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**AN ANALYSIS OF THE
GROWTH OF THE CAPITAL GOODS SECTOR IN INDIA
(1955 TO 1979)**

Dissertation Submitted in Partial Fulfilment of
the Requirements for the award of the Degree
of Master of Philosophy in Applied Economics
of Jawaharlal Nehru University, New Delhi


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I hereby affirm that this dissertation titled "An Analysis of the Growth of the Capital Goods Sector in India (1955 to 1979)" ^{being submitted} to the Jawaharlal Nehru University in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy is entirely my own work and has not been considered for the award of any other degree at this or any other University.


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I have supervised the above stated dissertation submitted by Sri R. Ramana and I certify that it is his original work.


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CHAPTER - I

INTRODUCTION

On the Classification of the Capital Goods Sector - This study attempts an analysis of the factors influencing the actual pattern of growth of the capital goods sector in India since the launching of the Second Five Year Plan, which had marked an attempt at a conscious programme of planned industrialisation. The prior requirement of any such study, is the need to demarcate the specific activities and industries which would constitute an aggregate capital goods sector. In practice, for empirical purposes, the definition of the capital goods sector, or the demarcating line between the capital goods sector and the consumption goods sector is based on certain accepted conventions. However, these conventions in themselves are related to the classification of the capital goods sector adopted in theoretical growth models which have recognized the historical importance of this sector. Therefore, it would be necessary to briefly describe the conceptual basis of some of these growth models in this section.

An important theoretical model which had incorporated the crucial significance of the capital goods sector was

formulated by Feldman for the purposes of the industrialisation programme of the Soviet Union. He formulated the notion of investment priority for the capital goods sector, as a precondition for attaining a high rate of growth in a backward economy, based on Marx's two departmental schema of expanded reproduction. In this schema of Marx, Department I or the investment goods sector consists of industries producing machinery and raw materials both for Department I and II, while Department II or the consumption goods sector consists solely of industries manufacturing final consumer goods for the whole economy. Accordingly, Feldman's classification of the capital goods sector included industries manufacturing machinery and all raw materials, or goods not yet in the final stages of consumption.¹

This particular clarification of the capital goods sector adopted by Feldman for his theoretical model creates two problems. Firstly, it clubs together in the capital goods sector, both machinery and intermediary goods which are non-homogenous entities in terms of their relationship to final output, thereby rendering a rather loose theoretical classification of the capital goods sector. Secondly, the implication of the classification adopted by Feldman would be to include a whole set of industries

manufacturing raw materials for the consumption goods sector in the capital goods sector, which particularly from the point of view of a model of economic development whose starting point was the expansion of capacities in the capital goods sector, is unsatisfactory.²

Maurice Dobb in a different context adopted a particular classification of the capital goods sector, which may be used as a basis for an alternative classification³. He says, that for certain purposes, one of the best ways of treating Marx's two departments or sectors, is to treat each one of them as being vertically integrated back to their own raw materials, so that the output of each sector can be theoretically assumed to consist of its final products only. This would involve the treating of Department I or the capital goods sector as consisting of machines and equipment for the production of consumer goods and more capital goods and the production of raw material exclusively for capital goods. That is, this classification of the capital goods sector by Dobb, unlike Feldman's takes into account the sector producing machinery and equipment and the current flow of intermediary products going into the production of more machinery and equipment.

In reality however, there is no complete vertical

integration and almost all intermediary goods are used as current input requirements in both the sectors, though the proportions in which each intermediary good is used between the two sectors varies. Therefore, for empirical purposes, a strict separation of some intermediary goods as exclusively belonging to the capital goods sector is not possible. One can only distinguish between intermediary goods which are mainly used as current input requirements in the capital goods sector and those which are not.

As pointed out earlier, the demarcating line for defining the capital goods sector has to be based on certain accepted conventions, which of course will have to be related to the theoretical conceptions of this sector. Accordingly, for the purpose of this study, the capital goods sector can be defined as consisting of machinery and equipment and those basic intermediary goods which are mainly used for building up further stocks of machinery and equipment. However, this definition will have to be qualified by the fact, that a part of these basic intermediates are also used as current input requirements for the consumer goods sector, while other intermediates which have been excluded in this definition are partly used as current input requirements in the capital goods

sector. In the Indian case, this classification has the advantage of ready empirical verification, because of its closeness to the functional classification adopted by the Reserve Bank of India, which distinguishes between machinery and equipment on the one hand and basic intermediates on the other.

In any analysis of the capital good sector, it is necessary to make a distinction between machinery and equipment on the one hand and intermediates on the other because, as the Raj-Sen model shows, of the differing relationships of these two sets of commodities with final output. That is, while that part of the capital goods sector consisting of machinery and equipment is in the nature of accumulated stocks of commodities, capable of producing a further flow of various commodities over time without getting completely exhausted in one production cycle, intermediates are in the nature of a current flow of commodities for the production of a flow of final goods in the same period and get completely exhausted in one production cycle.⁴ This factor has also been emphasised by Morishima, who specifically incorporates the distinction between machinery and intermediates in terms of the time dimension of these two sets of commodities, in a liner

model, for the manufacture of final output⁵. In fact, Oscar Lange also brings out the theoretical distinction between machinery and intermediates by distinguishing in a liner model, between investment coefficients which have a turnover period greater than one and technical coefficients, giving inter-industry intermediary flows, which have a single turnover period⁶. This distinction becomes important later for understanding the differing performances of these two components of the capital goods sector in India.

In order to analyse the two-sectoral relationship in the Indian case, it is also necessary to distinguish between the industrial component and the agricultural component of the consumer goods sector. This is because since the industrial component of the consumer goods sector is relatively more elastic to demand, its output can very easily adjust to the level of demand, unlike the case of agricultural output, which is relatively more inelastic to demand, which implies that price adjustment occurs more easily than quantity adjustment in response to changes in demand. This distinction has crucial importance for the analysis in later Chapters.

Development of the Capital goods sector in the Pre-Independence Period.

While the previous section discussed some of the conceptual issues involved in the classification of the

capital goods sector, this section analyses the level of development of the capital goods sector in the pre-independence period in India, in order to fully appreciate the factors influencing the formulation of the Mahalanobis' strategy during the Second Plan. As the state of the capital goods sector in India at the time of independence was organically linked to the colonial policy on industrialisation, an attempt is made in this section to analyse the factors influencing the growth pattern of some of the major industries during this period, and trace their effects on the growth of the capital goods sector as a whole.

One of the most important aspects of colonial policy which influenced the course of industrialisation in the pre-independence period was the development of railways. The construction of railways was started in 1853, necessitated as argued by Macpherson, more due to the need for opening up the Indian market and to transport raw materials, rather than military strategic reasons, which is borne out by the direction of the early railway routes which were mostly along the existing trade routes. In fact, no purely military railways was built until the 1870s⁷.

From 1853 to 1869 the construction of railways was carried out by private companies which were guaranteed a 5% interest on their capital. Since this proved to be

costly for the Government, between 1869 and 1879, it experimented with railway construction entirely on its own. However, from 1879 onwards, private companies were again allowed into the field with financial assistance. Thus, through all these agencies, the extension of railways till the First World War was extremely rapid and continuous.⁸ As the First World War resulted in a considerable degree of congestion in railways, the Government further extended railways in India, and between 1924 and 1932 alone 5360 miles were added to the existing mileage. The depression years however radically altered the financial condition of the railways and no addition to railway mileage was made between 1932 and the beginning of the Second World War. During the Second World War, since even some of the existing railway lines had to be dismantled to help military operations abroad, the war conditions in this case, unlike during the First World War adversely affected the development of railways in India.⁹

In spite of the rapid development of railways till 1914, the capital goods industries connected with railways did not show a concomitant development during this period. This was mainly because, the greater part of the essential rolling stock and locomotives were imported from U.K. throughout the 19th and early part of the 20th century. Rails and sleepers and keys of iron and steel were also imported exclusively from the U.K. In fact, in some years

such as 1913-14, the value of total imports of railway plant and rolling stock to the value of the total capital programme of the railways was about $\frac{1}{2}$.¹⁰ This high import dependence of the railways was in spite of a considerable pressure on the Government by the beginning of the 20th century to buy an increasing share of railway equipment from India.¹¹

However, after the First World War, there were certain policy changes which resulted in some development of the capital goods industries connected with railways. In 1923, the Indian Tariff Board (ITB) decided to grant assistance to the wagon-building industry in the form of bounties, instead of providing tariff protection, in order to keep the costs of this industry low and this led to the beginning of the development of the wagon building industry in India.¹²

When it came to the question of whether or not to recommend protection for the locomotive industry in India, the ITB had to comply with the Indian Fiscal Commission's condition that an industry ought to have a large home market in order to qualify for protection. A locomotive factory to be economic had to produce at least 200 a year, whereas the estimated demand of the railways fell far short of it during this period. Since during this period there was no prospect whatsoever for the demand to increase in the near

future, the ITB refused to recommend tariff protection for the locomotive industry and therefore no private (or public) locomotive works were established in India until after independence.¹³

That is, the possibilities open for the development of the capital goods sector in the period when the development of railways was rapid could not be fully exploited because the Government did not really push through very many positive measures to develop industries complementary to railways. The stimulus given to the wagon-building industry at a later stage was somewhat half-hearted, while the locomotive industry was constricted by economic reasons.

One industry in the capital goods sector, which had rapid development in the pre-independence period was the coal industry. Coal mining, in a significant sense, started during the period 1850-55 and by 1880 coal production had reached a million tons.¹⁴ By 1900 coal production went up to 6 million tons, which further shot up to 22.6 million tons in 1919.¹⁵ This growth in production was followed by a period of stagnation and by 1944 coal production was only 25.8 million tons. This was however followed by a sharp spurt in production to 36.8 million tons in 1952.¹⁶ With the exception of Japan which produced 30 to 50% more, India was the largest coal producer in Asia during this period.

However, in spite of the relatively high level of development of the coal industry, there was very little expansion of industries manufacturing machinery and equipment for the coal industry during this period. There were two reasons for this. Firstly, this was related to the more general factor of inadequate protection in the pre-independence period for the greater part of the capital goods sector, especially the machinery and equipment component of it, which hampered the growth of these industries. The second was more specifically related to the technological structure of the coal industry in the pre-independence period.

In the pre-independence period, the technological structure of the coal industry was extremely primitive and there was very little stimulus for modernisation, primarily because the profitability of manual methods of production was high, given the cheap availability of labour. This feature of the coal industry is brought out by Buchanan's study, which indicates the use of predominantly human labour in most of the operations pertaining to the coal industry.¹⁷ In 1921 for instance, 1/4 of the mines had no mechanical power and 15 of this type employed over 200 labourers each. Buchanan points out, that in many open pits, coal was carried hundreds of yards of steep grades on women's heads, and movement of cars within mines and even up the inclines and out was accomplished

to a large extent by human power. According to Buchanan, in 1929, not a single mechanical conveyor was working underground in India, though England had 100 in 1907 and 2100 in 1928. Above ground, the same lack of mechanical equipment prevailed, except at the best of the mines. Much of the coal was carried on women's heads and stocked in heaps in the open air and again put in baskets and carried by the same method to the coal cars. While coal cutting machines come into being during the depression years, they were still a small number as compared to the "human coal-cutters". As the profitability of the primitive methods of mining in the coal industry were high and in fact compared quite favourably, according to Buchanan, with the profitability rates in other countries which used mechanised operations, there was very little stimulus for the development of machinery and equipment connected with the coal industry in the pre-independence period.

As far as the iron and steel industry is concerned, the tremendous possibilities open for its development in the 19th century as a consequence of the growth of railways could not be adequately utilised, because the Stores Rules of the Government during this period, required purchases of iron and steel to be basically made through imports.¹⁸

However, by the beginning of the 20th century there were certain policy changes which provided the stimulus to

the development of the iron and steel industry in India. In this period, Belgium was emerging as a very serious competitor to Britain, which until then, had a virtual monopoly over steel exports to India, and this fact, it has been argued, could possibly have led to the positive attitude of the Government to the development of the iron and steel industry in India during this period.¹⁹

In 1896, the Government agreed to purchase 10,000 tons of pig iron and castings annually for 10 years from the Bengal Iron and Steel Company which was incorporated in England in 1889. Consequently, its annual production of pig iron rose to 25,000 tons in 1909, of which 10,000 tons were supplied to the State Railways. However, the Government refused to buy steel from this company, and attempts to manufacture steel were a complete failure and the steel works had to be closed down by 1906.²⁰

In August 1905 however, the Commerce and Industry Department guaranteed to purchase from the Tata Iron and Steel Company (TISCO), 20,000 tons of steel rails annually for 10 years.²¹ Along with this, the Government also granted concessions in railway rates, on freight movements.²² Given the fact, that the location of TISCO, was situated favourably, both in terms of the backward and forward linkages (the company's colliery in the Jharlia field supplying coal and

Calcutta being the biggest market for steel in India at that time), the company was able to start the profitable production of pig iron in 1912. The steel works also started production simultaneously, and in 1913, several thousand tons of steel were passed by the Government Inspector.²³

The First World War created an enormous demand for munitions, and the Tatas eagerly seized the opportunity and undertook the manufacture of steel shell, so much so, that 75% of their output during this period consisted of steel shell. Thus during the First World War, the company supplied the demands of the Munitions Department, railways and local engineering firms, and also exported considerable quantities of pig iron to Japan.²⁴

After the war, TISCO was faced with a difficult situation, when the prices of steel imports started falling from 1921 onwards. The profits of the company fell to 4% in 1921-22 and in 1923-24, no dividends could be paid out. However, the Government once again intervened in favour of the Tatas, and granted protection for the steel industry. TISCO, thus survived the crisis and made further steady progress.

Again however, the development of the iron and steel industry before independence, did not lead to a consequent development of the machinery sector connected

with the steel industry. Apart from the more general reason of lack of protection for the major part of the machinery sector during this period, this was also related to the nature of technology in the steel industry. Unlike in the case of coal, where it was technologically possible to use methods predominantly relying on manual labour in mining, the production of iron and steel to be viable had to, as was pointed out by a British engineer, be on a sufficiently large scale and incorporate modern technology.²⁶ That is, the cheap availability of labour could not be an impeding factor for mechanised methods of production in the iron and steel industry, unlike the case of the coal industry. Given the levels of development of indigenous industry, the supply of machinery incorporating the latest technology to the steel industry, had obviously to be imported from abroad. Also, given the fact that before TISCO was fully initiated and ready for full time operations, the First World War came with its great demand for steel, new equipment had to be rushed from America to expand capacity, and very little opportunity was given for the building up of indigenous capacity to supply equipment for the steel industry.²⁷

The linkages of the capital goods sector, with the two most important industries of the pre-independence period, namely cotton textiles and jute were also extremely tenuous.

Prior to the First World War, there had been some development of the cotton textile industry due to the half-hearted protective measures adopted by the Government, though the protectionist policies in themselves, were for purely financial reasons.²⁸ The machinery and equipment which was used for the indigenous industry during this period was almost entirely dependent on imports, primarily from the U.K. In fact, it has been estimated that these two industries accounted for more than 1/2 the total imports of machinery and mill work for use by the modern industrial sector before the First World War.²⁹

However, with discriminating protection in 1923, there was rapid development of industries such as cotton textiles, sugar etc. Though some development of the machinery sector connected with these consumer goods did take place after the First World War, this was not of any significant magnitude, because of the lack of protection and other forms of encouragement for the development of these industries.³⁰

The growth of some of the basic intermediary industries such as cement, electricity and also steel came to depend on public works such as roads, bridges, irrigation channels and railways for sustenance, particularly when trade conditions affected the level of private demand.³¹

Therefore, a crucial variable which influenced the growth of this segment of the capital goods sector before independence was public investment. Table 1.1 gives the trends in public investment in the inter-war years.

Table 1.1 Trends in Public Investment before the Second World War (Rs. million)

<u>Year</u>	<u>Gross Public Investment</u>
1925-26	644
1926-27	735
1927-28	827
1928-29	827
1929-30	750
1930-31	814
1931-32	670
1932-33	488
1933-34	338
1934-35	334
1935-36	350
1936-37	436
1937-38	359

Source: Rajat K. Ray - Industrialisation in India-Growth and conflict in the Private Corporate Sector 1914-47, OUP (1979) - Table 40, p. 257.

Table 1.1 shows a steep fall in the absolute level of public investment between 1925-26 and 1937-38. This steep fall in the level of public investment, which was a

consequence of the pursuit of a contra-cyclical financial policy in a situation of depression, hindered the development of some of the above mentioned basic intermediary industries. At a more general level, the fall in the level of public investment would lead to a fall in incomes, which leads further to a fall in demand for consumer goods industries, which again through a secondary effect curbs the demand for capital goods industries and thereby affects the growth of the capital goods sector as a whole. With the advent of the Second World War however, imports were severely cut and the war time needs necessitated the building of the capital goods sector to some extent.

To sum up, the consequence of the sum total of policies on industrialisation pursued in colonial India resulted in an extremely inadequate development of the capital goods sector. In fact, by 1951 the industries which can very broadly be classified as part of the capital goods sector constituted only 22% of the gross value of industrial output, while the non-capital goods sector (Primarily consumer goods) constituted 78% of the manufacturing industry's gross value of output.³²

Given the relatively higher level of development of some of the important basic intermediary items such as coal, iron and steel etc, the leading place within the capital

goods sector was occupied by the ferrous metallurgical industries which accounted for 20.67% of the total value of the capital goods sectors output in 1951.³³ Even within ferrous products, it was basically the semi-finished products for use in transport equipment which predominated, while the linkages in general between the machinery sector and metallurgy were very weak. In fact, the machinery and equipment component of the capital goods sector was so inadequately developed that, at the time of independence, a substantial part of the capital goods needed for the depreciation requirements for the consumer goods sector had to be imported.³⁴

The strategy of industrialisation in the Post-Independence Period.

Given the inadequate development of the capital goods sector in India at the time of independence, it became necessary to formulate a strategy which would remove the serious bottlenecks of a lopsided industrialisation under colonial rule.

The theoretical basis for the strategy of industrialisation adopted in India was formulated by Mahalanobis. Given the general export pessimism which permeated the 1950s Mahalanobis emphasised the necessity of consciously building the capital goods sector by appreciably increasing the proportion of investment to be

allocated for this sector, rather than rely on large scale imports of machinery. Even if the export permission which influenced Mahalanobis' strategy was not warranted, it has been argued, the rationality of the strategy would still be justified on different counts. This is because, as the argument goes, the exploitation of export possibilities would necessitate a wide diversification of the industrial structure and given the comparative advantage of India on items such as steel, the model of development for an open economy would approximate that of a closed economy.³⁵

Mahalanobis demonstrated with a two sector model, that this strategy of directing a high proportion of investment to the capital goods sector in a closed economy, would lead in the long-run, to a higher rate of growth of consumption than if a much lower proportion of investment was allocated to the capital goods sector.³⁶ This is because, a high proportion of investment going to the capital goods sector would lay the basis for future investment by providing a flow of machinery and equipment. The consequent increase in the productive potential of the economy through accumulation of stocks of machinery and equipment, though causing consumption to grow slowly initially, because of the low proportion of investment going to the consumer goods sector in the early stages, would eventually make possible a

high rate of growth in the long-run, when the existing capacities can be used to augment the productive potential of the consumer goods sector.

Also, given the acute dependence on capital goods imports at the time of independence, it was not only necessary to build the capital goods sector for achieving high rates of growth, but also to achieve independence from strategic imports for political reasons, and attain relative self-sufficiency in most activities. However, it should be noted that this concept of self-sufficiency did not imply autarky and the exclusion of trade.

At this stage, it is necessary to emphasise that the distinctive contribution of Mahalanobis was not only for making a case for capital goods industries in general, but in stressing the role of machine building industries in particular within this sector. He argued that for rapid industrialisation, it is not only necessary to develop machine building industries internally, but it is also imperative to keep the costs of these machines as low as possible. In fact, to quote Mahalanobis, "the further removed the type of capital goods under consideration from the production of consumer goods, the greater is the need for keeping the price low."³⁸ There is an implicit suggestion by Mahalanobis in the same context, that the

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reduction in costs may be achieved through the use of automation and electronically controlled machines.³⁹ However, this emphasis on cost reduction is not fully developed by Mahalanobis, either in terms of its implications for his whole theoretical scheme, or even, very clearly, in terms of the way in which it is sought to be achieved. Nevertheless, there is the conception of an important relationship between technical change and the capital goods sector, and especially the need for achieving rapid technical change in the machine tool industry, as a possible way of reducing costs.

