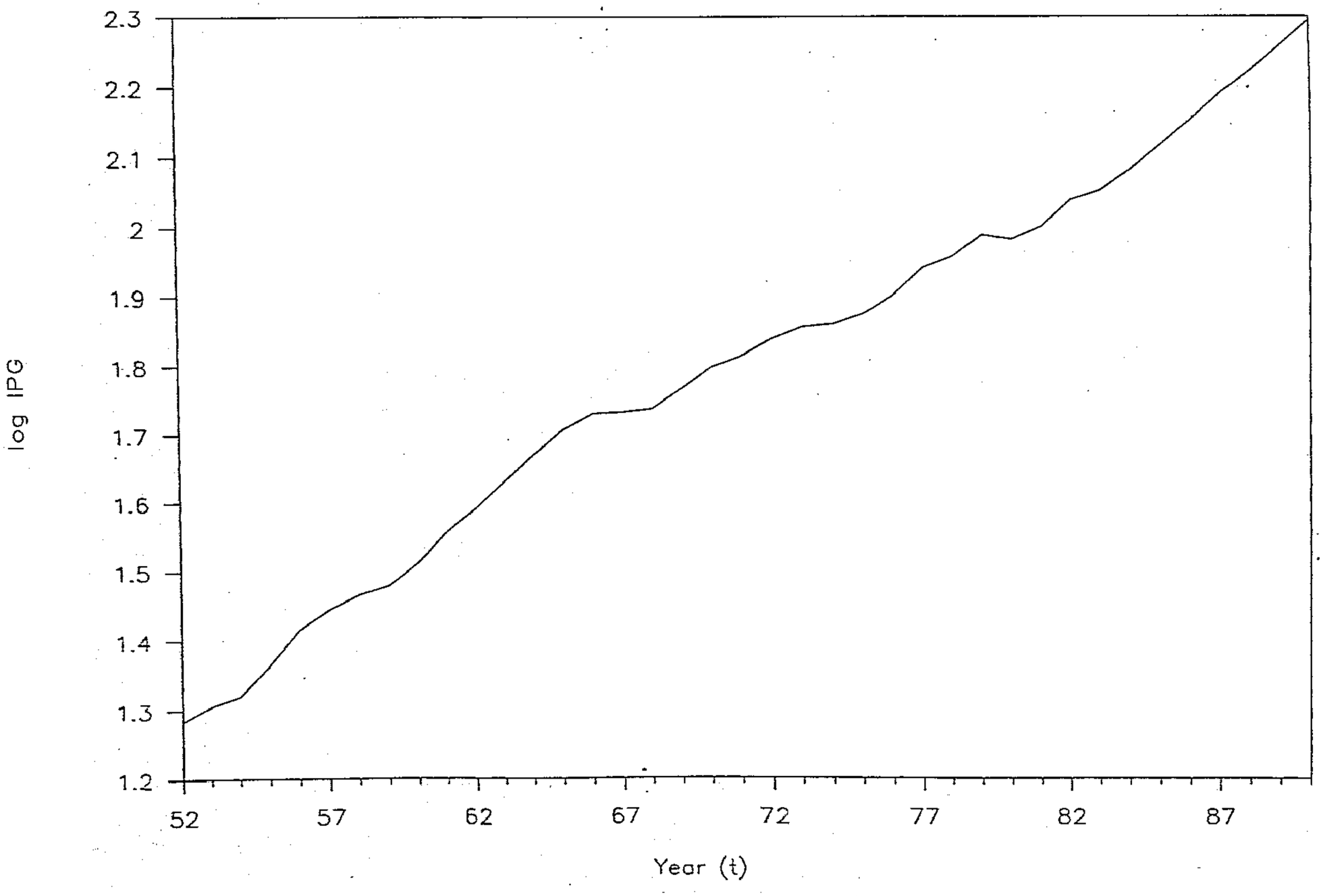

log IPI
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
52
57
62
67
72
77
82
87
Year (t)

Figure 4.1


log IPG
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
52
57
62
67
72
77
82
87
Year (t)

basic and capital goods[2]. It may be noted that such a breakup of the industrial sector facilitates analysis of possible backward and forward linkages between industry groups. Table 4.1 also presents the period wise average (annual) rates of growth of outputs of these industry groups. One important feature of industrial growth revealed by this Table is that both the deceleration as well as the revival in rates of growth seem to have been experienced across-the-board. There are, however, some differences too. For instance, the basic and capital goods industries recorded the minimum average rate of growth in the second half of the sixties, while the intermediate goods exhibited the same in the next quinquennium. Again, among the three groups, consumer goods industries have experienced the lowest growth rates in all the periods.

The features noted above are also evident from Figures 4.2-4.4, which plot against time, the logarithms of indices of production of consumer goods, basic and capital goods and intermediate goods, respectively. An attempt to identify the years of switch in time trends on the basis of these figures reveals the following observation. The decline in the rate of growth of consumer goods industries seems to have started around 1959-60, while in the case of the basic and capital goods industries, it occurred around 1965-66. The intermediate goods industries seem to have been affected much later, with the break appearing around 1970-71. In terms of the revival, however, both intermediate and basic and capital goods industries display increases in rates of growth in the early eighties. Consumer goods too seem to experience a revival around the same time, but fluctuations around the trend tend to be greater.

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[2]The coverage of the groups so constructed differs slightly from the corresponding ones in the official index. The official indices are not available for a number of years in the fifties and eighties, bringing in the need to construct a separate series.

The above observations are next sought to be investigated rigorously. In particular, for each industry group, we try to identify the points of switch in trend by fitting log-linear equations. The methodology adopted is as follows. The logarithm of index of industrial production of each industry group is regressed on time, using a number of dummy variables, to delineate different subperiods over which average growth rates could have differed. To illustrate the procedure, the equation estimated in each case is of the following form :

$$\log x_t = \alpha + \beta t + \gamma D + \delta Dt + \varepsilon D_1 + \theta D_1 t$$

where t is time (in years), x_t is the index of industrial production in question and D and D_1 are dummy variables for two different subperiods, defined differently for different equations. For example, one pair of dummies used are as follows.

$$D = \begin{cases} 1 & \text{for each of the years from 1950-51 to 1959-60,} \\ 0 & \text{elsewhere.} \end{cases}$$

and

$$D_1 = \begin{cases} 1 & \text{for each of the years from 1980-81 to 1989-90,} \\ 0 & \text{elsewhere.} \end{cases}$$

Alternative schemes of periodization have been used in order to identify the points of switch for the different industry groups. The choice of these alternative schemes has been influenced by the information gleaned from Figures 4.1-4.4 as well as from the existing debates in the literature. Operationally, we have chosen those regression equations which yield the best results in terms of significant coefficients of dummy variables and values of $\bar{R}^2$ and the DW statistic.

To discuss the results, we first take up the consumer goods industries. In terms of the above criteria, we get the best results by considering the following periodization, viz., 1951-52 to 1964-65,

Table 4.2 : Log Linear Trend Equations

Eq. No.	Intercept	time	D		D'		D''		D_1		D_1'		$\bar{R}^2$	D.W.
			Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope		
	Consumer Goods Industries :													
C.1	3.93 (196.8)	0.0223 (22.67)	-0.1163 (-4.28)	0.0133 (3.89)							-0.3053 (-3.10)	0.0105 (3.54)	0.9926	1.78
C.2	3.9123 (105.06)	0.023 (14.11)			-0.0805 (-2.03)	0.0083 (3.78)					-0.2862 (-2.84)	0.0097 (3.09)	0.9930	1.87
C.3	3.8542 (61.29)	0.0261 (8.36)			-0.0223 (-0.35)	0.0052 (1.51)			-0.1692 (-2.16)	0.0050 (1.45)			0.9932	1.89
C.4	3.9184 (148.60)	0.0231 (15.40)	-0.1033 (-3.22)	0.0124 (3.47)					-0.2334 (-4.22)	0.0079 (3.73)			0.0027	1.76
	Basic and Capital Goods :													
B.1	3.2831 (72.79)	0.0457 (20.61)	-0.6769 (-11.04)	0.0523 (6.76)							-1.2521 (-5.62)	0.0393 (5.89)	0.9936	0.74
B.2	3.3139 (56.53)	0.0441 (17.21)			-0.723 (-11.61)	0.0575 (16.65)					-1.2830 (-8.09)	0.0409 (8.22)	0.9971	1.32
B.3	3.2929 (45.89)	0.045 (11.01)	-0.6866 (-7.87)	0.0530 (5.44)					-0.5804 (-3.86)	0.0207 (3.58)			0.9908	0.60
B.4	3.4829 (25.69)	0.0352 (5.24)			-0.892 (-6.44)	0.0664 (8.96)			-0.7705 (-4.57)	0.0306 (4.12)			0.9947	0.75

Table 4.2 contd.

Eq. No.	Intercept	time	D		D'		D"		D_1		D'_1		$\bar{R}^2$	D.W.
			Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope	Intercept	Slope		
	Intermediate Goods Industries :													
I.1	2.9150 (103.53)	0.0588 (42.04)	-0.1154 (-2.99)	0.0048 (0.99)							-0.8263 (-5.89)	0.0252 (5.99)	0.9975	1.50
I.2	2.9561 (55.21)	0.0570 (24.33)			-0.1805 (-3.18)	0.0122 (3.88)					-0.8674 (-5.99)	0.027 (5.94)	0.9976	1.40
I.3	2.8876 (64.04)	0.0606 (23.57)	-0.088 (-1.60)	0.0030 (0.49)					-0.3402 (-3.60)	0.0105 (2.88)			0.9964	1.28
I.4	2.9271 (26.22)	0.0586 (10.58)			-0.1516 (-1.33)	0.0107 (1.75)			-0.3797 (-2.73)	0.0125 (2.05)			0.9965	1.17
I.5	3.1463 (27.48)	0.0496 (10.90)					-0.3523 (-3.05)	0.0166 (3.49)			-1.0577 (-5.99)	0.0343 (5.74)	0.9976	1.31
	General Index of Industrial Production :													
G.1	3.1637 (99.34)	0.0516 (30.60)	-0.228 (-4.89)	0.0089 (1.51)							-0.9678 (-5.72)	0.0301 (5.93)	0.9959	1.21
G.2	3.2582 (24.74)	0.0473 (9.03)					-0.3512 (-2.64)	0.0213 (3.89)			-1.0623 (-5.23)	0.0343 (4.98)	0.9964	1.23
G.3	3.3388 (22.95)	0.0435 (6.82)			-0.453 (-3.45)	0.0285 (4.05)			-0.6227 (-3.89)	0.0234 (3.33)			0.9947	0.86
G.4	3.1242 (57.13)	0.0541 (17.35)	-0.1885 (-2.83)	0.0063 (0.85)					-0.4081 (-3.56)	0.0128 (2.90)			0.9941	0.92
G.5	3.2878 (41.47)	0.046 (13.29)			-0.3851 (-4.44)	0.0248 (4.98)					-1.0601 (-4.90)	0.0350 (5.05)	0.9918	1.61

Table 4.2 Contd.

NOTES : 1. The Dummies in the above equations are defined below :

$$D = \begin{cases} 1 & \text{for each year upto 1959-60;} \\ 0 & \text{elsewhere.} \end{cases}$$

$$D' = \begin{cases} 1 & \text{for each year upto 1965-66;} \\ 0 & \text{elsewhere.} \end{cases}$$

$$D'' = \begin{cases} 1 & \text{for each year upto 1969-70;} \\ 0 & \text{elsewhere.} \end{cases}$$

$$D_1 = \begin{cases} 1 & \text{for each year from 1975-76 onwards;} \\ 0 & \text{elsewhere.} \end{cases}$$

$$D_1' = \begin{cases} 1 & \text{for each year from 1980-81 onwards;} \\ 0 & \text{elsewhere.} \end{cases}$$

2. Figures in brackets represent t-ratios of the coefficients, in this as well as the following tables.

1965-66 to 1979-80 and 1980-81 to 1989-90, being the three different periods. These particular periods will be called periods I, II and III respectively, for later reference. (All the regression results are given in Table 4.2). The average rate of growth of output of this group is found to be rather low all through, being in the range of 2 to 3.5 per cent per annum. Its average annual rate of growth, which was around 2 per cent in the second phase, showed a recovery to 3.3 per cent in the third phase (equation (C.2) of Table 4.2)[3]. Replacing 1965-66 by 1959-60 as the year of the switch and/or considering 1975-76 in place of 1980-81 as the year of reswitch too yield statistically significant differences in growth rates across different subperiods (eqs. (C.1) and (C.4) of Table 4.2), lending weight to the proposition that the change in the growth rate of this industry group was initiated earlier, but the effect got consolidated by 1965-66 for the first switch and by 1980-81 in case of the second switch.

Coming to the basic and capital goods industries, once again the same periodization, i.e., I, II and III as defined above, yields the best results. The average rate of growth per annum is found to have declined from 10.2 percent to 4.4 percent before rising to 8.5 per cent across the three subperiods (eq. (B.2) of Table 4.2). It may be pointed out that the recovery in the third phase does not raise the average rate of growth to the pre-1965 levels. Using any other combination of points of switch gives satisfactory results; however, the fit is poorer in terms of values of $\bar{R}^2$ and DW statistic.

For the intermediate goods industries also we compare results

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[3]As explained earlier, we fit a regression equation of the form

$$\log x_t = \alpha + \beta t + \gamma D + \delta Dt + \varepsilon D_1 + \theta D_1 t.$$

The rates of growth for the three subperiods then are obtained as follows : coefficient of t (β) gives us the rate of growth of the second subperiod, while ($\beta+\delta$) represents the rate of growth for the first subperiod and ($\beta+\theta$) for the third subperiod.

using the various alternative points of switch and observe that the year 1959-60 does not turn out to be a useful point of switch, i.e., the rate of growth does not appear to be statistically different before and after this period. The results are better with the use of either 1965-66 or 1971-72 as the year of switch. In the case of the second switch, 1980-81 is found to yield good results. The results obtained here portray the same picture as that of the other industry groups. In this case, however, the rate of growth in the third phase is found to be higher than that in the first phase. This is in contrast to the behaviour of the other two groups of industries.

As would be expected from the above discussion, if one considers the industrial sector as a whole (i.e., the general index of industrial production), using 1965-66 and 1980-81 as points of switch would yield the best results. The rate of growth is found to have declined from around 7 percent in the first phase to 4.5 precent in the second phase, before it experiences a recovery to around 8 per cent in the third phase.

An interesting feature of the industrial growth that emerges from this discussion is that while consumer goods (as well as basic and capital goods industries) show a statistically different (i.e., lower) rate of growth even with 1959-60 as the year of change in trend, intermediate goods show a decline only from 1965-66 onwards. This suggests that possibly the former two sets of industries had experienced a slowdown much earlier than the latter. For all the three groups, using 1965-66 as the break point gives good results, suggesting that all industries did experience a decline, although the impact was sharpest for basic and capital goods industries.

With this picture of the behaviour of industrial outputs, we take up in the following sections an analysis of various explanations which have been offered in the literature for such a behaviour.

4.3. Explanations for Stagnation

As observed in the last section, the rate of growth of industrial output recorded a significant decline around the mid-sixties. This decline had been fairly widespread, being experienced by almost all groups of industries. This phenomenon, generally referred to as 'stagnation in industrial growth' in the literature, evoked intense debate regarding causal factors and explanations. The arguments in the debate can be classified into two broad sets depending on whether the emphasis is on the demand side factors or the supply side constraints. This section starts by looking into the demand side factors ; this is followed by a discussion of the supply side factors.

4.3.1. Demand Side Explanations

Broadly speaking, sources of demand for industrial output in an economy are mainly of three kinds : consumption demand, investment demand and exports. In the initial stages of development of the Indian industrial sector, however, there existed an additional source, viz., the demand resulting from deliberate policies of import substitution adopted in the economy. Of these various sources of demand, exports never constituted a substantial component in the total demand for industrial output in India. Over the period from 1951-52 to 1987-88, the value of export of manufacturing output as a percentage of value of total manufacturing production accounted for only about 6 to 7 percent, falling to less than 6 per cent in the eighties. This possibly explains why the behaviour of exports do not figure in any of the explanations for stagnation. We, therefore, turn to other explanations.

(a) Exhaustion of Import Substitution possibilities

In the fifties India embarked on the path of development with a narrow industrial base, in terms of both the size of the industrial

sector as well as its spread (diversity). A large part of the domestic demand was met by imports. The introduction of the planning process with an emphasis on heavy industry and large public investments during the second plan generated significant growth in demand; alongside, the policy of import substitution channelled the demand towards domestic industry, thus providing a boost to the rates of growth of both industrial output and investment. The import-substitution policies, however, could provide only a temporary stimulus, lasting as long as there existed uncaptured domestic markets. In fact, it has been argued that this stimulus possibly got exhausted by the mid-sixties. References to this kind of an explanation can be found in studies such as Bagchi (1970), Patnaik (1981), Nayyar (1981) and Ahluwalia (1985).

The extent of import substitution is expected to be reflected in the decline in imports-to-availability ratios over time. Ahluwalia (1985, Tables 6.3 and 6.4, pp. 119-20) computed these ratios for major industrial groups for three isolated points of time, viz., 1959-60, 1965-66 and 1979-80. She observed that, in general, the ratio for any group was smaller in 1965-66 compared to its values in both 1959-60 and 1979-80 and hence argued that there was a slowdown in the stimulus provided by import substitution policies after the mid-sixties. There are a number of objections that one may raise to such an analysis. Firstly, a reversal of the trend in the behaviour of the imports-to-availability ratio is being used to argue for the exhaustion of the possibility of import substitution. But the same observation may also indicate the economy's increasing dependence on imports vis-a-vis domestic production. Secondly, it is fairly obvious that by using ratios for three discrete points in time, one cannot infer about changes in the trend behaviour, not to speak of the timing of exhaustion of stimulus provided by the import substitution policies.

We thus note that although import substitution policies did play a role in diverting demand to the domestic industry, the evidence is not sufficient to infer anything about the timing of the exhaustion of this stimulus. Rangarajan (1982b, pp. 593) argues that since this stimulus has to work largely through creating demand for domestic capital goods industries, one should look at the share of imported machinery in total investment in machinery and equipment. This ratio, having declined after 1965-66, is found to have stabilised in the early seventies, suggesting an exhaustion of the stimulus at that time. However, it may be noted that the imports-to-availability ratios for industries of electrical and non-electrical machinery experienced a decline even in 1979-80 i.e., the ratio for 1979-80 was lower than that for 1965-66 (Ahluwalia, 1985, p. 119). This seems to indicate a possible persistence of import substitution at least beyond 1965-66. Thus, all the evidence put together suggests that while the stimulus might have been diminishing or even got exhausted, the exact timing of this phenomenon is difficult to ascertain. In other words, the exhaustion of import substitution possibilities can play only a limited role in explaining the phenomenon under consideration.

(b) Consumption Demand

The general argument runs as follows. Owing to a number of reasons, aggregate consumption demand grew slowly. Hence, the demand for capital goods by the consumer goods industries also grew slowly, implying a slow growth of output of capital goods too. These two together could have sustained only a slow growth in industrial output, in general. If one adds to this the fact that the stimulus provided by the import substitution policies was tapering off, the result obviously would be a reduction in the rate of growth of industrial output. This constitutes the basic line of argument embodied in the hypothesis under consideration.

Broadly, two kinds of arguments have been advanced to explain the failure of consumption demand to increase sufficiently fast. One set of arguments is based on the slow growth of agricultural income while the other traces the source of the problem to the existing as well as the emerging distribution of income. In what follows, we shall examine both the arguments critically.

(b.1) Agricultural incomes as a source of demand

The slow growth of agricultural outputs and agricultural incomes have been argued to result in the slow growth of demand for industrial consumer goods (Raj, 1976, p. 230-31; Chakravarty, 1979, p. 1238). The Indian economy is predominantly an agrarian economy. In the early fifties about 56 percent of GDP originated in agriculture. Although, this percentage has gone down almost uninterruptedly over the years, the share of agriculture in real GDP was still as high as 37 percent in the late eighties. This clearly highlights the importance of the agricultural incomes as a source of demand for industrial output.

A major objection to this line of argument arises from the fact that income accruing to the cultivators is determined jointly by the levels of marketable surplus of the agricultural outputs and the expenditure of the rest of the economy on it and not simply by the levels of production or the marketed surplus alone. This raises doubts about considering agricultural income as an independent source of demand for industrial goods. Of course, such an objection becomes invalid if there exists an agent like the government which, through its intervention in the foodgrains market, can create a divergence between incomes accruing to the agriculturists and the expenditure by the rest of the economy on agricultural goods.

Interestingly, studies on growth rates of agricultural outputs, give conflicting results, with Patnaik (1981, p. 66)

claiming a decline in such rates in the post mid-sixties, while Srinivasan (1979, pp. 1287) and Ahluwalia (1985, pp.37-39) find no evidence of either deceleration or acceleration. Some others seem to find some acceleration in the trend rate of growth since the late sixties (Alagh and Sharma, 1980; Sawant, 1983). The evidence examined does not support a hypothesis that the decline in the rate of growth of agricultural output was responsible for a decline in the industrial growth rate. However, these definitely suggest that one possible stimulus to the industrial demand was playing a very low key role, making the industrial sector more vulnerable to shocks from the other components of demand.

(b.2) Income distribution and the demand for industrial output

The basic argument runs as follows. Corresponding to any given level of aggregate income, the quantum of demand generated is a function of the distribution of income. It is argued that the extent of inequality in the existing distribution of income has concentrated purchasing power in the hands of only a few upper income groups, whose demand consists mainly of "luxury" goods. Since such consumption is argued to reach saturation rather fast, the rate of growth of consumption demand slows down after a while. A rapid growth of the industrial sector, therefore, requires a more equal distribution of income, generating a pattern of demand tilted in favour of mass consumer goods (Nayyar, 1981).

The difficulty with this kind of analysis is that it depends crucially on certain assumptions which are questionable. For instance, the argument that the demand of certain income groups becomes saturated faster is based on the assumption that the commodity basket produced (and consumed) domestically remains unaltered overtime. Similarly, another underlying assumption is that the propensity to consume the industrial good is higher for some of the relatively poorer income groups, a redistribution of income in

favour of whom would, therefore, be expected to raise the level as well as the rate of growth of demand for industrial output. The latter assumption, however, needs to be empirically established, since the poorer sections in the Indian economy are usually argued to have a low propensity to consume the industrial goods, even though their aggregate propensity to consume is considered to be relatively high.

In an empirical investigation, Krishnaji (1984) finds that the per capita private final consumption expenditure on the manufactured goods is negatively related to both the price of cereals and the square of per capita income. The latter result suggests that the demand for manufactured goods tapers off with increases in income. It may, however, be noted that this result is obtained from cross-section data, and it remains to be shown that an analysis of time series data also yields the same result.

So far we have considered arguments based on a given (i.e., unchanged) distribution of income. The literature includes studies which go a step further and seek to establish that owing to changes in terms of trade and government policies, the distribution of income has been shifting over time, and shifting in such a way as to have an adverse impact on the demand for industrial output. We, therefore, examine these arguments.

