THE PORTFOLIO BEHAVIOUR

OF

INDUSTRIAL CORPORATIONS

IN INDIA

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BY

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ABSTRACT

The study presents models of portfolio behaviour for four industries, viz., cotton textiles, sugar, transport equipment and nonelectrical machinery. The first two industries are consumer goods industries and produce to stock. The other two are capital goods industries and produce to order. The study uses econometric techniques to estimate influence of variables explaining changes in capital stock, inventories, accounts receivable, cash balances and government bonds and also the composition of liabilities (debt and equity).

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A COMPLETE LIST OF NOTATION

Symbol	Description	Stock or Flow
CP	Capacity utilization $\frac{(Q^t/NFA_{t-1})}{(Q_t/NFA_{t-1})_{Max}}$ Ratio of actual output per unit of capital to maximum output per unit of capital over the sample period)	ratio
DEBT	Total debt liabilities(TD + TDUE)	stock
DEPAC	Accumulated depreciation	stock
DEPFLO	Depriation flow (ΔDEPAC = DEPFLO)	flow
DIV	Dividends	flow
EQ	Paid-up capital(common and preferred)	stock
GFA	Gross fixed assets (NFA + DEPAC)	stock
GP	Gross profits (NP + DEPFLO + ΔTAXPRO)	flow
IF	Internal funds (DEPFLO + RTE +ΔTAXPRO)	flow
INT	Interest paid	flow
INV	Total inventories(INV^f + INV^r + INV^g)	stock
INV^f	Inventories of finished goods	stock
INV^g	Inventories of Goods-in-Process	stock
INV^r	Inventories of raw materials	stock
INV^{other}	Inventories of unclassified goods	stock

Symbol	Description	Stock or flow
K_t	Expenditure on labour and capital	flow
LD	Longterm debt outstanding	stock
MR	Utilization of raw materials	flow
M	Quantity of money(Currency plus total deposits)	stock
NFA	Net fixed assets (GFA - DEPAC)	stock
NP	Net profits (RTE + DIV)	flow
NW	Net worth (EQ + RS)	stock
OA	Other unclassified assets	stock
OL	Other unclassified liabilities	stock
OP	Orders placed for raw materials	flow
P^f	Price index of finished goods	
P^{is}	Index of prices of iron and steel manufacturers	
P^{mp}	Index of prices of metal products	
P^{rm}	Index of prices of raw materials	
Q	Output (SALE $+\Delta INV^f$ $+\Delta INV^g$)	
RC	Average rate of interest on debt outstanding (INT/TD)	
REC	Accounts receivable	stock
RG	Government bond yield	
RL	Prime Lending Rate	
RS	Reserves and Surplus	stock

Symbol	Description	Stock or flow
RTE	Retained earnings (NP-DIV)	flow
SALE	Sales income	flow
SD	Short-term debt outstanding	stock
SLRC	SALE * RC(Sales times interest rate)	
SLRL	SALE * RL(Sales times interest rate)	
SLTP	SALE * STP	
STP	Stock Price Index	
TA	Total assets	stock
TAXPRO	Tax provision outstanding	stock
TD	Total debt outstanding (SD+LD)	stock
TDUE	Trade Dues (Accouts payable)	stock
TGS	Total government and semi-goverment securities.	stock

(All stocks are year-end figures, the year extending from April 1 to March 31, Thus total assets at the end of 1950 will refer to total assets on March 31, 1951).

Superscripts

Symbol	Description
*	Desired quantitity(e.g.M* = desired quantity of (money
e	Expected quantity (e.g.$SALE^e$ = expected sales)

Introduction and Outline of the Study

This study presents models of portfolio behaviour of nonfinancial corporations in India. The industries selected for study are cotton textiles, sugar , transport equipment and nonelectrical machinery. The first two industries are consumer goods industries while the latter two are capital goods industries. Looked at another way, the first two industries produce to stock while the latter two produce to order.

The study was undertaken mainly for two reasons. First, econometric models of the Indian economy have generally ignored the role played by the nonfinancial corporate sector. In an economy dominated by agriculture and unorganised small businesses, the growth of the corporate sector occupies a unique position as an indicator of the growth of modern industry. Econometric models of the Indian economy have not explicitly recognized the role played by the corporate sector. Models of corporate portfolio behaviour presented in this study could be used as a part of an elaborate Brookings-type model of the Indian economy to show more clearly interactions between the various financial and real sectors. Second, existing models of nonfinancial portfolio behaviour have some unsatisfactory features which limit their usefulness as a guide to monetary and fiscal policies. The Dhrymes-Kurz model (1967) for the U.S. and the Sastry model (1967) for India are cases in point. These models and also our approach are briefly outlined below.

The models by Dhrymes-Kurz and Sastry lump together industries which are likely to differ in terms of elasticities of demand for their products, financing patterns and factors affecting fixed investment and inventories. The use of data aggregated over several industries is likely to be particularly unsatisfactory in the case of planned economies like India, where different industries are in different categories in terms of five year plan priorities and are, therefore, subject to different incentives and regulation. In this study, therefore, we have chosen four industries and estimated separate models to explain their portfolio behaviour.

Some dependent variables specified in existing models are defined in a way which is likely to result in misspecification. Sastry has, for example, specified an equation for the composite variable "change in debt net of the change in current assets (money, government bonds and accounts receivable"). In our models, we have specified four separate equations for changes in debt, money, government bonds and accounts receivable.

Additionally, unlike Sastry, we have used time series data and this has enabled us to assess the effects of hitherto neglected variables such as forecasting errors, interest rates, wholesale prices, capacity utilization rates and stock price indices. The data used in the study are available on an annual basis and cover the period 1950-68.

The plan of study is as follows:

Chapter I presents a brief review of India's experience with planned economic growth. The chapter also outlines the main features of government industrial policy.

Chapter II presents the basic balance-sheet and income-expenditure identities. The following identity has been used as a starting point:

The sum of changes in gross fixed assets, inventories, accounts receivables, money balances, government bonds and other assets equals the sum of changes in total debt (short debt plus long debt plus trade dues) and equity capital plus the difference between gross profits (net profits plus depreciation flow) and dividends.

Behavioural equations are specified for gross fixed investment, inventory investment, changes in current assets (receivables, money and government bonds,) the change in total debts, the change in equity capital and dividends. Gross profits are obtained as a residual.

Chapter 3 expounds the theoretical framework in the context of which hypotheses about individual assets and liabilities are developed in subsequent chapters. In particular, the alternative views of cost of capital advanced by Duesenberry-Lintner-Kuh on the one hand and Modigliani-Miller on the other are discussed. The chapter also outlines, using the models by Dhyrmes and Kurtz and Sastry as a backdrop, our approach in the present study. The approach is already briefly described above.

Chapters 4-7 develop hypotheses and estimate ordinary least squares equations for changes in various assets and liabilities.