The theoretical perspective with which the planning process was launched in India implied the necessity for some forms of control over decisions of production, distribution and consumption. In India, the Government opted out of having complete control over production, investment and distribution decisions and chose to operate rather on the basis of a mixed economy, which as an idea, had been mooted much earlier. Accordingly, planning for industrialisation involved a two-pronged strategy where, on the one hand, the state directly entered production by setting up a series of basic and heavy industries, and on the other, a whole range of industries were left for the private sector to invest indirectly. The activities which came under the dominance of the private sector were to be indirectly guided by the

State through a system of individual controls and licensing policies.

With the acceptance of planning in a mixed economy, the two Industrial Policy Resolutions of 1948 and 1956, proceeded to assign industries between the public and private sectors. According to the Industrial Policy Resolution of 1956, the public sector was to have an important role to play in the development of the capital goods sector. While the Government was to step up its investment for building heavy industry and removing bottlenecks in transport, electricity etc., the private sector was to produce a large range of consumer and intermediary goods that such an expansion in public investment warranted.

The consequence of the adoption of this strategy of industrialisation in India on the actual performance of the capital goods sector, and the ^{causal} ~~causal~~ factors influencing its performance are analysed in Chapter II. Chapter III outlines the disaggregated growth pattern of some important industries in the capital goods sector and also indicates the causes for the divergent trends within this sector. Chapter IV analyses the technological changes which have taken place in the machine tool

industry, since this aspect, as pointed out earlier, was of some importance to Mahalanobis in his strategy for building the capital goods sector in India.

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CHAPTER - II

CAUSAL FACTORS AFFECTING THE PERFORMANCE OF THE CAPITAL
GOODS SECTOR IN INDIASection-1

The first section of this Chapter traces the growth pattern of the capital goods sector in the context of the overall performance of the Indian economy for the period 1955 to 1979. The second and third sections analyse the causal factors influencing this growth pattern of the capital goods sector. The analysis of the growth of the capital goods sector starts with the year 1955 and not 1951, firstly because it was only with the formulation of the Second Five Year Plan that a cogent articulation of a conscious planning and industrial development strategy was laid out, and secondly the low base for most individual industries in the capital goods sector in 1951 would artificially inflate the growth rates for the period prior to the mid-sixties. Table 2.1, summarises^{See} the growth pattern of Indian industry, and for convenience in computation of growth rates, the period under consideration is extended till 1980.

Table 2.1 Annual Compound Growth Rates in Index Numbers of Industrial Production.

Use-based or functional classification	1955 to 1960	1960 to 1965	1965 to 1976	1976 to 1980 (3 year averages at the end points)
General Index	7.2	9.0	4.1	4.5
Basic Industries	12.1	10.4	6.5	4.8
Capital Goods Industries	13.1	19.6	2.6	4.8
Intermediate Goods Industries	6.3	6.9	3.0	4.2
Consumer Goods Industries	4.4	4.9	3.4	4.3

Source: S.L. Shetty - Structural Retrogression in the Indian Economy since the Mid-sixties (EPW Reprint) (Table 4) and Reserve Bank of India Bulletin (various issues).

Notes: Annual compound growth rates between 1955 and 1960 are calculated using C.S.O. Index Numbers (1956 = 100). For the period 1960 to 1965 and 1965 to 1970, the growth rates are calculated using C.S.O.'s Index Number (1960 = 100). From 1970 to 1976, the series with the base 1970 is used. For the period 1976 to 1980, the compound annual growth rates have been derived independently using C.S.O.'s Index Number (1970 = 100) and using 3 year averages at the end points.

Before contrasting the trends in the capital goods sector with the overall industrial performance, it is necessary to clarify the classifications adopted in the table. Table 2.1 gives the use-based or functional classification as defined by the Reserve Bank of India. In this scheme, the capital goods industries include all industries manufacturing machinery and equipment, while basic goods include industries such as iron and steel, cement, electricity etc. As pointed out earlier, for our purposes therefore, the capital goods sector will include the RBI's classification of capital goods and basic goods, with the qualification that part of the basic goods are also used as intermediary input requirements by the consumption goods sector.

The pattern of industrial growth in India, shown in Table 2.1, can be broken into two distinctive stages - the period prior to the mid-sixties and the period after the mid-sixties. In the first phase, overall industrial production grew at a high compound annual rate of 7.2% between 1955 and 1960 and further accelerated to 9% between 1960 and 1965. The period after 1965 was however characterised by a distinct slowing of the growth process and the compound annual growth rates between 1965 and 1976

was only 4.1%. For the period 1976 to 1980, the compound annual growth rates of overall industrial production was only 4.5%.

Table 2.1 shows that the pattern of growth and stagnation observed for the industrial sector as a whole, exhibits itself far more emphatically in the case of the capital goods sector. While basic industries grew at a high rate of 12.1% per annum between 1955 and 1960 and 10.4% between 1960 and 1965, a marked deceleration occurred in the period 1965 to 1976, when the compound annual rate of growth was 6.5%. However, it should be noted that in spite of a significant deceleration in the rate of growth of output of basic industries after the mid-sixties, this rate of growth in itself was relatively higher than that for the industrial sector as a whole during the same period. The annual rate of growth of output of basic intermediates between 1976 and 1980 was 4.8%. The category capital goods (machinery and equipment) grew at a compound annual rate of 13.1% between 1955 and 1960, which accelerated to a very high 19.6% between 1960 and 1965. This was however, followed by a drastic decline in the period 1965 to 1976, when the compound annual rate of growth was a mere 2.6%. Though the rate of growth of output of capital goods (machinery and equipment) picked up to 4.8% between 1976

and 1980, this affords no comparison with the high rates of growth of output achieved during the Second and Third Plans.

Not only was there a steep decline in the growth of output of the capital goods sector after the mid-sixties, but there was also the emergence of considerable excess capacity, especially in the machinery and equipment component of this sector as shown in Table 2.2.

Table 2.2 Capacity Utilization Rates (in percentage)

Industry group	1960 to 1965	1966 to 1970	1971 to 1975	1976	1977
Basic Industries	86.0	82.0	77.4	84.8	86.6
Capital Goods Industries	85.9	66.4	60.2	59.4	59.2
Intermediate Goods Industries	89.3	81.9	74.7	79.6	80.7
Consumer Goods Industries	86.6	82.2	80.1	80.4	81.5

Source: I.J. Ahluwalia - Industrial Performance in India 1959-60 to 1978-79 - An Analysis of Deceleration in Growth since the Mid-sixties. Indian Council for Research on International Economic Relations (Table 23).

Notes: The capacity utilisation rates have been obtained from the Reserve Bank of India Reports on Currency and Finance.

The Reserve Bank of India's concept of capacity utilisation are used.

While the basic industries component of the capital goods sector had an excess capacity averaging almost 20% after the mid-sixties, which is comparable with the capacity utilisation rates in the consumer goods industries and the intermediate goods industries, the category capital goods (machinery and equipment) had an excess capacity averaging almost 40% after the mid-sixties. That is, in relation to industry as a whole, the machinery and equipment component of the capital goods sector in India exhibited a much steeper fall in the rate of growth of output and far lower levels of capacity utilisation. The second and third sections of this Chapter attempt an explanation for the above trends.

Section -2

The second and third sections of this Chapter attempt an analysis of the causal factors which have influenced the particular pattern of growth of the capital goods sector which have been noted above. In analysing the reasons for the sharp deceleration in the rate of growth of output of the capital goods sector, along with the emergence of excess capacity after the mid-sixties, it may be useful, at the outset, to outline theoretically some of the causal factors which have a significant influence on the performance of the capital goods sector.

Section-2 provides an abstract schematic presentation of the possible influences of particular patterns of import-substitution and investment in the economy, on the trends in output and capacity of the capital goods sector. It is argued that the deceleration in output of the capital goods sector is firstly, partially related to a exhaustion of the import - substitution process in the economy. Secondly, and more importantly, it is argued that the decline in the rate of growth of public investment arising from an increase in the rate of growth of household (private) investment can imply a deceleration in the rate of growth of output of the capital goods sector. It is argued, that this would be the case, if there are differences in the compositional structure of public and household investment, in which case a decline in the rate of growth of demand for the output of the capital goods sector, arising from a decline in the rate of growth of public investment, may not be fully offset by an acceleration in the rate of growth of household (private) investment. These two aspects are theoretically dealt within detail below.

It should be emphasised here, that the theoretical analysis in this section does not purport to be a comprehensive explanation of every facet of the capital goods sector. Nevertheless, it does lay out logically certain macro relationships and their possible impact on

the performance of the capital goods sector, which may be of some help. These relationships, in fact, are considered more concretely in section-3 of this Chapter for explaining the actual trends in the capital goods sector in India.

We will first consider theoretically, the impact of a process of import-substitution on the pattern of growth of the capital goods sector. If tariff protection is effective in shutting out a substantial part of the imports of capital goods, then the total domestic requirements of the capital goods before the introduction of the tariff, can become a target for investment, assuming of course, an abstraction from other factors independently influencing the size of the market. The stimulus for investment in the capital goods industries would exist till the entire domestic requirements are met by indigenous production. Thereafter, the stimulus for additional investments in the industries of the capital goods sector would be dependent upon an increase in the demand for these items, arising from factors other than import-substitution, which we have abstracted from, for the time being

Along with this, if there is a simultaneous process of import-substitution in the consumer goods industries also, the consequent additions to the indigenous production of consumer goods, would indirectly lead to additional

demands for the output of the capital goods sector. The exact magnitude of this indirect demand for the output of the capital goods sector would depend upon the choice made about the source for procuring capital goods. If there are leakages in the system through imports of the additional capital goods requirements, then the additions to the production of consumer goods as a consequence of import-substitution would have a negligible indirect demand for the output of the capital goods sector.

Chapter III takes up this aspect in greater detail, to indicate how the available evidence points to an exhaustion of the import-substitution process in most of the important industries of the capital goods sector after the mid-sixties. This implies that the high rates of growth of the output of the capital goods sector between 1955 and 1965, can partly (only partly because there were other factors operating, which will be indicated below) be accounted for by a rapid rate of import-substitution in this sector during this period. Consequently, the fall in the rate of growth of output of the capital goods sector thereafter, may be linked partially atleast, with the exhaustion of the import-substitution process in this sector after the mid-sixties. To this direct effect, can also be added, the indirect effect arising from a slower rate of growth of the output of the consumer goods sector

after the mid-sixties, which itself is again linked to some extent with the slowing down of import-substitution in this sector.

A more direct and fundamental variable which has a crucial bearing on the performance of the capital goods sector, is the pattern of investment in an economy, which itself is, of course, related to a whole set of factors, including import-substitution. It therefore becomes necessary to dwell theoretically on the implications of particular investment patterns, on the trends in output and capacity of the capital goods sector. We consider below a schematic presentation of this aspect.

In a closed mixed economy, the following identity would hold ex-post.

$$I_g - S_g = S_p - I_p$$

I_g = gross public investment

I_p = gross private investment

S_g = gross public savings

S_p = gross private savings

If we consider a single period, with full utilisation of capacity, any sudden increase in I_p which is not followed by a simultaneous decumulation of inventories would result in inflation. This inflation can have mixed consequences.

Firstly, S_p can increase by an amount equal to the addition to I_p . However, if the government mobilises additional resources in the ensuing inflationary situation, S_p would increase by an amount which is less than ΔI_p .

That is,

$$\Delta I_p = \Delta S_g + \Delta S_p$$

This incidentally implies that with the ex-post savings data, it is not possible to empirically distinguish between voluntary and forced savings in an economy.

The inflation arising as a consequence of the sudden increase in I_p can bring forth a set of mixed responses. If the government wants to avoid inflation completely, I_g can be reduced by an amount equivalent to the increase in I_p . On the other hand, it is possible for the government to choose a combination between some reduction in I_g and some inflation. That is, the impact of an increase in I_p on I_g will depend upon the conscious policy of the government.

The relevance of this type of a model in the Indian case may be questioned, because the existence of unutilised capacity should logically imply output response to additional investment rather than price response. While it is true, that this may hold in general, there is one crucial sector - namely agriculture, where capacities are

relatively fixed. Therefore, any sudden increase in I_p would lead to inflationary increases in agricultural prices, which can have generalised inflationary consequences. This implies that I_g will necessarily have to adjust to this change in I_p , though the exact magnitude of the adjustment depends upon the conscious policy decision of the government.

Given this relationship, at the logical level, between I_g and I_p in a mixed economy like India, we shall now consider the implication of this relationship on the output of the capital goods sector.

In a closed economy, investment in any given time period is definitionally equal to the output of the investment goods sector. For convenience, we can break up investment (I) in a given time period into two components. Firstly, there are material components such as machinery steel etc., which go into investment. Secondly, there is the value added in installation and construction. However, the definition of the capital goods sector adopted for our study, incorporates only the material components of investment as constituting the output of the capital goods sector.

Therefore any investment (I) in a given time period, with our definition of the capital goods sector, will imply a demand for the output of the capital goods sector equal to OI , where, $OI < I$.

In our single period model of the mixed economy, let us first consider a situation where the composition of I_g and I_p , in terms of the proportion between the material component and the value added component is the same.

That is,

$$\frac{I_g}{O_1 I_g} = \frac{I_p}{O_2 I_p}$$

$O_1 I_g$ = Demand for output of capital goods sector from I_g

$O_2 I_p$ = Demand for output of capital goods sector from I_p

In this case, if an increase in I_p leads to an equivalent reduction in I_g , the demand for the output of the capital goods sector, and consequently its supply will remain unchanged.

However, let us assume a situation where, for instance, because of the greater importance of construction in I_p , the value added component in I_p is proportionately higher than the value added component in I_g .

That is,

$$\frac{I_p}{O_2 I_p} > \frac{I_g}{O_1 I_g}$$

This consequently implies, that the "capital goods intensity" of I_g is greater than the "capital goods intensity" of I_p .

Now, in our single period model, any increase in I_p which leads to an equivalent decrease in I_g , given our assumptions, would lead to a reduction in the demand for the output of the capital goods sector. Not only would there be a reduction in the output of the capital goods sector, but simultaneously, there would also be some inflation, because the "foodgrain intensity" of I_p is higher than that of I_g . This implies, that if the government, in this situation, wants to avoid inflation completely, I_g will have to be reduced by an amount greater than the increase in I_p . The logical consequence of this would be a further reduction in the demand for the output of the capital goods sector, and hence its supply.

However, if the proportionate importance of construction in I_p implies that the demand for basic intermediates such as steel cement etc. is proportionately higher than the demand for machinery and equipment, arising from I_p , then with our above assumptions, the demand for basic intermediates will fall relatively less than the demand for machinery and equipment.

So far, our entire discussion has been based on a single period model. However, what holds for a single period, will also logically hold for a profile. If there is a particular rate of growth of I_g and I_p , which results in

non-inflationary growth, any increase in I_p above this critical rate of growth will lead to an inflationary situation. Again, the government can drastically reduce the rate of growth of I_g to avoid inflation altogether, or have a mix between a slightly slower rate of growth of I_g and some inflation. The implication of this, if we recall the assumptions of our single period model, would be a fall in the rate of growth of output of the capital goods sector. This aspect is discussed concretely at some length on the basis of the available empirical evidence in section-3 of this Chapter.

At this stage, it may be necessary, to consider briefly, an alternative relationship between I_g and I_p , within the confines of the model used so far. If, over a profile, an increase in the rate of growth of I_p leads to inflationary price increases in agriculture, the rate of growth of I_g can be reduced along with diverting a greater proportion of I_g into agriculture. If investments in agriculture are relatively more labour-intensive, then the fall in the rate of growth of output of the capital goods sector would be steeper, than if over the profile, a constant proportion of I_g went into agriculture. This aspect is also discussed concretely in Section-3 of this Chapter.

So far, the entire discussion has been carried out in terms of the demand effect of investment. But investment in any economy has a dual role. It not only creates a demand for the output of the capital goods sector, but also adds to capacities in the capital goods sector. In order to analyse the implications of the demand and supply effects of investment, it may be useful to consider a schematic discussion of this aspect by Kalecki, in a theoretical model of the business cycle.⁴⁰

In this model, where investment in a closed economy, is definitionally equal to the output of the investment goods sector, if investment which has been growing at a particular rate making possible full capacity utilisation in the investment goods sector, stops growing and stays constant at a level higher than depreciation requirements, this will over a period of time lead to increasing excess capacity in the investment goods sector along with a zero rate of growth of output. This is because, any positive constant level of investment over a period of time, which is higher than replacement requirements, adds to capacities in a situation where there is no additional demand for investment goods. This implies a zero rate of growth of output of the investment goods sector, along with the emergence of increasing excess capacity over time.

In our model, if I_g which has been growing over a period of time, stops growing in order to avoid inflationary pressures in the economy, and remains constant at a level higher than depreciation requirements, this effect considered in isolation, will lead to a zero rate of growth of output of the capital goods sector, along with the emergence of increasing excess capacity over a period of time. However, when we consider the case where this constant level of I_g is a consequence of an increase in the rate of growth of I_p , the latter effect would offset to some extent, the implications of a constant level of I_g on the capacity and output of the capital goods sector.

All these aspects are analysed more concretely with the help of the available evidence in section-3 below.

Section-3

In the light of the theoretical discussion in section-2, this section analyses the empirical evidence available on some of the crucial variables, pointed out earlier, which significantly influence the performance of the capital goods sector. Given the important role of the public sector in the development of the capital goods sector in India, we first focus on the trends in public investment.

Table 2.3 Public Sector Gross Domestic Capital Formation (Rs. Crores) (1970-71 prices).

Year	GDCF	Year	GDCF
1950-51	645.9	1965-66	3114.5
1951-52	715.3	1966-67	2620.9
1952-53	609.5	1967-68	2682.7
1953-54	683.4	1968-69	2440.3
1954-55	962.3	1969-70	2399.9
1955-56	1128.7	1970-71	2809.0
1956-57	1452.2	1971-72	2991.4
1957-58	1847.8	1972-73	3156.8
1958-59	1544.1	1973-74	3764.5
1959-60	1686.7	1974-75	3719.2
1960-61	2030.2	1975-76	4487.1
1961-62	1947.7	1976-77	4740.9
1962-63	2832.9	1977-78	4137.4
1963-64	2614.7	1978-79	4691.6
1964-65	2910.9	1979-80	4832.2

Source: National Accounts Statistics - various Issues.

Notes: The public sector GDCF figures at current prices are deflated using the implicit GDCF deflator at 1970-71 prices. Compound annual growth rates are calculated using 3 year averages at the end points.

Table 2.4 Public Sector Gross Domestic Capital Formation
by Type of Authority (Rs. crores)- (1970-71 prices)

Year	Government Administration	Departmental Undertakings	Non-departmental Undertakings
1950-51	192.0	428.9	37.4
1951-52	245.5	432.0	40.1
1952-53	100.0	440.5	71.4
1953-54	96.0	475.1	114.7
1954-55	328.8	567.2	68.4
1955-56	278.2	766.8	81.4
1956-57	396.9	900.6	154.8
1957-58	610.0	1002.7	235.1
1958-59	373.2	784.4	386.5
1959-60	412.3	620.3	652.2
1960-61	595.6	600.9	824.9
1961-62	465.3	785.8	753.9
1962-63	575.5	976.3	862.5
1963-64	541.3	1074.8	983.0
1964-65	668.0	1138.7	1062.5

Contd--48.

Table 2.4 (Contd...)

Year	Government Administration	Departmental Undertakings	Non-departmental Undertakings
1965-66	629.7	1075.2	1364.7
1966-67	423.5	921.9	1249.7
1967-68	620.3	821.7	1217.6
1968-69	382.9	840.1	1193.7
1969-70	540.7	773.4	1059.2
1970-71	581.0	843.0	1349.0
1971-72	699.4	939.5	1352.6
1972-73	887.4	996.0	1273.4
1973-74	1036.1	991.6	1736.8
1974-75	666.0	925.6	1901.2
1975-76	680.3	963.9	2627.0
1976-77	728.3	1126.0	2890.5
1977-78	641.3	1214.2	2163.6
1978-79	795.2	1378.1	2878.0

Source: 1950-51 to 1959-60. P. Narain et. al. Public Sector Investment and its Financing. The Journal of Income and Wealth, Vol. 3, No. 1, 1978. 1960-61 to 1978-79 - National Accounts Statistics. Various Issues.