(b.2.1) Effects of Changes in Terms of Trade

Changes in intersectoral terms of trade in favour of the agricultural sector are argued to affect income distribution both within the agricultural sector as well as between the two sectors- agriculture and industry. Such a change in terms of trade, redistributes income in favour of the landowners and against those sections of the population who are net purchasers of foodgrains. Industrial workers as well as agricultural labourers would belong to

the latter category. Given that their wages (when fixed in money terms) respond to prices only with a lag, if at all and that their demand for foodgrains is price-inelastic, their demand for industrial consumer goods would get curtailed when terms of trade move in favour of the agricultural sector; on the other hand, the beneficiaries from such a change in terms of trade may not expand their consumption by the corresponding amount. This could result not only in a change in the pattern of demand in favour of consumption of "luxury" goods but also a decline in the aggregate demand for industrial consumer goods. A continuous shift in terms of trade in favour of the agricultural good could, therefore, have a depressing impact on the demand for and hence on the growth of the industrial output. In addition, changes in terms of trade, working through the costs of industrial production, could adversely affect profitability in industry and hence create a depressing effect on the supply side as well.

Some empirical studies try to investigate the adverse impact of a rise in foodgrains prices on the demand for industrial consumer goods. For instance, Radhakrishna and Murty (1980) use the NSS data to estimate the quintile-specific elasticities of demand and show that while the demands (for any commodity group) by all quintile groups are adversely affected by increases in cereal prices, the impact is largest for the lowest quintile, suggesting that the demand from this group registers the sharpest fall. This then indicates a change in the composition of demand for industrial goods in the face of a change in nominal prices of cereals.

Again, while intertemporal fluctuations in the relative price of foodgrains are expected to be closely related to those in per capita availability of foodgrains, Mitra (1977) and Patnaik (1981) maintained that such fluctuations after the mid-sixties were not totally in response to the fluctuations of foodgrains availability. They argued that the government interference in the foodgrains market, by sustaining a price above the market clearing price,

resulted in an accumulation of large stocks of foodgrains with the government. The failure of agricultural prices to fall even in the event of good agricultural production was offered as a proof of the conjecture that prices were being proped up above the market clearing level. Mitra (1977) argued that this process, by depressing demand for industrial consumer goods, led to a stagnation in the industrial growth. Patnaik (1981, pp. 85-86) carried the argument a step further and maintained that in the process the government had lost control over liquid resources which, in turn, restricted its effort to expand public investment and hence to generate demand for industrial goods.

(b.2.2) Effects of Government Policies

Fiscal and other policies followed by the government are potentially capable of altering the existing distribution of income. Various taxes and subsidies play precisely such a role. As is widely accepted, the tax structure in India tends to be regressive. In addition, measures like deficit financing, which have grown in size over the years, are supposed to generate inflationary pressures in the system, once again implying some redistribution of income in favour of property owners. Further, as mentioned earlier, government interference in the foodgrains market is also argued to serve a similar purpose. All such measures are argued to have contributed to making the distribution of income more skewed. Chakravarty (1979, pp. 1236-1239) and Patnaik and Rao (1977, p. 127) argue that these policies have resulted at least in some kind of a 'disproportionality crisis' by adversely affecting the growth of demand for industrial consumption goods and hence the necessary stimulus to the growth of private investment was missing. Public investment, on the other hand, is supposed to be constrained by a lack of sufficient access to investible resources in the economy. In this context, it is also maintained that government interference in the foodgrains market has contributed to shift the control over liquid investible resources to

private hands. We shall take up this part of the argument in the next subsection.

The arguments presented in this section fall basically into two distinct groups - those based on a given distribution of income and those requiring a worsening distribution of income. Any examination of the relevant evidence, therefore, should consider both the aspects. Empirical evidence in favour of or against the first group of arguments is difficult to obtain; the only studies which try to infer about such effects are some cross-section studies based on the NSS data (Krishnaji, 1984; and Radhakrishna & Murthy, 1980). Most of the evidence cited, however, relates to the second aspect which we will take up next.

The available empirical evidence does not point to any secular deterioration in the distribution of income. Most of these studies examine the size distribution of per capita personal consumption expenditure obtained from the NSS enquiries for the various rounds. Ahluwalia (1985, pp.59-61) quotes evidence which shows a decline in the Gini coefficient of size distribution based on both nominal and real per capita consumption expenditures for both rural as well as urban India over the period, 1960-61 to 1973-74. Some of the more recent studies also reveal that over a longer period measures of inequality like Gini coefficient etc. have shown only fluctuations and no trend increase or decrease over time. Bhattacharya et. al. (1992, ch.4) present these results for the period from 1952 to 1983 for rural India, while Maiti and Chattopadhyay (1993) obtain similar results for urban India for the period from 1952 to 1990.

One may object to the use of measures of inequality in consumption expenditure as a proxy for the same in income distribution on the ground that the objective here is to study the pattern of consumption demand corresponding to a given distribution

of income. However, the NCAER surveys on the household income, consumption, etc. which provide Gini coefficients for income inequality in both rural and urban sectors, reveal the same picture, i.e., an absence of any secular trend in the measures of inequality.

Finally, intertemporal movements in terms of trade in our economy do not support the view that government intervention in the foodgrains market affected terms of trade in such as a way as to create an adverse impact on the distribution of income. In effect, the evidence shows that after the mid sixties the relative price of foodgrains, i.e., the price of foodgrains relative to that of manufactures, exhibited only a declining trend at least upto the early seventies. In fact, the data presented in the Table 3 of Appendix B shows that if one considers a longer period, say, from the early fifties to the end of the eighties, the relative price of foodgrains is found to have fluctuated around a declining or at most a horizontal trend, but not surely around any increasing trend.

Again, existing evidence does not support the view that the government intervention in the foodgrains market through procurement and public distribution of foodgrains has led to any deterioration in distribution of income. Using the data for the period 1952-70 Chakrabarti (1977, pp. 61, 68) obtains results which show that higher the rate of procurement of cereals (i.e., the amount of cereals procured as a proportion of output) in the last year, lower would be the relative price of cereals in the current year. Bhattacharya, et.al.(1992, ch.5) find an inverse relation between the per capita procurement (and hence distribution) of cereals and the incidence of rural poverty, implying that such government intervention has a favourable effect on the total consumption expenditure of even the rural poor.

Thus the evidence examined here does not support a hypothesis that there was a systematic deterioration in the distribution of

income. Of course, it should be added that there is not enough evidence either to support or to rule out the possibility of the existing distribution of income imposing a constraint on the rapid growth of the industrial demand.

To briefly summarise the discussion in this subsection (i.e., constraints to the growth of consumption demand), it would be useful to recapitulate our observations in the last section regarding the growth of the consumer goods industries. Consumer goods industries are found to have experienced relatively low rates of growth. Consumer durables, on the other hand, are said to have experienced fairly high rates of growth throughout the entire period. However, the fact that the latter industries continue to constitute a rather small fragment of total industrial output implies that the demand generated for these industries would be insufficient to trigger off industrial growth on a wide and large scale.

As regards the factors responsible for such a pattern of demand, the available evidence suggests that while the rate of growth of demand from agricultural incomes and the pattern of demand generated by the existing distribution of income in the economy might have made the industrial sector vulnerable to any shocks coming from the other sources of demand, these cannot provide a complete explanation for the phenomenon of deceleration in industrial growth.

(c) Investment Demand

Investment constitutes another major component of demand, and has figured quite prominently in the discussions on the explanations for deceleration in India's industrial growth. The fact that the basic and capital goods industries had experienced the brunt of the decline in growth indicates the inadequacy of the growth of investment demand to be the most obvious of explanations.

Aggregate investment demand has two broad components - public investment and private investment. While public investment is usually taken to be guided by such factors as the desired rate of growth of the economy, it can at times be constrained by other factors as well, e.g.,the rate of growth in agricultural output, anticipated rate of inflation, availability of investible resources etc.. Private investment, on the other hand, is a function of variables such as the expected rate of growth on one side and the availability of various infrastructural facilities on the other. Further, public investment appears as a crucial variable influencing the private investment. There are many possible mechanisms through which the former can influence the latter - some of these influence the supply side of the industries while some work through the demand side linkages. These are briefly discussed below.

(i) Public investment, being autonomously determined, is not only a source of direct demand for the basic and capital goods industries in both the public and private sectors, but also stimulates the aggregate demand in the economy through the multiplier effects, thus inducing an expansion of consumer demand too. This also serves as a stimulus to private investment. These are all demand side effects of public investment on private investment.

(ii) One principle component of public investment is the investment in infrastructural facilities, sufficient availability of these facilities constituting an essential precondition for the growth of private investment. One can visualise a supply side linkage in this argument.

(iii) In the event of a constraint on the availability of investible resources, these two forms of investment may have to compete with each other for funds. In such a situation, one could expect a negative relation between the two, and any investment in the public sector, say, would lead to a cut down in private investment. In this case, however, one has to examine the causes of resource constraint in order to identify whether the underlying explanation works basically through the demand side or the supply side.

Let us consider (i) above in some more detail. Here one talks about the role of public investment in generating and sustaining demand in the domestic economy. Bagchi (1970), Chakravarty (1979) and Patnaik (1981) focus on this particular function of public investment. A decline in public investment would imply a decline in the demand for industrial goods, which in turn, could lead to a decline in private investment. In ascertaining the factors responsible for this decline, there appears to be some concensus among these authors. They argue that the lack of sufficient government control over the distribution of income as well as the allocation of resources was one of the principle factors responsible for the government's inability to expand public investment, in particular, and public expenditure in general, following a curtailment of inflow of foreign assistance in the mid-sixties. Bagchi (1970, pp. 179-184) locates the source of the problem in too little savings which have emerged from the existing distribution of income, and in the decline in the rate of growth of income caused by a decline in the rate of growth of autonomous expenditure. Chakravarty (1979, pp. 1235, 1238), on the other hand, argues that there is "too much savings" and too little growth in consumer demand in the economy. He argues that with the lack of access to this surplus, the government is constrained in its capacity to expand expenditure, while the private sector does not find it profitable enough to take up large scale investment, given the slow rate of growth of demand.

Implicit in both these explanations is another constraint to the expansion of autonomous expenditure, viz., the shortage in the availability of foodgrains which has exposed the system to inflationary pressures whenever demand expanded. Chakravarty (1979, pp. 1236) and Patnaik and Rao (1977, pp. 126-127) hold that the inflationary pressures have been further aggravated by the policy of intervention in the foodgrains market: such intervention has been argued to introduce a "ratchet effect" on the price of foodgrains,

thus intensifying the inflationary pressures.

Any attempt to investigate the empirical validity of such an argument would have to take into account the other possible linkages between public and private investment as well. The time series on various categories of real fixed capital formation show a close correspondence between the series for public and private investment, the relation is closer if one considers private corporate investment (Rangarajan (1982a) examines the evidence on these variables). Specifically, the decline in public investment in the mid-sixties is found to have been accompanied by a decline in private investment as well. On the face of it, such evidence would suggest that it is the demand side linkage which predominates[4]. However, it is possible to argue that the phenomenon, viz., the decline in public and private investment, was a result of scarcity of investible resources, which is strictly a supply side bottleneck. We will take up these issues in the next subsection. Suffice it to say here that whatever be the underlying factors for a decline in investment expenditure, there appears to exist consensus all around that such a decline did contribute to a decline in the rate of growth of industrial output.

4.3.2. Supply Side Explanations

In seeking to define supply side constraints to industrial growth in Chapter 3, we talked of two kinds of constraints - constraints affecting shifts of the supply function and those restricting movements along it. The supply function of an industry generally indicates the profit maximizing output levels given the output prices and prices of inputs/availability of the scarce inputs. Any change in these prices or availability of the inputs is expected

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[4]Of course, a decline in investment in infrastructural facilities may result in a decline in private investment with a lag.

to induce at least one of the above-mentioned changes. The same change could also evoke changes in the pattern and volume of investment or provide incentives to innovate and economise on the use of scarce inputs, leading to an outward shift of the supply function. Thus a supply bottleneck can arise only when none of these shifts takes place as required.

There are mainly four kinds of explanations relating to the supply side: inadequacy in supply of inputs, wage goods constraints, resource bottlenecks to the expansion of investment and finally inefficiency in the use and allocation of resources. We will take up each of these in the following discussion.

(a) Inadequate Supply of Inputs

Shortages in input availability, i.e., shocks in the supply of inputs, can be of two kinds: (i) temporary one-time shocks and (ii) a sustained decline in the supply of inputs or temporary but repeated random shocks. Obviously, bottlenecks due to (i) cannot lead to a prolonged deceleration in industrial growth. On the other hand, in the case (ii), the industries in question are expected to respond by taking some remedial measures, like finding alternative sources of supply and/or choosing a suitable combination of inputs so as to reduce its dependence on inputs in short supply. Given that such are the likely responses of the industries, the persistence of supply bottlenecks must mean the existence of constraints on operation of these responses.

The existing literature considers the supply of inputs to industry mainly from the agricultural sector. The supply of inputs of agricultural origin is subject to random fluctuations, i.e., the second kind of input shock mentioned above. In addition, a slow growth of agricultural production and the consequent slow growth in the supply of inputs could prove to be an input bottleneck to industrial growth.

Interestingly, there is no evidence of a decline in the rate of growth of outputs of agro-based industries around the mid-sixties, although it has remained low throughout (Ahluwalia, 1985, p. 21). While admitting a decline in rate of growth of production of inputs of agro-based industries from the mid-sixties Ahluwalia (1985, p. 50), however, argues that the existing policies proved to be a constraint to the expansion of both capacity and outputs here; i.e., the various policies did not permit smooth shifts of the supply function leading to the emergence of a supply bottleneck. The argument, though logically tenable, is difficult to test empirically. In fact, one may argue that the decline in the rate of growth of output of commercial crops was only in response to a decline in demand for such crops, with industries exhibiting tendencies of substituting such inputs by inputs of non-agricultural origin (synthetics)[5]. That such a process was in operation can hardly be denied. However , it is difficult to ascertain whether this is due to international demonstration effects, say, or is the result of improvement in the efficiency of domestic resource use as a response to endogenous constraints.

(b) Bottlenecks to an Expansion of Capacity

The literature on Indian industry recognises bottlenecks to the expansion of capacity as a primary manifestation of supply side bottlenecks to industrial growth. There are mainly three kinds of explanations offered for a decline in the rate of capacity creation in the mid-sixties:

(b.1) the wage goods constraint,

(b.2) insufficiency of infrastructural facilities,

(b.3) paucity of investible resources.

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[5]To cite a few examples, cotton fibres are being substituted by synthetic fibres (e.g. rayon), jute sacking by other synthetic packaging material such as thermocol, etc.

(b.1) Wage Goods Constraint

An expansion of output in industry usually requires an expansion of employment. This involves increased demand for the wage goods, an insufficient supply of which could raise the relative price of these goods (price of wage goods relative to prices of industrial outputs); if the real wage rates in terms of the wage goods remain more or less unchanged, the product wage rates in industry would rise, having an adverse effect on the profitability of industrial production. This would adversely affect the production in industries both in the short run and the medium run, i.e., by forcing the industries to cut down their current level of production given their objective of profits and also, by discouraging investment and capacity creation. Chakravarty (1974) provides a very clear exposition of this argument. Since the principal component of the wage goods basket is food, this constraint is a reflection of a supply bottleneck in agricultural sector. A slow growth of marketed surplus of agricultural goods would, therefore, tend to restrain the growth of industrial output.

While a rigorous verification of the above hypothesis is difficult, Ahluwalia (1985, Ch.3) makes an attempt in that direction. She examines evidence on trends in agricultural production, marketed surplus and per capita availability of foodgrains and observes that none of these series has exhibited any secular declining trend. Moreover, the series on terms of trade also fails to show any marked increasing trend over time. These then lead her to argue that the availability of wage goods could not have been a constraining factor.

(b.2) Insufficiency of Infrastructural Facilities

The availability of sufficient infrastructural facilities is usually considered as an essential precondition for investment in production. However, investment in the sectors providing such facilities involves long gestation lags and also tends to be lumpy.

Hence, it does not usually attract private investment. In fact, in the Indian context a large part of such investment is undertaken by the public sector. Given this, the availability of infrastructural facilities becomes constraining only if the public sector faces a sustained paucity of resources, or there surface errors in anticipation of demand for these services. Clearly, it is only the former that can generate a long term constraint.

In this context, there are repeated references in the literature to an imbalance in control over investible resources in the economy, with the private sector coming to control an increasing share (see Chakravarty, 1979, p. pp. 1233-34, 1237-38; Bagchi, 1970, pp. 191-92 and Patnaik, 1981, p. 85-86). Such an imbalance is argued to constrain public investment and at the same time, promote diversion of resources towards speculation (Patnaik and Rao, 1977, p. 127; Patnaik, 1981, p. 86).

In a supply constrained economy one would expect some reallocation of resources within the private sector so as to relax the bottlenecks arising out of insufficiency of infrastructural facilities. Such facilities consist mainly of electricity and transport facilities, both of which are potentially amenable to some substitution. Alternative sources of power could potentially be tapped to substitute for the insufficient supply of electricity from the public sector plants. On the other hand, one would expect a shift to technologies which economise on the use of electricity. Similarly, railway transport, provided by the public sector, can potentially be substituted for by road transport, which could be taken up by the private sector. While there do appear some references as to the private sector favouring road transport, shifts towards substitution for electricity are not observed to have taken place on any significant scale. Instead, over the period 1960-61 to 1978, Ahluwalia observes a major increase in the share of electricity in total energy consumption (including coal, oil and electricity)

from 17 percent to 30 percent (Ahluwalia, 1985, p.80). Thus, in the absence of adequate responses on the part of the private sector to relax whatever constraints on infrastructural facilities were there, it seems doubtful whether such constraints really constitute long term bottlenecks to growth.

(b.3) Paucity of Investible Resources

One of the prime constraints to indusrial growth in a developing economy is the lack of sufficient investible resources. This is argued to lead to a competition for resources between the public and private sectors, resulting in "crowding out" of private investment by public investment. The other two forms of linkages, however, talk of a positive relation between the two. The question, therefore, is which of these linkages is dominating. While some of the studies in the Indian context argue for the dominating influence of the crowding out effect (Sundarajan and Thakur, 1980; Krishnamurty, 1984), others support the view of a stronger complementary relation between the two, especially between public investment and private corporate investment (Rangarajan, 1982a, 1982b, p. 601).

The existence of a resource bottleneck would be expected to induce a shift in favour of more capital saving technologies, so as to yield maximum returns to capital as well as to ensure maximum possible expansion of capacity. Evidence, however, seems to suggest just the opposite, with an observed increase in incremental capital output ratios at least till the early eighties (Rangarajan, 1982b, p. 603; Raj 1984, p.1802-03). Raj(1984, p.1803) seeks to explain such a rising trend in terms of a relatively faster increase in the price index of capital goods vis-a-vis the general price index. However, it remains to be explained why, in the face of persistent excess capacities in the capital goods industries, prices of capital goods have increased relatively faster.

(c) Inefficiency in Allocation and Use of Resources

In most of the developing economies capital is a scarce resource, insufficiency of which is associated with the underdeveloped state of the economy. The need for achieving efficiency in the allocation and use of these resources, therefore, assumes vital importance. One set of explanations for industrial stagnation in India runs in terms of inefficiency in the allocation and use of resources. Two kinds of evidence are presented in this regard, viz., increasing capital output ratios and a negative rate of growth of total factor productivity.

Both Ahluwalia(1985, pp. 140-144) and Rangarajan (1982b, p. 602)[6] provide evidence to show that the capital-output ratios have been increasing over time, the phenomenon affecting almost all the industry groups. Further, this phenomenon is observed to have characterised the industrial sector over the entire period considered (i.e., 1960-61 to 1979-80).

The other part of the evidence of inefficiency in factor use is based on the estimates of total factor productivity growth. Ahluwalia (1985, Ch.7; 1991) shows that the Indian industry did not experience any significant total factor productivity growth; further, the evidence does not show any difference in behaviour in this regard between the pre-stagnation phase and the stagnation phase[7].

All this evidence is used to infer that the cumulative inefficiency through the years may have had a stifling effect on the

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[6]Rangarajan (1982b) deals only with sectoral incremental-capital-output ratios, while Ahluwalia (1985) discusses trends in capital-output ratios.

[7]Ahluwalia(1991) further observes that a decline in the rate of growth of capital stock was primarily responsible for the decline in the rate of growth of industry.

growth of manufacturing. The major cause of inefficiency in resource use identified in both these studies is the imbalance in the pattern of capacity creation, resulting in a coexistence of both demand constrained and supply constrained industries. An expansion of capacity in the latter set of industries is, therefore, argued to make possible better utilization of factors and resources, by raising their levels of production.

The policy regime, as it existed in this period, is also supposed to have contributed to the emergence of inefficiency in resource use. For instance, Ahluwalia (1985, p.163) argues that the industrial policy regime operated in such a way as to influence the pattern of investment down to the product level and the choice of technology, with its implications for the scale, expansion, location, direct import content as well as the terms of foreign collaboration in finance and knowhow. This is argued to have contributed to restricting not only foreign competition through open-ended import substitution policies, but domestic competition as well.

It may be pointed out that there are some major gaps in the above arguments. Consider, for example, the link between inefficiency in the use of factors and the decline in the rate of growth. The argument presumably runs as follows. A decline in the efficiency in the use of resources, specially of capital, implies the production of a smaller amount of output per unit of capital employed. This, in turn, results in a smaller volume of savings per unit of capital and a correspondingly smaller rate of growth of capital stock. In other words, a resource constraint appears to materialise in the process. The argument that even under such constraints to the expansion of capacity, efficiency does not improve, is based on an implicit assumption of the existence of demand deficiency. To see why such an assumption is crucial to this argument, consider the situation where the growth of output falls because of declining efficiency and fails to meet the growing demand,

i.e., there emerges excess demand for output. Consequent movements in prices or alternative indicators of excess demand then are expected to induce the industries to increase the growth of their outputs, if there were no resource constraints[8] and/or to improve efficiency. Obviously, the attempt to improve efficiency is likely to take place on a much more significant scale under a regime of resource constraint than otherwise.

Similarly, the argument that the existing policies suppress domestic competition thereby breeding inefficiency is also based on the same implicit assumption of the lack of sufficient growth in domestic demand. For, a rapid growth in domestic demand could have stimulated competition and improved efficiency in the domestic market. Thus, it is the slow-growing demand, i.e., the slow-growing market which, even in the absence of the policy barriers to entry, could encourage formation of oligopolies, which might ultimately generate effective barriers to entry, and the emergence of inefficiency. Thus, both the factors - the lack of foreign competition as well as the lack of domestic demand - seem to be essential for explaining the observed increase in inefficiency in resource use.

To briefly summarise the discussion in this section, of all the explanations offered for the phenomenon of industrial stagnation during the period since the mid-sixties, the demand side explanations seem to be based on much stronger grounds. For instance, the supply side explanations seem to indicate inefficiency either in the functioning of the existing markets or in the responses of individual agents to the market signals. Factors underlying such behaviour need to be examined critically and in greater detail for establishing the

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[8]In the absence of a resource constraint, output can be expanded by augmenting the installed capacity, i.e., here the existence of efficiency could imply a higher demand and faster growth in demand for capital goods industries.

significance of these factors in causing a slowdown in industrial growth independent of demand factors.

4.4. Factors Explaining Revival of Growth

The revival of industrial growth in the eighties has once again provoked some amount of debate regarding the underlying factors. Before examining the individual explanations, we would present a brief summary of the features of the industrial growth in the eighties, as identified in the ongoing debate.