Chapter 4 specifies and estimates demand for gross fixed investment. The investment function we have specified follows those used in the Brookings model and in Evans (1969). Thus, gross fixed investment is assumed to be determined by expected sales (represented by an exponentially declining weighted average of past sales), a modification variable represented either by capacity utilization or the stock price index, and variables describing the marginal cost of funds. The marginal cost of funds is represented by a combination of variables such as interest rates, lagged stock of debt outstanding and internal funds. Our results show that different sets of explanatory variables are needed to explain investment behaviour of different industries.

Chapter 5 presents and estimates inventory equations for the industries under study. The Reserve Bank of India has, rather inappropriately, classified inventories into "finished and semi-finished goods", "raw materials" and "others". Following the analysis in Abramovitz (1952), Stanback(1961) and Zarnovitz (1973), we have assumed that the category "finished and semi-finished goods" in the case of the two production-to-stock industries (cotton textiles and sugar) consists mainly of finished goods. In the case of the two production-to-order (PTO) industries, the category is assumed to be dominated by the semi-finished goods. For the PTS industries, therefore, demand functions for inventories of finished goods and raw materials are specified, the behaviour of the category "others" being explained by whichever of the two functions applies to the data better. Similarly, in the case of the PTO industries, demand functions for "semi-finished goods" and "raw materials" are specified, leaving the explanation of the category "others" to whichever of the two aforementioned functions satisfies the data best.

Production-to-stock inventories are assumed to have "planned" and "unplanned" components. Planned inventories are determined by expected sales (represented by current sales), price of the product and the rate of interest on borrowings. Unplanned (or unintended) inventories result from sales forecasting errors. The impact of the latter is measured by the coefficient of the variable "change in sales". Our estimated equations confirmed the significance of all these variables.

In postulating equations for PTO inventories we had to contend with the lack of data on new and unfilled orders. Our inventory equations for PTO industries assume that such industries can forecast, fairly precisely, sales on the basis of unfilled orders. Such industries are also assumed to be relatively free from unintended inventory changes. Our hypotheses are borne out in the case of one of the two PTO industries.

A more thorough analysis would be possible only upon the availability of data on new and unfilled orders.

Chapter 6 derives and estimates demand functions for current assets, viz. money, government bonds and accounts receivable. The change in the holding of each current asset is assumed to be determined by sales income, lagged stock of the asset and rates of return on alternative assets. Following De. Leeuw (1965) and Dhrymes-Kurz (1967), we have used changes in stocks of alternative assets as proxies for rates of return on these assets. Thus, the demand for money, for example, is explained by sales income, last year's money stock and changes in stocks of fixed capital, inventories, receivables and government bonds. Similar specifications are used in explaining demands for other current assets.

The evidence shows that sales income is an important determinant of demand for current assets. Another finding relates to the existence of asset substitution. The evidence seems to conform Tobin's hypothesis that substitution between current and liquid assets, is in general, more common than that between fixed and liquid assets.

Chapter 7 develops hypotheses and presents evidence on the dividend and external financing policies of industrial corporations. Dividend payments are assumed to depend upon past dividends, gross profits, availability of external funds and changes in stocks of fixed capital, inventories and receivables. The evidence shows that gross profits, requirements of capital growth, and also cost and availability of credit affect dividend pay-out.

Changes in debt and equity holdings are determined by such holdings outstanding, availability of internal funds and changes in stocks of fixed capital, inventories and receivables. There is substantial uniformity in the empirical results for changes in debt and equity. The evidence shows that fixed investment is an important determinant in changes in debt and equity. The coefficients of lagged stocks of debt and equity, in their respective equations, were either zero or very low. If these coefficients are interpreted as coefficients of adjustment of actual debt and equity to their maximun capacity levels, our evidence would imply reluctance on the part of industries to borrow or to float equity issues. Given the importance of cost and availability of debt and stock price indices in several of our model equations, it seems fair to conclude that for industries under study, risk variables are an important determinant of cost of capital. The empirical validation of risk variables tends to support Duesenberry-Kuh-Lintner hypothesis that cost of capital depends upon financial policies.

Chapter 8 presents two-stage least squares estimates of the equations that were estimated by ordinary least squares in Chapters 4-7 for changes in various assets and liabilities. The chapter also gives estimates of mean elasticities and relates the evidence to trends in particular assets and liabilities. We note here that conclusions derived on the basis of ordinary least squares are not altered by the application of the two-stage least squares method.

Chapter 9 provides a brief summary and a statement of major conclusions.

CHAPTER I

The Economic Growth in India and the Industrial Policy of the Government

This Chapter presents a review of India's experience with planned economic growth. Section I describes the pattern of investments during the three five-year plans and outlines some features of India's economic growth during 1950-68. Section II discusses the main features of Industrial Policy Resolutions of the Government. The section also describes in brief the operation of government regulation of industrial capacity and the distribution and pricing of industrial products. Section III describes the role played by banks and nonbank financial institutions.

I The Economic Growth of India Under the Five Year Plans

This section provides a brief survey of India's economic growth during 1950-68.

India's growth during the first three Plans(April 1, 1951 to March 31, 1966), especially during the first two, was quite impressive, even compared with the growth of presently developed countries during their take-off stages. Tables I and 2 below give some indicators of this growth.

Table I

India: Some Indicators of Growth (Annual Real Growth Rates)

Period	National Income	Per Capita Income	Aggregate Investment	Factory Employment
First Plan (April 1, 1951 to March 31, 1956)	3.5	1.6	24.5	1.5
Second Plan (April 1, 1956 to March 31, 1961)	4.0	1.8	10.7	3.8
Third Plan (April 1, 1961 to March 31, 1966)	2.9	0.4	4.2	4.9

Source: Velayudham (1967)

Table 2

India: Indicators of Sectoral Growth (Annual Real Growth Rates)

		Industrial Production			
Period	Foodgrains	Basic Industrials	Capital Goods	Intermediate Goods	Consumer Goods
First Plan	5.3	N.A.	N.A.	N.A.	N.A.
Second Plan	4.0	11.9	11.3	5.0	3.5
Third Plan	-1.9	7.1	14.8	6.4	5.2

Source: Velayudham (1967)

Tables 1 and 2 show that the rates of growth of national income, per capita income and investment were higher during the first two Plans than during the third. An important part of the explantion is the performance of agriculture whose share in national income remained around 45% in 1968 compared with 49% in 1951. Agriculural production increased at annual percentage rates of 4.2% and 4.3% during the first two plans but declined by 1.1% during the third. The increase in agricultural production during the first two plans resulted not only from an increase in acreage under cultivation but also from an increase in yield per acre. Between 1950-68, acreage under cultivation increased by 22% and the yield per acre by 20%. Most of the increase in acreage and yield took place during the first two plans.

Foodgrains production is a sizeable part of agricultural production and currently accounts for 67% of the agricultural output. As can be seen from Table 2 above, foodgrains production increased substantially during the first two plans and declined during the third.