Notes: The figures at current prices are deflated using the implicit GDCF deflator at 1970-71 prices. Compound growth rates are calculated using 3 year averages at the end points.

It can be seen from Table 2.3 which shows the trends in public sector gross domestic capital formation at 1970-71 prices, that public investment grew at a compound annual rate of 11.1% between 1951-52 and 1965-66. Between 1955-56 and 1965-66, the annual rate of growth of public investment in real terms was 9.3%. The high rates of growth of public investment achieved prior to the mid-sixties could not be sustained thereafter, and between 1966-67 and 1978-79, public investment grew at a compound annual rate of only 4.1% in real terms. For the period 1965-66 to 1978-79, the rate of growth of public investment works out to a mere 3.6%.

A disaggregated picture of public investment by type of government authority which is considered in Table 2.4, shows that gross domestic capital formation in government administration (comprising central, state and local governments) grew at a compound annual rate of 8.7% between 1951-52 and 1965-66 at 1970-71 prices. The annual rate of growth of public investment in this category between 1955-56 and 1965-66 works out to 5.5%. For the period 1966-67 to 1977-78, gross capital formation in government administration grew at a compound annual rate of 2.4% in constant prices.

Gross capital formation in departmental undertakings (comprising railways, posts and telegraphs, navigation,

irrigation, drainage, power projects etc.) grew at a compound annual rate of 6.5% between 1951-52 and 1965-66, or 3.4% between 1955-56 and 1965-66 in constant prices. Thereafter, there was a deceleration in the rate of growth of public investment in this category, and between 1966-67 and 1977-78, gross capital formation in departmental undertakings grew at a compound annual rate of 2.5% in constant prices.

Non-departmental undertakings are mainly organised as companies and a few of them are statutory corporations, and it is this category which accounts in a major way for the role of the public sector in building capacities in the capital goods sector. Between 1951-52 and 1965-66, gross capital formation in non-departmental undertakings grew at an extremely high rate of 25.7% in constant prices. The annual rate of growth of gross capital formation in non-departmental undertakings was even higher for the period 1955-56 to 1965-66 at 28.3%. However, this is partly accounted for by a low initial base. The post mid-sixties phase however saw a very steep decline in the rate of growth of gross capital formation in this category. Between 1966-67 and 1977-78, gross capital formation in non-departmental undertakings grew at an annual rate of only 6.8% in constant prices. The fact that Table 2.4

shows an almost constant absolute level of gross capital formation in non-departmental undertakings in real terms between the years 1965-66 to 1972-73, indicates that the steep deceleration in the rate of growth of gross capital formation in this category, is not exclusively a low base effect.

The high rates of growth of public investment as a whole, as well as the various components within it prior to the mid-sixties implied a high rate of growth of demand for the output of the capital goods sector, arising from this factor. This, along with the rapid rate of import-substitution during this period, implied a high rate of growth of the output of the capital goods sector.

We now have to focus concretely on two other factors. The first is the sharp deceleration in the output of the capital goods sector as a whole, as well as the emergence of considerable excess capacity in this sector after the mid-sixties. The second is the differential output and capacity trends in the machinery and equipment component and the basic intermediary components of the capital goods sector, especially after the mid-sixties.

Firstly, as indicated earlier, there was a sharp fall in the rate of growth of public investment after the

mid-sixties. Not only was there a fall in the rate of growth of public investment, but as Table 2.4 indicates, the absolute level of gross capital formation in real terms in non-departmental undertakings was almost constant for the period 1965-66 to 1972-73. Along with this, the absolute level of gross capital formation in departmental undertakings remained at an almost constant level for an even longer time span (1965-66 to 1975-76).

Given the fact that gross capital formation in these two categories accounts for a substantial production of the output of the capital goods sector, this implies, that for roughly the 10 year period after 1965-66, gross capital formation in departmental and non-departmental undertakings was adding capacities to the capital goods sector, without simultaneously creating any additions to the demand for the output of the capital goods sector. In the absence of counteracting influences, which are analysed below, this would actually have led to an almost zero rate of growth of the output of the capital goods sector, along with increasing excess capacity in this sector, for the 10 year period.

The reason why the basic intermediary component of the capital goods sector, had relatively higher rates of growth of output as well as relatively higher levels of

capacity utilisation than the machinery and equipment component after the mid-sixties, is firstly, because the accelerator effect in a situation of declining rate of growth of investment (assuming that the strict multiplier does not operate) acts more strongly on machinery and equipment than basic intermediates. This is because, as pointed out in the first Chapter, unlike machinery and equipment, which exists as accumulated stocks capable of producing a flow of final goods over a period of time, basic intermediates are in the nature of annual flows, with recurrent demand requirements. This implies, that user industries, can cut back on the demand for machinery more sharply than they can for basic intermediates. Secondly, and more importantly, it will be argued below, that the very factors which caused a decline in the rate of growth of public investment, simultaneously created the conditions for a relatively better performance of the basic intermediary component of the capital goods sector.

Since the trends in public investment influenced the performance of the capital goods sector in an important way, we now focus attention on the factors which caused a decline in its rate of growth after the mid-sixties. A crucial factor which caused a steep decline in the rate of

Table 2.5 Gross Savings in the Household Sector (3 yearly moving averages as a percentage of GDP at current prices)

Year	Gross Savings in the Household sector		Year	Gross Savings in the Household sector	
	(Financial Assets)	(Physical Assets)		(Financial Assets)	(Physical Assets)
1951-52	0.5	6.1	1966-67	3.4	7.8
1952-53	0.7	5.6	1967-68	2.7	8.4
1953-54	1.7	5.3	1968-69	2.5	8.5
1954-55	2.8	5.8	1969-70	2.8	8.7
1955-56	3.3	6.5	1970-71	3.2	9.1
1956-57	3.1	6.8	1971-72	3.8	8.4
1957-58	2.6	6.2	1972-73	4.7	8.2
1958-59	2.7	5.9	1973-74	4.6	8.2
1959-60	2.9	5.9	1974-75	4.9	8.7
1960-61	3.1	5.8	1975-76	4.9	9.0
1961-62	3.0	5.8	1976-77	5.8	9.2
1962-63	3.2	5.4	1977-78	6.5	9.7
1963-64	3.3	5.5	1978-79	6.6	9.7
1964-65	3.8	5.5			
1965-66	3.5	5.0			

Source: Capital Formation and Savings in India 1950-51 to 1979-80 - Report of the Working Group on Savings (Feb. 1982) Table 5.8.

**Table 2.6 Net Capital Formation in the Household Sector
(Rs Crores) - 1970-71 prices.**

Year	Net Capital Formation	Year	Net Capital Formation
1950-51	1089.0	1966-67	2188.6
1951-52	792.3	1967-68	1731.9
1952-53	515.2	1968-69	2110.5
1953-54	528.2	1969-70	2457.9
1954-55	509.1	1970-71	2168.0
1955-56	753.9	1971-72	2355.8
1956-57	985.1	1972-73	1715.3
1957-58	479.1	1973-74	2657.0
1958-59	264.5	1974-75	2439.8
1959-60	171.8	1975-76	2261.1
1960-61	823.6	1976-77	2860.5
1961-62	519.0	1977-78	3474.2
1962-63	845.3	1978-79	3421.9
1963-64	627.4		
1964-65	900.3		
1965-66	1132.9		

Source: 1950-51 to 1960-61 - From R.N. Lal Capital Formation and its Financing in India (Allied Publishers 1977). Table 6.7, p. 118. 1961-62 to 1978-79 - National Accounts Statistics - Various Issues.

Notes: Net capital formation figures in current prices have been deflated using the implicit Net Domestic Capital Formation deflator (1970-71 prices).

growth of public investment after the mid-sixties was a sharp spurt in the rate of gross domestic capital formation in the household sector during this period.

It can be seen from Table 2.5, which shows the three yearly moving averages of the rate of gross domestic capital formation in the household sector, that in 1951-52, the gross domestic capital formation in this sector constituted 6.1% of the G.D.P. By 1964-65, there was an actual decline in the rate of investment in the household sector to 5.5%. However, if the moving average around the year 1965-66 is taken, this indicates a rate of investment in this sector of 7%. The period after the mid-sixties however saw a sharp increase in the rate of investment in the household sector, and by 1978-79, the gross domestic capital formation in this sector constituted 9.7% of the GDP.

The magnitude of the increase in investment activity in the household sector is brought out even more sharply, if one considers the rates of growth of household investment during this period. Table 2.6 shows that the rate of growth of net capital formation in the household sector between 1951-52 and 1964-65, was a mere 0.8% per annum in constant prices. This however accelerated sharply after the mid-sixties, and between 1965-66 and 1978-79, the rate of growth of net capital formation in the household sector was 7.33% per annum in constant prices.

This increase in the investment activity of the household sector after the mid-sixties, which is reflected from the data on both the rate of investment, as well as the rates of growth of investment in this sector, created an additional demand for wage goods in the economy. Since the rate of growth of agriculture (especially foodgrains) showed no acceleration during this period*, and the consumption basket of the working class is heavily weighed by the foodgrain component, this additional investment activity of the household sector led to a demand-pull inflation in wage-goods.

* The debate on the performance of agriculture in India, has raged over the question of whether, there in fact was a significant deceleration in growth rates after the mid-sixties. Vaidyanathan pointed out, that while the average annual rate of growth in agriculture was over 3% between 1950-51/1954-55 and 1960-61/1964-65, this decelerated to 2.1% in the subsequent decade ending 1970-71/74-75. (A Vaidyanathan, EPW Sp.No. Aug. 1977). Later, by fitting 2 functions $\log y = at + bt$ and $\log y = a + bt + ct^2$, he showed that while foodgrains output did not decelerate between 1949 and 1975, there was a deceleration for all crops between 1949 and 1975. (A. Vaidyanathan, EPW Dec. 17, 1977). These results were contested by Srinivasan, who on the basis of fitting semi-logarithmic trends to various indices of agricultural production, found that the output of foodgrains and all crops grew more or less uniformly over the entire period 1949-50 to 1977-78, with no evidence of either acceleration or deceleration since 1967-68 (T.N. Srinivasan, EPW Sp. No. Aug. 1979).

In a situation where there were strong tendencies leading to a demand-pull inflation, it was not possible for the government to maintain the same rate of growth of public investment without creating unmanageable inflationary pressures, and therefore there was a steep cut in public investment after the mid-sixties.

There could however be an objection to the above formulation, based on the empirical data on the savings and investment patterns of the household sector. The data indicate firstly, that the savings of the household sector has been consistently higher than its investment throughout the period under consideration. Secondly, especially after the mid-sixties, there is no tendency for the households to shift from financial to physical assets. It could be argued on the basis of the above factors, that the increase in the capital formation of the household sector after the mid-sixties, is a consequence of voluntary savings in this sector, which need not necessarily lead to inflationary pressures in the economy.

Before discussing the flaw in this kind of a reasoning, it would be revealing to briefly outline the methodology used for computing the savings data of the household sector. Firstly, the non-financial component of savings of the household sector is computed by equating

it with the gross physical capital formation of the household sector, which itself is calculated as a residual by taking the difference between the total gross capital formation in the economy and the gross capital formation in the public and private corporate sectors.⁴¹ The financial assets of the household sector on the other hand, are calculated as a residual by taking the difference between the total financial assets in the economy and the financial assets held by the public and private corporate sectors. That is, the very methodology of computing the savings data indicates its ex-post nature, so that the figures in themselves cannot provide any clues regarding the voluntary or involuntary nature of household savings.

To begin with, the overall improvement in the rate of fixed asset formation in the household sector was largely a consequence of increased urban construction and non-farm investment. This is borne out from a significant improvement in the rate of pucca construction, as well as the continuance of moderately high levels of investment in the form of machinery and equipment.⁴² There is some evidence that this increase in investment is attributable to business enterprises organised in the form of sole proprietorships and partnerships. The number of such

enterprises has grown substantially, as also their percentage shares in total fixed assets, total value added and total employment in the private factory sector.⁴³

Also, there is evidence available to indicate that a substantial portion of the increased investments by this component of the household sector was financed through borrowings.⁴⁴ All this implies, that the entire additional investments by the household sector after the mid-sixties, cannot be solely attributed to additions to savings, through a cut in consumption. That is, the increase in the rate of savings of the household sector after the mid-sixties was not purely voluntary in nature, which implies that the additions to investment by this sector, created an additional demand for wage-goods in the economy. Since there was no acceleration in the rate of growth of agriculture after the mid-sixties, this additional demand for wage-goods implied a demand-pull inflation in wage-goods.

In fact, a part of the reason for the increase in the financial assets of the household sector was this demand-pull inflation, which led to additional cash holdings by the sellers of agricultural commodities. A second factor, which accounts for the increase in financial assets of the household sector after the mid-sixties is related to the procurement policies of the government. Every additional purchase of

foodgrains by the government, in contrast to purchase by traders who are part of the household sector itself, would lead to additional financial holdings by the household sector. This is because, sale to non-government agencies would be a transfer of financial assets and commodities within the household sector, while sale to the government would be a transfer of financial assets and commodities between two sectors in the economy. This would, in the pure accounting sense show up as an increase in savings held in the form of financial assets by the household sector.

Since procurement by the government after the mid-sixties has been on the rise, in fact, between 1970 and 1979, the ratio of procurement to total production of foodgrains rose from 7.7% to 12%⁴⁵; this partly accounts for an increase in the savings of the household sector held in the form of financial assets. While this, strictly speaking, is not a forced savings argument, it nevertheless shows that even in the pure accounting sense, the savings rate in the household sector after the mid-sixties, has been artificially inflated by this factor.

That is, the rise in the savings rate of the household sector after the mid-sixties, which is reflected in the empirical data is an ex-post consequence of a varied set of factors. The entire increase in the savings rate is not

voluntary in nature. Therefore, it can be established that the increase in the rate of gross capital formation by the household sector after the mid-sixties, implied a demand-pull inflation, which led to a cut in the rate of growth of public investment.

While an increase in the rate of growth of gross capital formation in the household sector after the mid-sixties led to a decline in the rate of growth of public investment, this increase in the rate of growth of capital formation in the household sector implied an increase in the rate of growth of demand for the output of the capital goods sector. Since household investment is not as "material intensive" as public investment, especially as investment in departmental and non-departmental undertakings, given the greater importance of construction in household investment,⁴⁶ this increase in the rate of growth of investment in the household sector, could not fully compensate for a decline in the rate of growth of demand for the output of the capital goods sector arising from a decline in the rate of growth of public investment.

Nevertheless, given the structure of the additions to investment in the household sector after the mid-sixties, which essentially occurred in capital formation in construction, and within construction under "pucca construction" as distinguished from "kutchha construction"⁴⁷,

which uses substantial quantities of basic intermediates such as steel, cement, etc., the increase in the rate of growth of basic intermediates was higher than the increase in the rate of growth of machinery and equipment arising as a consequence of the increased investment activity by the household sector during this period.

That is, the higher rate of growth of output of the basic intermediary component of the capital goods sector, in relation to the machinery and equipment component after the mid-sixties, is related in an important way to precisely that factor which caused a decline in the rate of growth of public investment during this period. Given this relatively higher rate of growth of demand for the output of basic intermediates after the mid-sixties, this also resulted in better levels of capacity utilisation in this segment of the capital goods sector.

We finally consider concretely, the relationship between public investment and agriculture which was outlined theoretically in section-2, and trace its impact on the trends in the capital goods sector. After the mid-sixties, it became necessary to divert a greater part of public investment to agriculture, in order to maintain the growth rates of the pre-mid-sixties phase. This follows from Table 2.7 which shows that while prior to the mid-sixties, the stimulus for agricultural growth came

Table 2.7 Growth Rate of Area, Production and Yield in Agriculture.

Item	Foodgrains		Non-foodgrains	
	1949-50 to 1964-65	1964-65 to 1978-79	1949-50 to 1964-65	1964-65 to 1978-79
Area	1.4	0.6	2.5	0.8
Production	3.0	3.4	3.5	2.6
Yield	1.4	2.3	1.0	1.3

Source: Sixth Five Year Plan 1980-85.
Government of India, Planning Commission
(Table 1.3).

**Table 2.8 Gross Domestic Capital Formation in
Agriculture (Rs. Crores) (1970-71 prices).**

<u>Year</u>	<u>GDCF in Agriculture</u>	<u>Year</u>	<u>GDCF in Agriculture</u>
1950-51	509	1975-76	1264
1951-52	691	1976-77	1886
1952-53	585	1977-78	2189
1953-54	665		
1954-55	529		
1955-56	772		
1956-57	785		
1957-58	809		
1958-59	758		
1959-60	605		
1960-61	736		
1961-62	660		
1962-63	766		
1963-64	791		
1964-65	927		
1965-66	1104		
1966-67	951		
1967-68	955		
1968-69	1049		
1969-70	1179		
1970-71	1298		
1971-72	1323		
1972-73	1444		
1973-74	1519		
1974-75	1248		

Source: National Accounts Statistics.

Notes: Compound annual growth rates are calculated using 3 year averages at the end points.

largely from an increase in the area under cultivation, it was necessary to accelerate the rates of growth of productivity after the mid-sixties, which as Table 2.7 shows, grew much faster than the rate of growth in area, for both foodgrains and non-foodgrains during this period, in order to maintain a constant rate of growth in agriculture.

An acceleration in the rates of growth of productivity in agriculture had obviously to come through greater investments in agriculture. It can be seen from Table 2.8 that while gross domestic capital formation in agriculture grew at a compound annual rate of 3.7% between 1951-52 and 1965-66 at 1970-71 prices, this accelerated to 5.8% in real terms between 1966-67 and 1976-77. While these figures relate to total investments in agriculture, this was undoubtedly, to a large measure achieved by an expansion of public investment in agriculture, especially irrigation after the mid-sixties.

While no complete time series on public investment in irrigation is readily available, the importance of this factor can be established indirectly. Public sector investment in irrigation and flood control, which was 7.9% of the total planned public investment during the Fourth Plan, increased to 9.1% during the Fifth Plan, which

probably underestimates the increase, as the Fifth Plan document refers to the category irrigation only.⁴⁸ Also, the percentage of gross irrigated area to gross sown area showed a sharp spurt after the mid-sixties, in which the government, no doubt, had an important role to play. The percentage of gross irrigated area to gross sown area which was 17.1% in 1950-51, increased to 19.9% by 1965-66. By 1978-79, this had shot up to 28.0%.⁴⁹

Given the relatively less capital intensity of public investment in agriculture, a diversion of an increasing part of public investment to agriculture after the mid-sixties, implies that rate of growth of demand for the output of the capital goods sector was reduced even more than suggested by the overall trends in public investment.

It is possible to point out at this stage, that the whole argument has abstracted from the investment trends in the private corporate sector, and the overall decline in the rate of growth of the output of the capital goods sector after the mid-sixties, due to the combined effects of the trends in public investment and household investment, may have been offset by the investment activity of the private corporate sector.

Firstly, the trends in private corporate sector investment do not suggest this to be the case. The gross capital formation of the private corporate sector as a percentage of GDP which was 2.9% in 1950-51 increased to 4.0% by 1954-65 at 1970-71 prices. However, by 1979-80, the rate of investment in the private corporate sector had fallen to 2.3% in 1970-71 prices.⁵⁰ That is, there was no counteracting stimulus to the demand for the output of the capital goods sector, arising from the investment activity of the private corporate sector. Secondly, even if it was theoretically possible to stimulate an increase in investment by the private corporate sector, this would, according to our argument further accentuate the demand-pull inflation in the economy and provoke further cuts in public investment.

Footnotes and References

40. Kalecki, M. (Cambridge University Press, 1971).
41. Report of the Working Group on Savings (Feb., 1982), pp. 3-4.
42. Report of the Working Group on Savings (Feb., 1982), p. 16.
43. Report of the Working Group on Savings (Feb., 1982), p. 25.
44. Report of the Working Group on Savings (Feb., 1982), p. 35.
45. Mihir Rakshit - Income, Saving and Capital Formation. A step towards a Solution of the Savings - Investment Puzzle - Economic and Political Weekly, Annual No. April 1982.
46. Lal, R.N. (Allied Publishers, 1977) pp. 115,118,122.
47. Report of the Working Group on Savings (Feb., 1982), p. 16.
48. Draft Fifth Five Year Plan and Fourth Five Year Plan - Government of India, Planning Commission.
49. Sixth Five Year Plan, 1980-85 - Government of India, Planning Commission. (Annexure 17, p. 14).
50. Report of the Working Group on Savings (Feb., 1982) (Table 4.3, p. 18).