With varying rates of growth of different industries, there appears to have occurred, a change in the structure of the industrial sector. Kelkar et.al (1990) isolate a shift in the importance from the metal-based and machine building industries as prime movers (i.e., sources of most rapid growth) in the first phase (i.e., during 1959-60 to 1965-66) to chemicals and petro-chemicals and products thereof in the recent phase of revival. Moreover, one finds consumer durables to be the fastest growing group followed by basic and capital goods industries . Intermediate goods industries, however, are found to have experienced the slowest growth (Kelkar et.al, 1990 ; Ahluwalia, 1991, Ch. 2). This is in sharp contrast to the behaviour in the first phase, where capital goods industries were the fastest growing group. Further, some increase in capital-labour ratios of various industries are also observed (Ahluwalia, 1991, pp. 76-79). With these features of growth in the eighties in mind, we now turn to a discussion of the various explanations offered for this growth. On the demand side are emphasised, a revival of public investment, an increase in the share of machinery and equipment in total capital formation and an increase in the share of purchased inputs in total inputs used in agriculture. On the supply side figure such explanations as increase in efficiency of infrastructural facilities and a change in the trade and industrial policies.

Consider first the demand side arguments. A decline in public investment, one of the factors causing deceleration in industrial growth since the mid-sixties, has been identified as a factor responsible for revival as well. An increase in the rate of growth of public investment along with a change in the composition of public investment has been argued to work towards stimulation of demand for the industrial output in general and for output of the capital goods industries, in particular (Nagaraj, 1990, pp.2320-21). The change in the composition of sectoral capital formation constituted a shift from agriculture towards industry and infrastructure. This possibly accounts for an increase in the share of machinery and equipment in the total capital formation.

Studies tend to support the hypothesis that the growth in the eighties has been demand induced. A step up in the rate of growth of consumer goods, both durable and non-durable, triggered by an increase in per capita GNP is argued to have worked as a pull on the output of capital and intermediate goods (Sengupta, 1993 ; Kelkar et.al, 1990). A stable ratio of indirect taxes to sale prices of manufactured goods is argued to have contributed to the transmission of the demand impulses across the industrial sector.

So far as the supply side explanations are concerned, improvements in the rate of growth of investment as well as efficiency in resource use in infrastructural sectors figure prominently in the literature (Ahluwalia, 1991 Ch. 3; Nagaraj, 1990, pp. 2321, 2323). Evidence of improvements in efficiency are found in the form of increases in plant load factor for thermal power plants, in revenue earning traffic in railways and in rates of growth of outputs of coal, electricity and cement. Further, Ahluwalia(1991, pp. 92-97, Ch. 7) argues that changes in trade and industrial policies have contributed to increased efficiency in resource use in industry (reflected in increases in total factor productivity growth

in the eighties), which, in turn, has stimulated industrial growth.

There are, however, some imminently disturbing features of this phase of revival in industrial growth. Evidence upto 1988-89 shows that even with an increase in the rate of growth of output of the registered manufacturing sector in the eighties, that of gross capital formation in this sector has not picked up. Such a behaviour in the context of widely publicised improvements in the investment climate seems to suggest a primarily demand constrained industrial sector, responding to stimuli to growth through increases in output and hence in the degrees of capacity utilization.

Two other disturbing features of this phase are a relatively sharper increase in prices of goods going into fixed capital formation vis-a-vis other prices and a percieved increase in dependence on imported inputs. In the context of a relatively more liberal import regime, the phenomenon of a relatively faster rise in prices of causes serious concern. For, liberal imports are argued to stimulate efficiency and introduce competition implying that prices would not be expected to rise fast, contrary to the observed trends. Similarly, the second feature, based on the evidence of an increase in the ratio of imported non-manufactured inputs as well as machinery and equipment in total inputs to the industry, suggests the possibility of industrial growth being more susceptible to the vagaries of international markets.

The above discussion brings together the potential contribution of demand as well as supply factors in explaining revival of industrial growth in the eighties. An analysis of factors responsible for the observed 'disturbing features' of this phase of revival, however, would be essential in order to assess whether this growth could be sustained over time.

4.5. Econometric Studies on the Indian Industry

In the literature on Indian industry there are some econometric studies which seek to explain the growth of the industrial sector. These studies are broadly of two types. On the one hand, we have studies attempting to assess the nature of constraints faced by the industrial sector, i.e, whether the demand or the supply is the constraining factor. The other set of studies aim at explaining econometrically the behaviour of the industrial outputs in terms of a number of exogenous and endogenous variables. In this section, we will examine these studies in some detail.

The first group of studies contains both aggregative studies considering the industrial sector as a whole (Lahiri, et.al., 1986 ; Goyal, 1992) as well as disaggregative industry specific studies (e.g.,Srinivasan, 1992b). In a nutshell, the approach used is to first obtain independent estimates of demand and supply for a given year and then by comparing these with the figure of actual level of production, some inference regarding the nature of the bottleneck facing the industry is sought to be drawn.

Lahiri and Roy (1986) use changes in the mark-up rate as a means of initially identifying years during which industrial outputs could be taken to be demand or supply constrained, and then, with the help of this information, they try to estimate the demand and supply functions. Srinivasan (1992b), on the other hand, uses Burkett's method which is based on defining submarkets with different excess demand/excess supply states and which allows for testing a hypothesis of discrete changes in regime.

Such models, however, would have very limited applicability. To explain, let us cite a few limitations of these models. Firstly, in each of these models, there is the possibility of rapid and repeated change of regimes. For instance, Lahiri and Roy derive that

industrial output was supply constrained in 1963 and 1965, but demand constrained in 1962, 1964 and 1966 since, these studies aim at throwing light only on the immediate constraints to growth (such as bottlenecks in supply of inputs), and not on the long term constraints to industrial growth. Secondly, the assumption of exogeneity of some of the explanatory variables appear questionable. For instance, Lahiri and Roy assume nominal agricultural income to be an autonomous variable, quite independent of such demand variables as government expenditure, bank credit, etc. If the latter variables affect demand for goods and services, they surely affect prices of goods, particularly prices of agricultural goods, and hence the nominal agricultural income. Finally, the regression results of their model are not very satisfactory. Goyal(1992), on the other hand, uses some short run as well as some long run criteria to assess the nature of the constraint. One of her conclusions is that as a result of a resource constraint, the industrial sector, specially the capital goods sector, faces a demand constraint.

These aggregative studies imply the existence of demand constraint in most of the years during the period from 1964-65 to 1979-80. The disaggregative studies (e.g. Srinivasan, 1992b), on the other hand, show that effectively, it is the basic and capital goods sectors which appear to be demand constrained.

The second set of studies seek to explain econometrically the intertemporal behaviour of the Indian industry. There is a fairly large amount of literature which explores the wide range of linkages between agriculture and industry. The supply side linkage is established through the supply of wage goods and agro-based raw materials, a scarcity in either exercising an adverse impact on industrial production. On the demand side, we have demand from the agricultural sector for industrial inputs, industrial consumer goods and capital goods. The demand for consumer goods is also strongly affected by the terms of trade across the sectors.

Ray(1991) and Rangarajan(1982a) seek to focus on the above relation . Ray(1991) uses the Box-Jenkins time series methods to ascertain the direction of casuality as well as the strength of the influence of agricultural production and infrastructural constraint on the industrial production. (Annual flow of electricity generation is used as an index of infrastructural facilities). The study shows that all the factors considered seem to have had significant impact on industrial growth during 1950-51 to 1983-84, although together, they provide only a partial or incomplete explanation of such growth.

Rangarajan(1982), on the other hand, develops a disaggregative model where the industrial sector is divided into three subsectors - basic and capital goods, consumer goods and intermediate goods. Outputs of all these goods are taken to be demand determined. This model considers public investment to be an endogenous variable, being determined by public sector savings, inflow of foreign funds and, a questionable variable - the time trend (introduced to capture the planners' intention of expanding investment).

The model is very interesting, but suffers from several limitations. Inclusion of both demand variables (time) and resource availability variables (savings, inflow of foreign funds) in the same equation for determining public investment seems to involve a logical fallacy - only one of them can be binding at given point in time, not both. One also notes that the model seeks to explain most of the endogenous variables by one-year lagged values of variables. Such an emphasis on lagged values may be objectionable even empirically. For instance, one regressor in his equation for the output of industrial consumer good is terms of trade in the preceding year. However, consumption demand is expected to be influenced more by current prices than by past prices. Moreover, the direct influence of the services sector on the demand for various goods has been ignored.

Given that the share of the services sector in GDP has grown over time (Bhattacharya and Mitra, 1991) and given that the government consumption expenditure (an expenditure made almost entirely on services) is substantial, the role of the services sector in influencing industrial outputs should not be too small. Finally, some of the equations including the one for public investment, have a poor fit.

In contrast to the studies discussed so far, there have been some attempts at providing a more general explanation of the growth of the industrial sector. Lahiri et.al.(1984) construct a fairly disaggregative model around the hypothesis of demand determined industrial outputs; their model seeks to explain output, price formation, money wage rate and unit costs for each of the industrial subsectors considered. Without going into a detailed discussion of the model we seek to point out some of its disturbing features. The postulated structural equations do not appear to be quite reasonable. For instance, agricultural and non-agricultural incomes are assumed to determine the aggregate private consumption expenditure at the first stage. The division of this total consumption expenditure between industrial and other goods is then postulated to be determined by autonomous expenditures, available quantum of bank credit, etc. However, the terms of trade between food and other goods should play some role in determining the division of total consumption expenditure between food and industrial goods and the study ignores the role of this important variable. Further, it is not clear why they have defined autonomous expenditure to include government final consumption net of payment of wages and salaries. Obviously, in the Indian economy, wages and salaries of the people engaged in government administration are not only policy determined, but play a major role in generating demand for various goods and hence, via multiplier effects, stimulate incomes all around. Similarly, commercial bank credit to the commercial sector is included as an exogenous variable to explain inventory demand.

However, one may argue that the inventory demand, at least in some years, might have been determined by levels of output and/or fluctuations in final demand, and this, in turn, would have determined the amount of credit disbursed. Thus, the direction of causality postulated in the equation may not be valid.

The discussions in this section brings out two important observations. Firstly, at least for the period of the sixties and the seventies or even the early eighties, demand appears to have been a major constraint to industrial growth. Secondly, the slow growth of agricultural production, though significant, does not completely explain the movements in industrial outputs.

4.6. Conclusions

In this chapter, we have attempted first to identify the distinguishing features in the intertemporal behaviour of industrial output in India. Next, in the light of such features and taking into account our discussions in the earlier chapters, a critical appraisal of the existing studies on the behaviour of industrial sector has been attempted. The discussion has tried to analyse the different demand side and supply side factors. Two broad inferences emerge from the analysis. First, demand side factors have appeared to be fairly crucial in influencing the behaviour of industrial outputs. Secondly, the studies dealing with supply side factors try to emphasise only the existence of what could be called purely short-run bottlenecks to industrial growth. Finally, the existing econometric models on Indian industry attempt to bring out mainly the importance of demand side explanations to industrial growth. None of these studies, however, seem to provide a very satisfactory explanation of the behaviour of the industrial outputs, leaving the ground open for some further investigation of these issues. This is what the present study attempts to do.

Chapter 5

SOME EVIDENCE ON LONG TERM BOTTLENECKS TO THE GROWTH OF INDIAN INDUSTRY

5.1. Introduction

Is Indian industry demand determined or supply constrained ? This is a question which has figured prominently in the recent studies on Indian industry (e.g., Lahiri and Roy, 1984; Srinivasan, 1992b; Goyal, 1992). As discussed in Chapter 4, these studies focus on the year-to-year bottlenecks to the growth of the modern industrial sector. The present chapter, however, seeks to investigate the same question from the point of view of long term constraints to growth. Here, we seek to examine the arguments and evidence presented in support of each hypothesis.

The chapter is organised as follows. The emergence of excess capacities is a major phenomenon characterising the Indian industries in the mid-sixties and seventies. This phenomenon can provide one possible criterion for assessing the nature of the bottlenecks faced by the industrial sector. Section 5.2 is devoted to examining the implications as well as the validity of this observation. The discussion in the preceding chapter seems to suggest the existence of a considerable amount of ambiguity regarding the implications as well as effectiveness of supply side bottlenecks in the Indian context. In section 5.3, therefore, we attempt to re-examine the implications of the various supply side constraints, in the light of our characterisation of a supply constrained industrial sector in chapter 3. Some evidence on the supply side factors is examined in section 5.4. Section 5.5 summarises the discussion in this chapter.

5.2. Capacity Utilization

The scarcity of capital is generally supposed to be the most crucial bottleneck to the development of an economy. Therefore, the underutilization of existing capacities in a developing country like India is a puzzle, which has received considerable attention in the literature (e.g., Bhagwati and Srinivasan, 1975; Paul, 1974; Srinivasan, 1992a, 1992b; Goldar and Renganathan, 1991).

Before taking up the problems of capacity utilization in the Indian context, a clear understanding of the concept of excess capacity is needed. The literature distinguishes between two kinds of excess capacity : intended excess capacity and unintended excess capacity. The former is said to exist when capacity production in the 'economic sense' (i.e., 'economic capacity') falls short of that in the 'engineering sense'[1]. Intended excess capacity could be the optimal response of an industry which faces fluctuations in demand or supply of inputs. Alternatively, it could be maintained for use as an effective entry deterrent measure. On the other hand, unintended excess capacities develop when actual production falls below the level of economic capacity. Such a situation may result not only from an asymmetry in capacity creation, but from unanticipated demand fluctuations and/or unexpected shortages of inputs. Further, intended excess capacities would suggest a consistent, steady underutilization of capacities, while unintended excess capacities are expected to play a much larger role in explaining fluctuations in the degree of capacity utilization over time.

The degree of capacity utilization is frequently used as an indicator of the demand pressures in the system, reflecting the need

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[1]Economic capacity refers to that level of output which maximizes profits given the technology, the fixed capital equipment, factor prices and/or the available quotas of the inputs under rationing (Srinivasan, 1992a, p. 140).

for the creation of additional capacities (Bhaduri, 1990; Taylor, 1985; Dutt, 1984)[2]. Consider a vertically integrated industrial sector. The degree of capacity utilization here would provide information on the status of the demand faced by this sector. For instance, an increase in capacity utilization here could well be interpreted as a signal to expand capacities. However, if the sector/ industry is not vertically integrated, the capacity utilization ratio at each stage of production would provide information on the need for expanding capacity either at that stage and/or at the preceding stage. This is so, because underutilization of capacities at a given stage due to, say, an insufficient supply of inputs would imply high degrees of capacity utilization in the industries producing those inputs. This should provide a stimulus for the creation of additional capacities there, at least after some time. Thus, persistent underutilization of capacities in this case cannot be attributed to insufficient supplies of inputs downstream. Rather, an insufficient growth in demand offers a better explanation. The only situation where such a shortage may be relevant in explaining underutilization is in the supply of non-industrial inputs. With these observations in mind, let us now turn to an examination of trends in capacity utilization indices in the Indian industries.

The degree of capacity utilization can be defined as the ratio of actual output produced to the capacity output (i.e., the economic capacity or the maximum level of output that can be produced). The different measures of capacity utilization differ in their definitions of capacity output. Alternative measures of capacity utilization used in the literature include Wharton index of capacity utilization, and those developed in Berndt and Morrison (1981) and Morrison (1985). The former uses the maximum output

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[2]Here, one is refering to levels of unintended excess capacities in the economy.

produced by a unit to-date as a measure of its capacity output, while the latter are based on the estimation of the cost functions and/or production functions of the industry in question.

We present two different sets of figures of capacity utilization. One set is computed from the CSO data and uses engineering capacity figures. The other set which uses the definitions of the Wharton index of capacity utilization was initially computed and published by the RBI (1970), and extended later by Ahluwalia (1985, p. 109).

CSO data

CSO publishes figures of both capacity production and actual production in respect of individual industries[3]. We measure the degree of capacity utilization in the i-th industry (to be denoted by CU_i) by the ratio of actual production to capacity production of that industry in the year in question. Although the definition implies that CU_i cannot assume a value larger than unity, the data are such as to yield values of CU_i exceeding unity for some industries for some years. Presumably, capacity production for a unit is usually defined with respect to some normal working hours per day or per week. (This 'norm' might vary not only across industries, but across different firms within the same industry). However, if for some reason, actual working hours exceeded normal working hours in a firm, one could well observe production in excess of capacity output. Of course, the method used by CSO for computing the capacity figures has not been stated explicitly. Since our interest is not so much in the extent of capacity utilization, but in the trend behaviour of the capacity utilization ratio, as long as CSO has used a consistent definition for capacity, these figures of CU_i do serve our purpose.

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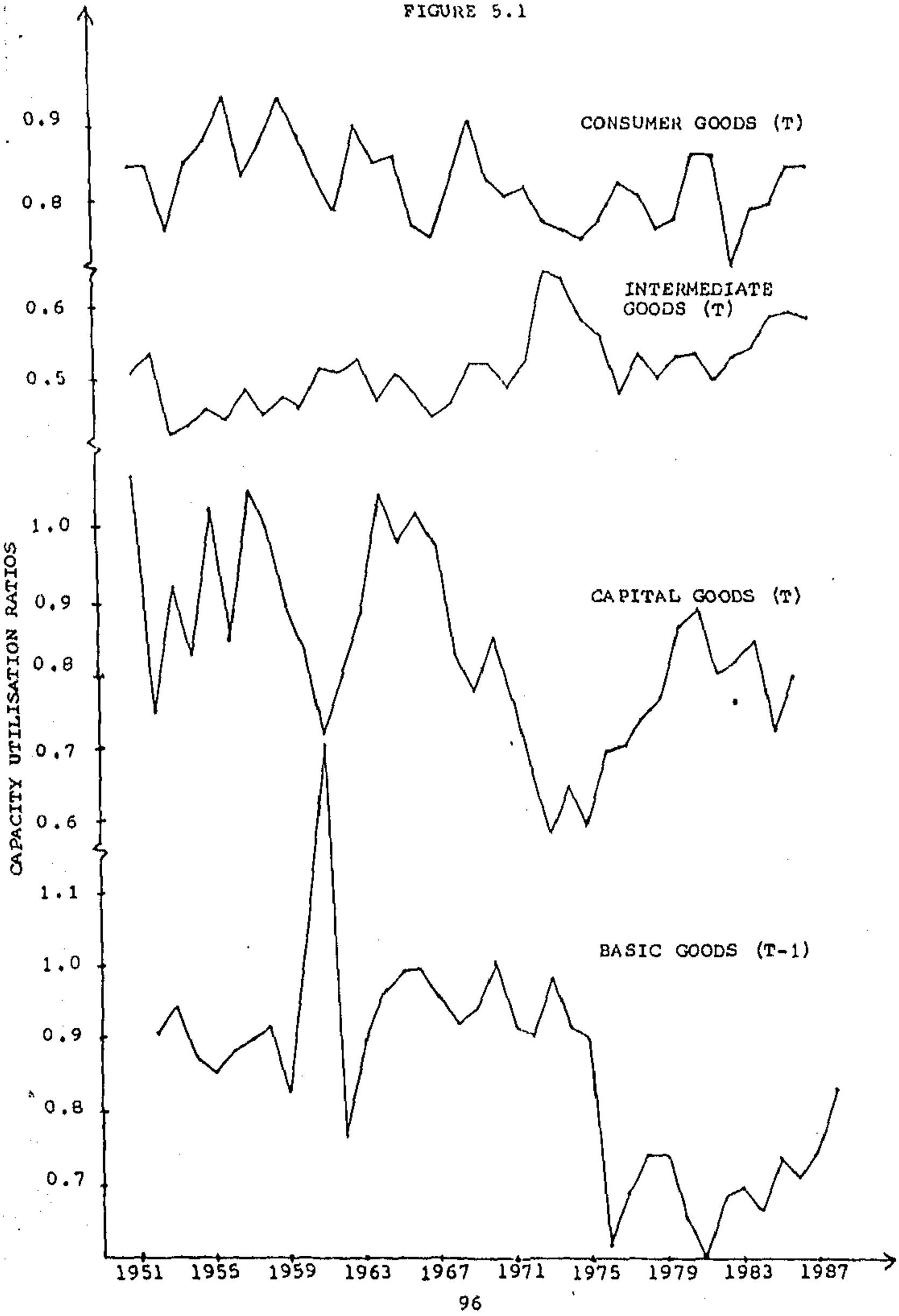
[3]We have taken these figures from Chandok et. al. (1990), Vol. II, pp. 1074-1105.

For the present study, we have computed the CU_i's for only large industries, i.e., for industries having a weight of 0.5 per cent or more in the official index of industrial production with base 1980-81 = 100. The selected industries have then been classified into four groups, viz., consumer goods, capital goods, intermediate goods and basic goods industries. The average capacity utilization ratio for a given group is then computed as the weighted average of the CU_i's of the selected industries within that group, where the weights are in proportion to their weights in the index of industrial production. Estimates of such average capacity utilization ratios for the four groups of industries are given in Table 1 in Appendix B and are shown in Figure 5.1.

The data on the average capacity utilization ratios (CU's) of various groups reveal a number of interesting observations. *First,* as Figure 5.1 shows, capital goods and basic goods industries are found to have experienced sharp falls in their degrees of capacity utilization (CU), while no such sudden or sharp changes are observed to have occurred in consumer goods and intermediate goods industries. Such ratios for the consumer goods industries appear to show a mild declining trend while those for intermediate goods industries suggest no such decline. *Secondly,* a closer look into Figure 5.1 suggests that in the case of basic goods and capital goods industries the entire period can be divided into subperiods, displaying varying behaviour in CU's. The degree of capacity utilization of the group of basic goods industries is found to exhibit a sharp decline after 1975. Taking this year as the point of demarcation, the observed value of the CU's on an average was much lower in the period after 1975 as compared to that in the period before 1975.

In the case of the capital goods industries, however, there appear two points of change : the period upto the mid-sixties display only fluctuations in CU_k without any definite trend; the

FIGURE 5.1


CONSUMER GOODS (T)
INTERMEDIATE GOODS (T)
CAPITAL GOODS (T)
BASIC GOODS (T-1)
CAPACITY UTILISATION RATIOS
0.9
0.8
0.6
0.5
1.0
0.9
0.8
0.7
0.6
1.1
1.0
0.9
0.8
0.7
1951
1955
1959
1963
1967
1971
1975
1979
1983
1987

displays only fluctuations in the CU_k without any definite trend; the period from the mid-sixties to 1977 appears as a phase of sharply declining capacity utilization ratios, and the period since 1978 shows a revival in such ratios.

We have also estimated linear trend curves for these ratios by the ordinary least squares method. The estimated relations, given in Table 5.1, also corroborate the above observations. For instance, the coefficient of time is negative and significant in the case of consumer goods industry (eq. (1)), while that in the case of intermediate goods industries is positive and significant (eq. (2)). Similarly, in the case of basic goods industries the declining trend reflects only the fact that the average level of CU_b in the second period was smaller than that in the first, as only the intercept dummy is significant (eq. (4)). Similarly, our observations on CU_k in the preceding paragraph are confirmed by equations (5) and (6).

Another interesting observation from Figure 5.1 is that a decline in the rate of capacity utilization in capital goods industries has been followed by that in the basic goods industries with a lag, particularly during the period from the late fifties to the early seventies. This appears to suggest that this decline in capacity utilization ratios was probably the result of a decline in the demand for the output of the capital goods industries, i.e., in investment demand. While a decline in public investment - the autonomous component of investment demand - could well be responsible for this decline, it appears worthwhile to explore the possibilities of a decline in investment demand from other quarters as well. The remaining part of this section is devoted to examining these possibilities.