Table 2 also records the impressive growth in industrial production. Industries are divided into 'basic', 'capital goods', 'intermediate goods' and 'consumer goods'. Basic industries consist of chemicals, mining, fertilizers, iron and steel, aluminium and electricity. Capital goods industries include industrial machinery, machinery components and accessories, prime movers, boilers, generating plants, railroad equipment and motor vehicles. Intermediate goods are defined to include cotton spinning and weaving, jute manufactures, wood and cork, tires and tubes, synthetic fibers, dye-stuff and dyes, petroleum refinery products, structural clay products and various products used for fittings, fixtures and fasteners. Consumer goods comprise mainly of cotton weaving, flour milling and grinding, sugar, oil, tea, pharmaceutical chemicals, paper and paper products, cigarettes, eletrical appliances, motorcycles and bicycles. The nonfinancial corporate sector consists of both the government and non-government non-financial companies. Our study will be concerned with a part of the nonfinancial corporate sector. Two of the four industries we have selected for study (Nonelectrical Machinery and Transport Equipment) belong to the category "capital goods" while the other two (cotton textiles and sugar) belong to the group "consumer goods." Looked at another way, the first two industries produce to order, while the latter two produce to stock.

The impressive rise in industrial production during the second and the third plan periods reflected the shift in emphasis from agriculture to industry. This shift in emphasis is brought out in Table 3 which gives a sectoral allocation of investment expenditures by the public(government) sector during the three plans. During the first plan, 44.5% of the government investment was devoted to agriculture while only 4.9% was allocated to industry and mining. During the second plan, the share of agriculture in government investment was reduced to 30.7% and that of industry and mining increased from 4.9% to 24.1%. However, severe shortages of food grains and agricultural raw materials were experienced during the second plan and this led to an increase in the share of agriculture in

Table 3

Sector Allocation of Investment by the Public Sector

(Percent of total investment).

Sector	First Plan (1951-56)	Second Plan (1956-61)	Third Plan (1961-66)	Annual Plan (1966-69)
Agriculture and Community Development	14.8%	11.8%	12.7%	17.3%
Irrigation and Power	29.7%	18.9%	22.3%	24.3%
Industry and Mining	4.9%	24.1%	22.9%	25.4%
Transport and Communications	26.4%	27.0%	24.6%	18.3%
Social Service and Misc.	24.2%	18.2%	17.5%	14.7%
Total Outlay (Millions Rs.)	19600	46720	85770	67560

Source: Various Issues of Report on Currency and Finance (Reserve Bank of India) planned government investment to 35% during the third plan. Despite this increase, lack of proper physical planning and adverse weather conditions combined to prevent a solution to agricultural shortages. As agriculture has always contributed more than 45% of national income and employed about 70% of the population, its performance has cumulative effects on prices, industrial production and balance of payments. The uncertainties of agricultural performance, recurring inflation and dwindling foreign exchange reserves in the face of persistent import deficits resulted in shortfalls in the realization of some five year plan targets.[1] A period of adjustment and short-term planning was, therefore, deemed necessary. As a result, five year plans were replaced by three annual plans during 1966-1969. As can be seen from Table 3, the average proportion of government investment devoted to agriculture during the three annual plans was higher than during the third five year plan.

Starting with the second plan, the five year plans formulated by the government also specified the investment targets which the private sector was expected to achieve. The role of the public sector in total investments has, of course, been increasing over the successive plans. During the Second and Third plans, public sector investments accounted for 54% and 60%, respectively, of the total investments (public plus private). Table 3 above has already given the sectoral distribution of public sector investments during the three plans. As regards the sectoral distribution

[1]For a brief survey of India's planning experience and a monetary model of inflation, see Khetan and Waghmare (1971).

of private investments, available estimates indicate that the role of private sector in the industrial group 'power generation, transport and communications' (i.e: heavy industries) was negligible, the public sector accounting to 85% and 95%, respectively, of the investments in this group during the Second and Third plans. The targeted share of private sector was, however, quite high in the group 'manufacturing and mining' accounting for 55% and 60%, respectively, of the total investments in this group during the two plans. The policy instruments used by the government to ensure desired private sector participation consisted of a system of incentives and controls. Licensing of capacity expansions and imports, regulation of pricing and distribution of products and the provision of finance through banks and non-bank financial institutions ('development banks') to particular industries were measures designed to encourage priority industries. The licensing and pricing aspects of government policy are discussed below in Section II. Section III describes the role played by banks and non-bank institutions.

II The Industrial Policy of the Government[2]

The industrial policy consisted partly of explicit specifications of industries to be developed within the government sector and partly of capacity expansions by industries and of distribution and pricing of industrial products. We have discussed these aspects of industrial policy under (a) Industrial Policy Resolutions, (b) Licensing of Industrial Capacity and (c) Controls on Pricing and Distribution.

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2 For a detailed discussion of the various aspects of planning and licensing, see J. Bhagwati and P.Desai (1970).

(a) Industrial Policy Resolutions

The first statement of government industrial policy was contained in the Industrial Policy Resolution of 1948. The Resolution assigned industries between the private and government sectors. The State was to have exclusive rights to the setting up of new establishments in iron and steel, shipbuilding, mineral oils, coal, aircraft production, and telecommunications equipment, with possible exceptions "in the national interest". The remaining areas of industrial investments were left open for simultaneous establishment of new industries by both the sectors.

The second Industrial Policy Resolution was announced in April, 1956, on the eve of the inauguration of the Second Five Year Plan. It was, in many respects, a reiteration of the first Resolution. Seventeen industries (called Schedule A industries), including heavy electrical plants and heavy castings and forgings of iron and steel were listed in a category where the state would either have a monopoly or have exclusive right to establish new industrial units.[3] Twelve other industries, called Schedule B industries, (including machine tools, ferro-alloys and tool steels, fertilizers, synthetic rubber, and chemical pulp) were specified as the new sector where the state would progressively establish new units, but private sector was expected to supplement the efforts of the State. The development of industries falling outside these two schedules was left to private enterprise.

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[3] This stricture, however, did not preclude the possibility of private enterprise setting up new units "in the national interest."

(b) Licensing of Industrial Capacity

A principal objective of the Industrial Policy Resolution of 1948 was to develop and regulate industrial production and investments according to the five-year plan priorities and targets. Consistent with this objective, the Industries (Development and Regulation) Act was passed in 1951. The Act stipulated that no "new" industrial undertakings could be established, nor any "substantial additions" effected to existing plants without the prior procurement of a license from the Central Government. Applications for new industrial ventures and capacity expansions were supposed to be assessed on the basis of their technical soundness, financial viability and the potential for export promotion or import substitution.