CHAPTER- III

ANALYSIS OF THE DISAGGREGATED GROWTH TRENDS IN
THE CAPITAL GOODS SECTOR (1955 to 1979)Section-1.

While the first section of the second Chapter dealt with the trends in the capital goods sector in terms of its break up between the machinery and intermediary input segments, this section traces the trends in the capital goods sector through a further sub-division into various functional categories. The second section of this Chapter attempts an analysis of the factors which have influenced the pattern of growth of the capital goods sector at this disaggregated level. In order to capture some of the factors influencing the growth pattern of individual industries in the capital goods sector, the production, imports and capacity utilisation trends, depending on the availability of data, are outlined below for some of the main industries in the capital goods sector.

The annual compound rates of growth of output of individual industries in the capital goods sector have been calculated by fitting a function, $\log y = A+Bt$ to the production data for the periods 1955 to 1965 and 1966 to 1979. The justification for taking 1965 as a cut-off point

in analysing the growth trends in the output of the individual industries in the capital goods sector, is because most of these industries exhibited a deceleration in the rate of growth of output after this period. This is brought out by Figures 1 to 7, which plot the output trends of a sample of some important industries in the various functional categories of the capital goods sector. The figures indicate a deceleration in the rate of growth of output of these industries roughly after the mid-sixties.

In analysing the output trends in some of the important industries of the capital goods sector, production data in value terms at current prices have been converted to constant prices (1961-62 = 100) by deflating with the Economic Advisor's wholesale price index of electrical machinery, or non-electrical machinery, or transport equipment, depending on the relevant category in which the individual industry falls. Import data in value terms have also been expressed in constant prices (1958 = 100), by deflating with the import price index of machinery and transport equipment provided by the Ministry of Commerce. The base year 1961-62 for production data and 1958 for import data are considered, so that meaningful import to domestic availability ratios can be calculated, in the absence of a common base year price for both.

From the data on production and capacities provided by the D.G.T.D., capacity utilisation rates are calculated by using the simple index: $\frac{\text{Production}}{\text{Capacity}} \times 100$. However, these capacity utilisation rates have to be interpreted with some caution, because of certain conceptual problems involved in the D.G.T.D.'s definition of capacity*

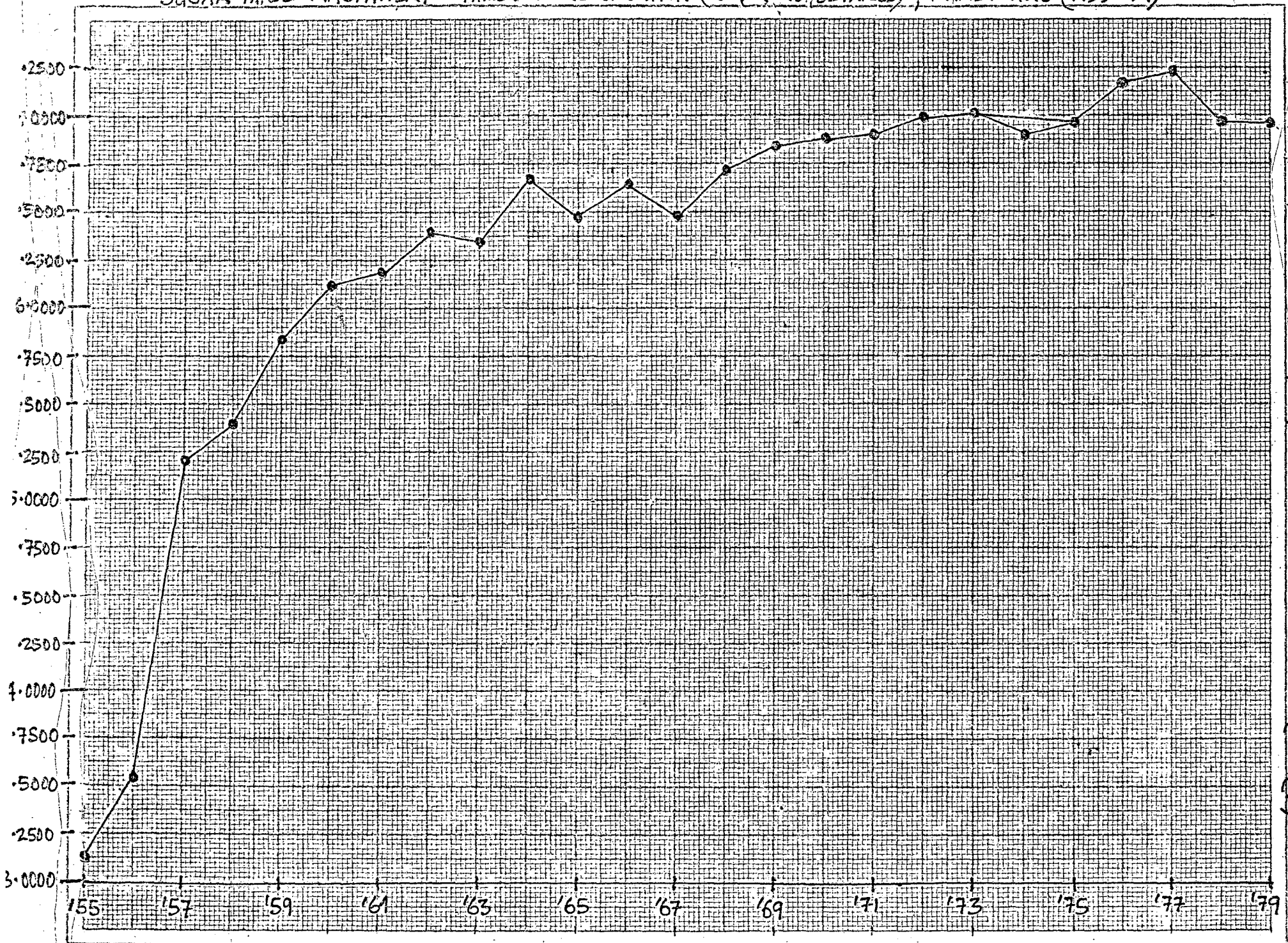
The individual industries of the capital goods sector are clubbed into various sub-groups based on their functional characteristics.

* The concept of capacity used by the D.G.T.D., is the engineering or technical concept, according to which the capacity of a producing unit is the maximum output that could be produced per unit time under normal working conditions, normal working conditions being specified in terms of number of shifts per day, number of working days per year etc.

Accordingly, the figures of capacity are reported by the firm on the basis of number of shifts per day and number of working days in a year as prescribed by the D.G.T.D., but not in accordance with their actual working conditions at the factory level or technical feasibility conditions.

It has been found that this will lead to underestimation of capacity for most products. However, since what is crucial for the analysis in this Chapter is the relative rates of capacity utilization in different industries, this underestimation of capacity does not seriously affect the analysis offered. This however, has to be qualified by the fact, that there could be a tendency to overestimate capacity in some industries for various reasons [Refer: Industrial Capacity and Production - K.L. Krishna - in Data Base of Indian Economy (ed.) by C.R. Rao].

SUGAR-MILL MACHINERY: Y-AXIS: VALUE OF OUTPUT (LOG_e; 1961/62 PRICES); X-AXIS: TIME (1955-79)



SUGAR-MILL MACHINERY: Y-AXIS: VALUE OF OUTPUT (LOG_e); X-AXIS: TIME

Figure 1.1

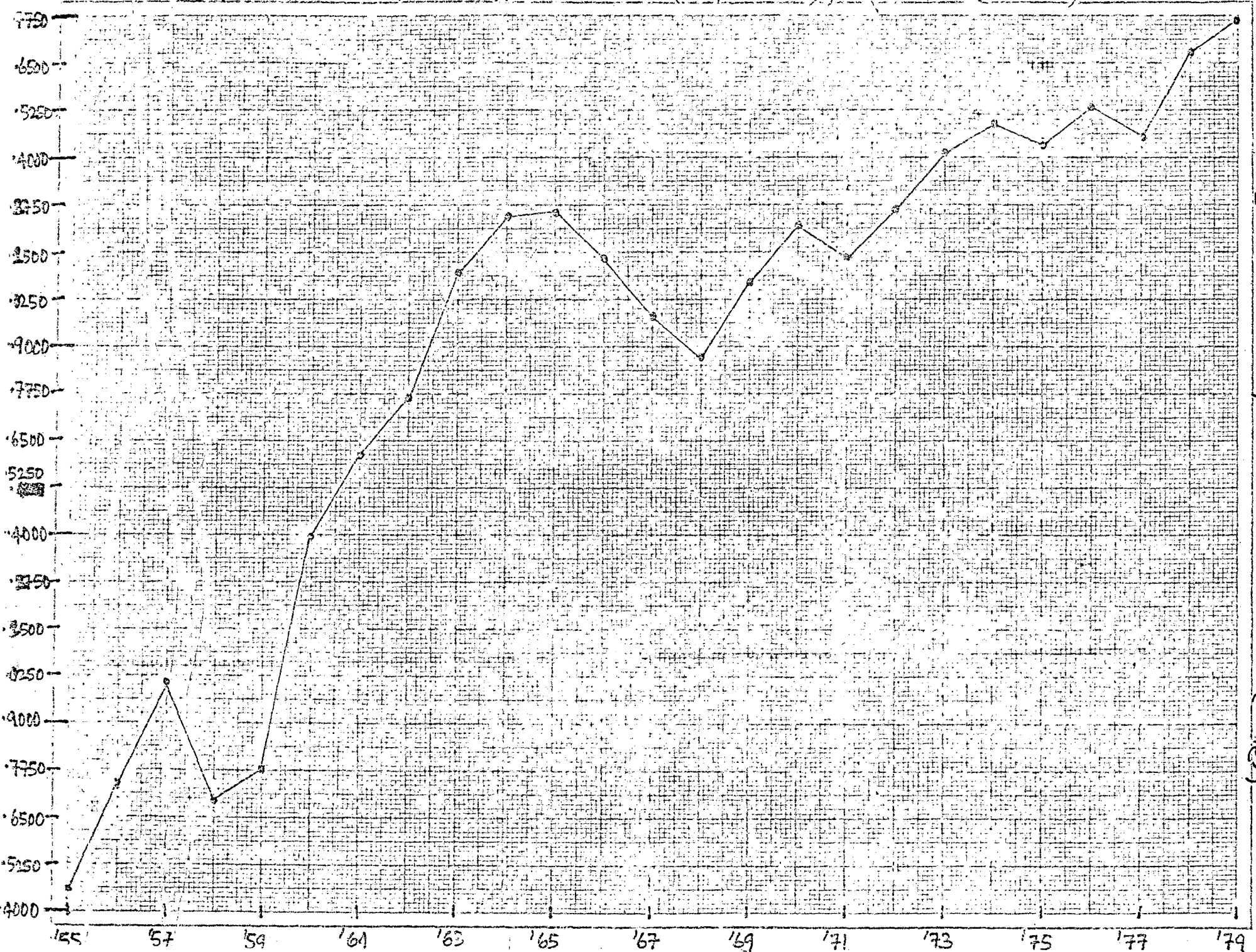
FIGURE 1.1 73

TEXTILE MACHINERY: Y-AXIS: VALUE OF OUTPUT (1961/62 PRICES); X-AXIS: TIME (1955-71)

Figure 1.2

FIGURE 1.2
74

TEXTILE MACHINERY: Y-AXIS: VALUE OF OUTPUT (Log_e); X-AXIS: TIME



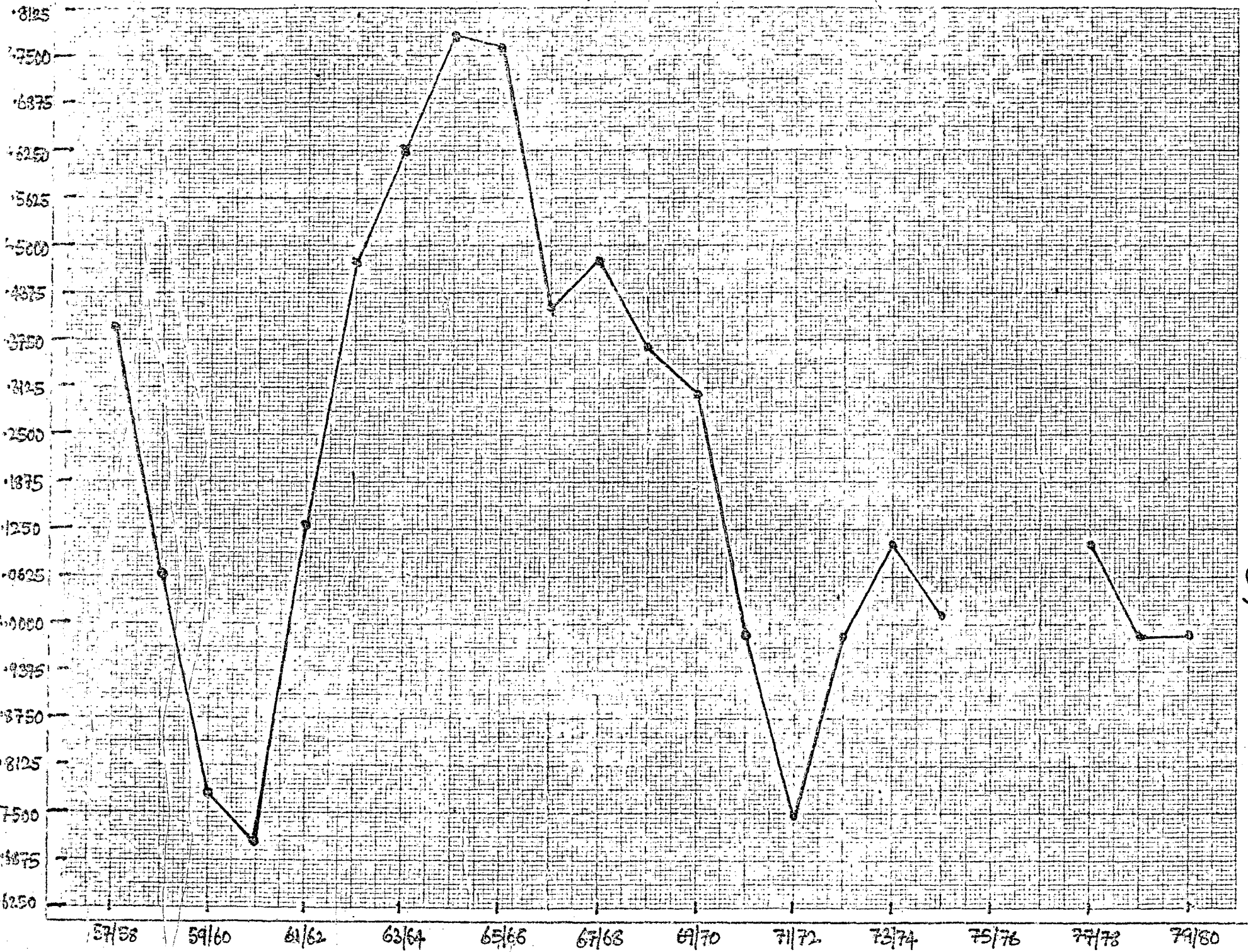
WAGONS: Y-AXIS: OUTPUT IN TONS (LOG_e); X-AXIS: TIME (1957/58 - 1979/80)

Figure 1.3

FIGURE 1.3

75

WAGONS : Y-AXIS: OUTPUT IN TONS (LOG_e); X-AXIS: TIME



COMMERCIAL VEHICLES: OUTPUT IN TENS; SEMI-LOG (LOG_e); 1955-78

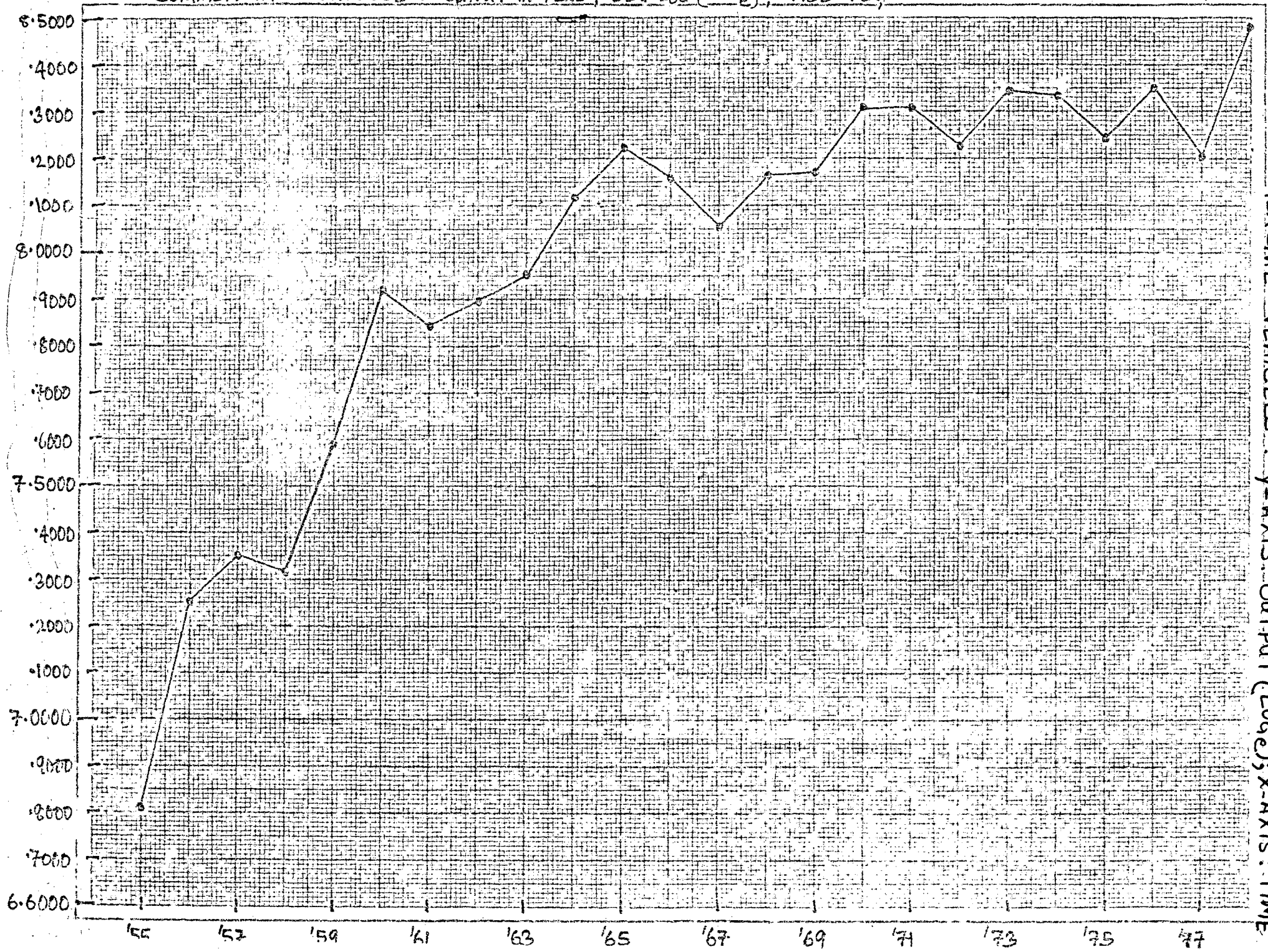


Figure 1.4 COMMERCIAL VEHICLES: y -AXIS: OUTPUT (LOG_e); X-AXIS: TIME

FINISHED STEEL: Y-AXIS: OUTPUT (LOG_e) IN THOUSAND TONS; X-AXIS: TIME (1955/56 - 1979/80)