If the industrial sector were demand determined, the rate of growth of capacity would be expected to depend positively on the capacity utilization ratio and/or the rate of growth of output. Our

Table 5.1 : Estimated Linear Trend curves for Capacity Utilization Ratios of Various Groups of Industries

Eq. No.	Dep. Var.	Explanatory Variables: Inter-cept	Time (t)	Dummy variables: Inter-cept (D)	Slope (Dt)	Inter-cept (D_1)	Slope ($D_1 t$)	$\bar{R}^2$	DW
1.	CU_c	0.87 (47.4)	-0.002 (-2.6)					.1465	1.50
2.	CU_i	0.46 (31.1)	0.003 (4.7)					.3816	1.01
3.	CU_b	1.02 (25.3)	-0.009 (-4.6)					.3740	1.28
4.	CU_b	0.92 (24.3)	0.001 (0.6)			-0.39 (-1.7)	0.004 (0.4)	.6436	2.06
5.	CU_k	0.93 (23.5)	-0.005 (-2.7)					.1563	0.79
6.	CU_k	1.53 (10.5)	-0.04 (-5.2)	-0.65 (-4.2)	0.041 (4.1)	-0.90 (-2.7)	0.04 (3.6)	.5017	1.71

Notes : (a) The dependent variables, CU_c, CU_i, CU_b and CU_k stand for the capacity utilization ratios of the groups of consumer goods, intermediate goods, basic goods and capital goods industries, respectively.

(b) The dummy variables are defined as follows :

$$D = \begin{cases} 1, & \text{for each of the years from 1953 to 1965,} \\ 0, & \text{elsewhere.} \end{cases}$$

In the case of basic goods, D_1 is given by

$$D_1 = \begin{cases} 1, & \text{for each of the years from 1975 to 1987,} \\ 0, & \text{elsewhere.} \end{cases}$$

In the case of capital goods, D_1 is given by

$$D_1 = \begin{cases} 1, & \text{for each of the years from 1977 to 1987,} \\ 0, & \text{elsewhere.} \end{cases}$$

discussion in Chapter 4 pointed to a decline in the rate of growth of output in the case of all the different industry groups in the mid- to late- sixties. Further, if we consider the relation between the degree of capacity utilization and the rate of growth of capacity, we find that for the consumer goods and intermediate goods industries, this relation is positive and significant, but no such relation exists in the case of either capital goods or basic goods industries (Table 5.2). A declining trend of capacity utilization ratio of the consumer goods industries together with a positive relation between the degree of capacity utilization and the rate of growth of capacity in this sector suggest that consumer goods industries too

Table 5.2 : Effects of Capacity utilization on Rates of Growth of Capacity : Some Linear Regression Results.

Name of the group	Explanatory Variables				$\bar{R}^2$	DW
	Intercept	CU_{-1}	Intercept Dummy (D)	Slope Dummy ($D.CU_{-1}$)		
Consumer goods	-36.13 (-1.53)	54.78 (2.00)	56.87 (1.89)	-70.61 (-1.97)	0.1159	1.34
Intermediate goods	-9.41 (-1.06)	26.40 (1.55)			0.0393	1.80
Basic goods	5.45 (1.22)	0.24 (0.05)			-0.0312	1.94
Capital goods	-5.98 (-0.19)	26.18 (0.70)			-0.0153	2.23

Notes : The dependent variable in each case is the rate of growth of capacity of the group of industries in question. CU_{-1} denotes the one-year lagged capacity utilization ratio for the group in question. The dummy variables are defined as follows :

$$D = \begin{cases} 1, & \text{for each of the years from 1953 to 1967,} \\ 0, & \text{elsewhere.} \end{cases}$$

$$D.CU_{-1} = \begin{cases} CU_{-1}, & \text{for each of the years from 1953 to 1967,} \\ 0, & \text{elsewhere.} \end{cases}$$

faced a demand constraint and this could have led to a decline in investment demand from this sector.

The results in Table 5.2 may be rationalised on the following grounds. A relatively larger share of the public sector compared to that of the private sector in the capital and basic goods industries and the obverse in the case of consumer and intermediate goods industries could account for the lack of a close correspondence between the rate of growth of capacity and the degree of capacity utilization in the case of the former set of industries. Presumably, the private sector responds to profit motives and incentives while the public sector is expected to be guided not so much by such motives but mainly by its long term plans and other objectives.

RBI Data

Table 5.3 below gives average capacity utilization ratios of four groups of industries over the four quinquennia in the sixties and the seventies. These estimates also confirm our earlier observations based on the CSO data, that the capacity utilization ratios of basic and capital goods industries have started declining since the sixties, the declining trend being most pronounced for the capital goods industries and further that the underutilization of

Table 5.3. : Average Capacity Utilization Ratios by Industry Groups during 1960-61 to 1979-80

industry group	average ratio (%) over the period			
	1960-65	1966-70	1971-75	1976-80
Basic goods	86.0	82.0	77.4	82.4
Capital goods	85.9	66.4	60.2	63.9
Intermediate goods	89.3	81.9	79.7	81.7
Consumer goods	86.6	82.2	80.1	81.3

Source : Ahluwalia (1986, Table 1.5, p. 109)

capacity in the capital goods industries has affected that of other industries with a lag[4]. The present data, however, indicates that the declining trend in the capacity utilization ratio was a general feature, shared by all broad groups of industries.

We thus observe that our first set of data on capacity utilization ratios, however incomplete coverage they might have, do present a reasonably correct picture about the trends in the extent of capacity utilization in the Indian industrial sector. Since the capital goods and basic goods industries had experienced sharp declining trends in capacity utilization ratios, particularly in the sixties and seventies, we have to examine the behaviour of demand for these goods. Let us then turn to the data on investment expenditures.

Investment in Fixed Capital

Investment expenditures in fixed capital generate demand for capital goods and also for basic goods. Aggregate investment is composed of two types of goods : machinery and equipment and construction. Investment in construction generates demand for basic goods like cement and steel. Annual data on these two components of investment at 1980-81 prices are given in Table 2 in the Appendix B. If one considers the period from the sixties onwards, the rate of growth of real investment in machinery and equipment had registered a sharp decline in 1965-66. Some amount of recovery was noticed in the mid-seventies. However, a uniformly high rate of growth was observed only in the eighties. Investment in construction presents a somewhat different picture. It continued to grow at a rate exceeding 6

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[4]As Ahluwalia (1991, p.19) observes, "Maximum decline in capacity utilisation in the second half of the sixties occurred in the capital goods industries. In the subsequent five-year period, the decline in capacity utilisation spread to the basic goods industries presumably reflecting backward linkages".

percent till 1968-69 whence its rate of growth dropped to 1 percent only. Its rate of growth continued to be low or negative upto the first half of the seventies. A brief revival in the next three years was again followed by a protracted period of low rate of growth upto 1987-88. Table 5.4 below presents the average annual growth rates of these two types of investment over various five-year periods.

Table 5.4 : Average Annual Rates of Growth of Gross Investment at 1980-81 Prices Over the Different Periods

(per cent)

period	investment in machinery and equipment	investment in construction	total investment
1951-52 to 1954-55	-14.5	2.9	-0.3
1955-56 to 1959-60	18.5	6.8	10.0
1960-61 to 1964-65	12.7	7.6	9.5
1965-66 to 1969-70	-2.1	5.3	2.1
1970-71 to 1974-75	6.3	-1.5	1.8
1975-76 to 1979-80	6.7	5.5	6.1
1980-81 to 1984-85	10.0	0.5	5.4
1985-86 to 1989-90	9.0	5.1	7.4

A comparison of the behaviour of investment in construction with that of capacity utilization ratios (CU's) of basic goods industries or some specific industries related to construction seems to indicate the strong effect which the former exerts on the latter. Take the case of cement industry, for example. Its capacity utilization ratio had registered a fall in 1971 and, except for a brief period of good years in the mid-seventies (viz., 1976-78), it had failed to show any sustained recovery till 1987 (Table 1 in the Appendix B). This evidence may, however, be considered biased, in view of the existence of controls in the cement industry. What, however, is not explained is the fact that even though controls were lifted in 1983, the degree of capacity utilization did not improve significantly at least upto 1987. This seems to indicate the

possibility of some demand problem faced by this industry as well.

While the evidence examined so far seems to suggest the emergence of a demand constrained economy at least by the mid-sixties, it may be worthwhile to examine whether the industrial sector has experienced any bottlenecks on the supply side as well. This question is taken up in the following section.

5.3. Supply side Bottlenecks and their Implications

The literature on the Indian industrial stagnation talks of broadly the following kinds of supply side constraints :

(i) constraints in the supply of agricultural inputs to industry,
(ii) wage goods constraint,
(iii) infrastructural constraints,
(iv) financial bottlenecks,
(v) bottlenecks caused by the existing policy structure.

Each of these constraints can affect decisions relating to production or investment in industry. In the following discussion we attempt to find out the logic and implications of each of the constraints from the point of view of its impact on long run production and investment decisions.

First, consider case (i), i.e., the *constraints in the supply of agricultural inputs to industry.* The logic here is simple. A shortfall or scarcity in the supply of such inputs would constrain the production of agro-based industries. Given that the agricultural prices are flexible, such a shortfall is expected to result in a rise in the prices of such inputs and hence a fall in the profit maximising levels of output of these industries, other things

remaining unchanged. Clearly, this is a short run response.

However, if such scarcities[5] persist, one would expect the industries to take up some corrective measures like tapping of alternative sources of supply of these inputs, finding their close substitutes and/or adopting technologies which minimise the use of such scarce inputs. A similar response is also expected to occur, if the inputs of non-agricultural origin also become scarce[6].

In case of each of these alternative solutions, there are two possible sources of supply - domestic and foreign. The import of the relevant inputs or its close substitutes as well as the import of the relevant technologies constitute alternative means of relaxing such a supply side bottleneck. The non-availability of foreign exchange and/or the existing policy framework could, however, serve as effective constraints to the adoption of such measures. The other alternative viz., the use of endogenous resources, still remains open, and the response of industries could take the form of finding either alternative indigenous sources of supply of, or substitutes to, the scarce inputs (e.g., through innovation or adaptation).

Again, *consider the wage goods constraint* (case (ii)). A shortage in the supply of wage goods is argued to raise the product wage rate in industry (through its *effect on* the relative price of

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[5]With the growth in both incomes and the demand for industrial goods, the demand for inputs would also grow and, unless their supplies grow sufficiently, a scarcity of these inputs is bound to emerge. In the case of agro-based inputs, this could be the result of insufficient investment in agriculture and/or inadequate growth of acreage under cultivation of the inputs in question.

[6]The scarcity of inputs in such cases might be the outcome of insufficiency of investment and/or inadequacy of domestic supplies, examples of the latter being petroleum and petroleum based inputs.

wage goods in terms of the industrial good)[7]. Since profit maximization requires the equalization of the product wage rate with the marginal product of labour, the result is likely to be a decline in the level of employment and the level of output. One can identify a close similarity between such a constraint and the input constraint considered earlier, given that the production decisions in both cases respond to a change in the input prices. In the present case, however, there is no physical scarcity of labour; yet there appears a supply side bottleneck, since the supply of labour to industry is constrained by the availability of wage goods[8]. In this case, the constraint could be relaxed by, say, the import of foodgrains. An alternative response could be in terms of a shift towards relatively more labour-saving technologies.

On the other hand, consider capital. Capital differs from the other factors of production in that in a given period the amount of capital and hence the level of productive capacity cannot be augmented, although it can very well remain underutilised. Thus the expansion of output may be constrained by the level of capital stock thereby making the industry supply constrained. Moreover, the rate of expansion of capital stock could also be constrained by the supply of investible resources. Clearly, while the inflow of investible resources from abroad can relax the constraint, a shift in favour of

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[7]Let w, p_w and p_m be the money wage rate, price of the wage goods and price of the industrial goods, respectively. The product wage rate in industry is given by

$$w/p_m = (w/p_w).(p_w/p_m)$$

So a rise in p_w/p_m will raise w/p_m, if the real wage rate in terms of wage goods (i.e., w/p_w) remains unchanged, or, if the rise in p_w/p_m outweighs the fall (if any) in w/p_w.

[8]Recall our discussion of the Lewis model in Chapter 2. This mechanism is emphasized in that model (See Chakravarty, 1974 and Ahluwalia, 1985, p. 34)

capital saving techniques may help mitigate the problem.

Similarly, the other three supply side constraints to industrial expansion can be shown to work through their effects on the supply of one or the other input. Consider first *infrastructural constraints* (case (iii)). The discussion in this area has centred around bottlenecks in the availability of mainly two kinds of facilities, viz., transport services and electricity. While electricity itself enters as an input in production, transport bottlenecks would affect the supply of other inputs to the industries and/or the supply of outputs to the users.

The lack of sufficient infrastructural facilities is argued to be the result of an inadequate growth of investment in the past and also of inefficiency in the use of resources. Investment in infrastructural facilites in India has been done mainly by the public sector. However, in the event of a short supply of such facilities, private investment might also be attracted, provided there were no restrictions on such investments[9]. Further, such constraints could encourage the private sector to search for substitutes as well as alternative technologies which economise on the use of such inputs.

Consider now the case of the *financial constraint* (case (iv)). It is argued that an insufficient supply of credit would constrain both the current level of production as well as the amount of investment. Further, artificially maintained levels of rate of interest which fail to reflect the true cost of lending are argued to distort the credit market. However, in such situations an efficient credit market should develop outside the institutional credit system where rates of interest respond to the changing demand-supply

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[9]While there exist restrictions on private investment in railways and in large electricity generating plants, investment opportunities, say, in road transport are open to private investors.

conditions. The rapid growth of company deposit schemes and of the volume of transactions in the stock market in the recent past can be interpreted as manifestations of such adjustments. To the extent that such alternatives emerge, financial constraint may not be a strictly binding constraint.

In this context it would be useful to refer to the ongoing discussion in the literature regarding the existence of imperfections in the credit market[10]. Such imperfections would imply inefficiency in the allocation of resources. Moreover, imperfections resulting from the existence of various official controls on the market (case (v)) could lead to the emergence of the phenomenon of 'rent-seeking'. For instance, consider the case where the formal credit market operates under various controls and hence an excess demand for credit develops. This could encourage the emergence of a parallel market where credit could be made available at a premium. The interest rate in this market would clearly be greater than not only the rate in the formal market but also the market rate that would have prevailed in the absence of control. The premium accruing in such cases is referred to as rent, given that it accrues only as a result of the existing body of controls. Thus it is argued that the absence of such market imperfections would have made a higher level of production feasible. However, such an explanation does not seem tenable in view of the marked fluctuations in industrial growth rates which have occurred in India within the existing market framework.

The constraints discussed so far could be binding only if the industries fail to respond to the various signals which such constraints would transmit. Thus, the factors ultimately responsible

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[10]There are a large number of studies in the context of the agrarian credit market (see Basu (1993) for a detailed discussion of these issues). In the context of the industrial sector also, one finds some discussion focussing on the phenomenon of differential access to credit by different industries.

for the prevalence of supply side bottlenecks, if any, will be those that prevent industries from responding to the emerging signals. Various policies, which had existed even till the mid- to late-eighties, are argued to have worked to discourage such responses. It is maintained that various controls on capacity expansion and/or entry into and exit from an industry and the system of protection of domestic industries have only resulted in inefficiency in investment allocation and the choice of techniques. Such restrictions are also argued to have curtailed the number of possible responces of an industry to the various bottlenecks (Ahluwalia, 1985, Ch. 8). In the area of finance too the official policy of pegging interest rates is argued to have led to an inefficient allocation of resources. Added to this were restrictions on the quantum as well as kinds of import, especially those involving import of technology. All these policies are supposed to have contributed to the emergence of or reinforcement of an already existing supply constraint. Under such circumstances, innovation or adaptation within the domestic industry appears as one viable means of circumventing the supply constraints - a measure which the industry would be expected to take up.

Given that technological progress is a viable form of response to a supply constraint and given that productivity growth in industry may be considered as an indicator of efficiency in resource allocation as well as of rate of technological progress in industry, it may be relevant to identify factors which affect productivity growth in industry. A fair amount of literature now exists on this issue with respect to other countries. One widely debated issue is the link between the degree of openness of an economy (i.e., trade policies of an economy) and productivity growth therein. While Nishimizu and Robinson (1984) find support for the hypothesis that in export-oriented Korea total factor productivity grew more rapidly than in internally oriented Turkey or Yugoslavia, the study by Kim and Kwon (1977) does not support the result for Korea. This study traces the source of total factor productivity growth to higher

capacity utilization and not to technical progress. Bhagwati (1978), Pack (1988) and Bruton (1989) too do not find conclusive evidence in favour of the hypothesis that countries with an external orientation benefit from greater growth in technical efficiency in the component sectors of manufacturing. (See Krishna (1991) for a discussion of these issues.)

In the context of an economy with liberal import policies, industrial growth based on direct foreign investment is generally argued to be the most suitable means of relaxing a number of constraints to growth[11]. While such a strategy helps to reduce the problem of availability of resources, it would also provide access to modern technology as developed elsewhere in the world. This surely constitutes a viable alternative, but the question remains : how does such a process contribute towards the development of a domestic base of technological capabilities considered to be an essential ingredient of any programme of long-run growth and diversification of an economy (Lal, 1993, p. 116) ? Studies of the East Asian and *ASEAN* economies, most of which had recorded high rates of growth and were open or had become progressively open to the inflow of direct foreign capital, seem to suggest that the domestic industry does not get automatically incorporated into such a growth process[12]. Of course, given the large economies of scale and externalities involved in conducting innovative research and development, the multinational corporations would find it economical to centralise their innovative activities and expenditure on such activities in the developed economies. Governments in developing economies therefore need to intervene and appropriately direct foreign investors to take measures so as to encourage the development of local innovative capabilities.

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[11]See, for instance, *Asian Development Review,* Vol. 11, No. 1, 1993. The entire issue discusses these questions.

[12]Cheu (1993) discusses East Asia, while Yue (1993) takes up the case of *ASEAN* economies.

The experiences of Singapore and South Korea show the effectiveness of such strategies taken by their governments.

Before concluding this section, let us briefly summarise the main points of the discussion. When a supply constraint manifests itself, industries are expected to make efforts to relax such a constraint, say by improving efficiency in the use of various inputs and/or innovating on existing technologies. If these attempts are successful, it means that a supply constraint can only be a short term phenomenon. A sustained supply constraint, therefore, must mean a failure or even the non-existence of such a response, and it is argued that this could only be the result of the various restrictive policies pursued by the government. These policies, with a multitude of controls, are argued to provide incentives for the diversion of resources from productive activities towards "rent yielding" activities. Hence, a relaxation of various controls is expected to ease the supply bottleneck. The same objective could also be achieved by opening up the economy and encouraging direct foreign investment. However, the endogenisation of the growth process in such cases would depend on active state intervention.

While the issues of opening up of the economy are going to be increasingly more relevant for India in the years to come, they do not provide plausible explanations for the past behaviour of the Indian industry. Our discussion, however, throws up a plausible hypothesis, viz., that the Indian industry worked under a supply constraint and yet could not respond to the supply side signals. Such a characterisation of the industrial sector raises serious doubts about the ability of the sector to respond to any other emerging stimuli, as would be expected to be witnessed in the course of liberalization of the economy. While the investigation of this particular eventuality/ possibility is beyond the scope of the present study, we attempt to examine some evidence on supply side constraints in the following section.

5.4. Some Evidence on Supply Side Bottlenecks

Most of the arguments on supply side constraints include the existence of a resource constraint on the expansion of capacity. The extent to which a resource constraint becomes binding may be examined by analysing the trends of domestic resource gap along with the trends of authorisation and utilization of external assistance. These trends are examined in the following subsection. Given that imports of relevant items could be a potential means of relaxing a supply constraint, possible effects of such imports on domestic industrial production are analysed next. This is followed by some discussion on infrastructural bottlenecks and financial constraints.

It may be pointed out that the evidence on the wage goods constraint and on the bottlenecks in the supply of agro-based inputs (if any) are not examined. Evidence on wage goods constraint, as already pointed out in Chapter 4, does not substantiate either the standpoint that the constraint was binding or the opposite. As per our discussion, an increase in capital-labour ratio would be expected to occur in that case. However, such an increase could well be the result of underutilization of capacities or of a shift towards more capital-intensive technologies induced by the existence of highly subsidised credit and capital market in the domestic economy. In other words, it is difficult to ascertain whether the wage goods constraint was binding or not. On the other hand, if one considers the agro-based inputs, while some evidence can be found to support a hypothesis that fluctuations in the supply of these inputs leads to to fluctuations in outputs using them, the fact that rate of growth of production of agro-based inputs has been neither high nor increasing, indicates the absence of incentives to expand supply. This suggests the possibility that an enhanced supply might not have been demanded. Moreover, the emergence of alternative inputs (e.g., synthetic substitutes), *albeit* not necessarily in response to a domestic supply constraint, could have relaxed such pressures.

5.3.1. Saving, Investment and Inflow of Foreign Resource

Table 5.5 presents annual data for the Indian economy on savings (S), investment (I) and resource gap (i.e., excess of I over S) at current prices, each as a proportion of gross domestic product (GDP) at current prices, for the past four decades. It is observed that except for the period from 1975-76 to 1977-78, investment has always exceeded savings. Further, the resource gap as a percentage of GDP, remaining small initially (less than 1 per cent), has shown a rising trend over the period from 1956-57 to 1967-68. Thereafter, a downswing is in evidence till 1979-80. Some increase in this percentage can be discerned in the eighties, although it continues to remain below 2 in most of the years.

The series of savings and investment ratios, however, exhibit interesting features. The series of investment ratios shows a rising trend, except for a brief phase of stagnation/decline during 1967-68 to 1970-71/ 1972-73. The series of the savings ratio , however, does not exhibit any increase or decline. In fact, it is seen to be fluctuating almost around a horizontal trend since the second half of the seventies. The observed behaviour of the investment and savings ratios indicates the existence either of a resource crunch, especially in terms of supply of foreign exchange resources, or of constraints on demand for goods and services with the resulting adverse effects on incentives for investment.