There were numerous other physical controls to be cleared by the prospective entrepreneur. If import of capital goods was necessary, an import license had to be obtained from the Capital Goods Licensing Committee. In the case of industries involving foreign collaboration, the consent of Foreign Agreements Committee was necessary. Public issue of equity capital also required approval of the appropriate committee. These various procedures entailed long and often unpredictable delays. A study of 78 companies started during the Second Plan and covering a wide range of industries revealed that for 55 of the 78 companies, the time lag between the year of incorporation and the commencement of production was at least 4 years. The study also showed that the delays involved in completing various formalities were not only long but variable.

(c) Controls on Pricing and Distribution

Controls on pricing and distribution of products were used by the government not only to encourage priority sectors but also to prevent an inflationary spiral by regulating prices of "basic products".

The Industries Act of 1951 had already empowered the government to regulate pricing and distribution of products of "scheduled" industries. Under the Act, such controls were exercised in respect to cement, motor-cars, scooters, commercial vehicles, drugs, medicines and petroleum products. The Essential Commodities Act of 1955 extended such controls to iron and steel, coal, fertilizers, cotton textiles, sugar and paper.

To sum up, though the four inustries under study operated in the private sector, they were regulated by a complex system of controls on capacity expansions and pricing and distribution of products.

Section III below describes the role played by banks and non-bank financial institutions in India's industrial development.

III The Role of Bank and Non-Bank Financial Institutions

Indian banks have, generally, been regarded as purveyors of short-term loans for the financing of wholesale trade and industrial inventories. Historically, a significant proportion of industrial loans by banks went to the three well-established industries, viz, cotton textiles, jute textiles and sugar. The inauguration of the second plan with its emphasis on industrial development, coupled with the monetary policy measures taken by the government to encourage loans to industries led to a rapid increase in the proportion of industrial loans by banks.

Table 4

Distribution by Purpose of Loans by Commercial Banks in India

(Proportion of Total Loans)

		1951	1956	1961	1966	1967
				(Percentages)		
I	Industry					
(i)	Cotton (ginning, pressing, weaving, etc.)	9.1	8.1	11.1	12.1	9.9
(ii)	Jute	4.1	3.0	2.5	2.7	2.8
(iii)	Sugar	5.9	6.3	7.7	5.2	3.9
(iv)	Engineering	N.A.	N.A.	8.4	16.0	15.9
(v)	Others	20.5	18.7	23.0	26.1	31.6
	Total of I	33.6	36.1	52.7	62.1	64.1
II	Wholesale Trade					
(i)	Agricultural Commodities	16.1	17.1	10.9	9.6	7.8
(ii)	Nonagricultural Commodities	17.5	17.4	16.1	10.5	9.7
(iii)	Retail and Other Trade	6.8	6.6	4.3	4.3	2.0
	Total of II	40.4	41.1	31.3	24.4	19.5
III	Financial	12.6	9.3	5.1	3.3	3.6
IV	Agriculture	2.1	2.0	0.5	2.4	2.0
V	Personal, Professional & Others	11.3	11.5	10.4	7.8	10.8
	Total I - V	100.0	100.0	100.0	100.0	100.0
	Nominal amount of Credit (billion Rs)	5.85	7.70	13.06	23.47	27.17

Source: Various issues of Statistical Tables Relating to Banks (Reserve Bank of India).

Table 4 gives the purpose-wise distribution of loans by commercial banks.

Table 4 shows that while the share of industrial loans in total bank loans increased from 33.6% in 1951 to 64.1% in 1967, the share of loans to internal trade decreased from 40.4% in 1951 to 19.5% in 1967. Second, the share of loans to engineering industries (transport equipment and machinery) which, according to available evidence, was close to zero in 1956 increased to about 16% by 1967. Cotton textiles and sugar continued to enjoy benefits of their historical links with banks and maintained their shares of total bank loans.

While the traditional role of commercial banks has been to finance inventories, there has been a gradual increase in the proportion of medium-term and long-term loans. Most major banks have also added the underwriting business to their list of functions.

The lack of financial institutions to provide medium-term and long-term finance and finance for new industries led the Government and the Reserve Bank of India (The Central Bank) to set up a number of special financial institutions. Some of the important institutions are described below.[4]

Industrial Finance Corporation: The Industrial Finance Corporation (IFC) was set up in 1948, to grant medium-term and long-term loans to industries and to underwrite new issues of capital by industrial conserns.

4For a comprehensive analytical account of these institutions, see G.Rosen (1962), Chapters II, III, IV and V; and L.C.Gupta (1969) Chapters VI & VII.

The National Industrial Development Corporation (NIDC): The NIDC was set up in 1954, to plan and formulate projects for new industries and products. As it has evolved, however, the corporation has become primarily an agency for granting special loans for the modernization and rehabilitation of jute textiles, cotton textiles and machine tool industries.

The Refinance Görporation of India: The Refinance Corporation for industry was set up in 1958, to provide refinance, as distinct from direct assistance, to primary lending institutions (such as commercial banks, State Financial Corporations and State Cooperative Banks) in lieu of their medium-term loans to small and medium-sized units in the private sector. The business of this corporation was taken over by the Industrial Development Bank (IDB) in 1964.

The Industrial Development Bank was set up to coordinate the operations of other institutions providing term finance to industry.

The Industrial Credit and Investment Corporation (ICICI): The ICICI was set up in 1955, to provide foreign exchange and rupee loans. The Corporation was, unlike the other specialized financial institutions, a private institution but was entitled to the support of the Government of India and the World Bank.

State Financial Corporations: Each state has a Corporation which assists medium and small-scale industries not covered by the other national corporations.

The specialized financial institutions, referred to above, have played a crucial role in the industrial development of India. During the second plan (1951-1956), the assistance provided by these institutions in the form of loans, underwriting and direct subscriptions to shares and debentures of industries amounted to Rs. 0.76 billion. This compares with bank credit to industries of Rs. 4.09 billion during the same period. Thus, during the second plan, financial assistance to industries by specialized non-bank institutions, constituted about 19% of bank credit to industries. During the third plan, their total assistance amounted to Rs. 3.64 billion or 47% of bank accommodation.

CHAPTER 2

The Basic Balance-Sheet Identities and Trends in the Pattern of Assets and Liabilities of the Selected Industries

This Chapter presents the basic balance-sheet and income-expenditure identities. The chapter also describes some trends in the assets and liabilities of industries selected for study.

I The Basic Balance-Sheet Identities

This section presents the basic balance sheet identities of the non-financial corporate sector.

Table 2-1 below gives a typical industrial balance sheet. The various assets and liabilities, as they apply to non-financial corporations in India, are also explained. Notation used is defined in appropriate places.

The various items of the balance sheet in Table 2-1 are described below[1].