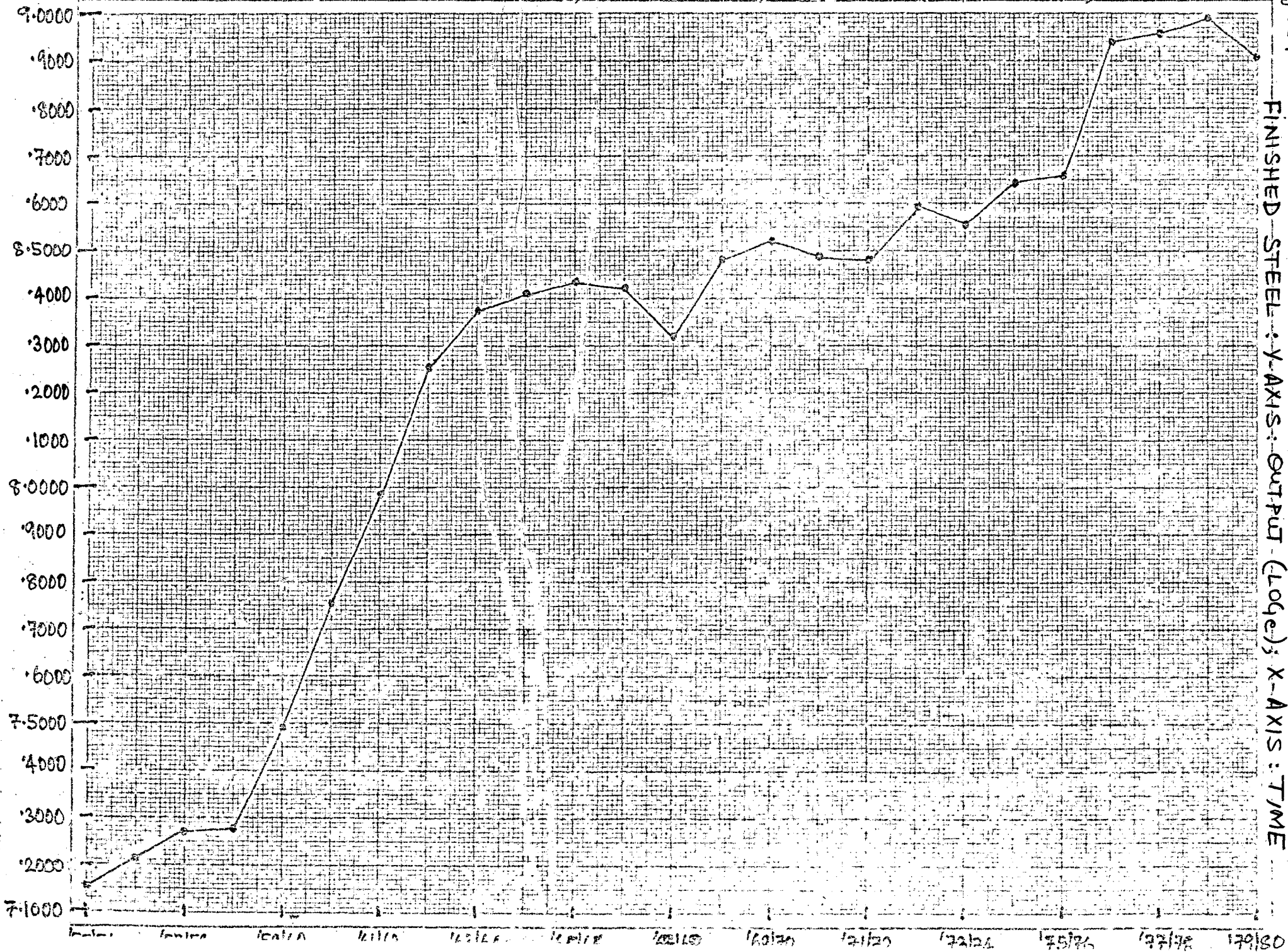
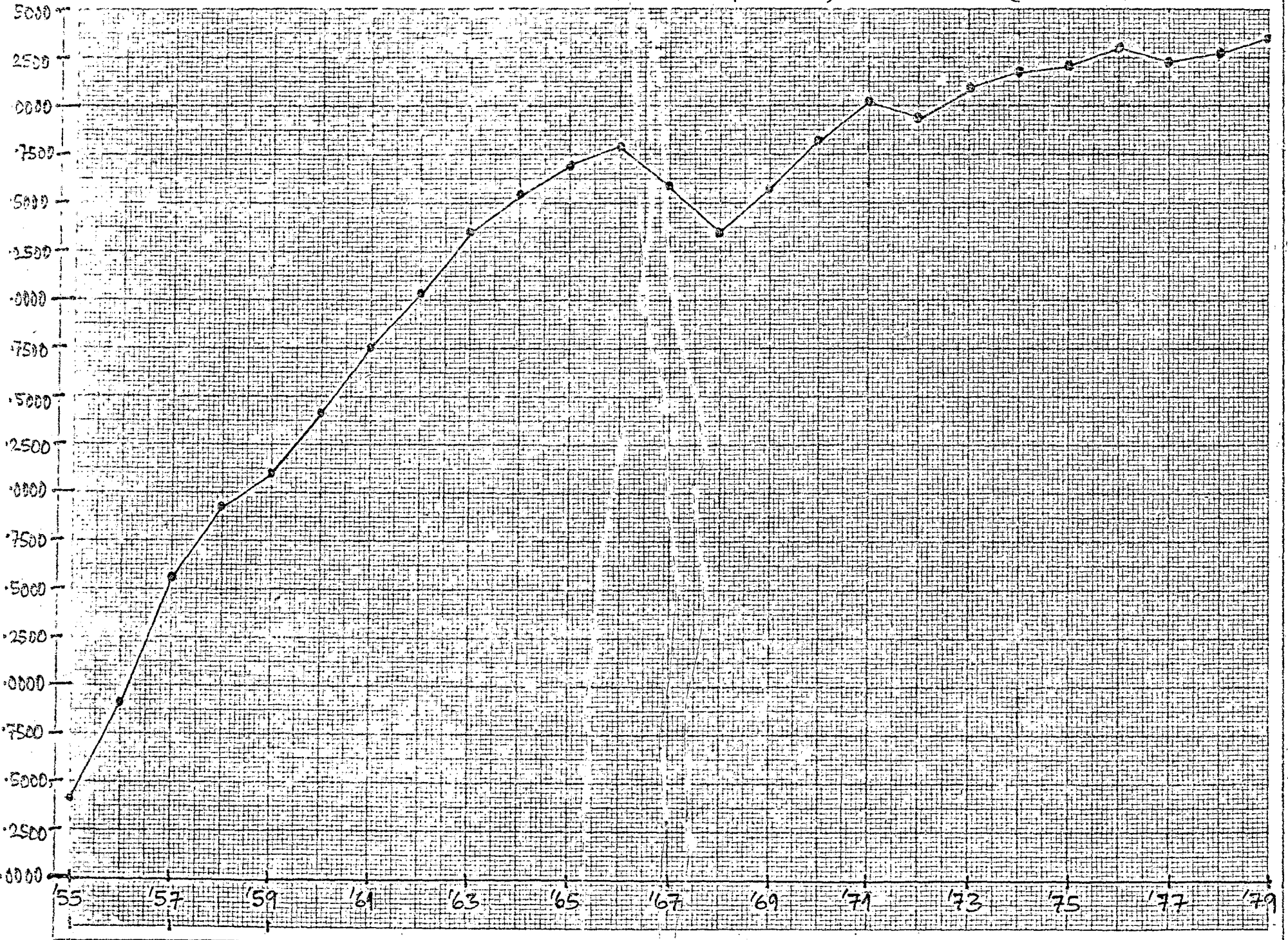


Figure 1.5

FINISHED STEEL: Y-AXIS: OUTPUT (LOG_e); X-AXIS: TIME

MACHINE TOOLS: Y-AXIS: VALUE OF OUTPUT (LOGE, 1961/62 PRICES); X-AXIS: TIME (1955-79)

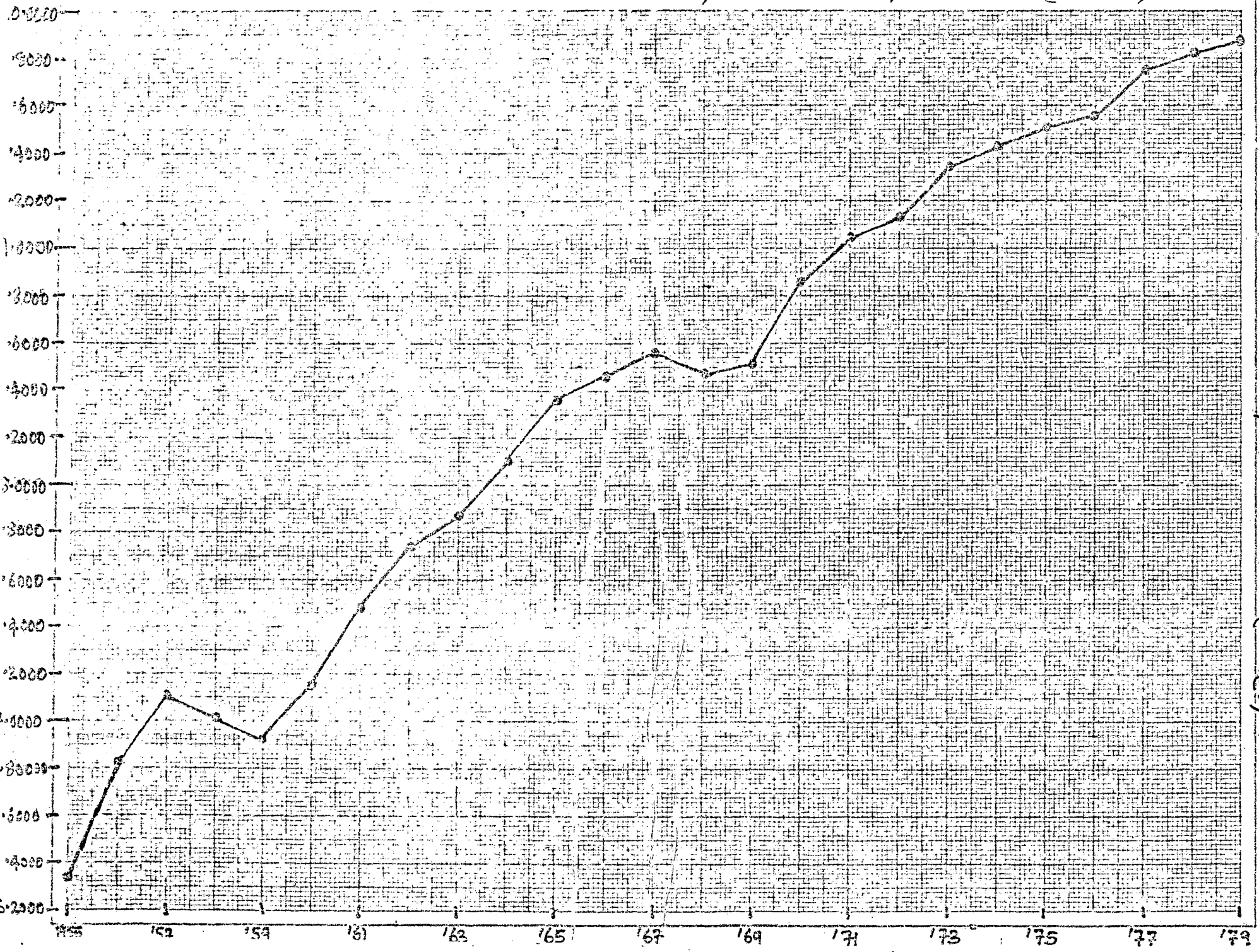


MACHINE TOOLS: Y-AXIS: VALUE OF OUTPUT (LOGE); X-AXIS: TIME

FIGURE 1.6 78

Figure 1.6

POWER TRANSFORMERS: Y-AXIS: OUTPUT (LOGe) IN THOUSANDS K.V.A.s., X-AXIS: TIME (1955-79)



POWER TRANSFORMERS: Y-AXIS: OUTPUT (LOGe); X-AXIS: TIME

Figure 1.7

FIGURE 1.7⁷⁹

Table 3.1 Trends in the Tea Machinery Industry

Year	Output (Rs. million) 1961-62 prices	Output (Rs. million) (Current prices)
1955	8.1	6.8
1956	9.2	7.9
1957	6.5	5.8
1958	7.8	7.1
1959	9.7	9.0
1960	12.6	12.1
1961	17.9	17.7
1962	15.4	16.1
1963	15.5	16.6
1964	11.9	13.2
1965	10.8	12.5
1966	9.5	11.6
1967	15.5	20.0
1968	13.5	17.8
1969	10.9	14.9
1970	8.0	12.0
1971	6.1	10.0
1972	7.4	13.0
1973	9.5	18.0
1974	8.8	22.0
1975	9.5	27.0
1976	10.7	31.0

Contd..

Contd...

Table 3.1

Year	Output (Rs. million) 1961-62 prices	Output (Rs. million) (Current prices)
1977	10.9	32.0
1978	12.2	38.0
1979	9.5	35.0

Source: D.G.T.D. Annual Reports @ Centre for Monitoring Indian Economy - Production and Capacity Utilisation in 620 Industries - 1970-79.

Note - Output Deflated by using Economic Advisor's price Index for non-electrical Machinery (1961-62 = 100).

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.439305

A (Alpha) = 2.0668

B (Beta) = 0.0641

For the period 1966-79:

R squared = 9.00456 (-03)

A (Alpha) = 2.3256

B (Beta) = 0.0055.

Table 3.2 Trends in the Oil Mill Machinery Industry

Year	Output (Rs.million) Current prices	Output (Rs. million) 1961-62 prices
1955	0.7	0.8
1956	1.1	1.3
1957	2.7	3.0
1958	2.9	3.2
1959	4.8	5.2
1960	NA	NA
1961	NA	NA
1962	3.1	3.0
1963	3.2	3.0
1964	4.7	4.2
1965	4.1	3.5
1966	4.6	3.8
1967	3.3	2.6
1968	5.1	3.9
1969	4.8	3.5
1970	10.0	6.6
1971	7.0	4.3

Contd..

Contd...

Table 3.2

Year	Output (Rs. million) Current prices	Output (Rs. million) 1961-62 prices
1972	7.0	4.0
1973	NA	NA
1974	10.0	4.0
1975	9.0	3.2
1976	7.0	2.4
1977	6.0	2.0
1978	7.0	2.2
1979	NA	NA

Source: D.G.T.D. Annual Reports ^{and} Centre for Monitoring Indian Economy - Production and Capacity Utilisation in 620 Industries 1970 to 1979.

Notes : Output in value terms are deflated by using the Economic Advisers Wholesale Price Index of Non-electrical Machinery 1961-62 = 100.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.421896

A(Alpha) = 0.4754

B(Beta) = 0.1035

For the period 1966-79:

R squared = 0.287419

A(Alpha) = 1.4752

B(Beta) = -0.0445.

Table 3.3 Trends in the Sugar Mill Machinery Industry

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices	Imports Domestic Avail- ability
1955	1.9	2.3	39.9	NA	NA
1956	3.0	3.5	89.7	NA	NA
1957	16.2	18.2	48.7	79.8	0.81
1958	20.0	22.2	50.4	50.4	0.70
1959	32.0	34.6	18.0	18.4	0.35
1960-61	44.0	45.7	10.5	10.2	0.18
1961-62	48.0	48.5	7.5	7.1	0.13
1962-63	64.0	61.2	2.9	2.7	0.04
1963-64	61.5	57.4	3.0	2.4	0.04
1964-65	88.3	79.8	3.9	3.3	0.04
1965-66	75.7	65.1	3.2	2.5	0.04
1966-67	93.6	76.6	2.1	1.0	0.01
1967-68	84.8	65.5	3.0	1.2	0.02
1968-69	110.2	83.4	7.1	2.9	0.03
1969-70	128.2	94.0	5.7	2.4	0.02
1970-71	146.3	97.0	1.5	0.6	0.01
1971-72	163.0	99.1	2.0	0.9	0.01
1972-73	191.0	108.9	0.8	0.3	Negligibly
1973-74	212.0	111.4	0.6	0.2	"
1974-75	252.0	101.2	0.5	0.1	"

Contd..

Contd...

Table 3.3

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices	Imports Domestic Avail- ability
1975-76	303.0	106.1	NA	NA	NA
1976-77	378.0	130.8	NA	NA	NA
1977-78	403.0	137.4	0.1	0.0	0.00
1978-79	332.0	106.3	2.7	1.2	0.01
1979-80	349.0	95.1	0.3	0.1	Negligible

Source: (Production):- Indian Sugar Year Book 1972-73 -
Published by the Indian Sugar Mill's Association-
Production data for 1970-79 from Centre for
Monitoring Indian Economy - Production and
Capacity Utilisation in 620 Industries 1970-79.
Imports- Basic Statistics Relating to the Indian
Economy - various Issues.

Notes: Output in value terms are deflated by using the
Economic Advisor's Wholesale Price Index of Non-
electrical Machinery 1961-62 = 100. Imports in
value terms are deflated using the import price
index of machinery and equipment (1958=100),
provided by the Ministry of Commerce.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.780622

A(Alpha) = 1.6844

B(Beta) = 0.3186

For the period 1966-79:

R squared = 0.538616

A(Alpha) = 4.3761

B(Beta) = 0.0324

Table 3.4 Trends in the Textile Machinery Industry

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices	Imports Domestic Availa- bility
1955	53.8	63.7	NA		
1956	73.0	84.7	NA		
1957	99.0	111.4	190.8		
1958	73.0	80.7	108.9		
1959	81.0	87.6	93.7		
1960	156.8	163.0	161.2		
1961	200.1	202.1	265.9	250.8	0.55
1962	247.0	236.4	263.9	249.0	0.51
1963	351.1	327.8	246.6	197.3	0.38
1964	419.8	379.6	275.7	229.8	0.38
1965	446.6	384.3	284.2	218.6	0.36
1966	416.4	340.8	304.5	142.3	0.29
1967	377.8	292.0	278.5	113.7	0.28
1968	346.1	261.8	157.8	64.9	0.20
1969	437.9	321.0	97.7	40.5	0.11
1970	559.2	370.8	89.0	34.6	0.09
1971	560.9	341.2	126.7	56.6	0.14
1972	682.8	389.3	164.1	54.7	0.12
1973	851.1	447.2	172.4	48.2	0.10

Contd...

Contd...

Table 3.4

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices	Imports Domestic Availa- bility
1974	1213.0	487.3	167.1	43.7	0.08
1975	1315.6	460.6	179.3		
1976	1466.1	507.3	129.7	54.7	0.10
1977	1381.0	471.0	187.7	91.1	0.16
1978	1844.1	590.3			
1979	2361.6	643.8			

Source: (Output) For 1955-59 - Programmes of Industrial Development 1961-66 - Planning Commission.
For 1960-70 - Annual Survey of Industries.
For 1971-79 - Indian Textile Bulletin - various Issues.

(Imports): Handbook of Statistics on the Cotton Textile Industry (11th ed.) - Indian Cotton Mills Federation (Refers to financial years).

Notes: Output in value terms are deflated using the Economic Advisors Wholesale Price Index for Non-electrical machinery (1961-62 = 100). Import figures are deflated with the Import Price Index of Machinery and Equipment (1958=100) provided by the Ministry of Commerce.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.918971
A (Alpha) = 4.1015
B (Beta) = 0.1928

For the period 1966-79:

R squared = 0.867812
A (Alpha) = 5.6327
B (Beta) = 0.0589

Table 3.5 Trends in the Wagon Industry

Year	Output (thousand numbers)	Imports (Rs million) Current prices	Imports (Rs million) 1958 prices
1955-56		151.6	
1956-57		215.2	
1957-58	17.3	287.0	470.5
1958-59	11.7	299.5	299.5
1959-60	8.8	327.4	334.1
1960-61	8.2	253.7	246.3
1961-62	12.5	155.0	146.2
1962-63	17.6	270.7	255.4
1963-64	20.5	217.7	174.2
1964-65	23.8	232.5	193.8
1965-66	23.5	248.7	191.3
1966-67	16.6	164.4	76.8
1967-68	17.7	227.2	92.7
1968-69	15.8	156.3	64.3
1969-70	14.9	115.8	48.0
1970-71	10.8	140.1	54.5
1971-72	8.5	199.4	89.0
1972-73	10.8	202.0	67.3
1973-74	12.2	253.3	70.8
1974-75	11.1	252.5	66.1
1975-76		277.6	
1976-77			

Contd..

Contd...

Table 3.5

Year	Output (thousand numbers)	Imports (Rs million) Current prices	Imports (Rs million) 1958 prices
1977-78	12.2	181.5	88.1
1978-79	10.8	124.2	51.2
1979-80	10.8	293.1	99.7

Source: (Output) Basic Statistics Relating to the Indian Economy - various Issues.

(Imports) Basic Statistics Relating to the Indian Economy - various Issues.

Notes : Imports are deflated using the import price index of machinery and equipment (1958=100) provided by the Ministry of Commerce. The import figures given are those for railway vehicles which are taken synonymously with wagons here.

Equation fitted: $\log y = A + Bt$.