In order to assess the intensity of a foreign resources crunch, we look into the figures of 'authorization' and 'utilization' of foreign assistance (inclusive of loans and grants). These figures are available only from 1966-67 onwards and are presented in Table 5.6. A look at these figures reveals that the authorised amount has exceeded the utilised amount in all the years except 1967-68, 1969-70 and 1970-71, indicating an incomplete utilization of available external assistance during most of the years. Thus it is difficult

Table 5.5 : Investment, Savings and the Resource Gap

Year	As percentage of GDP		
	Gross domestic capital formation	Gross domestic Savings	Resource gap
	(I)	(S)	(I - S)
(1)	(2)	(3)	(4)
1950-51	10.2	10.4	-0.2
51-52	11.9	10.1	1.8
52-53	7.9	8.2	-0.3
53-54	8.5	8.7	-0.2
54-55	10.6	10.5	0.1
1955-56	14.3	13.9	0.4
56-57	16.0	13.1	2.9
57-58	14.6	10.9	3.7
58-59	12.7	10.0	2.7
59-60	13.5	11.9	1.6
1960-61	15.7	12.7	3.0
61-62	14.2	12.2	2.0
62-63	15.8	13.4	2.4
63-64	15.4	13.3	2.1
64-65	15.1	12.7	2.4
1965-66	16.8	14.5	2.3
66-67	18.4	15.3	3.1
67-68	15.4	13.0	2.4
68-69	13.9	12.8	1.1
69-70	15.6	15.0	0.6
1970-71	16.6	15.7	0.9
71-72	17.3	16.2	1.1
72-73	15.9	15.4	0.5
73-74	19.1	18.4	0.7
74-75	18.3	17.4	0.9
1975-76	18.8	19.0	-0.2
76-77	19.7	21.2	-1.5
77-78	19.5	21.1	-1.6
78-79	23.3	23.2	0.1
79-80	22.1	21.6	0.7
1980-81	22.7	21.2	1.5
81-82	22.8	21.1	1.7
82-83	21.0	19.5	1.5
83-84	21.1	19.9	1.2
84-85	21.0	19.6	1.4
1985-86	23.4	21.0	2.4
86-87	23.4	21.6	1.8
87-88	22.1	20.2	1.9

Table 5.6 : External Assistance : Authorisation & Utilization

Year	Authorization (Rs crores)	Utilization (Rs. crores)	(3)/(2)
(1)	(2)	(3)	(4)
1966-67	140360	105530	0.75
67-68	70600	117720	1.67
68-69	93100	91320	0.98
69-70	62463	83695	1.34
66-67 to 69-70 (average)			**1.18**
1970-71	72187	78057	1.08
71-72	89002	82127	0.92
72-73	62603	60464	0.97
73-74	101143	69241	0.68
74-75	127277	96847	0.76
70-71 to 74-75 (average)			**0.88**
1975-76	214329	143608	0.67
76-77	96698	124752	1.29
77-78	180332	107565	0.60
78-79	203089	109424	0.54
79-80	121128	113861	0.94
75-76 to 79-80 (average)			**0.81**
1980-81	301174	135072	0.45
81-82	237983	151722	0.64
82-83	219813	170147	0.77
83-84	182982	163195	0.89
84-85	310341	163342	0.53
80-81 to 84-85 (average)			**0.66**
1985-86	418672	186879	0.45
86-87	332376	185480	0.56
85-86 to 86-87 (average)			**0.50**

to accept the hypothesis of the industrial sector remaining consistently resource constrained. In the seventies, for instance, the resource gap as a proportion of GDP remained low, although external assistance had remained underutilised. Thus a demand bottleneck, rather than a supply constraint, appears to be a more plausible explanation for the lack of growth of investment and industrial outputs.

The underutilization of foreign assistance has another implication. Bottlenecks in supply of inputs to industry, as argued earlier, can be relaxed through necessary imports. Such a solution

to a supply constraint is argued have been inaccessible owing to a foreign exchange crunch. However, the fact that the available foreign assistance had remained underutilised for most years would imply that if at all there were any supply side constraint to industrial growth, that could not have come from an insufficiency of importable inputs. In fact, the relation between imports and domestic production is a complex one and needs to be examined in greater depth. In the following subsection, we attempt to look into some of these aspects.

5.3.2. Imports and Domestic Production

Imports can affect industrial production from both the demand side as well as the supply side. In the preceding subsection, we have considered a supply side effect, viz., the possibility of easing the domestic scarcity of an input through its imports. However, if the industrial production were demand constrained, imports would have a detrimental impact on domestic production, to the extent that such imports compete with domestic production. Specifically, if imports were of final use goods, the dampening impact on domestic production would get enhanced, through its transmission to intermediate goods industries (backward linkages). The impact of imports on domestic production could, therefore, be either stimulating or depressing as the case may be.

In order to ascertain the nature of the relation between imports and domestic production in the Indian context, we consider two different categories of imports of non-agricultural goods - total such imports (M_1) and this total net of imports of final use goods (M_2)[13]. The use of these two different categories will enable one to

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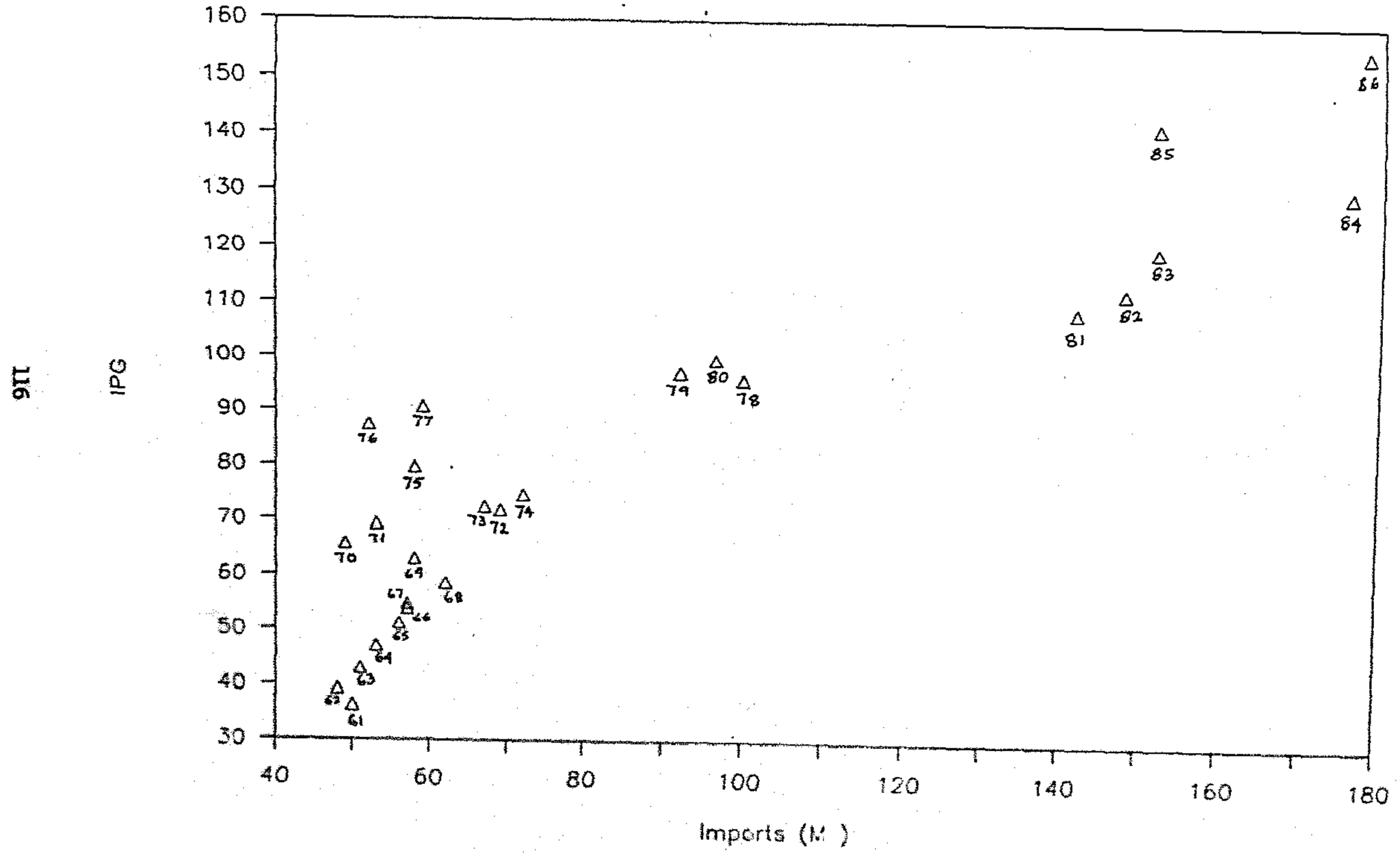
[13] M_1 includes both the inputs used by the industrial sector as well as the output produced by it, while M_2 includes only inputs or intermediate goods used by the industrial sector.

Figure 5.2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160
180
Imports (M)
IPG
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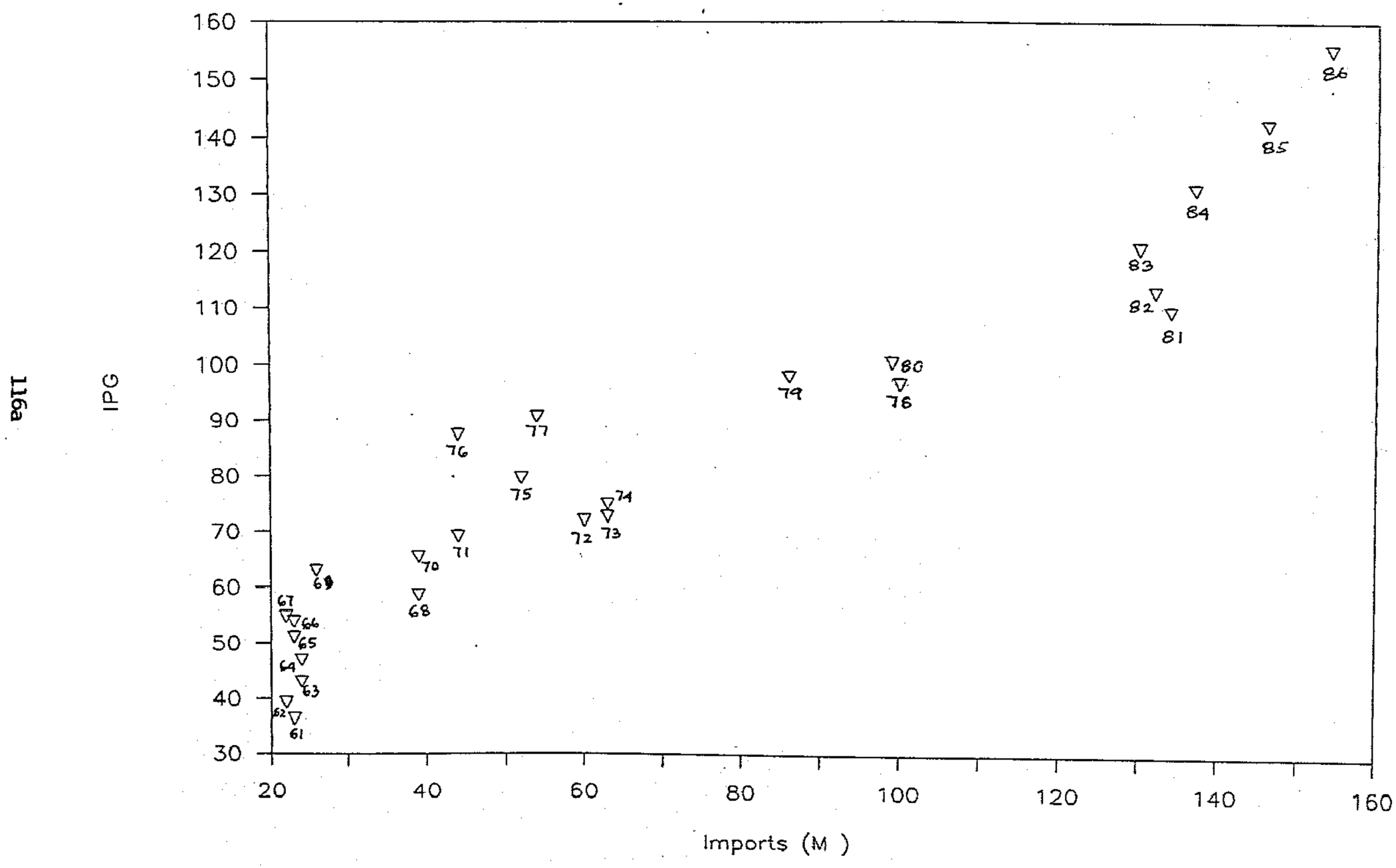
Figure 5.3



116a

distinguish between the two possible scenarios sketched out above. A look at the scatter between any one of the categories of imports and the index of general industrial production (Figures 5.2 and 5.3) shows that there are at least three different phases - the period prior to 1966-67, 1967-68 to 1977-78 and the period from 1978-79 onwards. The slopes of the relation appear different in the different subperiods.

Table 5.7 : Effects of Imports on Domestic Industrial Production : Some Estimated Relations

Sl. No.	Inter -cept	Import	Dummy D′		Dummy D		$\bar{R}^2$	DW
		M_i	D′	$D'M_i$	D	DM_i		
1.	4.161	0.036	-7.969	1.884	-2.221	0.540	0.9384	0.78
	(3.87)	(0.14)	(-3.83)	(3.64)	(-1.76)	(1.82)		
2.	3.278	0.262	1.685	-0.624	-2.093	0.482	0.8970	0.83
	(5.48)	(1.69)	(0.36)	(-0.42)	(-1.69)	(1.76)		

Notes :

(a) The equations estimated are of the following form :

$$\log IPG = \alpha + \beta \log M_i + \gamma D' + \delta D'M_i + \phi D + \mu DM_i ,$$

where i takes values 1 and 2 for equations 1 and 2, respectively and IPG stands for the index of industrial production (with 1980-81 =100).

(b) The dummies for equation 1 (i.e., the relation between IPG and M_1) are defined as follows:

For each year from 1960-61 to 1967-68, $D' = 1$ and $D'M_1 = \log M_1$ while for all other years, $D' = 0$ and $D'M_1 = 0$.

(c) The dummies for equation 2 (i.e., the relation between IPG and M_2) are defined as follows:

For each year from 1960-61 to 1968-69, $D' = 1$ and $D'M_2 = \log M_2$ while for all other years, $D' = 0$ and $D'M_2 = 0$.

(d) For both equations 1 and 2, for each year from 1978-79 to 1986-87, $D = 1$ and $DM_i = \log M_i$ while $D = 0$ and $DM_i = 0$ for all other years.

Using the data for the period 1960-61 to 1986-87, we, therefore, try to estimate econometrically the relation between aggregate domestic production of industrial goods and each of the two categories of imports. The results are summarised in Table 5.7

above. We use slope as well as intercept dummies to find out whether there were any shifts in the relations across the three subperiods.

The main results may be summarised as follows : if one considers M_1, there seems to exist some positive relation between imports and domestic production of industrial goods in the first and the third subperiods, while in the case of M_2, the nature of the relation seems to be positive in the second and the third subperiods, although the t-ratios of the coefficients for these two periods are well below 2. These equations have also very low values of DW statistic. Thus one has reasons to support the following observation : since, no strong correlation is found to exist for the second subperiod, imports do not appear to have imposed any constraint on the industrial production and investment particularly in the second subperiod - a period which has witnessed very low rates of industrial growth.

5.3.3. Pattern of Investment

If investments in infrastructural facilites are insufficient, both production as well as investment decisions in other sectors will be affected adversely. As argued in the earlier section, such a situation is likely to attract private investment in infrastructure. In other words, a change in the allocation of private investment is likely to take place, viz., a decline in total private investment alongside an increase in private investment in infrastructure (provided there were no resource constraint).

Table 5.8 showing the quinquennial growth rates of various categories of investments reveals some interesting features. The average annual rate of growth of investment in infrastructure which was quite high in the first three quinquennia, registered a sharp fall in the second half of the sixties. Its recovery to a two-digit level occurred only in the eighties. Public investment exhibited a similar behaviour, except that its rate of growth dropped to low

TABLE 5.8 : Average Annual Rates of Growth of Various Categories of Gross Domestic Fixed Capital Formation over Different Periods

(per cent)

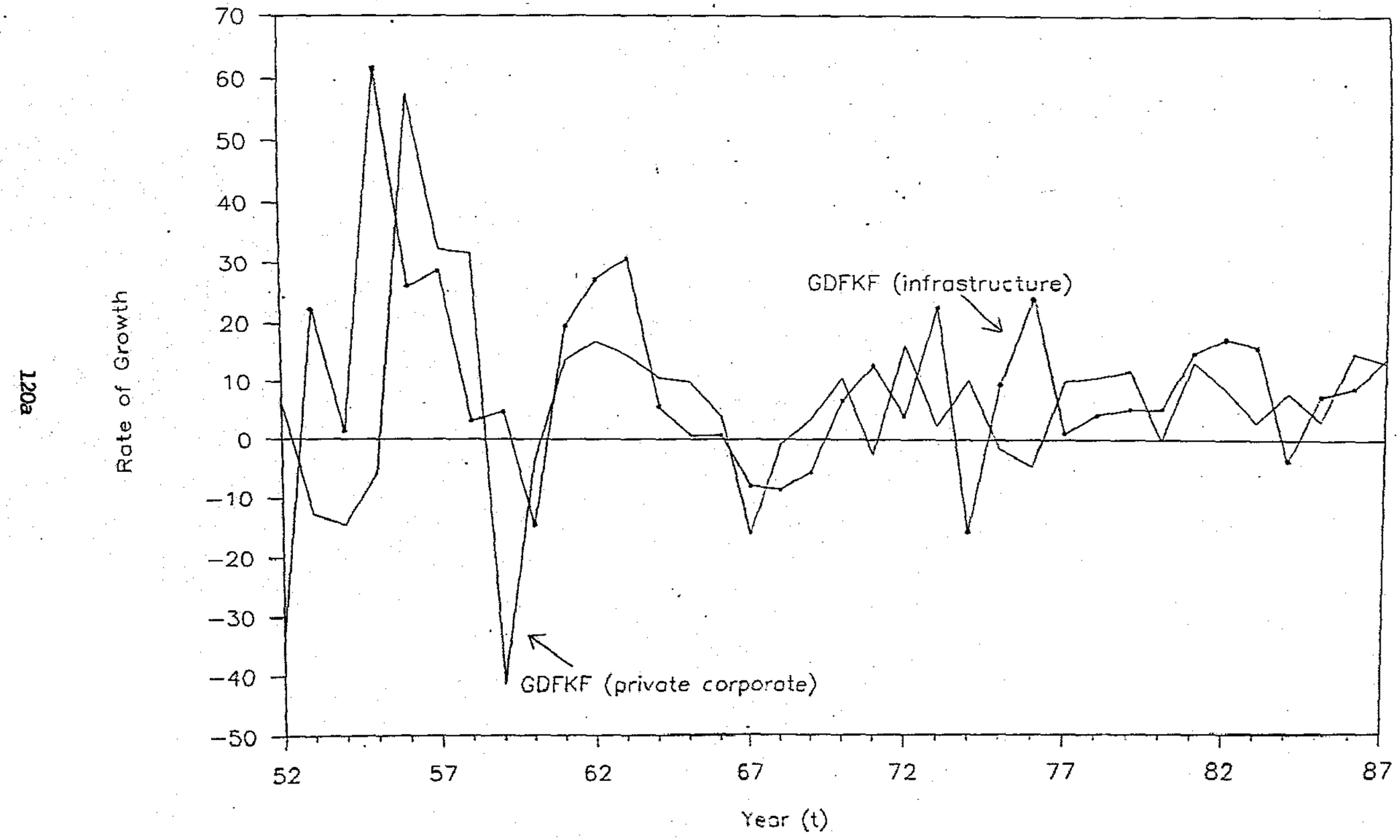
Period	Gross Domestic Fixed Capital Formation in			
	Private sector (total)	Public sector (total)	Infra-structure (total)	Machinery (private sector)
(1)	(2)	(3)	(4)	(5)
1951-52 to 1954-55	-4.95	12.03	13.04	-6.66
1955-56 to 1959-60	9.08	14.28	9.70	15.33
1960-61 to 1964-65	7.02	10.56	16.84	13.14
1965-66 to 1969-70	6.58	-3.36	-2.84	0.26
1970-71 to 1974-75	1.20	3.04	6.66	4.95
1975-76 to 1979-80	3.18	10.24	8.04	5.58
1980-81 to 1984-85	4.94	8.20	10.41	7.24
1985-86 to 1986-87	8.55	4.14	11.30	9.10

levels again in the second half of the eighties. A markedly different behaviour, however, was displayed by private investment. Its rate of growth registered a significant decline only much later in time, viz., in the seventies. Further, its rate of growth is found to have varied inversely to that in infrastructure in a number of years (see Figure 5.4). These suggest that if there were any link between these two, it must have worked with substantial time lags.

To carry the argument a little further, a look at Figure 5.5 shows that while a decline in the rate of growth of investment in infrastructure has been followed, with a lag, by that of private investment in machinery, a recovery of the latter is found to have preceeded that of the former, raising doubts about the direction of causality.

The evidence presented here, thus, seems to suggest that while there may be some effect of investment in infrastructural facilites on private investment, it is difficult to ascertain the strength or importance of such a causal relation.

Figure 5.5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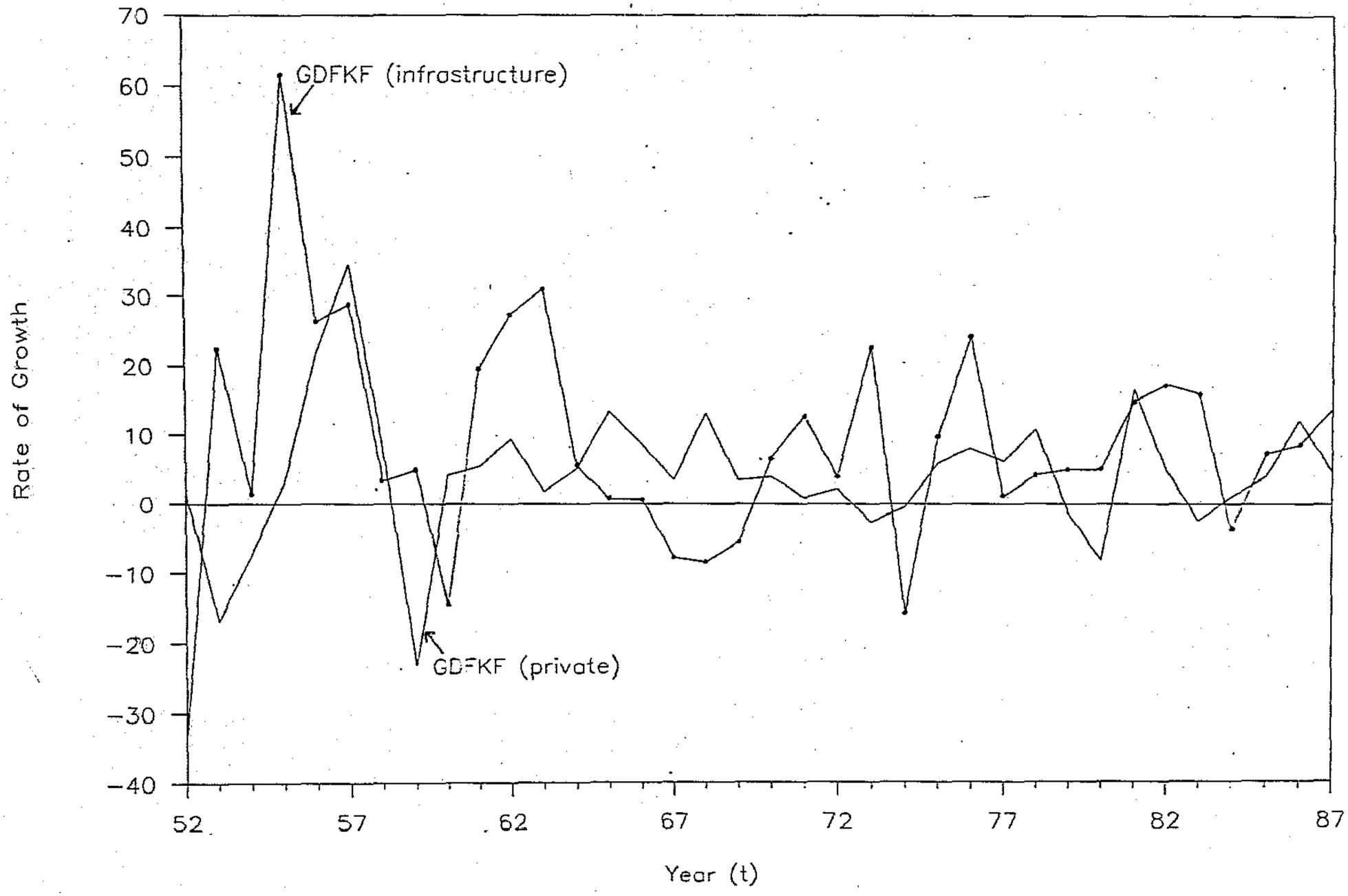
Rate of Growth
Year (t)
GDFKF (infrastructure)
GDFKF (private corporate)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−40
Rate of Growth
GDFKF (infrastructure)
GDFKF (private)
52
57
62
67
72
77
82
87
Year (t)

5.4.4. Financial Constraints

This subsection is devoted to examining some preliminary evidence on the possibility of a financial bottleneck either to the expansion of capacity or to the level of production. Table 5.9 presents figures of credit sanctioned and credit disbursed by the financial institutions over the period 1964-65 to 1987-88. A look at the ratio of the amount disbursed to that sanctioned shows that the ratio was consistently less than unity except for the year 1967-68, indicating an underutilization of the available amount of credit.