Assets

1. Net fixed assets(or capital stock) include land, buildings, plant and machinery.

2. Inventories are generally classified into finished goods, semi-

1.For a detailed description of the various items of assets and liabilities see Reserve Bank of India(1967) pp. 22–26

Table 2-1

Industrial Balance Sheet

Assets	Liabilities
1. Net Fixed Assets (NFA)	1. Paid-up Capital(EQ)
2. Inventories (INV)	2. Reserves and Surplus (RS)
3. Receivables (REC)	3. Taxation and Other Provisions (TAXPRO)
4. Investments in Government and semi-Government Securities(TGS)	4. Total Debt (TD)
5. Cash and Bank Balances (M)	5. Trade Dues (TDUE) (Accounts Payable)
6. Other Assets (OA)	6. Other Liabilities (OL)

finished goods (work in progress) and raw materials. For some unexplained reason, however, the Reserve Bank of India (R.B.I.) has classified inventories into "finished goods and semi-finished goods", "raw materials" and "others." This classification does not allow a separate statistical analysis of the groups "finished goods","semi-finished goods", and"raw materials." The category "others" is defined by the R.B.I. to include "stores, tools, implements, oil, coal, spare parts, foodstuffs, nursery stocks, packing material, building material, stationary, etc." Thus, depending upon the industry in question, this category is likely to correspond more closely to one of the three standard components.

3. Receivables include short-term credit allowed by sellers of goods to their customers.

4. Investments are classified by the Reserve Bank into "government securities", "semi-government securities", "shares of subsidiary companies"

and "others". Government securities include central and state government securities. Semi-government securities issued by municipalities, port trusts, and similar government bodies. Industrial corporations also invest in shares of their subsidiary companies. Details about such investments are, however, not known. The item "other investments" refers to investments in shares and debentures of nonsubsidiary companies. Because of the lack of meaningful information on this item, we have included it under the hold-all "other assets" described below.

5. Cash and bank balances include balances held in custody by directors, managers, and other office bearers and all deposits kept with commercial banks.

6. "Other Assets" cover all assets not included in categories defined above. They comprise of immovable properties, intangible assets (goodwill, patents, trade marks, etc.), miscellaneous non-current assets and non-government securities.

Liabilities

1. Paid up Capital includes capital paid up on common, preferred and deferred shares.

2. Reserves and Surplus is the cumulative sum of retained profits or losses carried forward. It mainly comprises of reserves for machinery replacement, price fluctuations and store depreciation.

3. Taxation and other provisions include some current and some non-current liabilities. Current liabilities include taxes outstanding (income tax,

wealth tax, super tax and sur-tax), dividends, bonuses, and employees' welfare expenses. Non-current liabilities relate to gratuity, pension and superannuation benefits to employees, and employer's contributions to provident fund.

4. Total debts or borrowings include loans from banks, non-bank financial institutions and other sources. Corporations in India also supplement their funds by accepting deposits from the public and by borrowing from their subsidiary companies.

5. Trade dues or accounts payable mainly include bills payable in lieu of purchases from suppliers of materials and services.

6. Other liabilities include non-current liabilities not included elsewhere. They comprise long-term security deposits from staff, customers, and agents, and also contributions made by employees to provident fund.

Table 2-1 leads to the following basic identity in terms of flows (the notation is given in Table 2-1 above):

(2.1)

$$\Delta NFA + \Delta INV + \Delta REC + \Delta TGS + \Delta M + \Delta OA =$$

$$\Delta EQ + \Delta RS + \Delta TAXPRO + \Delta TD + \Delta TDUE + \Delta OL$$

Identity (2.1) will be modified later, using the income-expenditure statement described below.

The income-expenditure statement is another important source of information about the portfolio behaviour of non-financial corporations. A sample income-expenditure statement is given below.

Table 2-2

Income-Expenditure Statement

Expenditure	Income
1. Raw materials and Components	1. Sales Income
2. Power and Fuel	2. Change in Inventories of Finished and semi-Finished Goods.
3. Employee's Compensations	
4. Excise Duty, Cess, Commissions	
5. Other Manufacturing Expenses	
6. Deprececiation Provision	
7. Interest	
8. Tax Provision	
9. Dividends	
10. Profits Retained.	
Total Expenditure	Total Income

The difference between total income and items 1-7 on the expenditure side is profits before taxes. Deducting current tax provisions (item 8) from profits before taxes gives profits after taxes or what we prefer to call "net profits" (NP). Thus, net profits is the sum of dividends (DIV) a d retained earnings (RTE). While depreciation provision is an item of cost, it is also a source of funds for the replacement of depreciated capital. The sum of depreciation flow (DEPFLO) and retained earnings constitutes internal funds (IF). Thus, we write,

$$NP = DIV + RTE \tag{2.2}$$
$$IF = DEPFLO + RTE \tag{2.3}$$
$$IF = DEPFLO + NP - DIV \tag{2.4}$$

The income-expenditure statement provides current (flow) data on sales, manufacturing costs and profits. It is a useful supplement to the balance sheet statement which provides data on the structure of assets and liabilities. As can be expected, the two statements are related. Retained earnings, for example, approximately equals the change in "reserves and surplus". In terms of our notation, we write:

(2.5) $RTE = \Delta RS$

Substituting (2.5) in (2.1) and assuming, for exposition, that changes in "other assets" and "other liabilities" cancel out (i.e. $\Delta OA = \Delta OL$), we get.

(2.6)

$$\Delta NFA + \Delta INV + \Delta REC + \Delta TGS + \Delta M =$$

$$\Delta EQ + RTE \div \Delta TAXPRO + \Delta TD + \Delta TDUE$$

Adding depreciation flow (DEPFLO) to both sides of identity (2.6) and noting that the change in gross fixed assets (ΔGFA) equals the change in net fixed assets (ΔNFA) plus depreciation flow (DEPFLO) we have:

(2.7) $$\Delta GFA + \Delta INV + \Delta REC + \Delta TGS + \Delta M =$$

$$\Delta EQ + RTE + DEPFLO + \Delta TAXPRO + \Delta TD + \Delta TDUE$$

Identity (2.7) equates sources and uses of funds. It states that the sum of internal (retained earnings plus depreciation flow) and external (changes in stocks of equity, debts, accounts payable and other liabilities) sources of funds must equal the sum of uses of funds for financial and nonfinancial assets. We will use identity (2.7) as a starting point in our discussion, in Chapter 3, of models of nonfinancial corporate sector.

II Trends in the Pattern of Assets and Liabilities of Industries Selected for Study

This section describes some trends[2] in the portfolio behaviour of the four industries under study, using as basis the data contained in balance sheets and the income-expenditure statements. We discuss the trends under the following headings: (a) pattern of financing vis-a-vis fixed capital formation; (b) the ratio of current assets to current liabilities; (c) bank finance and inventory growth; and (d) the relationship of inventories and receivables to sales.

(a) Financing of Fixed Capital Growth

While we do not accept a one-to-one correspondence between particular sources and uses of funds, it is safe to say that a large proportion of internal funds and new equity finance is used for fixed capital growth. Corporations can finance moderate expansions of capital with internal funds. If, however, the rate of growth of capital is high, they have to resort to external sources, raising finance through debt and equity issues. As there is generally a lag between the availability of finance and its expenditure on capital projects, it seems more appropriate to compare averages over five year periods.