For the period 1957-65:

R squared = 0.432179

A (Alpha) = 2.1223

B (Beta) = 0.0968

For the period 1966-79:

R squared = 0.384002

A (Alpha) = 2.7073

B (Beta) = -0.0316

Table 3.6 Trends in the Locomotive Industry

Year	Output (Numbers)
1955-56	179
1956-57	223
1957-58	249
1958-59	268
1959-60	279
1960-61	272
1961-62	248
1962-63	246
1963-64	234
1964-65	248
1965-66	233
1966-67	240
1967-68	185
1968-69	185
1969-70	127
1970-71	127
1971-72	107
1972-73	95
1973-74	84

Contd...

Contd..

Table 3.6

Year	Output (Numbers)
1974-75	90
1975-76	
1976-77	
1977-78	205
1978-79	202
1979-80	189

Sources: (Output) Basic Statistics Relating to
the Indian Economy - Various
Issues.

Equation fitted: $\log y = A+Bt$.

For the period 1955-65:

R squared = 0.995679

A (Alpha) = 5.4313

B (Beta) = 0.0115

For the period 1966-79:

R squared =

A (Alpha) = 4.9751

B (Beta) = -0.0008

Table 3.7 Trends in the Commercial Vehicles Industry

Year	Output (Numbers)	Imports (Rs million) Current prices	Imports (Rs million) 1958 prices
1955	9048	2.5	
1956	14121	27.6	
1957	15581	139.6	228.9
1958	15021	16.2	16.2
1959	19807	39.3	40.1
1960	27528	24.4	23.7
1961	25596	12.2	11.5
1962	26880	10.2	9.6
1963	28380	12.0	9.6
1964	33516	16.0	13.3
1965	37308	28.8	22.2
1966	34931	14.9	7.0
1967	31439	16.7	6.8
1968	35037	35.0	14.4
1969	35149	12.1	5.0
1970	40538	10.7	4.2
1971	40598	23.6	10.5
1972	37431	5.7	1.9
1973	42295	3.2	0.9
1974	41654	3.7	0.9
1975	38007	6.9	

Contd...

Contd...

Table 3.7

Year	Output (Numbers)	Imports (Rs million) Current prices	Imports (Rs million) 1958 prices
1976	42426		
1977	35485	1.5	0.7
1978	48462	25.2	11.6
1979		85.8	29.2

Source:(Output) Statistical Abstract, India (C.S.O)-
various Issues.

(Imports) Basic Statistics Relating to the
Indian Economy - various Issues.

Notes: Import data in current prices are deflated
with the import price index of machinery
and equipment (1958 = 100) provided by the
Ministry of Commerce, and imports refer to
financial years.

Equation fitted: $\log y = A+Bt$.

For the period 1965-65:

R squared = 0.914244

A (Alpha) = 9.3385

B (Beta) = 0.1251

For the period 1966-79:

R squared = 0.515262

A (Alpha) = 10.4349

B (Beta) = 0.0209

Table 3.8 Trends in the Automobile Industry

Year	Output (Numbers)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 prices
1955	13602	143.0	
1956	17128	186.2	
1957	15670	333.3	546.4
1958	11358	230.5	230.5
1959	16648	306.1	312.3
1960	24588	345.1	335.0
1961	28716	330.0	311.3
1962	30924	271.2	255.8
1963	23808	283.3	226.6
1964	33624	372.6	310.5
1965	35280	326.2	250.9
1966	37404	303.0	141.6
1967	38910	333.0	135.9
1968	44601	313.6	129.1
1969	43101	210.9	87.5
1970	45143	234.5	91.2
1971	50275	373.7	166.8
1972	52132	306.2	102.1
1973	55247	346.3	96.7

Contd..

Contd...

Table 3.8

Year	Output (Numbers)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 prices
1974	46810	488.8	128.0
1975	31641	482.9	
1976	38554		
1977	47900	491.2	238.4
1978	45600	605.3	278.9
1979	42800	730.9	248.6

Source: (Output) Statistical Abstract, India (C.S.O.)-
Various Issues.

(Imports) Basic Statistics Relating to the
Indian Economy - various Issues.

Notes: Imports at current prices are deflated with
the import price index of machinery and
equipment (1958 = 100). Provided by the
Ministry of Commerce. Imports refer to
financial years.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.757569

A (Alpha) = 9.4579

B (Beta) = 0.1024

For the period 1966-79:

R squared = 0.96834

A (Alpha) = 10.6685

B (Beta) = 0.0031

Table 3.9 Trends in the Diesel Engine Industry

Year	Output (Numbers)	Installed capacity (Number)
1955	10220	17820
1956	12015	22164
1957	16639	22164
1958	25766	22164
1959	30335	23220
1960	41680	36336
1961	44484	41292
1962	42648	41292
1963	55550	43692
1964	69236	43692
1965	88068	71312(123.5)
1966	107144	71312(150.2)
1967	114903	69084(166.3)
1968	116149	62460(185.9)
1969	137602	69312(198.5)
1970	66138	77064(85.8)
1971	84189	155004(54.3)
1972	78248	183996(42.5)
1973	137652	183996(74.8)

Contd..

Contd...

Table 3.9

Year	Output (Numbers)	Installed capacity (Number)
1974	110580	295992 (37.4)
1975	140304	295992 (47.4)
1976	106620	304284 (35.0)
1977	129700	304600 (42.6)
1978	136600	304600 (44.8)
1979	139900	304600 (45.9)

Source: Capacity & Production: (1955-76) - Statistical Abstract, India various Issues (1977-79)- Centre for Monitoring Indian Economy - Production and Capacity Utilization in 620 Industries 1970-79.

Notes: Figures in brackets indicate capacity utilisation rates.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.958452

A (Alpha) = 9.3536

B (Beta) = 0.2071

For the period 1966-79:

R squared = 0.140291

A (Alpha) = 11.4867

B (Beta) = 0.0214

Table 3.10 Trends in the Coal Industry

Year	Output (thousand ton)
1955	38839
1956	39910
1957	44204
1958	46074
1959	47829
1960	52593
1961	50065
1962	61370
1963	65956
1964	62440
1965	67162
1966	67974
1967	68223
1968	70813
1969	75411
1970	73698
1971	71824
1972	75658
1973	77870

Contd...

Contd...

Table 3.10

Year	Output (thousand tons)
1974	84102
1975	95911
1976	104900
1977	103900
1978-79	102000
1979-80	103900

Source: (Output) - (1955-75) - Statistical Abstract
various Issues.
1975 - 1979-80 - RBI Report on
Currency and Finance 1978-79 and
1980-81.

Equation fitted : $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.968327

A (Alpha) = 10.5658

B (Beta) = 0.0587

For the period 1966-79:

R squared = 0.887148

A (Alpha) = 11.0746

B (Beta) = 0.0385

Table 3.11 Trends in the Cement Industry

Year	Output (thousand tonns)
1955	4559
1956	5008
1957	5691
1958	6186
1959	6936
1960	7835
1961	8245
1962	8586
1963	9355
1964	9690
1965	10578
1966	11058
1967	11310
1968	11943
1969	13620
1970	13956
1971	14928
1972	15756
1973	15006

Contd..

Contd..

Table 3.11

Year	Output (thousand tonne)
1974	14265
1975	16235
1976	18700
1977	19200
1978-79	19300
1979-80	17600

Source: Output (1955-60) Statistical Abstract,
India (C.S.O.) - 1961.
(1960-1979-80) - RBI Report on Currency
and Finance - Various Issues.

Equation Fitted: $\log y = A + Bt$.

For the period 1955-55:

R squared = 0.978866

A (Alpha) = 8.4738

B (Beta) = 0.0833

For the period 1966-79:

R squared = 0.881782

A (Alpha) = 9.3424

B (Beta) = 0.0417

Table 3.12 Trends in Finished steel

Year	Output (thousand tons)
1955-56	1280
1956-57	1359
1957-58	1438
1958-59	1439
1959-60	1795
1960-61	2337
1961-62	2939
1962-63	3864
1963-64	4347
1964-65	4508
1965-66	4604
1966-67	4567
1967-68	4113
1968-69	4860
1969-70	5031
1970-71	4870
1971-72	4826
1972-73	5430
1973-74	5193

Contd..

Contd....

Table 3.12

Year	Output (thousand tons)
1974-75	5694
1975-76	5739
1976-77	7620
1977-78	7765
1978-79	8059
1979-80	7365

Source: Output - 1955-56 to 1965-66 -
 Statistics for the Iron and Steel
 Industry in India 1970.
 1966-67 to 1979-80 - SAIL Handbook
 1975-76 and 1980-81.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.946666

A (Alpha) = 7.0127

B (Beta) = 0.1544

For the period 1966-79:

R squared = 0.851408

A (Alpha) = 8.3274

B (Beta) = 0.0484

Table 3.13 Trends in the Machine Tool Industry

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices	Imports Domestic Availa- bility	Installed Capacity (Rs million)
1955	7.4	8.8	52.9			
1956	10.6	12.3	83.5			
1957	23.4	26.3	146.1	239.5	0.90	
1958	34.0	37.6	143.9	143.9	0.79	
1959	41.6	45.0	162.9	166.2	0.79	43.6
1960	58.6	60.9	209.4	203.3	0.71	47.8
1961	85.2	86.1	178.9	168.8	0.66	51.2
1962	120.1	114.9	189.5	171.2	0.60	95.7
1963	167.8	156.7	315.1	252.1	0.62	189.7
1964	209.7	189.6	344.4	287.0	0.60	240.6
1965	254.6	219.1	352.1	270.8	0.55	373.6(68.1)
1966	284.8	233.1	430.0	200.9	0.46	418.1(68.1)
1967	254.7	196.8	394.0	160.8	0.45	492.0(51.8)
1968	206.3	156.1	335.1	137.9	0.47	632.0(32.6)
1969	266.7	195.5	189.9	78.8	0.29	709.0(37.6)
1970	374.5	248.3	183.0	71.2	0.22	693.4(54.0)
1971	503.2	306.1	217.1	96.9	0.24	791.2(63.6)
1972	494.6	282.0	236.4	78.8	0.22	753.5(65.6)
1973	622.6	327.2	286.3	80.0	0.20	988.7(63.0)
1974	844.5	355.4	294.6	77.1	0.18	1077.0(82.1)
1975	1040.3	364.3	440.5	1266.0(82.2)
1976	1168.5	404.3	444.9	187.7	0.32	1212.0(96.6)

Contd..

Contd...

Table 3.13

Year	Output (\$ million) Current Prices	Output (\$ million) 1961-62 Prices	Imports (\$ million) Current Prices	Imports (\$ million) 1958 Prices	Imports Domestic Availa- bility	Installed Capacity (\$ million)
1977	1095.7	373.7	357.2	173.4	0.32	1530.0(71.7)
1978	1210.6	387.5	395.2	182.1	0.32	1600.0(75.7)
1979	1558.3	424.8				1600.0(97.4)

Source: Production and Import data have been taken from the information provided by the Indian Machine Tool Manufacturers' Association. Installed capacity data is taken from Statistical Abstract (various Issues).

Notes: Output in value terms are deflated by using the Economic Advisor's Wholesale Price Index of Non-electrical Machinery (1961-62 = 100). Imports in Value terms are deflated by using the import price index of machinery and equipment (1958 = 100), provided by the Ministry of Commerce.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.972702

A (Alpha) = 2.4326

B (Beta) = 0.3205

For the period 1966-79:

R squared = 0.811649

A (Alpha) = 5.2355

B (Beta) = 0.0675

Table 3.14 Trends in the Ball and Roller Bearings Industry

Year	Output (million Nos.)	Installed Capacity (million Nos.)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 prices
1955	0.9		4.0	
1956	1.2		13.8	
1957	1.7		31.0	50.8
1958	2.1		19.7	19.7
1959	1.8		23.2	23.7
1960	3.2		36.9	35.8
1961	..		47.0	44.3
1962	3.9		46.8	44.2
1963	5.0		43.8	35.0
1964	5.9		52.1	43.4
1965	8.3	11.9(69.7)	62.0	47.7
1966	9.2	11.6(79.3)	79.5	37.1
1967			89.0	36.3
1968	12.1	12.7(95.3)	77.9	32.1
1969	13.3	11.2(118.8)	77.8	32.3
1970	13.1	15.8(82.9)	94.4	36.7
1971	21.8	15.8(138)	122.6	54.7
1972	21.5	20.7(104)	107.7	35.9
1973	23.4	22.7(103)	117.3	32.8
1974	22.2	22.7(98)	154.2	41.7
1975	23.3	29.1(80)	173.9	

Contd..

Contd...

Table 3.14

Year	Output (million Nos.)	Installed Capacity (million Nos.)	Imports (Rs million) Current Prices)	Imports (Rs million) 1958 prices
1976	27.7	31.1(89)		
1977	28.6	31.4(91)	211.9	102.9
1978	29.5	31.3(94)	266.4	122.8
1979	28.6	31.4(91)	474.3	161.3

Source: Output and Installed capacity.
1955-60 - Programme of Industrial
Development 1961-66 - Planning Commission.
1960-79 D.G.T.D. Annual Reports and
Centre for Monitoring Indian Economy
Production and capacity Utilisation in 620
Industries 1970 to 1979.

Imports-Basic Statistics Relating to the Indian
Economy - various issues.

Notes: Imports at current prices are deflated with
the Import Price Index of Machinery and
Equipment (1958= 100) provided by the
Ministry of Commerce. Imports refer to
financial year (Figures in brackets give the
capacity utilisation rates).

Equation fitted: $\log y = A+Bt$

For the period 1955-65:

R Squared = 0.972406

A (Alpha) = -0.0100

B (Beta) = 0.2053

For the period 1966-79:

R squared = 0.880733

A (Alpha) = 2.3658

B (Beta) = 0.0898

Table 3.15 Trends in the Electric Motors Industry

Year	Output (thousand H.P)	Installed Capacity (thousand H.P)	Imports (Rs million) Current Prices	Imports (Rs million 1958 Prices)
1955	252	200	15.9	
1956	359	340	20.1	
1957	470	340	53.0	86.9
1958	623	340	28.1	28.1
1959	575	340	23.9	24.4
1960	696	602	31.9	31.0
1961	829	602	26.6	25.1
1962	986	1136	29.2	25.7
1963	1182	1136	28.7	23.0
1964	1317	1136	20.9	17.4
1965	1702	1352(125.9)	57.9	44.5
1966	1985	1358(146.2)	62.0	29.0
1967	1988	1416(140.4)	23.7	9.7
1968	1785	2218(80.5)	42.3	17.4
1969	2078	2569(80.9)	37.9	15.7
1970	2796	2569(108.8)	34.5	13.4
1971	2330	2569(90.7)	45.0	20.1
1972	2946	2735(107.7)	48.1	16.0
1973	2983	5008(59.6)	62.9	17.6
1974	2891	5012(57.7)	82.6	21.6
1975	3647	5418(67.3)	125.6	

Contd..

Contd...

Table 3.15

Year	Output (thousand H.P)	Installed Capacity (thousand H.P)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 prices
1976	3499	6652(52.6)		
1977	4000	6700(59.7)	49.3	23.9
1978	4100	6700(61.2)	60.4	27.8
1979	3700	6700(55.2)	86.0	29.3

Source: Production of capacity

1951-76 - Statistical Abstract, India (C.S.O.) - various Issues.

1977-79 - Centre for Monitoring Indian Economy - Production and Capacity Utilisation in 620 Industries 1970-79.

Imports: Basic Statistics Relating to the Indian Economy - various Issues.

Notes: Imports at current prices have been deflated with the Import Price Index of Machinery and Equipment provided by (1958 = 100) the Ministry of Commerce. Import data refers to financial years. Figures in brackets refer to capacity utilisation rates.

Equation fitted: $\log y = A + Bt$.

For the period 1955-65:

R squared = 0.9714
A (Alpha) = 5.7101
B (Beta) = 0.1709

For the period 1966-79:

R squared = 0.887364
A (Alpha) = 7.5259
B (Beta) = 0.0636

Table 3.16 Trends in the Power Transformer Industry

Year	Output (thousand K.V.A)	Installed Capacity (thousand K.V.A.)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices
1955	565	414	17.3	
1956	919	934	22.2	
1957	1219	934	41.8	68.5
1958	1127	934	29.0	29.0
1959	1016	934	26.7	27.2
1960	1282	1244	38.3	37.2
1961	1796	1244	80.2	75.7
1962	2306	1404	32.0	30.2
1963	2629	1999	41.8	33.4
1964	3308	1999	26.9	22.4
1965	4319	2122(203.5)	90.2	69.4
1966	4792	2182(219.6)	32.4	15.1
1967	5254	5066(103.7)	21.7	8.9
1968	4828	4946(97.6)	59.5	24.5
1969	5050	5995(84.2)	29.9	12.4
1970	7100	6265(113.3)	11.8	4.6
1971	8534	6265(136.2)	17.0	7.6
1972	9363	6688(139.9)	22.4	7.5
1973	11809	12570(93.9)	18.9	5.3
1974	12387	14878(83.3)	68.5	17.9
1975	13509	22162(60.9)	36.8	

Contd..

Contd...

Table 3.16

Year	Output (thousand K.V.A.)	Installed Capacity (thousand K.V.A.)	Imports (Rs million) Current Prices	Imports (Rs million) 1958 Prices
1976	14181	20162(70.3)		
1977	17300	26200(66.0)	42.6	20.7
1978	18500	28100(65.8)	55.4	25.5
1979	19300	28100(68.7)	80.9	27.5

Source: Output of Installed capacity.

1955-1976 - Statistical Abstract, India (C.S.O.)-
various Issues.

1977-79 - Centre for Monitoring Indian Economy -
Production and Capacity Utilisation
in 620 Industries 1970-79.

Imports - Basic Statistics Relating to the
Indian Economy - Various Issues.

Notes: Imports at current prices have been deflated with
the Export Price Index of Machinery and
Equipment (1958=100). Imports refer to financial
years. Figures in brackets refer to capacity
utilisation rates.

Equation fitted: $\log y = A+Bt$

For the period 1955-65:

R squared = 0.932131

A (Alpha) = 6.4690

B (Beta) = 0.1782

For the period 1966-79:

R squared = 0.964047

A (Alpha) = 8.3851

B (Beta) = 0.1214

Table 3.17 Trends in Power Driven Pumps

Year	Output (thousand Nos)	Installed capacity (thousand nos)
1955	34	67
1956	47	68
1957	64	68
1958	78	68
1959	85	89
1960	104	118
1961	127	119
1962	128	122
1963	161	131
1964	174	143
1965	225	185(121.6)
1966	294	185(158.9)
1967	312	182(171.4)
1968	292	145(201.4)
1969	358	160(223.7)
1970	269	160(175)
1971	245	455(53)
1972	276	412(68)
1973	347	497(97)
1974	265	360(75)

Contd..

Contd...

Table 3.17

Year	Output (thousand nos)	Installed Capacity (thousand nos)
1975	288	360(81)
1976	281	360(78)
1977	340	360(94)
1978	400	360(111)
1979	350	360(97)

Source: Output and capacity.

1955 to 1976 - Statistical Abstract, India(C.S.O)-
various Issues.

1977-79 - Centre for Monitoring Indian
Economy - Production and Capacity
Utilisation in 620 Industries
1970-79.

Notes: Figures in brackets indicate capacity utilisation
rates.

Equation Fitted: $\log y = A+Bt$

For the period 1955-65:

R squared = 0.971635

A (Alpha) = 3.7191

B (Beta) = 0.1713

For the period 1966-79

R squared = 0.130011

A (Alpha) = 5.6438

B (Beta) = 0.0120

Table 3.18 Trends in the Air and Gas Compressors Industry

Year	Output (thousand nos)
1955	
1956	
1957	
1958	Neg.
1959	0.5
1960	1.7
1961	2.5
1962	2.4
1963	3.0
1964	3.2
1965	2.9
1966	3.3
1967	6.1
1968	6.3
1969	5.6
1970	6.8
1971	5.0
1972	5.3
1973	5.9
1974	6.6
1975	5.9

Contd..

Contd...

Table 3.18

Year	Output (thousand nos)
1976	68
1977	7.9
1978	10.1
1979	12.2

Source: Output - Annual Report of the Ministry of Commerce and Industry - D.C.T.D. Annual Reports, and Centre for Monitoring Indian Economy. Production and Capacity Utilisation in 620 Industries 1970 to 1979.