Table 5.9 : Assistance Sanctioned and Disbursed by Financial Institutions

Year	Amount Sanctioned (Rs. crores) (S)	Amount Disbursed (Rs. crores) (D)	Fraction Utilised (D/S)
(1)	(2)	(3)	(4)
1964-65	11810	9050	0.7663
1965-66	18750	11030	0.5883
66-67	15200	14080	0.9263
67-68	10860	13610	1.2532
68-69	16030	11160	0.6962
69-70	17730	13620	0.7682
1970-71	25430	15990	0.6290
71-72	34270	19140	0.5585
72-73	32590	21880	0.6714
73-74	44674	30164	0.6752
74-75	54957	42530	0.7739
1975-76	64830	43520	0.6713
76-77	97685	59730	0.6115
77-78	120185	70396	0.5857
78-79	136129	93062	0.6836
79-80	206047	135221	0.6563
1980-81	252580	160292	0.6346
81-82	274679	206482	0.7517
82-83	323167	237116	0.7337
83-84	411558	293567	0.7133
84-85	564757	350178	0.6201
1985-86	661312	492427	0.7446
86-87	797957	565559	0.7088
87-88	929773	677878	0.7291

Table 5.10 : Growth of Deposits with Scheduled Commercial Banks

Year	Investment -Deps. ratio	Credit -Deps. ratio	Agg. Deps. (nominal)	ROG of agg. Deps. (%)	Wholesale Price Index (1980-81=100)	Rates of growth Price Index (%)	Rates of growth Real Deps. (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
51-52	36.0	70.6	822	-6.70	50.4	6.11	-12.88
52-53	36.5	63.6	831	1.09	44.1	-12.50	13.59
53-54	37.5	63.5	847	1.93	46.2	-4.76	-2.83
54-55	36.5	66.1	943	11.33	43.0	-6.93	18.26
55-56	34.5	73.0	1043	10.60	40.8	-5.12	18.26
56-57	29.5	76.6	1175	12.66	46.5	13.97	-1.31
57-58	30.4	66.3	1451	23.49	47.9	3.01	20.48
58-59	87.5	62.0	1635	12.68	49.8	3.97	8.71
59-60	37.6	59.3	1902	16.33	51.7	3.82	12.51
60-61	32.0	75.6	1746	-8.20	55.1	6.56	-14.76
61-62	31.3	73.6	1922	10.08	55.2	0.18	9.90
62-63	29.0	72.8	2042	6.24	57.3	3.80	2.44
63-64	28.0	79.5	2285	11.90	60.9	6.28	5.62
64-65	27.8	78.8	2583	13.04	67.5	10.84	2.20
65-66	27.5	77.6	2950	14.21	72.7	7.70	6.51
66-67	26.1	78.6	3426	16.14	82.8	13.89	2.25
67-68	25.1	78.7	3856	12.55	92.4	11.59	0.96
68-69	24.3	78.3	4338	12.50	91.3	-1.19	13.69
69-70	28.2	79.0	5028	15.91	94.8	3.83	12.05
70-71	23.1	79.5	5906	17.46	100.0	5.49	11.97
71-72	23.2	74.1	7106	20.32	105.6	5.60	14.72
72-73	25.0	70.8	8643	21.63	116.3	10.13	11.50
73-74	23.3	73.0	10139	17.31	139.7	20.12	-2.81
74-75	23.9	74.1	11827	16.65	174.9	25.20	-8.55
75-76	32.3	76.8	14155	19.68	173.0	-1.09	20.77
76-77	31.5	75.0	17566	24.10	176.6	2.08	22.02
77-78	35.6	67.3	22211	26.44	185.8	5.21	21.23
78-79	33.7	65.9	27016	21.63	185.9	0.05	21.58
79-80	33.4	67.8	31759	17.56	217.6	17.05	0.51
80-81	34.7	66.8	37988	19.61	257.3	18.24	1.37
81-82	34.6	67.9	43733	15.12	281.3	9.33	5.88
82-83	35.7	69.1	51358	17.44	288.7	2.63	14.81
83-84	35.1	68.2	60596	17.99	316.0	9.46	8.53
84-85	39.0	67.8	72244	19.22	338.4	7.09	12.13
85-86	35.8	65.8	85404	18.22	357.8	5.73	12.49
86-87	37.6	61.6	102724	20.28	376.8	5.31	12.69
87-88	39.4	59.8	118045	14.91	405.4	7.59	7.32

Notes : The abbreviations 'Deps.', 'agg' and 'ROG' denote respectively deposits, aggregate and rate of growth. Data on deposits (in Rs. crores) refer to those as on the last Friday of each year.

However, what is not evident is whether the credit sanctioned here was for production purposes or for the purpose of capacity creation. This, therefore, does not permit us to arrive at any conclusions regarding the presence of a binding constraint in one of the two forms of credit.

Next we examine some data on credit and deposits for scheduled commercial banks in Table 5.10. The credit to deposits ratio (col. (3)) shows substantial fluctuations , remaining fairly and consistently high during the period 1960-61 to 1976-77 as compared to the periods before and after. We also examine the rate of growth of real value of deposits i.e., nominal deposits deflated by the general wholesale price index (col. (8)). The real amounts of deposits registered a low rate of growth in the sixties, i.e., during 1962-63 to 1967-68, but showed a rise after that (except in the years of oil shock). This questions the validity of the contention that a slow down in growth of deposits and hence in credit availability has served as a bottleneck to the industrial growth.

At a broad level, therefore, the evidence in this subsection does not support the hypothesis of a persistent financial crunch. However, there might have existed some short intervals during which such bottlenecks were binding.

5.5. Some Conclusions

The evidence examined in this chapter does not seem to support the hypothesis that supply bottlenecks imposed any long term constraints on industrial growth in India. If at all there were any such bottleneck, it must have been a short run phenomenon. While the first four kinds of constraints from the supply side, as enumerated in Section 5.3, clearly appear to be of short term nature, the effects of the last kind of bottleneck to growth are difficult to

assess. In other words, it is difficult to establish that the slow down in growth was a result of such a policy regime, or alternatively, that a different policy structure might have promoted a higher rate of growth of the industrial sector, i.e., a more rapid rate of transformation of the dual economy.

On the other hand, the evidence on the capacity utilization and capacity creation in the industrial sector points towards the possibility of demand being the predominant long term bottleneck. Insufficiency of the demand pressures faced by the industrial sector seems to provide a good explanation both for the observed behaviour of capacity utilization as well as for the inefficiency in utilization of resources in the economy. A decline in the rate of growth of public investment in the mid-sixties (i.e., corresponding to the phase of deceleration), and a revival of public expenditure in the late seventies and early eighties (during the phase of revival of growth in the industrial sector) also confirm that autonomous stimuli to domestic demand possibly played a key role in influencing industrial behaviour in the entire period considered.

Chapter 6

AN EMPIRICAL MODEL TO EXPLAIN INDUSTRIAL GROWTH

6.1. Introduction

Our study so far reveals that the industrial sector in India appears to face a long-term constraint to growth from the demand side. Using this as the basis we seek to explain econometrically the behaviour of industrial output in India in this chapter. We propose to use the dual economy framework to describe the functioning of the economy. Section 6.2 develops the basic model to be used for the purpose, while the empirical results are presented in Section 6.3. Section 6.4 summarises the findings of this chapter.

6.2. The Model

The dual economy models studied in Chapter 2 have at least two limitations. These are developed in the context of a closed economy and do not explicitly consider any economic role of the government. Since we propose to analyse the constraints to growth in the Indian economy, the framework suitable for this purpose needs to be free of these limitations. Further, we shall make a few other modifications. *Firstly*, the economy will be subdivided into an agricultural and a non-agricultural sector, the latter being defined to include both the manufacturing as well as the tertiary sectors. One of the major outputs of the tertiary sector is the services provided by government administration and the main item of expenditure on this product is the government consumption expenditure. The introduction of the external sector, however, does not require any major modification. The external sector provides an alternative source of demand as well as an alternative source of supply. *Secondly*, in order to be able to capture the role of

different factors in constraining the different industry groups, we consider some disaggregation of the industrial sector. Given that the industrial sector is being perceived as demand constrained, it appears logical to consider a disaggregation according to the use-based classification. To be specific, the industrial sector is subdivided into three industry groups - consumer goods, intermediate goods and capital goods (inclusive of basic goods)[1]. *Finally*, we make one simplifying assumption, namely that foodgrains is the representative output of the agricultural sector. This assumption may be justified on the grounds that foodgrains production is important in India, not only quantitatively[2], but qualitatively as well, and that its output and relative price are the two basic variables which affect decision making in a developing economy and figure prominently in various macro models for such economies. With this basic structure, we will now try to identify the factors affecting demand for output and levels of production of the various industry groups.

The demand for the output of industrial consumer goods (Y_c) is mainly consumption demand, originating from both agricultural and non-agricultural sectors. Such demand from either sector depends on the real income originating from that sector (which may be approximated by the real output of that sector measured in terms of,

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[1]Capital goods and basic goods industries are being lumped together to form one group of industries which will be broadly referred to as capital goods. Such an aggregation is done on the ground that outputs of both these groups of industries are affected by the same set of demand variables. These variables include government (and private) investment in both machinery and equipment and construction (the latter requiring basic goods like steel and cement) and investment in agriculture which generates demand for a basic good like fertilizer. Interestingly, Rangarajan (1982b) also uses a similar disaggregation.

[2]For instance, in the index numbers of agricultural production with the triennium ending 1969-70 as the base, foodgrains output has a weight of 68.1 per cent.

say, manufacturing prices), and the relative price. Thus, Y_c may be taken to depend on Y_n, pX and p, where Y_n, X and p are respectively, non-agricultural output, the foodgrains output and the relative price of foodgrains (i.e., the price of foodgrains relative to the price of manufactures). It may be noted that the variable Y_n measures the aggregate income of capitalists and workers engaged in the non-agricultural sector[3] while the variable pX gives a measure of income of the agriculturists. Of course, the value of the marketed surplus of foodgrains would be a better indicator of the income accruing to the latter. However, the data available on this variable is not very reliable, nor do these have satisfactory coverage. On the other hand, quantum of marketed surplus would be crucially and closely related to the level of output. Hence, to keep the structure simple, we take the levels of output as the relevant variable. Since marketable surplus in a given year is likely to originate not only from current production (X), but also from the preceding year's production (X_{-1}), it appears appropriate to take outputs of both the years as determining real incomes of agriculturists in the year in question.

Apart from the income variables, the other important variable affecting the consumption demand is the relative price of foodgrains (p). A *ceteris paribus* rise in p will induce mainly an income effect on the demand for the consumption of the industrial good. The reason is simple. Given that the demand for foodgrains is price inelastic, when p rises, a larger proportion of the incomes of consumers (particularly of those dependent on the market for their consumption of foodgrains) will be spent on foodgrains and hence, Y_c will be

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[3] In general, a rise in Y_n is expected to raise the income of the workers. Further, if the output is demand constrained, producers are producing at less than their profit maximising output and hence a rise in output will raise their profits also (Rakshit, 1982, pp. 149-50).

affected adversely[4]. Thus the demand for industrial consumer goods may be written as :

$$(1) \quad Y_c = \gamma(Y_n, pX, pX_{-1}, p)$$

The investment demand, i.e., the demand for capital goods, has broadly two components : demand by the government (public investment) and demand by the private sector (private investment). Public investment is assumed to be autonomously determined, but private investment is an endogenous variable. One of the prime determinants of private investment is public investment itself. In a demand constrained economy, autonomous expenditure is expected to determine the level of demand in the system which, in turn, would determine the level of private investment. Moreover, private investment will be induced only when there are sufficient investments in infrastructure which, in turn, are undertaken mainly by the public sector in our economy[5]. The other variable which influences the overall demand is the real income originating in agriculture. As in the case of consumer goods demand, pX and pX_{-1} will be used as proxies for agricultural income. A rise in this income will raise the demand for industrial goods and hence may induce further private investment in the latter sector. A rise in agricultural income may encourage private investment in the agricultural sector too[6]. Thus,

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[4]The effect of a rise in p on Y_c in the context of such inelastic foodgrains demand has been illustrated in Chap. 2, pp. 11-12. See also Bose (1989, pp. 31-33).

[5]Of course, if resources were a constraining factor, could get 'crowded out', given the government's overall control over resources. However, some theoretical and empirical models conceived for India consider private investment to be stimulated by public investment (see Rangarajan, 1982b, p. 601).

[6]It is often argued that a rise in p, by raising unit costs of production in the industrial sector, may reduce profits and hence investment demand in this sector. However, there exists no empirical support for such an argument in the case of the Indian economy. Hence, we do not consider p as an explanatory variable in this relation.

we postulate private investment at constant prices (PI) to be a function of GI, pX and pX_{-1}.

In addition to the variables mentioned so far, there is one other variable to which domestic production of capital goods (Y_k) was supposed to have been related to, at least in the past, viz., the imports of capital goods. The policy of import substitution pursued so vigorously after the Second Five Year Plan encouraged domestic production of capital goods. In fact, the import substitution strategy is supposed to have been an important feature of the industrialization process in India, particularly in the sixties and the seventies[7]. Hence, in order to assess the impact of the imports of capital goods on domestic production, we introduce the quantum of imports of capital goods (M_k) as an explanatory variable for Y_k[8]. Thus we may write :

$$(2) \quad Y_k = \beta(GI, PI(GI, pX, pX_{-1}), M_k)$$
$$= \phi(GI, pX, pX_{-1}, M_k)$$

Turning to the output of intermediate goods industries (Y_r), we postulate a simple relation, viz., that it depends on the real incomes of both the agricultural and the non-agricultural sectors :

$$(3) \quad Y_r = \psi(Y_n, pX)$$

The non-agricultural sector includes the manufacturing sector as well as the tertiary sector. As mentioned earlier, we will take government consumption expenditure at constant prices (GC) as the only autonomous variable affecting the output of the tertiary sector

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[7]See Desai (1970) and Ahluwalia (1985, Ch. 6).

[8]Maiti (1986, pp. 83-84) finds a strong inverse relation between India's import and domestic production of capital goods. Rangarajan (1982a, pp.19-21) also finds this variable to be exerting a significant impact on the domestic production of capital goods.

directly[9]. Thus the aggregate demand for the non-agricultural output can be written as a function of the variables affecting outputs of various industrial groups, in addition to government consumption expenditure :

$$(4) \quad Y_n = \nu(Y_n, pX, pX_{-1}, p, GC, GI, M_k)$$

It may be noted that the relative price of foodgrains itself is an endogenous variable and we need the (market) demand for and supply of foodgrains to determine its value. There exists considerable literature on this topic (e.g., Chakrabarti, 1974). All these studies reveal that the relative price of foodgrains responds *positively* to the non-agricultural real income and *inversely* to the output(s) of foodgrains. The reason is simple. A *ceteris paribus* rise in Y_n raises the market demand for foodgrains while a *ceteris paribus* fall in either X or X_{-1} reduces the market supply of foodgrains; in each case, the relative price rises as a consequence. Thus we may postulate :

$$(5) \quad p = \omega(Y_n, X, X_{-1}), \qquad \omega_1 > 0; \qquad \omega_2, \omega_3 < 0.$$

Equations (4) and (5) constitute the two basic relations which determine equilibrium in this system. These relations could be used to solve for the two endogenous variables in the system, viz., Y_n and p, as functions of the exogenous (and predetermined) variables alone. The latter include : X, X_{-1}, GC, GI and M_k. Thus one may express these relations as follows :

---

[9]The output of the tertiary sector may be divided into two components : services rendered by the government and those provided by the private sector. The supply of the latter is expected to depend on the demand for such services and such demand may be taken to be a function of the real incomes of the remaining two sectors. Thus the relation for the output of the tertiary sector (Y_t) may be written as

$$Y_t = \tau\ (GC, Y_n, pX)$$

$$(4R) \quad Y_n = N(X, X_{-1}, GC, GI, M_k)$$
$$(5R) \quad p = \Omega(X, X_{-1}, GC, GI, M_k)$$

Substituting these relations into equations (1) - (3), we get the *reduced form* expressions for Y_c, Y_k and Y_r :

$$(1R) \quad Y_c = \Gamma(X, X_{-1}, GC, GI, M_k)$$
$$(2R) \quad Y_k = \Phi(X, X_{-1}, GC, GI, M_k)$$
$$(3R) \quad Y_r = \Psi(X, X_{-1}, GC, GI, M_k)$$

On the other hand, using (4) to eliminate Y_n from these relations, we get, what could be referred to as *partial reduced form* equations where the effect of p on these variables too can be explored. These relations appear as follows :

$$(1P) \quad Y_c = \Gamma_p(GC, GI, pX, pX_{-1}, p, M_k)$$
$$(2P) \quad Y_k = \Phi_p(GI, pX, pX_{-1}, M_k)$$
$$(3P) \quad Y_r = \psi_p(GC, GI, pX, pX_{-1}, p, M_k)$$

We shall try to estimate both types of equations. The following section presents the empirical results.

6.3. The Empirical Results

In our empirical exercises we have used the indices of industrial production to represent the outputs of the three industry groups. We have tried to fit both linear and log-linear regression equations. In each case, log-linear regression equations have yielded better results and hence we report only the log-linear regression results here. Equations have been estimated by the OLS method on the basis of the annual data for the period from 1951-52 to 1989-90. The results obtained are discussed below.

Output of Consumer Goods (Y_c)

Table 6.1P presents results of the partial reduced form equations, while Table 6.1R presents those of the complete reduced form equations[10]. Results for both the systems show that all variables considered appear with significant coefficients of expected signs. Both the income terms of the agricultural sector as well as the autonomous expenditure terms[11] (i.e., government's real consumption expenditure, GC, and real investment expenditure, GI) have positive and significant coefficients (equations (PCI) and (RCI)). Lumping together GC and GI into a single explanatory variable, GCI (i.e., GCI = GC + GI), yields almost the same results in each structure (equations (PC2) and (RC2)). We, therefore, report mainly the equations involving the aggregate variable, GCI. We observe that the coefficient of the relative price (p) in the partial reduced form is significant and negative, as expected. Further, coefficients of both the income variables for agricultural sector are positive and significant.

From the survey of literature in Chapter 4, we have noted that the two widely discussed issues in the context of industrial growth in India are those of industrial stagnation (supposed to have set in around the mid-sixties) and a revival (claimed to have come about in the eighties). The impact of these phenomena is sought to be captured, in an indirect way, by examining whether the structure of relations postulated in (PC1) and (RC1) has undergone any

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[10] As mentioned above, we present OLS estimates for both the reduced form and the partial reduced form equations. As is well known, such estimates in the latter case are likely to be affected by least squares bias. However, we analyse the results since, the output of any particular industry group is not expected to be the crucial variable in explaining the of relative price, p, which is the endogenous variable retained in the partial reduced form equations.

[11] We have also tried exports of manufacturing output as an additional exogenous demand variable. However, its coefficient does not turn out to be significant.

Table 6.1P : Estimated Log-Linear Regression Equations for the Consumer Goods Output (Y_c)

(Partial Reduced Form)

Eq. No.	Intercept	Explanatory Variables									$\bar{R}^2$	D.W.
		GCI	GC	GI	pX	pX_{-1}	p	D	DGCI	D'		
PC1	0.2966 (0.83)		0.1848 (4.42)	0.1166 (3.89)	0.1640 (2.83)	0.1342 (1.87)	-0.2832 (-3.99)				0.9898	1.55
PC2	-0.1336 (-0.48)	0.2899 (9.55)			0.1816 (3.30)	0.1528 (2.20)	-0.2826 (-3.98)				0.9898	1.52
PC3	-0.2608 (-1.05)	0.2588 (8.98)			0.1366 (2.67)	0.2136 (3.30)	-0.2248 (-3.41)		0.0050 (3.13)		0.9919	1.68
PC4	-0.1421 (-0.30)	0.2577 (8.63)			0.1362 (2.64)	0.2020 (2.87)	-0.2245 (-3.15)	-0.0117 (-0.24)	0.0002 (1.35)	-0.0053 (-0.22)	0.9918	1.82
PC5	-0.3897 (-0.87)	0.2616 (8.69)			0.1359 (2.60)	0.2212 (3.17)	-0.2169 (-3.01)	0.0499 (2.94)		0.0078 (0.34)	0.9916	1.68
PC6	-0.1902 (-0.41)		0.1510 (3.23)	0.1186 (4.18)	0.1289 (2.34)	0.2162 (2.98)	-0.2130 (-2.90)	0.0140 (0.56)		0.0468 (2.52)	0.9914	1.67
PC7	-0.4368 (-0.88)	0.2591 (9.08)			0.1363 (2.69)	0.2075 (3.23)	-0.2280 (-3.37)	-0.5785 (-1.28)	0.0605 (1.40)		0.9921	1.83
PC8	-0.2616 (-1.05)	0.2592 (8.95)			0.1373 (2.67)	0.2132 (3.28)	-0.2261 (-3.42)	0.0508 (3.07)			0.9918	1.67
PC9	-0.0197 (-0.06)		0.1391 (3.37)	0.1223 (4.48)	0.1347 (2.51)	0.2082 (2.96)	-0.2285 (-3.40)	0.0498 (2.83)			0.9916	1.65

Table 6.1R : Estimated Log-Linear Regression Equations for the Consumer Goods Output (Y_c)

(Reduced Form)

Eq. No.	Intercept	Explanatory Variables								$\bar{R}^2$	D.W.
		GCI	GC	GI	X	X_{-1}	D	DGCI	D'		
RC1	0.4043 (5.10)		0.1938 (6.28)	0.1071 (3.87)	0.1334 (2.43)	0.1570 (2.62)				0.9904	1.56
RC2	0.1506 (2.08)	0.2969 (10.68)			0.1568 (2.89)	0.1529 (2.51)				0.9900	1.52
RC3	0.2902 (2.80)	0.2928 (10.83)			0.1304 (2.41)	0.1547 (2.62)		0.0028 (1.82)		0.9906	1.56
RC4	0.5703 (3.20)	0.2657 (8.86)			0.1292 (2.48)	0.1531 (2.69)	-0.9189 (-1.86)	0.0923 (1.94)	-0.0317 (-1.73)	0.9914	1.83
RC5	0.4446 (2.57)	0.2762 (9.00)			0.1275 (2.35)	0.1600 (2.71)	0.0368 (2.09)		-0.0208 (-1.15)	0.9906	1.58
RC6	0.5448 (3.04)		0.1935 (4.44)	0.1035 (3.58)	0.1062 (1.89)	0.1590 (2.71)	0.0299 (1.64)		-0.0002 (-0.01)	0.9908	1.62
RC7	0.3164 (3.04)	0.2917 (10.92)			0.1335 (2.49)	0.1479 (2.53)	-0.6698 (-1.38)	0.0672 (1.44)		0.9908	1.71
RC8	0.2855 (2.76)	0.2929 (10.81)			0.1310 (2.41)	0.1549 (2.61)	0.0285 (1.77)			0.9906	1.55
RC9	0.5434 (5.14)		0.1938 (6.51)	0.1034 (3.86)	0.1061 (1.94)	0.1590 (2.76)	0.0298 (1.90)			0.9911	1.62

significant changes across the two periods mentioned above. A number of dummy variables are introduced to investigate the issue - two intercept dummies, D and D', for the period of the eighties and the period upto 1964-65, respectively and a slope dummy for the aggregate public expenditure, DGCI, for the period of the eighties[12]. We observe that the introduction of the slope dummy for government expenditure improves the results in each system (equations (PC3) and (RC3)). The t-ratio of the coefficient of this variable is around 2, although the size of the coefficient is very small. As regards the two intercept dummies, we observe that the coefficient of the intercept dummy D' does not turn out to be significant while the coefficient of D, which is negative when DGCI is also present as an additional regressor but positive in other cases, has a t-ratio close to 2 in many cases (equations (PC4) - (PC9) and (RC4) - (RC9)).