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2 The discussion of these trends is based upon tables which are omitted to save space.

A study of the financing patterns of the four industries under study shows that for all the four industries, there was a continuous decline in the proportion of gross investment financed by internal funds. For transport equipment and nonelectrical machinery, the ratio of new equity issues to new debt issues rose between the first two plans but declined later. In the case of sugar, there was a secular increase in the ratio of new equity issues to new debt issues. For cotton textiles the ratio fell during the first three plans and increased during the period of annual plans.

(b) The Ratio of Current Assets to Current Liabilities

Textbooks in business finance use this ratio as an indicator of liquidity of a corporation's balance sheet. Current assets are those which are immediately convertible into cash or tend to be so convertible within a short time, say a year. Thus defined, current assets include cash balances, government and semi-government securities and accounts receivable. Current liabilities comprise of short-term liabilities payable within a year. Thus defined, they would generally include trade dues, taxation liabilities and short-term debt. As the separate data on taxation liabilities are not available, we have defined current liabilities to include trade dues and bank debt.

An examination of the data on current assets and current liabilities show that current liabilities increased at a faster rate than current assets for the four industries.

We also note that amongst assets, receivables increased at a much faster rate than cash and government bonds. In fact, for cotton textiles and transport equipment, cash balances and government securities held in 1968 were lower than those held in 1950.

(c) Bank Finance and Inventory Growth

Banks in India are generally regarded as the purveyors of inventory finance. They lend on the security of agricultural and non-agricultural goods. Such loans are repaid when inventories "turn-over" into sales.

A comparison of the rates of growth of inventories, net capital stock, bank debt and non-bank debt reveals two interesting features of trends in sources and uses of funds. First, except in the case of transport equipment, bank debt increased at a much faster rate than non-bank debt. Second, bank debt increased at a much higher rate than inventories for all the four industries. This suggests that bank loans were also used for financing assets other than inventories.[3]

(d) The Relationship of Inventories and Receivables to Sales Income

Inventories and accounts receivable depend mainly upon sales. We first discuss the various components of inventories.

Industries maintain inventories of finished goods to be able to meet orders on demand. Such inventories are held mainly by industries that produce to stock (PTS). Examples are cotton textiles and sugar.

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3 See also G.Rosen (1962), Chapter III for a simi lar interpretation.

Inventories of semi-finished goods are held mostly by industries which produce to order (PTO). Examples are transport equipment and non-electrical machinery. In the case of PTO industries, direct and indirect costs of keeping finished goods inventories on hand are higher than the costs of meeting demands out of future output. The direct costs refer to the costs of storage and obsolescence and the indirect costs include the "costs" of risk associated with a highly fluctuating demand facing such industries. Production-to-order commodities generally involve several stages of production and hence a long production period. As new orders for products of these industries cannot be met out of stocks as in the case of production-to-stock industries and also, as rapid and frequent fluctuations in production rates are costly, these industries have a high (sometimes greater than unity) ratio of unfilled orders to sales. The latter implies a higher proportion of semi-finished goods relative to the proportion of finished goods in total inventories.

Raw materials are needed not only to meet any immediate needs of production but also to forestall any possible interruption in its continuity.

As noted in Section I above, instead of the usual classification of inventories into "finished goods", "goods-in-process" and "raw materials", the Reserve Bank has classified inventories into "finished and semi-finished goods", "raw materials" and "others". It is clear from the above discussion, however, that for cotton textiles and sugar(production-to-stock industries), the category "finished and semi-finished goods" is likely to consist mainly of finished goods, while for transport equipment, and non-electrical machinery (production-to-order industries,) it is likely to be dominated by semi-finished goods. While discussing trends in inventories/sales ratios, we will assume that this is indeed so. As regards the category "others", it is difficult to say anything *a priori*. However, in the light of the above discussion of production-to-stock and production-to-order industries, it seems likely that for cotton textiles and sugar, the category "others" consists largely of either finished goods or raw materials. In the case of transport equipment and nonelectrical machinery, the category "others" is likely to be dominated by either semi-finished goods or raw materials.

An examination of the RBI data on inventories, receivables and sales of the four industries under study reveals the following trends:

Finished Goods: There were only mild fluctuations in the ratio of finished goods inventories to sales in the case of the cotton textile industry. For most years, the ratio fluctuated in the narrow range of 14% to 17%. For sugar, the ratio increased from 31% in 1950 to 44% in 1955, after which it continued to decline. The ratio stood at 28% in 1968.

Semi-Finished Goods: There was a continuous decline in the ratio of semi-finished stocks to sales for transport equipment. The ratio declined from 35% in 1950 to 17% in 1968. For nonelectrical machinery, the ratio increased from 25% in 1950 to 32% in 1953 after which it declined gradually to 19% in 1965. The ratio recovered steadily to 24% in 1968.

Raw Materials: The ratio of raw material to sales declined for both cotton textiles and sugar. For cotton textiles, the ratio declined from 22% in 1950 to 10% in 1968. For sugar, the ratio decreased from 7% in 1950 to 2% in 1968. For transport equipment, the ratio dropped temporarily from 26% in 1950 to 15% in 1951 after which it increased gradually to around 20% by 1968. In the case of non-electrical machinery, the ratio increased from 8% in 1950 to around 20% by 1968.

Receivables: Receivables are used by business corporations to establish markets for their products.

For cotton textiles, the receivables/sales ratio increased very gradually from 8% in 1951 to 12% in 1968. For sugar, the ratio declined from 20% in 1950 to 7% in 1958, after which it increased gradually to 13% in 1968. In the case of transport equipment, there was an increase in the receivables/sales ratio from 30% in 1950 to 35% in 1953, after which the ratio started its downward trend reaching 16% in 1967. For nonelectrical machinery, the ratio declined from 22% in 1950 to 19% in 1953. The ratio started its upward trend in 1953 and reached 35% in 1968.

To sum up, the following broad trends were observed in the portfolio behaviour of the four industries:

1) There was a decline in the proportion of investment financed by internal funds. This appears to be mainly due to the high rates of capital accumulation, particularly during the Second and Third Plans.

2) There was a deterioration in the liquidity position, measured by the ratio of current assets to current liabilities.

3) The ratio of finished goods inventories to sales fluctuated little in the case of cotton textiles, while it declined for sugar. The ratio of semi-finished inventories to sales declined continuously for transport equipment. This ratio had a mixed trend in the case of nonelectrical machinery.

4) The ratio of raw materials to sales dclined for cotton textiles and sugar, and increased for transport and nonelectrical machinery.

5) There was an increase in the ratio of receivables to sales for cotton textiles and nonelectrical machinery. For sugar and transport equipment, there was a gradual decline in the ratio.