Equation fitted: $\log y = A+Bt$

For the period 1959-65:

R squared = 0.631883

A (Alpha) = -0.9723

B (Beta) = 0.2400

For the period 1966-79:

R squared = 0.684118

A (Alpha) = 1.4829

B (Beta) = 0.0575

Table 3.19 Trends in the Chemical Machinery Industry

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices
1955		
1956		
1957	4.1	4.6
1958	7.1	7.8
1959	9.6	10.4
1960	13.9	14.4
1961	21.7	21.9
1962	45.8	43.8
1963	50.0	46.7
1964	67.3	60.8
1965	74.4	64.0
1966	89.7	73.4
1967	90.0	69.6
1968	110.0	83.2
1969	133.1	97.6
1970	170.0	112.7
1971	202.0	122.9
1972	262.0	149.4
1973	309.0	162.4
1974	367.0	147.4
1975	381.0	133.4

Contd..

Contd....

Table 3.19

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices
1976	674.0	233.2
1977	689.0	234.9
1978	720.0	230.5
1979	749.0	204.2

Source: Output - ^G DPTD Annual Reports.
 - Annual Reports of the Ministry of
 Industry and Commerce.
 - Centre for Monitoring Indian Economy
 Production and Capacity Utilisation in 620 Industries
 1970-79.

Notes: Output at current prices have been deflated with
 the Economic Advisor's wholesale Price Index
 of Non-Electrical Machinery (1961-62= 100).

Table 3.20 Trends in the Paper Machinery Industry

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Installed Capacity (Rs million) Current Prices	Imports (Rs million) Current Prices	Imports (Rs. mi- llion) 1958 prices	Imports Domestic Availab- ility
1955				18.7		
1956				27.0		
1957				56.0	91.8	
1958				26.3	26.3	
1959				31.1	31.7	
1960	0.2	0.2		24.5	23.8	0.99
1961	4.5	4.5		66.7	62.9	0.93
1962	8.6	8.2		32.3	30.5	0.79
1963	13.4	12.5		88.1	70.5	0.85
1964	14.6	13.2		36.5	30.4	0.70
1965	16.8	14.5	60.5(27.8)	22.0	16.9	0.54
1966	23.0	18.8	64.5(35.7)	77.4	36.2	0.66
1967	23.5	18.2	59.0(39.8)	79.0	32.2	0.64
1968	27.1	20.5	64.0(42.3)	81.5	33.5	0.62
1969	33.0	24.2	44.5(74.2)	59.6	24.7	0.51
1970	34.0	22.5	61.0(56)	23.0	8.9	0.28
1971	54.0	32.8	66.0(82)	41.0	18.3	0.36
1972	62.0	35.3	137.0(46)	41.1	13.7	0.28
1973	49.0	25.7	146.0(34)	72.8	20.3	0.44
1974	81.0	32.5	194.0(53)	91.8	24.0	0.42

Contd..

Contd...

Table 3.20

Year	Output (Rs million) Current Prices	Output (Rs million) 1961-62 Prices	Installed Capacity (Rs million) Current Prices	Imports (Rs million) Current Prices	Imports (Rs million) 1958 prices	Imports Domestic Availa- bility
1975	177.0	62.0	357.0(50)	69.4		
1976	150.0	51.9	357.0(42)			
1977	134.0	45.7	357.0(38)	182.2	88.4	0.66
1978	255.0	81.6	410.0(62)	194.6	89.7	0.52
1979	274.0	74.7	410.0(67)	207.6	70.6	0.49

Source: Output and Installed capacity - Annual Reports of the Ministry of Commerce and Industry - D.G.T.D. Annual Reports.

-Centre for Monitoring Indian Economy

-Production and Capacity utilisation in 620 Industries 1970-79.

Imports-Basic Statistics Relating to the Indian Economy - various Issues.

Notes: Output at current prices are deflated using the Economic Advisor's Wholesale Price Index of Non-electrical Machinery (1961-62=100). Imports at Current prices are deflated using the Import price Index of Machinery and Equipment (1958=100) provided by the Ministry of Commerce. Imports refer to financial years. Figures in brackets indicate capacity utilisation rates.

Table 3.21 Trends in the Tractors and Harvestors In

Year	Output (thousand nos)	Installed capacity (thousand nos)
1955		
1956		
1957		
1958		
1959		
1960	0.8	
1961	0.2	
1962	1.6	
1963	1.6	
1964	2.7	
1965	6.3	11.0(57.3)
1966	7.6	24.5(31.0)
1967	10.5	24.5(42.9)
1968	13.8	24.5(56.3)
1969	18.1	24.5(73.9)
1970	19.9	30.0(66)
1971	16.5	33.0(50)
1972	18.3	42.5(43)
1973	23.5	41.4(57)
1974	29.1	50.0(58)

Contd..

Contd..

Table 3.21

Year	Output (thousand nos)	Installed capacity (thousand nos)
1975	32.4	52.9(75)
1976	36.7	48.8(65)
1977	34.7	53.4(65)
1978	53.0	58.9(90)
1979	60.1	58.9(108)

Source: Output and Capacity - Annual Reports of the
Ministry of Commerce & Industry. D.G.T.D.
Annual Reports.
Centre for Monitoring Indian Economy.
Production and Capacity Utilisation in
620 Industries 1970-79.
Figures in brackets indicate capacity
utilisation rates.

Table 3.22 Rates of Growth of output of some Important Industries in the Capital Goods Sector for the Sub-periods (1955 to 1965) and (1966 to 1979)

Industry	Rate of growth of output	
	1955-1965	1966-1979
Tea Machinery	6.4	-0.5
Oil Mill Machinery	10.4	-4.5
Sugar Mill Machinery	31.8	3.24
Textile Machinery	19.3	5.9
Wagons	9.7	-3.2
Locomotives	(1957-65) 1.2	-0.08
Commercial Vehicles	12.5	2.1
Automobiles	10.2	0.3
Diesel Engines	20.7	2.1
Coal	5.9	3.9
Cement	8.3	4.2
Finished Steel	15.4	4.8
Machine Tools	32.1	6.8
Ball & Roller Bearings	20.5	8.9
Electric Motors	17.1	6.4
Power Transformers	17.8	12.1
Power Driven Pumps	17.1	1.2

Contd..

Contd..

Table 3.22

Industry	Rate of growth of output	
	1955-1965	1966-1979
Air & Gas Compressors	24.0 (1959-65)	5.8
Chemical Machinery	36.4 (1958-65)	10.3 (1966-78)
Paper Machinery	17.6 (1961-78)	
Tractors & Harvestors	26.5% (1961-78)	

Notes: For convenience, table 3.22 presents the fitted growth rates of output for various industries in one place. These rates of growth of output are calculated from the data provided in Tables 3.1 to 3.21.

Consumer Goods Machinery

In this category, we consider some of the main industries manufacturing machinery for the consumer goods sector, and these, as will be shown below, exhibit a similarity in the growth pattern over the entire period under consideration. It can be seen from Table 3.22, that the fitted rate of growth for the output of tea machinery between 1955 and 1965 was 6.4% per annum. This fell sharply after the mid-sixties, and the rate of growth achieved between 1966 and 1979 was a negative 0.5% per annum. Again, Table 3.22 shows that between 1955 and 1965, the annual rate of growth of production of oil mill machinery was 10.4%, which decelerated very sharply to a negative 4.5% between 1966 and 1979.

Production of sugar mill machinery on the other hand, grew extremely fast at 31.8% per annum between 1955 and 1965, which decelerated, as can be seen from Table 3.22, to 3.2% per annum between 1966 and 1979. As can be seen from Table 3.3, the high rates of growth prior to the mid-sixties occurred in a situation of a steep decline in import dependence. While the ratio of imports to domestic availability was 0.81 in 1957-58, by 1965-66, this ratio had declined to 0.04, indicating that the process of import-substitution in sugar mill

machinery was completed by 1965.

The growth pattern of textile machinery follows a slightly different pattern from the rest of the industries in this sub-group. Between 1955 and 1965, the output of textile machinery grew at 19.3% per annum, but declined to 5.9% per annum between 1966 and 1979. This rate of growth in the latter phase, it should be noted, is much higher than the rates of growth achieved after the mid-sixties by the other industries in this sub-group. Table 3.4 shows a decline in the level of import dependence prior to the mid-sixties in the case of textile machinery also. While the ratio of imports to domestic availability was 0.55 in 1960, this fell to 0.36 in 1965. However, this declining trend in imports continued in the latter half of the sixties, and by 1970 this ratio was 0.09. That is, in the case of textile machinery, the process of import-substitution, unlike in the case of sugar mill machinery continued till 1970.

These examples show, that the category "consumer goods machinery" of the capital goods sector, had a marked deceleration in the rate of growth of output after the mid-sixties, the only exception being textile machinery which achieved relatively higher rates of growth during this period.

Transport Equipment:

The transport equipment component of the capital goods sector can be further sub-divided, in terms of industries connected with railways, and those connected with road transport. From Table 3.22, it can be seen that between 1957-58 and 1965-66 output of wagons grew at 9.7% per annum, which decelerated very sharply to a negative 3.2% between 1966-67 and 1979-80. While the import of wagons at 1958 prices was Rs. 470.5 million in 1957-58, this fell as can be seen from Table 3.5, to Rs. 76.8 million in 1966-67, indicating a process of import-substitution during this period.

Table 3.22 shows that the locomotive industry exhibits a distinctly different trend from most of the other industries in the capital goods sector. Output of locomotives (in numbers) registered an annual rate of growth of only 1.2% between 1955-56 and 1965-66, which is very much lower than the rates of growth achieved in the rest of the industries, in spite of its almost negligible development in the pre-independence period. However, this could partly be because, the figures as shown in Table 3.6 are in numbers, which cannot capture the changes in the value of output arising due to shifts from steam to diesel locomotives. Between 1966-67 and 1979-80, the rate of growth of output of

locomotives decelerated to a negative 0.03% per annum.

Output of commercial vehicles (passenger buses and trucks) grew at an annual rate of 12.5% between 1955 and 1965, which decelerated to 2.1% between 1966 and 1979. Table 3.7 shows substantial fluctuations in the imports of commercial vehicles in the entire period under consideration, though the magnitude of the imports themselves have not been very significant, reflecting probably the nature of imports, the function of which was to meet fluctuations in domestic demand. Table 3.22 shows that between 1955 and 1965, output of automobiles grew at 10.2% per annum which decelerated sharply to 0.3% per annum between 1966 and 1979. Table 3.8 indicates a substantial degree of import dependence in this industry in the entire period under consideration.

It can be seen from Table 3.22, that the output of diesel engines grew at a compound annual rate of 20.7% between 1955 and 1965, which decelerated to 2.1% per annum between 1966 and 1979. Though there was a steep decline in the rate of growth of output of this industry after the mid-sixties, there was more than full capacity utilisation in the five years after 1965. However, this was followed by the emergence of unutilised capacity

averaging about 60% in the latter half of the seventies.

Thus it can be seen that the category "transport equipment" of the capital goods sector had a drastic decline in the rate of growth of output after the mid-sixties. Within transport equipment, the industries connected with railways show a much steeper fall (in fact negative rates of growth) than those of the industries connected with road transport. Not only did the industries connected with railways show a sharper deceleration after the mid-sixties, but the rates of growth of output achieved prior to the mid-sixties were also relatively lower than those of the industries connected with road transport.

Basic Intermediates:

Most of the basic intermediate goods industries, show a similarity in the growth pattern, which is a slower rate of growth of output than the machinery and equipment component of the capital goods sector prior to the mid-sixties, and a slower deceleration in the rate of growth of output in comparison to the machinery and equipment component in the post mid-sixties phase.

Table 3.22 shows that some of the important items in this category such as coal, cement and finished steel had an annual rate of growth of output of 5.9%, 8.3% and

15.4% respectively between 1955 and 1965. In the period after the mid-sixties, the rate of growth of output in these industries slowed down to 3.9%, 4.2% and 4.6% respectively.

Other Machinery*

This loosely termed category "other machinery", includes the rest of the industries in the capital goods sector. Table 3.22 shows that machine tools, which is most basic to any programme of machine building had a very high rate of growth of output of 32.1% per annum between 1955 and 1965. This decelerated to 6.8% per annum between 1966 and 1979. As can be seen from Table 3.13, the fall in the rate of growth of output after the mid-sixties coexisted with considerable excess capacity, averaging 50% in the five years after 1965, though the capacity utilisation rates improved towards the latter half of the seventies, when it averaged almost 80%. The machine tool industry was characterised by a considerable degree of import dependence in spite of a continuous process of import-substitution throughout the period under consideration. While the ratio of imports to domestic availability for machine tools was 0.90 in 1957, this declined to 0.55 in 1965 and further to 0.32 in 1979.

Table 3.22 shows that ball, roller and tapered bearings grew at a compound annual rate of 20.5% between

1955 and 1965, which declined to 8.9% between 1966 and 1979. However, it can be seen from Table 3.14, that this decline in the rate of growth of output after the mid-sixties was largely a low base effect. Also, Table 3.14 shows that the imports of ball, roller and tapered bearings at constant prices showed no declining trend between 1957 and 1974, in fact it showed a sudden spurt upwards towards the end of the seventies. The import trends, along with a situation of almost full capacity utilisation after the mid-sixties, suggests a relatively buoyant demand situation for the ball, roller and tapered bearings industry during this period.

Table 3.22 shows that between 1955 and 1965, electric motors and power transformers grew at 17.1% and 17.8% per annum respectively. Between 1966 and 1979, the rates of growth of output for these two items were 6.4% and 12.1% respectively. While there was full capacity utilisation for both electric motors and power transformers in the latter half of the sixties, by the end of the seventies excess capacity emerged for both the industries. Tables 3.15 and 3.16 show that the import trends in both these industries are also similar, with no perceptible declining trend in real terms between 1957 and 1974.

Contrary to the other industries of this sub-group, output of power driven pumps exhibit a very steep decline in the rate of growth after the mid-sixties. It can be seen from Table 3.22, that between 1955 and 1965, output of power driven pumps grew at 17.1% per annum, which decelerated to 1.2% between 1966 and 1979. However, as Table 3.17 shows, this steep deceleration in the rate of growth of output of power driven pumps after the mid-sixties, coexisted with high degrees of capacity utilisation.

Industries which came into production well after the Second Plan got going, are in fact the most dynamic elements in the capital goods sector. Table 3.22 shows, that the output of air and gas compressors grew at 24.0% per annum between 1959 and 1965, which declined to 5.8% per annum between 1966 and 1979. Also, between 1958 and 1965, output of chemical machinery grew at 36.4% per annum, which declined to 10.3% between 1966 and 1978. However, as Table 3.18 and 3.19 show, the very high rates of growth of output in these two industries prior to the mid-sixties, is partially due to a low base effect.

Table 3.22 shows that between 1961 and 1978, output of paper machinery grew at a compound rate of 17.6% per annum. Table 3.20 shows, that while there was a fall in the ratio of imports to domestic availability from 0.99 in

1960 to 0.54 in 1965, thereafter there was no perceptible falling trend in the ratio of imports to domestic availability. By 1979, this ratio stood at 0.49 for paper machinery. The capacity utilisation rates for paper machinery show considerable fluctuations in the period after the mid-sixties.

Table 3.22 shows that the output of tractors and harvestors grew at a compound annual rate of 26.5% between 1961 and 1978. Between 1966 and 1979, the rate of growth of output works out to 16.2% per annum. Table 3.21 shows, that while the capacity utilisation rates for tractors and harvestors was not very high between 1965 and 1974, the latter half of the seventies was characterised by high levels of capacity utilisation.

Thus, it can very clearly be seen that the category "other machinery" constitutes the most dynamic component of the capital goods sector. Most of these industries, whose production started well after independence, not only had very high rates of growth of output in the pre-mid-sixties phases (though this has to be partly qualified by the low initial base from which most of these industries started), but also continued to achieve reasonable rates of growth of output after the mid-sixties. Most of these industries were also characterised by a considerable degree

of import dependence and relatively higher rates of capacity utilisation in relation to the rest of the capital goods sector after the mid-sixties.

That is, this section shows certain clear trends in the growth pattern of different industries in the capital goods sector in the period under consideration. The category "consumer goods machinery", on the whole, exhibits a steep fall in the rate of growth of output after the mid-sixties. The category "transport equipment" of the capital goods sector had a marked deceleration in the rate of growth of output after the mid-sixties. Within transport equipment, the industries connected with railways show a much steeper deceleration (in fact negative rates of growth) than those of the industries connected with road transport. Also, the rates of growth of output of the industries connected with railways were relatively lower than those of the industries, connected with road transport, even prior to the mid-sixties. While output of basic intermediates grew at a slow rate prior to the mid-sixties, the deceleration in the rate of growth of output thereafter, was not very marked, so that the rates of growth of output of basic intermediates after the mid-sixties was relatively higher than that of "machinery and equipment", as a whole. As already pointed out above, the category "other machinery" has been the most dynamic component of the capital goods

sector, both in terms of the rates of growth of output achieved prior to the mid-sixties, as well as thereafter.

Section-2. This section attempts an analysis of the reasons for the divergent trends within the capital goods sector, in a situation of a general decline in the rates of growth of output of the sector as a whole after the mid-sixties. The explanatory analysis of the trends in individual industries offered here, is not exhaustive for obvious reasons, and only an attempt is made to focus on certain crucial factors, based on the data provided in section-1 of this Chapter, which have influenced the growth pattern of particular industries.

The divergent output trends in the individual industries of the capital goods sector, are sought to be linked to the diversity in demand conditions for different industries of this sector. In order to do this, an attempt is made to capture the "market situation", at a general level, for different industries or sub-groups within the capital goods sector, which prompted differing output responses. This "market-based" hypothesis would be applicable to the entire capital goods sector, in spite of the substantial participation of the public sector in the manufacture of capital goods, because the output response of the public sector units, as in the case of the private

sector, is also largely demand determined. This is because, in the absence of complete centralised target fixation, the only criterion by which the public sector units can decide on their levels of output, would be through the market signals. An explanatory hypothesis for the divergent trends in the different industries of the capital goods sector is attempted below.

Firstly, in the category "consumer goods machinery", given the absence of adequate data for tea and oil mill machinery, it is not possible to fully account for the particular pattern of growth noted in the previous section. The high rate of growth of output of 31.5% per annum between 1955 and 1965 in sugar mill machinery, was largely due to the rapid rate at which import-substitution took place in this industry during this period, as is brought out by Table 3.3. Given the fact that the process of import-substitution was completed by the mid-sixties, and there was no major acceleration in the rate of growth of output of the consuming industry (i.e. sugar), there was no stimulus for further continuing a high rate of growth of production of sugar mill machinery, and the rate of growth of output fell steeply.

The reasons for the high rates of growth of textile machinery in relation to the rest of the industries of this sub-group after the mid-sixties, in spite of the completion

of the import-substitution process by 1970, are the following. Firstly, the relatively higher rates of growth of output after the mid-sixties was a consequence of technological changes which occurred in textile machinery. This was especially so in the case of processing machinery, whose technological structure changed in response to the demand for colourful and fancy textiles, and provided a stimulus for growth during this period. In fact, the share of more expensive machinery within processing machinery increased from 40% in 1964 to 64% by 1969.⁵¹ Secondly, the sharp spurt in exports of textile machinery during this period also provided a stimulus for the relatively higher rate of growth of output after the mid-sixties. Table 3.23 shows that between 1966 and 1976, exports of textile machinery increased at an extremely rapid rate of 27.8% in constant prices. The high rates of growth of exports in this period was a consequence of the low prices of textile machinery (40% below international prices) and short delivery dates.⁵² This spurt in exports was largely confined to spinning machinery because of its more current design in relation to weaving and processing machinery,⁵³ which is reflected by the fact that between 1969 and 1979, output of spinning machinery grew at 25.1% per annum in current prices. That is, the combination of all these factors is likely to have provided the stimulus for a relatively higher rate of growth of output in this industry after the mid-sixties.