Thus the relations (PC1) and (PC2) or (RC1) and (RC2) seem to have undergone some changes in the eighties. The same increase in autonomous expenditure seems to bring forth a larger increase in the demand for consumer goods industries in the eighties than that in the preceding period. This change in behaviour is apparent when one compares (PC3) with (PC8) or (RC3) with (RC8). One may choose either equation from each set.

Output of Capital Goods (Y_k)

Regression results for the output of capital goods (Y_k) are

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[12]Since the regression equations tried are log-linear, these dummies are defined as follows :

$$\log D \approx \begin{cases} 1, & \text{for each year from 1980-81 to 1989-90.} \\ 0, & \text{for all other years.} \end{cases}$$

$$\log D' \approx \begin{cases} 1, & \text{for each year from 1951-52 to 1964-65,} \\ 0, & \text{for all other years.} \end{cases}$$

$$\log DGCI \approx \begin{cases} \log GCI, & \text{for each year from 1980-81 to 1989-90,} \\ 0, & \text{for all other years.} \end{cases}$$

given in Table 6.2. We begin by considering government investment at constant prices (GI) and the (quantity index of) import of capital goods (M_k) as the only two explanatory variables (equation (PK1)). These two variables are expected to affect both private as well as public investment. The coefficients of both variables are found to be significant, with imports exerting a negative impact on Y_k. This points to the possibility of a competitive relation between imports and domestic production of capital goods. The $\bar{R}^2$ is fairly high; however, the DW statistic is low.

It is argued that the eighties have witnessed a revival of industrial growth and that this revival has been fostered, to a large extent, by the behaviour of government expenditure, particularly by a stable growth in government investment expenditure (Nagraj, 1990, p. 2321; Bhargava and Joshi, 1990, p. 2660; Goyal, 1992, p. 898). In order to examine the validity of such a hypothesis, we introduce a pair of dummy variables - an intercept dummy (D, as defined earlier) and a slope dummy for government investment in the eighties (DGI)[13]. The results are given in equation (PK2). We observe that DGI has a positive and statistically significant coefficient, indicating a larger stimulus being provided by a given level of public investment in the eighties compared to that in the earlier period.

To obtain the results of the partial reduced form equations, we introduce in the above formulation two additional regressors, pX and pX_{-1}, i.e., proxies for income accruing to the agricultural sector in the current period (equation (PK3)). Both the income proxies appear to have constituted a significant influence on domestic production. The $\bar{R}^2$ and DW too have improved. However, the t-ratio of the estimated coefficient of M_k has reduced. Presumably,

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[13] This is defined as follows :

$$\log DGI = \begin{cases} \log GI & \text{, for each year from 1980-81 to 1989-90,} \\ 0 & \text{, elsewhere.} \end{cases}$$

Table 6.2 : Estimated Log-Linear Regression Equations for the Capital Goods Output (Y_k)

Eq-No.	Intercept	Explanatory Variables												$\bar{R}^2$	DW
		GI	M_k	pX	pX_{-1}	X	X_{-1}	GC	D_1	D_1M_k	D	DM_k	DGI		
	Partial Reduced Form														
PK1	-5.5040 (-19.77)		1.1511 (21.09)	-0.125 (-2.17)										0.9764	0.62
PK2	-5.4217 (-16.59)		1.1624 (21.81)	-0.1648 (-2.51)							-4.4191 (-2.17)		0.4582 (2.17)	0.9780	0.83
PK3	-8.7195 (-14.25)		0.8546 (12.57)	-0.0612 (-1.24)	0.3052 (2.47)	0.3033 (1.86)					-2.5985 (-1.76)		0.2673 (1.75)	0.9893	1.43
PK4	-4.9986 (-4.26)		0.7553 (12.02)	-0.3001 (-3.02)	0.2267 (2.20)	0.1955 (1.31)			-1.3852 (-2.52)	0.2500 (2.18)	-5.8463 (-2.88)	0.2111 (1.03)	0.5146 (1.80)	0.9930	1.66
PK5	-4.8550 (-5.08)		0.8015 (14.63)	-0.2836 (-3.49)	0.3526 (4.56)				-1.2589 (-2.60)	0.2247 (2.22)	-7.7457 (-4.26)		0.8288 (4.27)	0.9923	1.90
	Reduced Form														
RK1	-3.9635 (-6.52)		0.5585 (7.27)	-0.1483 (-1.93)			0.1904 (1.93)	-0.0772 (-0.66)	0.3761 (5.69)	-0.9341 (-2.34)	0.1729 (2.09)	-4.9959 (-3.01)	0.5249 (2.94)	0.9951	1.57
RK2	-3.7478 (-5.55)		0.5451 (8.24)	-0.1730 (-2.00)			0.1566 (1.64)		0.3569 (5.25)	-1.0906 (-2.43)	0.2038 (2.21)	-4.0917 (-2.32)	0.1381 (0.86	0.3553 (1.50)	0.9952	1.44
RK3	-4.0163 (-6.73)		0.5310 (8.32)	-0.1329 (-1.63)			0.1708 (1.83)		0.3728 (5.71)	-0.9071 (-2.30)	0.1666 (2.05)	-4.7303 (-2.97)		0.4964 (2.89)	0.9952	1.46

there might have been changes in the impact of imports on domestic production over this long period of forty years which needs to be taken into account. This is what we seek to explore next.

The import substitution strategy is argued to have had a significant effect on the domestic production of capital goods. However, such substitutions are supposed to have taken place on a substantial scale from the sixties only (Ahluwalia, 1985). On the other hand, industrialization in the eighties was somewhat different from that in the past. For one thing, after a long period of restriction imports tended to be liberalised, raising questions as to whether the nature of imports now is competetive, thereby hindering domestic production, or complementary, thereby facilitating industrial production at home[14]. In order to investigate these questions, we introduce yet three more dummy variables - an intercept dummy for the fifties (D_1), and slope dummies for imports for the fifties and the eighties (D_1M_k and DM_k, respectively)[15]. The corresponding regression results are given in eq. (PK4). The results show that in the fifties imports of capital goods do not appear to have much influence on domestic production. Although D_1M_k has a significant positive coefficient, the elasticity of Y_k with respect to the import substitution variable during the fifties is estimated to be very small, viz., - 0.06 (obtained by adding the coefficients

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[14]The import intensity of the sector producing machinery and transport equipment is argued to have shown some increase in the eighties (Sengupta, 1993; p. M-60).

[15] The dummies are defined as follows :

$$\log D_1 = \begin{cases} 1, & \text{for all the years from 1951-52 to 1959-60,} \\ 0, & \text{for all the other years.} \end{cases}$$

$$\log D_1M_k = \begin{cases} \log M_k, & \text{for all the years from 1951-52 to 1959-60,} \\ 0 & \text{for all the other years.} \end{cases}$$

$$\log DM_k = \begin{cases} \log M_k, & \text{for all the years from 1980-81 to 1989-90,} \\ 0, & \text{for all the other years.} \end{cases}$$

of M_k and D_1M_k). However, there does not seem to be any significant change in its influence in the eighties, i.e., the adverse impact of the import of capital goods on domestic production of the same continued even upto the third phase. Moreover, the coefficient of pX_{-1} does not appear to be significant. Hence dropping these two explanatory variables we obtain equation (PK5), where the results show some improvement in the value of the DW statistic and a marginal fall in $\bar{R}^2$. However, the coefficients of all the variables now turn out to be statistically significant, i.e., the domestic output of capital goods industry appears to have been affected by government investment, imports of capital goods, and income accruing to agriculturists . So far as changes in responses overtime are concerned, the quantitative impact of imports of capital goods on domestic production is found to be different in the fifties as compared to the later period. Similar differential impact of government investment is discernable between the periods of the pre-eighties and the eighties.

The estimated equations presented above represent the partial reduced form equations. In these results is included one endogenous variable, viz., the relative price (p). Eliminating this variable, we arrive at the final reduced form relation, as derived in the preceding section (equation (2R) in section 6.2). Results corresponding to this formulation are presented in equations (RK1) - (RK3) in Table 6.2. The equation (RK1) corresponds to the reduced form version of the equation (PK5), obtained after substituting for p. Once again, we find that both D_1M_k and DGI have positive significant coefficients, confirming our results noted in the preceding paragraph. The coefficient of the lagged foodgrains output, however, does not turn out to be significant. The rest of the variables included appear with statistically significant coefficients. Quite expectedly, dropping X_{-1} from the relation does not alter the result much (equation (RK3)). The inclusion of DM_k, i.e., an import slope dummy for the eighties, does not change the

results at all, with its coefficient not being significant (equation (RK2)). The results thus suggest that the demand side variables, GI and GC, play a significant role in explaining the behaviour of capital goods output. Negative coefficient of imports for the second and third phases seems to provide a stronger support of the hypothesis of a demand determined industrial output. (For, in a demand constrained industry augmenting supply through imports, as argued earlier, would be detrimental to domestic production). Current foodgrains output or income too provides a demand side stimulus, whether the impact be through investment demand or consumption demand from agriculture. Equations (PK5) and (RK3), therefore, seem to provide fairly good explanations for Y_k.

Output of Intermediate Goods (Y_r)

The regression results for the intermediate goods output (Y_r) are presented in Table 6.3. In order to explain the behaviour of this output once again we start with the partial reduced form. Starting from the formulation of (3P) in section 6.2, we find that while GC, GI, pX and p appear to have significant influence on the production of intermediate goods output, pX_{-1} and M_k do not seem to play any significant role (equation (PR1)). Given the indirect nature of influence of these factors, it is not really unexpected that these variables do not appear with significant coefficients.

Dropping these two variables from the equation improves the t-values of all the included variables while leaving the other results more or less unchanged (equation (PR2)), indicating that these two variables are not very important for explaining intermediate goods output. Equation (PR3) presents a relation closer to the structural form relation, where the output of intermediate goods is sought to be explained in terms of outputs (or proxies for outputs) of the various sources of demand, i.e., agricultural outputs, outputs of the other two industrial subsectors (viz., Y_c and

Table 6.3 : Estimated Log-Linear Regression Equations for the Intermediate Goods Output (Y_r)

Eq. No.	Intercept	Explanatory Variables										$\bar{R}^2$	D.W.
		GC	GI	pX	pX_{-1}	p	M_k	X	X_{-1}	Y_c	Y_k		
	Partial Reduced Form												
PR1	-2.6427 (-5.48)	0.7516 (12.95)	0.1065 (1.82)	0.3776 (4.38)	0.0134 (0.64)	-0.5822 (-5.59)	0.0027 (0.10)					0.9957	1.51
PR2	-2.6979 (-5.94)	0.7552 (13.68)	0.1104 (2.40)	0.3791 (4.50)		-0.5702 (-5.61)						0.9959	1.40
PR3	-5.2298 (-12.69)	0.5162 (7.28)						0.1905 (2.00)	0.2729 (3.20)	0.5108 (2.14)	0.0979 (1.43)	0.9966	1.28
	Reduced Form												
RR1	-5.4757 (-41.31)	0.6651 (13.89)	0.0847 (1.50)				0.0201 (0.79)	0.2830 (2.94)	0.3390 (4.01)			0.9962	1.26
RR2	-5.5168 (-45.54)	0.6601 (13.99)	0.1140 (2.69)					0.2606 (2.85)	0.3435 (4.10)			0.9963	1.20

Y_k) and government consumption (GC), the latter serving as a proxy for the demand generated by the autonomous services sector. The results here show that all the variables, except Y_k, appear with significant coefficients; the t-ratio of the coefficient of Y_k is, however, low. This possibly explains why the coefficient of M_k in equation (PR1) is not significant. The above results also suggest weak backward linkages between Y_k and Y_r.

The reduced form result corresponding to the equation (PR1) (i.e., equation (RR1)) confirms the preceding observation. M_k, once again, does not figure as a useful explanatory variable. Both series of foodgrains outputs, however, turn out to have significant impact on Y_r. This possibly captures the effect of p on Y_r - since p depends on both current as well as lagged output, as argued in the earlier section, replacing p by both outputs might have yielded such a result. Excluding M_k from the equation does not alter the results substantially, although the DW statistic is low (equation (RR2)). While the results obtained in the case of intermediate goods output do not provide very good explanations for the behaviour of this output, given the indirect nature of demand (i.e., derived demand) in this case, very good explanations are possibly difficult to obtain, unless one goes for a more elaborately specified model beyond this simple reduced form structure. However, the variables included do play a significant role in determining the output here and this can well be treated as evidence in favour of the hypothesis of a demand constrained industrial sector.

6.4. Implications of the Results Obtained

The results obtained in the preceding section seem to confirm the basic hypothesis of the present study, i.e., that the long-term constraints to the growth of the Indian industrial sector are demand side constraints. In the following paragraphs we shall attempt to comment briefly on the probable implications of the results obtained.

Let us consider first the output of consumer goods industries (Y_c). The demand for this output, captured through variables such as government consumption and investment expenditures, and income accruing to the agricultural sector, seems to provide a fairly good explanation for the behaviour of output of this sector. All these variables are found to have a stimulating influence on the domestic demand for Y_c. Given that the time period considered is rather long, it may be expected that the elasticity of demand with respect to a given explanatory variable here might have varied over this period. An interesting result obtained is that of a larger coefficient of autonomous expenditure (GCI) in the eighties, i.e., that a one per cent increase in GCI is estimated to induce a larger increase in Y_c in the eighties than in the preceding period. To put it differently, there appears to have occurred an increase in the value of the multiplier corresponding to autonomous expenditure in the eighties. A number of plausible explanations could be advanced for this phenomenon. The marginal propensity to consume the industrial good could have increased in the eighties, presumably owing to some shifts in the distribution of personal disposable income in this period in favour of groups having relatively higher propensity to consume the industrial good. Changes in the structure of taxes and government expenditures might have been responsible for such changes in income distribution.

The other plausible explanation relates to changes in the tax and transfer rates in the economy. An increase in the tax rate leads to a decline in the multiplier, while a rise in the rate of transfers would be expected to increase it. In the eighties, the pattern of expenditures and revenues of the government had undergone some changes. While the tax rates are found to be have been more or less stable in the eighties (Sengupta, 1993; Kelkar, et. al., 1991), transfers as a percentage of total expenditure and presumably as a proportion of GDP as well, are observed to have increased (Rao and

Tulsidhar, 1991, p. 19). This might have brought about an increase in the multiplier effect associated with a given increase in autonomous expenditure in the eighties than in the past.

In the case of capital goods sector too, demand side factors are found to provide fairly satisfactory explanations for the behaviour of output. While domestic demand variables do play an important role, imports of capital goods too are found to be crucial in explaining trends in output here. The influence of imports on domestic production, however, is found to have varied over time. During the fifties, imports are not found to have affected domestic production significantly (the estimated coefficient is close to zero). The magnitude of the impact, however, changes in the later period when the domestic production is found to be negatively related to imports. This suggests that during this period the domestic production of capital goods was possibly demand constrained, since, other things remaining unchanged, an increase in this production could come about only with a reduction in imports of the same.

On the other hand, in the eighties the domestic production of capital goods is found to have received a larger stimulus from public investment than in the past. Presumably, investment opportunities might have been better and wider during the eighties and public investment might have induced private investment more in this period than before. (Recall our results for Y_c where we have found public expenditures to create a larger multiplier effect on the demand for consumer goods in the eighties than in the earlier period).

In the case of intermediate goods output (Y_r), once again, we get fairly good results using the demand side factors. However, given the indirect nature of influence of such factors on the former, it appears that the results obtained here could be improved upon through, say, the use of a model specified in greater detail and /or the use of more sophisticated estimation procedures.

From the empirical results obtained in this chapter we observe that while responses of the different groups of industrial outputs to demand side variables vary over time, autonomous expenditure and specifically, public expenditure emerge as the key variables for explaining the behaviour of industrial output in India. This clearly indicates that the Indian experience corresponds to the case of transformation of a dual economy through recourse to public investment and expenditure as discussed in Chapter 3. The implications of such a growth path, as discussed earlier, seem to conform to the Indian experience. The industrial sector emerges to be demand constrained, with growth being dependent on the stimuli provided by increases in autonomous expenditure. Growth in this sector, thus, remains contingent on exogenous factors.

Chapter 7

SUMMARY AND CONCLUSIONS

The present study has been aimed at analysing the process of growth of the Indian industrial sector and, in the process, identifying the factors helping and/or constraining such growth. The growth of this sector is being visualised as a part of a broader process of development of the economy, where development is being viewed as a process of transformation of a traditional economy into a modern economy. The interim stage in any such transformation would involve the coexistence of a traditional or agrarian sector and a modern or industrial sector. This stage is referred to as the 'dual economy' stage in the literature. We have sought to use this framework in our study of the growth of the Indian industrial sector.

The development of a dual economy has largely been viewed as synonymous with the growth of the modern sector. The process of, and constraints to, such development have excited a considerable amount of debate. Our analysis of some of the studies in this area has revealed broadly two kinds of constraints, on the basis of which dual economy models are characterised as either demand determined models or supply constrained models. In the former group of models, economies are found to respond to demand based stimuli (like, say, a stepping up of the level of autonomous expenditure) while in the latter group of models economies are supposed to be constrained by various types of supply bottlenecks. Both groups of models, however, isolate the lack of sufficient growth of the agricultural sector as a potential constraint.

The survey of literature on dual economy models raises at least a couple of questions in one's mind. Firstly, what are the various ways in which the rate of transformation of a dual economy can be stepped up ? Secondly, how does one explain the existence or

evolution of different kinds of dual economies, specially the demand and supply constrained dual economies ? The latter question has been touched upon briefly in chapter 2, while an answer to the first question has been attempted in chapter 3 where possible alternative ways of stimulating the rate of transformation of a dual economy have been explored. Chapter 2 has dealt with a closed economy with no government. Considering an open economy and an active role for the government, Chapter 3 discusses the existence of additional stimuli to development, not all of which are endogenous to the functioning of the economy.

The analysis of the intertemporal behaviour of outputs of the Indian industrial sector carried out in Chapter 4 brings out two prominent features of the growth process of this sector - a decline in rates of growth in the mid sixties and a revival of such rates in the late-seventies or early eighties. The literature dealing with the question of what explains these phenomena is found to focus on some supply side as well as some demand side impulses. On the demand side figure factors like changes in the levels of autonomous expenditure (public investment being the most prominent of such expenditure), pattern of demand corresponding to the existing distribution of income and the growth of agricultural outputs and incomes. Among supplyside factors, the emphasis is put on inefficiency of resource use and insufficiency of infrastructural facilities (the former being attributed to the then existing policy framework). Also, studies deal with the question of whether Indian industry is demand or supply constrained, the emphasis being only on *immediate* bottlenecks to output expansion.

Since the concern of the present study is on factors hindering the transformation of the Indian economy, we direct our attention to mainly the medium term or long term bottlenecks of growth. Given that the short term constraints are relatively easier to be taken care of, it is longer term constraints which need to be isolated and analysed. Our study of the trends in capacity

utilization and rates of growth of capacity in chapter 5 show that both consumer goods industries and capital goods industries had faced a demand constraint. This meant the generation of a demand constraint for basic goods industries as well. On the other hand, if one examines the evidence and arguments usually advanced in support of supply side bottlenecks, the existence of a sustained supply side bottleneck does not seem to be substantiated. In other words, the secondary evidence seems to suggest that the long term constraint on the Indian industry has been the demand constraint.

Using this as a basic premise, we then try to construct a small model in chapter 6 to explain the behaviour of industrial outputs. The results of our empirical exercises corresponding to this model show that the demand side variables provide a reasonably good explanation for the behaviour of these outputs. Public expenditure, i.e., public investment and consumption expenditure as well as income accruing to the agricultural sector are found to provide a fairly satisfactory explanation for the intertemporal behaviour of various groups of industrial outputs separately. So far as the output of capital goods is concerned, an additional influence has been the policy of import substitution. In fact, the domestic production of capital goods is estimated to have been negative related to the imports of such goods, particularly since the beginning of the sixties. This lends additional support to the contention that the domestic production of capital goods was possibly demand constrained, since an increase in this production could come about, other things remaining unchanged, only with a reduction in imports of the same. Another interesting result is that the degree of response of output of a given group of industries to a given explanatory variable has varied across the different periods, particularly between the period of the pre-eighties and the eighties. While some probable explanations have been advanced for such a result the study does not take up a complete investigation of this particular issue.

The results of this chapter, when viewed in the light of our discussion of the dual economy models in the earlier chapters, imply that the Indian economy and consequently the Indian industrial sector has been moving along a growth path determined mainly by the behaviour of public expenditure. A decline in public investments in the mid-sixties and a step up in public expenditure in the late seventies seem to explain a large part of the fluctuations in growth rates of industrial outputs.

Given this structure of the Indian economy, it would be of interest to briefly explore what the possible effects of the currently introduced changes in policy are likely to be. The entire set of measures introduced so as to liberalise the existing body of controls in the various domestic and external sectors are advocated for on the grounds that such measures, by stimulating completion, would generate pressures for more efficient utilization of resources (see Ahluwalia, 1985, Ch. 7; 1991, Chs. 4, 7; GOI, 1992). The measures introduced include relaxing controls on investment decisions in industry through allowing free entry and more open access to foreign technology, along with greater openness and even encouragement to foreign investment in the domestic economy. The process of transformation envisaged is one where the scope of the public sector is to be progressively reduced and an increasingly larger role is to be assigned to private entrepreneurship and foreign resources.

Let us examine, in a little more detail, the changes in the policy being brought about. In a recent review of the new policies (GOI, 1992), the changes have been categorised and summarised under the following heads : correcting fiscal imbalances, reforms in industrial policy, trade and exchange rate policies, foreign investment policies, tax reforms, financial sector reforms and public sector reforms. The first and the last measures, i.e., correcting fiscal imbalances and public sector reforms, would involve some curtailing of the demand stimulus provided by autonomous expenditure.

This is expected to be made up through an enhanced inflow of foreign investible resources supposed to be induced by a relaxation or simplification of the existing controls. The financial sector reforms as well as the industrial policy reforms are being advocated to generate competition and efficiency in the domestic economy. All these changes are purportedly aimed at making the individual producers the pivot of growth.