CHAPTER 3

The Theory of Cost of Capital and

Models of Nonfinancial Behaviour

This chapter expounds the theoretical framework in the context of which hypotheses about individual assets and liabilities are developed in subsequent chapters. We have also briefly reviewed two studies which provide a starting point for our model equations. The equations are specified and estimated, in chapters 4-7.

Section I discusses alternative views of cost of capital. The alternative views refer to those advanced by Duesenberry-Linter-Kuh on the one hand and Modigliani-Miller on the other. Section II briefly reviews a simultaneous equation model of a part of the U.S. nonfinancial sector due to Dhrymes and Kurz. Section III summarizes a similar model for India by V.K.Sastry. Section IV outlines our approach in the present study.

I Alternative Views of the Cost of Capital

This section discusses the concept of cost of capital relevant for corporate investment decisions.

Duesenberry (1958) argues that in competitive markets the marginal cost of funds - the minimum expected rate of return to make the investment worthwhile - depends upon the mix of various sources of funds. This view is in contrast to the one propounded by Modigliani-Miller (1958; 1961; 1967) and Mossin (1973) who hold that in perfect capital markets the marginal cost of capital funds is invariant with respect to the finance mix. We start with an exposition of Duesenberry's views.

The demand for investment depends upon the relationship between the marginal efficiency of investment (mei) and the marginal cost of funds (mcf). The research on investment has mainly concentrated on the former which is assumed to depend upon sales anticipations, capacity utilization and the existing capital stock. Duesenberry has discussed the marginal cost of funds schedule in detail but he recognizes that it may be unimportant in some industries (e.g. automobile industry) where the demand for additional investment is, in general, accompanied by an increase in internal funds (depreciation plus retained earning). We may represent Duesenberry's view diagramatically.[1]

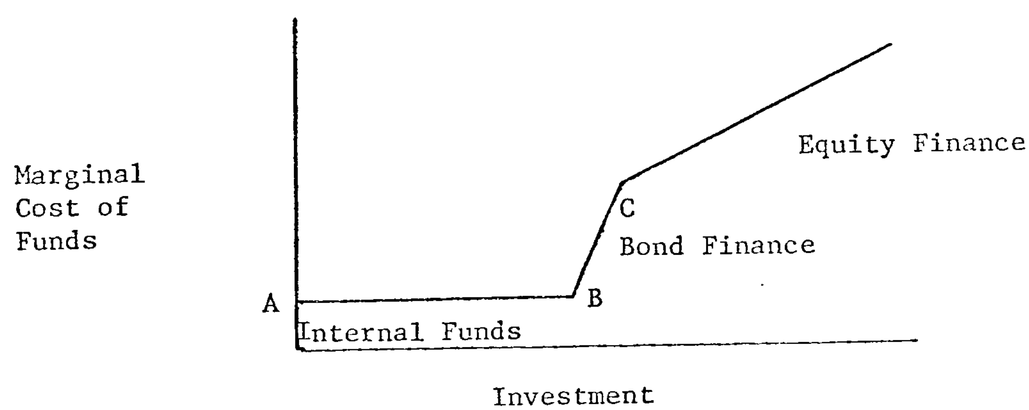

Figure 3.1

[1] For a detailed discussion of the portfolio approach to the theory of investment, see J. Duesenberry (1958), Chapter 4 and Evans (1969), p.p. 86-95 & 114-128. A similar treatment is available in Kuh(1971), Chap. 2

The region AB represents investment financed by internal funds. No risk is involved here and the opportunity cost is the interest foregone. The mcf rises sharply with investment financed by bonds because the necessity of regularly meeting interest payments increases the riskiness of the portfolio. The actual rate of interest may or may not reflect this risk premium which rises with the ratio of interest costs to expected profits. Rising interest costs increase the probability of dividend curtailment, of possible reduction in internal funds and of additional borrowings. The extra risk factor will be more important for industries (e.g. metal products) whose profits and output fluctuate considerably. This point also explains why public utilities with their more stable profits can afford to carry a larger proportion of debt and equity in their portfolios. The region beyond c depicts investment financed by equity floatation. The mcf for equity financing is higher than that for bond financing mainly because interest payments are deductible before corporate income tax while dividend payments are not. As dividends are paid out of after-tax profits and the rate of corporate tax is 50%, it would cost the firm four times as much to finance through equities as through bonds. This analysis, of course, ignores the risk involved in additonal borrowing through bonds. However, unless the risk premium on debt is considerable, it would seem that the cost of equity capital is higher than the cost of bond finance. This conclusion will be reinforced by taking into account the issue cost of equity floatation and the effect of equity floatation on stock prices.

The shape of the marginal cost of funds schedule will, in general, depend upon the debt-liquidity position. An increase in actual debt relative to the "safe" level or a reduction in liquidity (cash plus governments) below the desired level will increase the marginal cost (inclusive of risk). Also, an increase in debt relative to liquid assets or an increase in nonfinancial assets (inventories, receivables and fixed assets) relative to internal funds will raise the risk-inclusive marginal cost. These considerations imply that corporations in their efforts to balance risk and return, will consider substitution possibilities along the entire range of assets and liabilities. An application of these considerations to figure 3.1 would lead us to alter portion AB in figure (3.1). It seems unduly restrictive to assume that the marginal cost of funds equals the market rate of interest over the entire range of internally finanaced investment. An increase in internal funds brought about by a reduction of dividends will have implications for the mcf schedule. A firm which does not pay dividends or pays a fraction of the customary yield may run the risk of diminishing its credit wothiness, if lowered dividends are interpreted by security markets as an indication of lower expected earnings. Dividend curtailment may also affect investor confidence and make it difficult for the firm to raise capital through equity issues. Thus, it would seem that given the existing debt-liquidity position and current and expected flows of funds, the greater the contemplated level of investment, the riskier will be the future debt-liquidity position. These considerations imply that the AB section of figure (3.1) may not be horizontal but upward sloping. This conclusion, we note, follows from our consideration of alternative sources and uses of funds.

The above conclusion about the marginal cost of capital being a function of the finance mix has been challenged by Modigliani and Miller. They contend that the marginal cost of capital relevant to a particular risk class is invariant with respect to the debt/equity mix. A risk class is defined by Modigliani-Miller thus: "any two companies will be said to be in the same risk class at a specific point in time t if the elements of the streams generated by the physical assets held by each at t are perfectly correlated and proportional."[2] In other words, the price per dollar of expected return is the same for companies in a risk class. We have briefly reviewed the Modigliani-Miller theory below.