The reason for the relatively low rates of growth in industries connected with railways, prior to the mid-sixties, could possibly be linked to the fact that prior to the Second Plan, the industries connected with railways were relatively better developed than the rest of the machinery and equipment component of the capital goods sector. This fact has already been pointed out in Chapter I. Therefore, there was no reason to accelerate the rates of growth of industries connected with railways, as fast as the industries connected with road transport, during the Second and Third Plans. Given the significant role that the public sector played in the development of transport, the very sharp decline in the rates of growth of output of transport equipment, was because of a steep decline in the rate of growth of public investment. This was specially so in the case of railways. The share of railways in the net domestic capital formation of the public sector declined from 16.1% in 1961-62 to 13.9% in 1965-66 and more steeply to 7.5% by 1970-71. This declining trend continued and, by 1975-76, investment in railways constituted a mere 4.1% of the net domestic capital formation of the public sector.⁵⁴

The reason for the fall in investment in railways and consequently, the lower rates of growth of output of the

Table 3.23 Exports of Textile Machinery and Production of Spinning Machinery

Year	Exports of textile machinery (Rs million) (1958 prices)	Production of spinning machinery (Rs million) Current Prices
1966	4.5	-
1967	9.7	-
1968	17.9	-
1969	57.8	106.0
1970	60.3	151.6
1971	53.5	167.3
1972	36.4	146.5
1973	26.3	218.8
1974	91.2	462.8
1975	NA	549.0
1976	52.2	617.0
1977	..	523.9
1978	..	727.8
1979	..	994.4

Source: Exports: Handbook of Statistics on the Cotton Textile Industries (11th edition).

Production: Indian Textile Bulletin - Various Issues.

Table 3.24 Freight Traffic (billion ton kms)

Year	Railways	Road
1960-61	87.7	35
1961-62	91.2	40
1962-63	100.7	44
1963-64	106.8	47.5
1964-65	106.6	51
1965-66	116.9	55
1966-67	116.6	56
1967-68	118.9	59
1968-69	125.1	64
1969-70	128.0	65
1970-71	127.4	66
1971-72	133.2	66
1972-73	136.5	67
1973-74	122.4	67
1974-75	134.3	71
1975-76	148.3	73
1976-77	156.8	76

Source: National Transport Policy Committee -
Planning Commission.

industries connected with railways in relation to those connected with road transport after the mid-sixties, could probably be related to the nature of demand for transport equipment, which is a derived demand, depending on movements in freight traffic. It can be seen from Table 3.24, that while railway freight traffic grew at the compound annual rate of 2.96% between 1960-61 and 1976-77, road freight traffic grew at the compound annual rate of 4.18% between 1960-61 and 1976-77, largely because of the greater efficiency of road transport for short distance freight movements. That is, the faster rate of growth of demand for road transport equipment, most likely accounts for the relatively better performance of industries connected with road transport, in comparison with those connected with railways.

The relatively higher rates of growth of output of basic intermediates, especially cement and steel after the mid-sixties, noted in the previous section, is again linked to the buoyant demand situation for these industries. This buoyant demand situation arose due to two factors. This is firstly because, as was pointed out earlier, of the total rate of gross capital formation in the economy, the rate of gross capital formation in the household sector showed the greatest increase after the mid-sixties. Also this increase

in the rate of capital formation in the household sector after the mid-sixties, took place essentially under capital formation in construction and within construction under "pucca construction" (as distinguished from Kutchha construction).⁵⁵ Consequently, this pattern of capital formation in the household sector led to a spurt in demand for some of the main basic intermediate goods.

Secondly, as noted in Chapter II, the rate of growth of capital formation in government administration had a less steep fall than the rate of growth of gross capital formation in non-departmental undertakings after the mid-sixties. Since much of the physical capital formation, especially in government administrative departments consists of the construction of houses and other buildings which create a demand for cement, steel, structurals etc.,⁵⁶ this gave an added stimulus for a relatively higher rate of growth of output in some of these basic intermediates after the mid-sixties.

As far as the category "other machinery" is concerned, this had very high rates of growth of output prior to the mid-sixties, largely because most of these industries started from a very low base at the time of the Second Plan. However, the reason why most of these industries exhibited relatively higher rates of growth of output after the

mid-sixties, is because of a buoyant demand situation facing this category, which is reflected from the trends in capacity utilisation and imports shown in Section-1. For example, the demand stimulus for machine tools after the mid-sixties, arose both due to a continuous process of import substitution, as well as the technological diversification during this period, about which more will be said in the next Chapter. Again, ball and roller bearings had high levels of capacity utilisation after the mid-sixties, as well as a spurt in imports, which implies a growing demand situation for this industry during this period. Electric motors and power transformers also show a similar trend in imports and capacity utilisation, which could probably account for the relatively better performance of these industries after the mid-sixties. The high rate of growth of output of tractors and harvestors after the mid-sixties, is very clearly linked to what has been identified as the "intensive phase" of growth in agriculture during this period, which necessitates a high level of demand for these items.

That is, the divergent trends in individual industries in the capital goods sector, seems largely a reflection of the state of the market for each individual industry.

Footnotes and References

51. IBRD: India-Survey of the Textile Machinery and Cotton Textile Industries, p. 18.
52. IBRD: India, Part I, p. 4.
53. IBRD: India, Part I, p. 11.
54. National Accounts Statistics - Various Issues.
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CHAPTER - IV

CHANGES IN THE TECHNOLOGICAL STRUCTURE OF THE MACHINE
TOOL INDUSTRY IN INDIA

As was pointed out in the introduction, a distinctive contribution of Mahalanobis was his emphasis on the need to keep the price of capital goods low, in order to achieve rapid industrialisation. In dealing with this aspect, his attention was focused, especially on those capital goods furthest removed from the production of consumer goods.⁵⁷ This emphasis, as was pointed out earlier, implied the conception of a crucial relationship between technological change and the capital goods sector, and especially the need for achieving rapid technological progress through extensive automation in the machine tool industry, which is basic to any programme of development of the capital goods sector. Therefore, in order to focus on this important relationship, this Chapter briefly describes the changes in the technological structure of the machine tool industry in India. This makes it possible, to empirically verify the extent of the technological transformation in this industry.

However, before empirically tracing the scope of the technological changes in the machine tool industry in India, it may be useful, to outline at the outset, the broader context in which these changes occurred. The technological structure of the machine tool industry in India underwent a diversification in the context of two important trends, which have already been noted. Firstly, the growth trends in the capital goods sector analysed in the previous Chapters, indicate a diversification of the structure of the capital goods sector after the mid-sixties, due to a faster rate of growth of what we have called the category "other machinery", in relation to "transport equipment" and "consumer goods machinery". These changes in the industrial structure within the capital goods sector, with the production of more complicated machines, required greater sophisticated machining operations, for which it became necessary to have a simultaneous technological diversification of the machine tool industry.

Secondly, machine tools are not only necessary for the manufacture of components of all capital goods, and for the maintenance of machines, but are also used for the direct manufacture of consumer goods of the engineering variety.⁵⁸ Given a relatively faster rate of growth of consumer durables after the mid-sixties, it was necessary to diversify the

technological structure of the machine tool industry, especially in a situation, where sophisticated consumer durables requiring precision finishes came into being.

The precise nature of the changes in the technological structure of the machine tool industry in response to the broader changes in the industrial structure in the period under consideration are discussed below.

It can be seen from Table 4.1, which provides a break up of the technological structure of the machine tool industry, that lathes constituted 48.47% of the total production of machine tools in 1963. This however, decreased to 36.2% in 1965, and further to 33.71% in 1975, though by 1979, the production of lathes as a percentage of total machine tool production went up to 41.06%. The basic function of the lathe is 'turning' which is a machining process for generating external cylindrical forms by removing metal, usually with a single point cutting tool. However, similar operations can be done much faster by capstan and turrets, because it simultaneously brings four tools into cutting position. Automatics also perform similar operations, and do so much faster and more efficiently than the lathe and the turret, because they complete the machining cycle automatically and operator fatigue and error are considerably reduced. Moreover, during the automatic machining operation, the operator is free

Table 4.1 Technological structure of the Machine Tool Industry in India.

(Figures represent the percentage of each item to total machine tool production)

	1963	1965	1971	1975	1979
Automatics	0.00	1.18	0.32	3.80	6.56
Boring	0.14	0.14	0.54	1.22	1.07
Broaching	0.00	0.00	0.18	0.13	0.09
Drilling	13.49	20.15	16.00	19.18	13.46
Gear Cutting	0.00	0.02	0.79	0.64	0.89
Grinding	11.33	13.13	15.54	13.26	7.86
Lapping, honing & Polishing	0.47	0.29	0.44	0.66	0.32
Capstan and turrets	0.88	1.78	5.15	3.50	5.27
Lathes	48.47	36.21	30.29	33.71	41.06
Milling	6.35	8.96	6.83	7.58	10.26
Planing	1.16	1.01	0.34	0.16	0.07
Presses	5.76	6.39	7.76	5.04	3.33
Sawing	4.28	3.55	3.26	2.63	2.02
Shaping	4.52	4.66	3.89	2.44	2.18
Shearing & Sheet metals	2.18	1.26	2.67	2.12	1.60
Slotting	0.73	0.55	0.24	0.24	0.33
Screwing & threading	0.00	0.19	0.14	0.65	0.53
Hammer	0.23	0.32	0.28	0.57	0.20
Tapping	0.00	0.00	NA	NA	NA
Bending	0.00	0.05	NA	NA	NA
Reaming	0.00	0.00	NA	NA	NA
Machine Tools CNES	0.00	0.16	1.82	2.47	2.88

Source: Indian Machine Tool Manufacturer's Association
 Various Annual Reports.
 (IMTMA data collected from D.G.T.D.)

to operate another machine, or is permitted to inspect the completed parts without loss of time.⁵⁹

Unlike lathes, both capstan and turrets and automatics constituted a negligible proportion of the total production of machine tools during the mid-sixties. In 1963, the production of capstan and turrets constituted a mere 0.88% of the total production of machine tools, which however, increased to 1.78% by 1965. On the other hand, automatics were non-existent in 1963, though by 1965, production of automatics constituted 1.48% of the total production of machine tools. This situation however, changed after the mid-sixties, and by 1979, the production of capstan and turrets and automatics, constituted 5.27% and 6.56% of the total production of machine tools respectively.

That is, prior to the mid-sixties, when there was a rapid increase in the production of machine tools, the basic operation of "turning" was carried out predominantly by lathes, which could not however, perform more complex operations with the requisite speed and efficiency of automatics and capstan and turrets. It was only after that, when the rate of growth of output of machine tools had decelerated sharply, that there was technological diversification^s for the "turning" operation, with lathes being replaced to an increased extent by capstan and turrets and automatics.

The process of circular hole making, or 'internal turning' can be done by three types of machines. These are, drilling, boring and reaming machines. The simplest type of machine which performs this operation is the drilling machine. On the other hand, boring machines and automatic drilling and precision drilling machines are essentially used for heavy production. Reaming, which is a process of hole enlarging, usually used for producing an accurate hole with good surface finish, requires the most technologically sophisticated machines in this related set of operations.⁶⁰

From Table 4.1, it can be seen that the production of drilling machines predominated throughout the period. In 1963, production of drilling machines constituted 13.49% of the total production of machine tools and this proportion increased to 20.15% in 1965. By 1979, production of drilling machines still accounted for 13.46% of the total production of machine tools. Production of boring machines accounted for a mere 0.14% of the total production of machine tools in 1963 and 1965, which however, increased to 1.07% in 1979. Reaming machines on the other hand, were completely non-existent in the period prior to the mid-sixties, and no data are available for the later period. That is, in the

process of 'internal turning', or hole making, the machine tool industry both prior to the mid-sixties, and even after, was predominated by the technologically simpler tools.

The process of metal removal, to produce flat surfaces on horizontal, vertical and angular planes can be done by shaping, slotting, milling, planing and broaching machines. Table 4.1 shows that in 1963 and 1965, the production of shaping, slotting, milling and planing machines together accounted for 12.76% and 15.18% of the total production of machine tools respectively. By 1979, they constituted 12.84% of the total production of machine tools. On the other hand, broaching which is a high production metal removal process, which can machine both simple surfaces and complex contours, produce precision finishes and eliminate the need for highly skilled machine operators,⁶¹ did not exist at all, both in 1963 and 1965. Even in 1979, production of broaching machines constituted a mere 0.09% of the total production of machine tools.

Grinding or abrasive machining refers to^a process of material removal in the form of small chips, by the mechanical action of irregularly shaped abrasive particles, that are used loose in bonded wheels or coated belts. Grinding is a precision finishing process for producing smooth surfaces with close tolerances.⁶² The production of grinding machines

constituted 11.33% of the total production of machine tools in 1963, which increased to 13.13% in 1965 and further to 15.54 of the total production of machine tools in 1971. However, by 1979, the production of grinding machines as a percentage of the total production of machine tools dropped sharply to 7.86%.

Further smoothening operations are usually needed after grinding and this is done by honing, lapping and polishing machines. Honing is a low-velocity abrading process, using bonded abrasive sticks for removing stock from metallic and non-metallic surfaces. As one of the last operations performed on the surface of a part, honing generates functional characteristics specified for a surface and involves the correction of errors resulting from previous operations.⁶³ Polishing produces a highly water-resistant surface on any reasonably symmetrical part. The object of superfinishing is to remove surface fragmentation or smear metal, to correct inequalities in geometry such as grinding flats and to restore surface integrity by eliminating stresses and burns.⁶⁴ Lapping is a final finishing operation which results in four major refinements in the workpiece: (a) extreme accuracy of dimension; (b) correction of minor imperfections of shape; (c) refinement of surface finish; (d) close fit between mating surfaces. Lapping greatly increases the life of moving parts

which are subject to wear and tear, by eliminating the hills and valleys and creating a maximum percentage of bearing area.⁶⁵

In spite of the need for precision finishing touches in the manufacture of sophisticated machinery for heavy industrial production, the indigenous production of lapping, honing and polishing machines have constituted a tiny fraction of the total production of machine tools throughout the period under consideration. The production of these machines which constituted 0.47% of the total production of machine tools in 1963, fell to 0.29% in 1965. By 1979 they constituted a mere 0.32% of the total production of machine tools. Consequently, even after the mid-seventies, India was importing more of these machines than what was produced indigenously.⁶⁶

Most metals have adequate ductility at room temperature and hence conventional bend forming can be applied to form these metals to the required manufacturing tolerances. However, sophisticated bending machines are required for some of the high strength alloys and refractories which do not have adequate ductility at room temperature and which must be formed at high temperature.⁶⁷ Table 4.1 shows that while bending machines did not exist at all in 1963,

they formed a mere 0.05% of the total production of machine tools in 1965. The data on bending machines for the later period is not available.

Before a flat-rolled coil or sheet metal can be cold worked, it must be cut to size. This can be done either by shearing machines or gear cutting machines. Shearing is a method of cutting by forcing two offset blades in opposite directions against the material to be cut, the two opposing forces being propelled by mechanical or hydraulic power. Gear cutting machines, on the other hand, are automated in their cutting operations and can also be used for a wide variety of operations in combination with other tools.⁶⁸ It can be seen from table 4.1, that while the production of shearing and sheet metal machines constituted 2.18% of the total production of machine tools in 1963, gear cutting machines did not exist at all during this period. However, by 1979, while the production of shearing and sheet metal machines declined to 1.60% of the total production of machine tools, the production of gear cutting machines had been underway, and in fact accounted for 0.89% of the total machine tool production in 1979.

Power presses are commonly used in the cold working of metals and many non-metallic products. These machines are capable of imposing compressive stresses on the workpiece material, in the amount, location, direction and for the

period of time needed to accommodate the specified operation.⁶⁹ Unlike other items, India was well endowed, even in the initial phases of planning with pressing machines. It can be seen from Table 4.1 that the production of presses accounted for 5.76% and 6.39% of the total production of machine tools in 1963 and 1965 respectively. This however, declined to 3.33% in 1979.

The above picture of the technological structure of the machine tool industry in India suggests, that in the period when the output of machine tools had a rapid rate of growth, the technological basis of the industry was pre-dominanted largely by the relatively simpler tools. However, with the deceleration in the rate of growth of output of machine tools after the mid-sixties, there was a slight technological diversification towards relatively more sophisticated machines.

However, even this level of disaggregated data on machine tools does not provide a complete picture of the changes in the technological structure of this industry in India, since our data do not capture the technological changes in each item over a period of time. For instance, a beginning has recently been made in highly developed technologies such as numerical controls, digital readouts,

programme controllers, electrical and electronic controls etc.⁷⁰ The application of these processes in the machine tool industry greatly enhances the productivity of even basic tools such as lathes. These developments as the indirect evidence indicates, have been incorporated increasingly in the machine tool industry after the mid-sixties. For instance, while the data does not distinguish between high priced and low priced machine tools, it was found through various studies, that unlike in recent years, the average price of domestic machines in the sixties was less than half the average price of imported ones,⁷¹ reflecting obviously the predominance of the simpler machine tools during this period. This goes to show that the technological diversification in the machine tool industry after the mid-sixties, is not adequately captured by even the disaggregated data which we have used, and on all accounts, it is likely to have been more than what is indicated by the data.

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CHAPTER - V

SUMMARY AND CONCLUSION

This Chapter summarises, on the basis of the findings of the previous Chapters, the dynamics of the growth process of the capital goods sector in India, since the launching of the Mahalanobis' strategy of industrialisation during the Second Plan.

Firstly, the growth trends in the capital goods sector since the Second Plan, can be broken into two distinctive phases - the period prior to the mid-sixties and the period after the mid-sixties. While the first phase was characterised by high rates of growth of the output of the capital goods sector, there was a sharp deceleration in the rates of growth of output after the mid-sixties. Within the capital goods sector, the performances of the machinery and equipment and basic intermediary components exhibit certain divergent trends. The machinery and equipment component of the capital goods sector had a much sharper fall in the rate of growth of output and for lower levels of capacity utilisation than the basic intermediary component of the capital goods sector after the mid-sixties.

A further sub-division of the capital goods sector based on certain functional characteristics reveals certain interesting trends. While the category "consumer goods machinery" had high rates of growth of output prior to the mid-sixties, this decelerated sharply thereafter. The category "transport equipment" also had a marked deceleration in the rate of growth of output after the mid-sixties. Within transport equipment, the industries connected with railways show a much steeper deceleration (in fact negative rates of growth of output) than those of the industries connected with road transport. Also, the rates of growth of output of the industries connected with railways were relatively lower than those of the industries connected with road transport, even prior to the mid-sixties. While output of basic intermediates grew at a slow rate prior to the mid-sixties, the deceleration in the rate of growth of output thereafter was not very marked, so that the rates of growth of output of basic intermediates after the mid-sixties was relatively higher than that of "machinery and equipment" as a whole. The category "other machinery", which basically consists of the components "machinery other than electric" and "electrical machinery", has been the most dynamic component of the capital goods sector, in terms of achieving relatively higher rates of growth of output, both prior to the mid-sixties and thereafter.

It has been argued, that the deceleration in the rate of growth of output of the capital goods sector is related firstly, to the exhaustion of the import-substitution process in some of the important industries of the capital goods sector after the mid-sixties. Secondly, and more importantly, the slowing down of the rate of growth of output of the capital goods sector after the mid-sixties is linked to the changes in the structure of investment, in the economy. It has been pointed out, that the rate of growth of public investment had to be cut back after the mid-sixties, in order to minimise the possible inflationary consequences on wage-goods, of an increase in the rate of growth of household investment. Since household investment is not as "material intensive" as public investment (especially investments in departmental and non-departmental undertakings), the increase in the rate of growth of household investment after the mid-sixties, could not fully compensate for the decline in the rate of growth of demand for the output of the capital goods sector, arising from a decline in the rate of growth of public investment.

However, given the structure of additions to investment in the household sector after the mid-sixties, which essentially occurred in capital formation in construction, and within construction under "pucca construction" as

distinguished from "kutchha construction", which uses substantial quantities of basic intermediates such as steel, cement, etc., the increase in the rate of growth of basic intermediates was higher than the increase in the rate of growth of machinery and equipment arising as a consequence of the increased investment activity of the household sector during this period. Hence the differences in the rates of growth of output of basic intermediates and machinery and equipment after the mid-sixties.

The divergent output trends in the individual industries of the capital goods sector, have been linked to the diversity in demand conditions for different industries of this sector. It has been argued that this "demand-based" or "market-based" hypothesis would be applicable to the entire capital goods sector, in spite of the substantial participation of the public sector in the manufacture of capital goods, because the output response of the public sector units, as in the case of the private sector, is also largely demand determined.

Finally, the technological changes in the machine tool industry are considered, given Mahalanobis' conception of the need for cost reduction in this industry. It is argued, that the changes in the industrial structure

within the capital goods sector, with the production of more complicated machines, as well as the faster growth of technologically intensive consumer durables after the mid-sixties, required greater precision in machining operations and this induced technological changes in the machine tool industry towards greater sophistication.

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