Changes in policy related to the inflow of foreign resources and foreign technology are argued to aid rapid technical progress in the domestic economy. All these changes do assign a prime role to foreign investment, thus implying a continuance of the demand constrained status of the domestic economy. As a result, the success of the new measures would be crucially dependent on the growth of the export markets and/or inflow of foreign investment[1]. These views are also expressed in several discussions on the reforms package (Mookherji, 1992, p. 795; Nayyar, 1993, p. 651). On the other hand, the alternative stimulus in the form of growing autonomous domestic expenditure is dependent on the success of the tax reforms in raising revenues[2].

The orientation of production in the modern sector towards exports has two implications. Firstly, growth in the domestic economy

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[1]In a very recent study, Joshi and Little derive similar implications. They argue that "It is to be expected, given political realities, that the axe should fall on (public) investment in the initial stages of a stabilization programme. But a prolonged investment famine would clearly be disastrous." Further, "If the fall in public investment is not offset by a rise in domestic and foreign private investment, growth will be slow for several years with obvious risks for the reforms programme." (Article entitled "Macro-Economic Stabilization in India, 1991-1993 and Beyond", Economic and Political Weekly, Dec. 4th, 1993, p. 2662)

[2]Given the objective of curtailing fiscal deficits, the element of autonomy in public expenditure is restricted or reduced anyway. See Rakshit (1991) for discussion on the implications of the alternative ways of reducing fiscal deficits.

would be susceptible to the vagaries of the external market in addition to the fact that growth does not get endogenised. Secondly, growth of the modern sector can be an isolated process without affecting the traditional sector. As discussed in chapter 5, the former leads to the possibility that technical progress in the domestic economy may remain continuously dependent on the inflow of foreign technology. This introduces another element of exogeneity in the growth of the industrial sector. Thus growth of the modern sector is likely to remain susceptible to shocks and fluctuations. The second implication suggests that the economy may experience growth, but not through the transformation of the dual economy into a modern economy; the traditional sector, i.e., agriculture, fails to get integrated with the process of growth of the rest of the economy. Indeed, a rapid growth of the modern sector could well take place without disturbing the status quo here[3], suggesting that the desired transformation of the economy might be kept in abeyance.

The growth strategy, based on the inflow of foreign investible resources, on the other hand, can be successful in transforming the dual economy, provided such a growth process can endogenise the process of technical progress in the domestic economy. As we have mentioned in chapter 5, the emerging literature on the development strategies of successful outward looking economies, like the East Asian economies, points towards the importance of an active, interventionist role of the government in inducing this process of endogenisation of technical progress and growth. This means that the role envisaged for the government in the current phase of liberalization in the Indian economy should be examined critically. In fact, a number of recent studies on the Indian economy (e.g., Rakshit, 1991; Nayyar, 1993) reiterate such a need for an assessment

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[3]Rakshit (1991, p. 1985) and Nayyar (1993, p. 649) examine the possible implications of the various reforms on the agricultural sector.

of the current economic policies and the role envisaged for the government. While the current approach appears to emphasize on a diminishing, and an increasingly non-interventionist role of the government, the usefulness and the importance of some interference requires to be reassessed in the light of the experiences of the successful outward looking economies.

Appendix A

STABILITY OF EQUILIBRIUM IN THE DUAL ECONOMY MODELS

Each of the models has been reduced in the text to a system of two equations involving only two (endogenous) variables. To derive conditions for stability of equilibrium of any model one has to postulate adjustment mechanisms which will describe the behavior of the system in disequilibrium. Here we shall refer the readers to the 'dual adjustment process' of Rakshit (1982, Ch.7) which characterises the basic adjustment mechanisms of a large class of dual economy models.

To talk about this mechanism in brief, an excess demand in the agricultural market is postulated to cause a rise in the relative price of the agricultural good (p) in all the models. Further, in the demand constrained models an excess demand for the industrial good is supposed to induce an expansion of output and hence of employment in this sector (L_2). On the other hand, in the neoclassical model and the Lewis model, the factor which propels growth of employment in the industrial sector is not the existence of excess demand in this sector, but the discrepancy between the wages in the two sectors. As long as the marginal product in industry exceeds the agricultural wage rate (in units of the industrial good), labour migrates from the agricultural sector to the industrial sector and industrial employment continues to increase. Algebraic formulations of these hypotheses are now given below.

Let us use E_i to denote the levels of excess demand in the ith sector. Then,

$$(A.1) \quad E_1 = F_w + F_c + I_\alpha + - X_1$$

$$(A.2) \quad E_2 = M_s + M_w + M_r + M_c + I - X_2$$

Thus, in all the models,

$$(A.3) \quad dp/dt = \varphi (E_1), \qquad \varphi' > 0.$$

On the other hand, while in the demand constrained models, we have

$$(A.4) \quad dL_2/dt = \psi (E_2), \qquad \psi' > 0$$

in the rest of the models,

$$(A.4a) \quad dL_2/dt = \xi (G),$$

where $G = \{\partial X_2/\partial L_2) - p.a.$

Starting from these adjustment mechanisms, it is possible to establish the stability of equilibrium, in each of the models[1]. As an example, let us consider the neoclassical model.

In the neoclassical model industrial employment responds to the wage gap between the two sectors :

$$(A.4N) \quad dL_2/dt = \xi \left[\frac{\partial X_2}{\partial L_2} - p.\alpha. \frac{Q_1 (L_1)}{L_1}\right], \qquad \xi' > 0.$$

$$= \xi [G]$$

where, $$G = \frac{\partial X_2}{\partial L_2} - p.\alpha. \frac{Q_1 (L_1)}{L_1}$$

The adjustment mechanism (A.3) and (A.4N), along with the equations of the neoclassical model specified in the text, would yield the following conditions for stability of equilibrium in this model :

$$(IN) \quad \varphi' (\partial E_1/\partial p) + \xi' (\partial G/\partial L_2) < 0$$

$$(IIN) \quad D_1 = (\partial E_1/\partial p).(\partial G/\partial L_2) + (\alpha.Q_1/L_1). [(\partial F_w/\partial L_2) + (\partial F_c/\partial L_2) + (\partial X_1 + \partial L_1)]$$

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[1]For the definitions and conditions of stability of a differential equation system, see Gandolfo (1971). Rakshit (1982) contains a discussion of conditions of stability in the context of his model.

where,

$$(A.5)\quad \frac{\partial E_1}{\partial p} = \frac{\partial}{\partial p}\,(F_w + F_c + I_\alpha - X_1)$$

$$\frac{\partial G}{\partial L_2} = \frac{\partial^2 X_2}{2} - p.\alpha.\frac{Q_1}{L_1}\,(1-\eta)$$

η being the elasticity of agricultural output with respect to employment in the agricultural sector. In view of the assumption of diminishing marginal product of labour in agriculture, η is expected to be less than unity. Thus with the assumption made in this text, we have

$$(A.6)\quad \frac{\partial E_1}{\partial p} < 0, \qquad \frac{\partial G}{\partial L_2} < 0$$

and hence (IN) and (IIN) are likely to be satisfied. In addition, since,

$$\frac{\partial E_1}{\partial L_2} > 0 \quad \text{and} \quad \frac{\partial G}{\partial p} < 0,$$

we have

$$(a)\quad \left.\frac{dL_2}{dp}\right|_{AA} = -\frac{(\partial E_1/\partial p)}{(\partial E_1/\partial L_2)} > 0$$

$$(b)\quad \left.\frac{dL_2}{dp}\right|_{WW} = -\frac{(\partial G/\partial p)}{(\partial G/\partial L_2)} > 0,$$

thus establishing stability of the equilibrium situation presented in Figure 3.

Appendix B

THE DATA BASE

This Appendix gives the data which have been used in this study. We shall use the following set of *abbreviations* for this purpose:

CPG : Chandhok and the Policy Group (1992) : *The Data Base of the Indian Economy*, Vols. I and II.

CSO : Central Statistical Organiation, published by the Government of India.

NAS : *National Accounts Statistics*, published by CSO (Annual).

ES : *Economic Survey*, Government of India (Annual).

RCF : *Report on Currency and Finance*, published by the Reserve Bank of India (Annual).

IIP : Index Numbers of Industrial Production (base 1980-81 = 100), constructed cy CSO.

GFCF : Gross Fixed Capital Formation.

ROG : Annual Rate of Growth (per cent).

1. Capacity Utilisation Ratios : CSO Data

Average capacity utilisation ratios in different groups of industries, computed on the basis of the CSO data, are presented in Table 1 below and their methods of computation have already been discussed in Section 5.2 in the text. The figure in parentheses below the name of an industry group gives the total of weights (in IIP) of industries included in that group. The group called 'basic goods' here excludes electricity.

2. Gross Fixed Capital Formation (GFCF)

(a) For years from 1951-52 to 1979-80, figures of GFCF at 1980-81 prices for the entire economy by type of assets (viz., machinery & equipment and construction) are obtained from CPG (Vol. I, p. 305) and are given in cols. (2), (4) and (6) of Table 2. To obtain GFCF by the public sector, first of all, implicit price deflators (with base 1980-81 = 100) are computed, separately for (i) machinery & equipment and (ii) construction, from the corresponding series at current prices and at 1980-81 prices. Figures of GFCF (at current prices) by the public sector in each type of assets are then deflated by the relevant deflator to yield the corresponding figures at 1980-81 prices. By adding the latter over the two types of assets, one gets total GFCF by the public sector (col. (8) in the Table).

(b) Figures for the relevant series upto 1979-80 are taken from CPG (Vol. I) and those since 1980-81, from various issues of NAS.

3. Government Final Consumption Expenditure at 1980-81 prices

Figures of the series for years upto 1979-80 are taken from CPG (Vol. I, p. 285, p. 291) and for years thereafter, from various issues of NAS. The series on GC is given in Col. (9) of Table 2.

4. Indices of Industrial Production (base 1980-81 = 100)

We begin the discussion with the group called *capital goods*. As pointed out in chapter 6, this group includes not only the typical capital *goods* industries (viz., sections 35 (machinery other than electrical machinery). 36 (electrical machinery) and 37 (transport equipment)), but also basic goods industries (viz., sections 1 (mining etc.), 32 (non metallic mineral products), 33 (basic metal and metal products) and 34 (metal products)). The weights of these seven groups in IIP are respectively 0.0624, 0.0578, 0.0639, 0.1146, 0.03, 0.0981, and 0.0229, their total weight adding upto 0.4496. Thus the index of production of capital goods is computed as a

weighted average of indices of production of these seven sections (where the weight of a section is taken to be its weight in the IIP as a proportion of 0.4496).

The index of production of the group called *consumer goods* is computed as the weighted average of indices of production of following industries, viz., sections 20-21 (food products), 22 (beverages, etc.), 23 (cotton textiles), 27 (wood and wood products), 28 (paper, paper-board and products thereof) and 29 (leather etc.); the total weight of these sections in the IIP is 0.2338. Similarly, the index of production of the group called *intermediate goods* is computed as the weighted average of indices of production of sections 25 (jute, etc.), 30 (rubber, etc.) and 31 (chemicals, etc.), their total weight in the IIP being 0.1851.

Figures of indices of production of these groups as well as that of the general index of industrial production (IPG), given in cols. (2)-(5) of Table 3, are obtained as follows :

(i) Indices for different sections as well as of IPG (base 1980-81 = 100) are taken from CPG (Vol. II), for years upto 1979-80 and from various issues of ES and RCF, for years thereafter.

(ii) For years upto 1959-60, indices for different sections and the general index by financial year are computed from those by calendar year, by using the following method : index for, say, 1951-52 = 3/4th of the index for 1951 *plus* 1/4th of the index for 1952.

(iii) For years from 1960-61 to 1969-70, the index for section 25 is not available by financial year. Therefore, first financial year-wise figures of this index are computed from its values given by calendar year, by using the method described in (ii) above. Next, the index for the group of *intermediate goods* industries, by financial year, are computed by taking the weighted

average of indices of production of constituent sections by financial year.

5. Quantum indices of import of non-agricultural goods and of import of industrial raw materials with base 1978-79 = 100 (M_1 and M_2)

Import of the non-agricultural goods (M_1) is defined as the total imports net of imports of agricultural goods. The index here is obtained by taking the difference between the indices for these two their respective categories of imports, the weights applied being shares in total imports in the year 1978-79. Similarly, the imports of industrial raw materials (M_2) is defined as M_1 less imports of goods of final use. The series of M_2 is constructed by taking the required data from CPG (Vol.II). The series is constructed only till 1986-87, for want of readily available data. The series of M_1 and M_2 are given in cols. (6) and (7) of Table 3.

6. Quantum index of import of machinery and transport equipment with base 1978-79 = 100 (M_k)

For years 1952-53 to 1968-69, figures are obtained by dividing import of the group called machinery and transport equipment (MT) at 1961-62 prices in a year by the value of the same in 1978-79, the series at 1961-62 prices being taken from Maiti (1986, p. 108).

M_k for the year 1951-52 is computed as follows : for two years 1951-52 and 1952-53, import of MT at current prices are deflated by the corresponding unit value index (base 1948-49 = 100) to get such import figures at constant prices. The percentage change of the latter between 1952-53 and 1951-52 is then applied to the figure of M_k (base 1978-79 = 100) for the year 1952-53 to get the same for 1951-52.

For years 1969-70 to 1979-80, figures of M_k are obtained by dividing the quantum index of import of MT (base 1968-69 = 100) for a year by the same for the year 1978-79, all these figures being obtained from CPG (Vol. II, p. 943).

Figures of M_k from 1980-81 onwards are taken from various issues of RCF and the April, 1992 issue of *Monthly Abstract of Statistics* (published by CSO).

The series on M_k, constructed in this way, is given in col. (8) of Table 3.

7. Relative Price of Foodgrains with base 1981-82 = 100 (p)

The relative price of foodgrains (p) is defined to be the ratio of wholesale price index of foodgrains to that of manufacturers. Figures of both the series are obtained from CPG (vol. I) for years upto 1979-80 and from ES, 1991-92, for years thereafter. Figures of p are given in col. (7) of Table 3.

8. *Foodgrains output (X)*

Figures are obtained from the series of net production of foodgrains by agricultural year available in ES for 1991-92. Figures of X are given in Col. (8) of Table 3. (Figures of p and X for the year 1950-51 are 123.3 and 48.1, respectively.)

Table 1 : Average Capacity Utilization Ratios in Groups of Industries/Selected Industries in India, 1951-1987

(per cent)

Year	Consumer goods (11.25)	Capital goods (4.875)	Basic goods (10.552)	Intermediate goods (11.167)	Electricity generation (11.429)	Cement (1.598)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1951	0.848	1.072	0.909	0.510	0.364	0.932
1952	0.847	0.752	0.945	0.536	0.339	0.932
1953	0.758	0.926	0.877	0.427	0.332	0.902
1954	0.853	0.830	0.857	0.439	0.344	0.989
1955	0.80	1.023	0.883	0.462	0.364	0.948
1956	0.945	0.852	0.898	0.448	0.382	0.865
1957	0.835	1.052	0.915	0.489	0.403	0.884
1958	0.879	1.006	0.830	0.455	0.422	0.860
1959	0.938	0.900	1.048	0.477	0.443	0.820
1960	0.890	0.840	1.304	0.466	0.415	0.870
1961	0.828	0.723	0.769	0.516	0.430	0.870
1962	0.788	0.803	0.899	0.511	0.440	0.883
1963	0.904	0.916	0.967	0.532	0.466	0.908
1964	0.855	1.045	0.990	0.475	0.462	0.906
1965	0.864	0.984	0.999	0.512	0.417	0.903
1966	0.766	1.021	0.960	0.486	0.411	0.879
1967	0.751	0.983	0.923	0.455	0.396	0.857
1968	0.831	0.836	0.940	0.474	0.418	0.809
1969	0.915	0.782	1.006	0.528	0.421	0.876
1970	0.831	0.856	0.916	0.528	0.433	0.823
1971	0.810	0.769	0.903	0.495	0.456	0.770
1972	0.821	0.670	0.990	0.533	0.452	0.796
1973	0.774	0585	0.918	0.653	0.457	0.759
1974	0.762	0.658	0.904	0.642	0.437	0.721
1975	0.749	0.597	0.616	0.590	0.450	0.770
1976	0.775	0.698	0.692	0.565	0.470	0.871
1977	0.829	0.707	0.730	0.488	0.441	0.877
1978	0.813	0.745	0.742	0.540	0.439	0.881
1979	0.763	0.778	0.665	0.501	0.420	0.758
1980	0.778	0.875	0.603	0.539	0.419	0.681
1981	0.868	0.894	0.682	0.543	0.433	0.715
1982	0.867	0.809	0.696	0.508	0.417	0.639
1983	0.706	0.824	0.668	0.539	0.406	0.681
1984	0.794	0.858	0.736	0.552	0.421	0.738
1985	0.800	0.727	0.714	0.591	0.423	0.740
1986	0.853	0.803	0.749	0.600	0.441	0.673
1987	0.852	*	0.834	0.591	0.432	*

* not computed for want of requisite data.

Table 2 : Gross Fixed Capital Formation and Government Consumption Expenditure in India

(Amount in Rs. Crores and at 1980-81 prices)

	Gross fixed capital formation							
	construction		machinery and equipment		total		public sector	GC
	amount	ROG	amount	ROG	amount	ROG	amount	amount
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1951-52	3813		3942		6406		1721	2548
52-53	3942	3.38	2731	-30.72	6673	4.17	1785	2551
53-54	3558	-9.74	2408	-11.83	5966	-10.59	2098	2583
54-55	3704	4.22	2128	-11.63	5832	-2.25	2410	2598
1955-56	4218	13.75	2051	-3.62	6269	7.49	3227	2670
56-57	4737	12.30	3239	57.92	7976	27.23	3641	2856
57-58	5576	17.70	4337	33.90	9913	24.29	3722	3216
58-59	5036	-9.68	5645	30.18	10681	7.75	3586	3330
59-60	5435	7.92	3391	-39.93	8826	-17.37	4223	3390
1960-61	5757	5.92	3783	11.53	9540	8.09	5151	3573
61-62	6219	8.02	4336	14.62	10555	10.64	5102	3836
62-63	6451	5.92	4759	9.96	11210	6.21	5873	4629
63-64	6587	2.11	5558	16.79	12145	8.34	6611	5733
64-65	7410	12.49	6013	8.19	13423	10.52	7411	5939
1965-66	8112	9.47	6872	14.29	14484	11.63	7798	6516
66-67	8741	7.75	7145	3.97	15886	6.02	6777	6572
67-68	9359	6.46	5781	-19.09	15140	-4.70	6237	6705
68-69	10157	8.53	5585	-3.39	15742	3.98	6312	7073
69-70	10296	1.37	5785	3.58	16081	2.15	6179	7764
1970-71	10536	2.33	6056	4.68	16592	3.18	6335	8492
71-72	10623	0.82	6050	-0.10	16673	0.49	7006	9396
72-73	10698	0.71	7008	15.83	17706	6.20	8316	9402
73-74	11119	3.94	7502	7.05	18621	5.17	8137	9305
74-75	10035	-9.75	8399	11.96	18434	-1.00	6957	8875
1975-76	9171	-3.17	8150	-2.96	17867	-3.08	8201	9799
76-77	11267	15.95	8326	2.16	19593	9.66	10144	10576
77-78	12586	11.71	9475	13.80	22061	12.60	10806	10898
78-79	14110	12.11	10066	6.24	24176	9.59	10843	11706
79-80	13461	-4.60	10941	8.69	24402	0.93	11142	12424
1980-81	13649	9.52	12627	12.42	26276	10.90	11693	13084
81-82	13869	1.61	14210	12.54	28079	6.86	13152	13663
82-83	13008	-6.21	16288	14.62	29296	4.33	15247	15075
83-84	12564	-3.41	17068	4.79	29632	1.15	15551	15718
84-85	12718	1.23	18066	5.85	30784	3.89	16433	16983
1985-86	13960	9.77	19014	5.25	32974	7.11	17080	18924
86-87	14590	4.51	21407	12.58	35997	9.17	19231	20849
87-88	15045	3.12	24910	16.36	39955	11.00	18660	22660
88-89	15578	3.54	26062	4.62	41640	4.22	19490	23877
89-90	16252	4.33	27642	6.06	43894	5.41	20042	25337

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)	Net foodgrains output (mil. tonnes)
	Consumer goods Y_c	Capital goods Y_k	Intermediate goods Y_r	General IPG	M_1	M_2	M_k	p	X
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
51-52	46.6	15.0	18.2	19.2			55	113.2	48.1
52-53	48.7	15.9	18.7	20.2			36	118.0	54.1
53-54	50.6	16.8	18.9	20.9			36	108.3	63.3
54-55	52.2	20.3	20.8	23.1			27	88.0	61.9
1955-56	54.6	24.4	23.5	26.1			48	89.2	60.7
56-57	57.0	26.3	24.2	27.9			64	102.7	63.4
57-58	58.4	37.7	24.6	29.3			101	104.2	58.3
58-59	59.8	28.3	27.2	30.2			92	111.9	69.0
59-60	62.0	30.9	30.1	32.6			110	102.0	67.5
1960-61	63.2	36.4	31.6	36.2	50	23	132	94.5	72.0
61-62	64.7	40.5	33.7	39.2	48	22	136	91.9	72.1
62-63	64.2	45.3	37.7	42.9	51	24	135	92.7	70.3
63-64	68.5	52.3	41.3	46.9	53	24	132	95.9	70.6
64-65	72.9	56.8	43.2	51.0	56	23	157	114.7	78.2
1965-66	73.8	59.5	44.5	53.8	57	23	141	114.5	63.3
66-67	73.4	58.9	47.2	54.1	57	22	99	120.8	65.0
67-68	69.5	57.0	48.6	54.7	62	39	118	135.6	83.2
68-69	76.0	61.1	54.3	58.5	58	26	108	119.2	82.3
69-70	79.5	64.5	56.5	62.9	49	39	78	123.3	87.1
1970-71	80.1	65.3	59.6	65.4	53	44	88	113.8	94.9
71-72	81.4	68.2	69.0	69.1	69	60	109	107.9	92.0
72-73	84.5	71.5	71.5	71.8	67	63	101	111.8	84.9
73-74	84.6	72.4	71.5	72.4	72	63	118	115.9	91.6
74-75	88.3	76.1	70.5	74.7	58	52	91	132.2	87.4
1975-76	86.9	83.1	77.2	79.6	52	44	90	115.8	105.9
76-77	89.5	91.0	85.4	87.3	59	54	91	99.4	97.3
77-78	92.2	92.6	90.8	90.6	92	86	117	108.5	110.6
78-79	99.7	97.8	96.3	97.5	100	100	100	109.7	115.4
79-80	94.4	96.7	98.3	96.2	96	99	92	98.0	96.0
1980-81	100.0	100.0	100.0	100.0	142	134	155	96.0	113.4
81-82	106.0	107.9	115.1	109.3	148	132	199	100.0	116.6
82-83	103.4	114.2	117.7	112.8	152	130	249	105.5	113.3
83-84	108.1	123.6	126.4	120.4	176	137	341	108.7	133.3
84-85	114.0	134.5	139.1	130.7	152	146	227	99.7	127.4
1985-86	122.6	147.7	147.8	142.1	178	154	278	100.1	131.6
86-87	127.2	163.0	161.9	154.8			345	100.2	125.5
87-88	126.0	177.6	179.3	167.0			349	102.0	122.8
88-89	127.0	192.6	205.1	180.9			356	106.7	148.7
89-90	132.9	213.8	215.4	194.6			396	97.9	149.6

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