Modigliani-Miller (hereafter MM) assume that the rational management of a firm adopts as its working criterion for portfolio decisions the maximization of the market value of shares held by current owners of the firm.[3] They also assume (i) rational investment behaviour, (ii) perfect markets, (iii) no taxes and (iv) perpetual uniform income of X per period. Then, the equilibrium market value of any firm in a risk class is:

$$V = \frac{1}{P_k} \bar{X} \quad (3.3)$$

2 Modigliani-Miller (1958), pp. 185

3 There is unanimity amongst rival theorists that the market value of equity is the variable to be maximized. Also, the rival models assume perfectly competitive capital markets. The differences in results of rival theories are therefore, at least partly, traceable to their different assumptions about risk and uncertainty. These differences are clarified below.

where V = sum of market values of all securities, P_k = cost of capital in risk class k and $\overline{X}$ = expected level of average annual earnings generated by currently held assets. Investment will take place if dV/dI > 1 or if $\frac{d\overline{X}}{dI} > P_k$. The reciprical of P_k is referred to as the market capitalization rate.

MM use (3.3.) to advance the hypothesis that "the market value of a firm depends only on its real earning power and on the market capitalization rate for pure equity streams of its class and not at all upon the particular mix of security types that characterize its financial structure."[4]

Modigliani-Miller agree that the above conclusion will be altered when the preferential tax treatment accorded to debt is introduced. Assuming a constant rate of t of income tax, they find that the marginal cost of debt capital (p^k) is lower than the marginal cost of equity capital. ($p^k/1-t$).

Modigliani-Miller maintain that though their formal model with taxes implies the dependence of the cost of capital on financial policy, the conclusion of the model without taxes - viz. the invariance of the cost of capital with respect to finance mix - is more likely to apply to the real world. This is so because the tax advantage of debt is likely to be offset by higher equity yields which levered corporations generally have to pay. Moreover, corporations cannot push debt/equity ratios higher than lenders can absorb. A big bond issue with tight lender-imposed restrictions may also pose a threat to the firm's freedom of

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[4] Modigliani-Miller (1967),p. 184

action. Thus, a change in the rate of interest or tax rate will not have more than a marginal effect on the debt/equity ratio.[5]

In his survey, Jorgensen (1971) has used the statistical significance of variables such as internal funds, holdings of liquid assets and debt capacity as the criteria to test the validity of the D-K-L theory. He found that in most studies, these variables were not significant. He interpreted this finding as invalidating the D-K-L hypothesis.

Most models reviewed by Jorgensen in his survey are single equation models. They do not determine investment in a simultaneous equation framework. This makes his verdict on the rival theories only tentative. There seems general agreement, however, that accelerator variables are more important than cost-of-capital variables.

In the next two sections, two simultaneous equation models - one for the U.S. by Dhrymes and Kurz and the other for India by V.K.Sastry - are briefly reviewed. In our own model, we have used some elements of the approach used in these two models.

II The Dhrymes-Kurz Model

Dhrymes and Kurz (1967) have estimated a model, using cross-section data, in which explicit account is taken of the interdependence between the decisions to invest, to pay dividends and to raise external finance. The model also recognizes that the various assets are likely

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[5] This is the interpretation of the Modigliani-Miller thesis as given in Miller (1963).

to be substitute for each other. We start the discussion by recalling identity (2.7):

$$(2.7) \quad (\Delta GFA + \Delta INV + \Delta REC + \Delta M + \Delta TGS) = (\Delta EQ + RTE + DEPFLO + \Delta TAXPRO + \Delta TD + \Delta TDUE)$$

Defining total debt, TD, as the sum of short term (SD) and long term debt (LD) and rearranging terms, we have:

$$(3.10) \quad \Delta GFA + \Delta INV + \Delta REC + \Delta M + \Delta TGS = (\Delta SD + \Delta LD + \Delta EQ + RTE + DEPFLO + \Delta TAXPRO + \Delta TDUE)$$

Now, retained earnings (RTE) equal net profits (NP) (i.e. gross profits minus current taxation provision) minus dividends (DIV) ie. RTE = NP - DIV where NP is net profits and DIV is dividends. Substituting this equality in (3.10)above and rearranging, we get:

$$(3.11) \quad \Delta EQ + \Delta LD - DIV - \Delta GFA = (\Delta INV + \Delta REC + \Delta M + \Delta TGS - \Delta TDUE - \Delta SD - \Delta TAXPRO) - DEPFLO - NP$$

Dhrymes and Kurts (heretoafter D-K) regard new equity issues (ΔEQ), new longterm debt issues (ΔLD), dividends (DIV) and gross fixed investment (ΔGFA) endogenous. They have postulated behavioural equations to explain gross fixed investment (ΔGFA), dividends and longterm finance. The sum in parenthesis to the right of the equality sign in (3.11) is assumed exogenous. Let us denote this sum by ΔNCA (change in net current assets).[6] Dhrymes and Kurz also assume depreciation (DEPFLO) and net profits (NP) exogenous.

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[6]Dhyrmes and Kurz have acknowledged the possibilit of a specification error in treating ΔNCA exogenous.

The behavioural equations explaining gross fixed investment, dividends and change in longterm finance are as follows: (sign-superscrips denote the direction of influence)

$$(3.12) \quad \Delta GFA = f_1(\overset{+}{NP_{-1}}, \quad \overset{+}{SALE_t - SALE_{t-3}}, \quad \overset{-}{\Delta NCA} \quad \overset{-}{DIV}, \overset{+}{\Delta LD})$$

$$(3.13) \quad DIV = f_2(\overset{+}{NP}, \quad \overset{-}{\Delta NCA}, \quad \overset{-}{\Delta GFA}, \quad \overset{+}{\Delta LD})$$

$$(3.14) \quad \Delta LD = f_3(\overset{-}{\frac{LD}{TA}}, \quad \overset{-}{RC} \quad \overset{-}{DEPFLO} \cdot \quad \overset{-}{NP} \quad \overset{+}{DIV} \quad \overset{+}{\Delta GFA})$$

A few comments about these equations are in order:

Gross Fixed Investment: According to equation (3.12),gross investment depends positively upon lagged profits (NP_{t-1}), the change in sales during the last three years, $SALE_t$ - $SALE_{t-3}$[7] (the D-K date are on an annual basis) and longterm finance raised (ΔLD), and negatively upon the change in net current assets (ΔNCA) and dividends (DIV).

Dividends: According to equation (3.13) dividends are directly related to net profits (NP) and longterm finance raised (ΔLD) and inversely to gross fixed investment and change in net current assets.

Longterm Finance: Demand for longterm finance is assumed to depend positively upon gross fixed investment and dividends and negatively upon depreciation funds (DEPFLO) , net profits (NP), corporate bond rate (RC) and the ratio of long debt to total assets (LD/TA).

The data in the D-K model consist of financial accounts of

7The D-K data are on an annual basis.

181 firms over the period 1947 - 60. The firms were drawn from a variety of industries such as textiles, retail trade, alcohol and food, chemicals, machine tools, transport and electrical equipment, mining and steel.

III V.K. Sastry's Model of Investment, Dividend and External Finance Behaviour of Nonfinancial Corporations

This section briefly summarizes a well-done study of nonfinancial corporate behaviour by V.K.Sastry (1967). This study, an unpublished dissertation at the University of Pennsylvania, seems to be the only study of Indian nonfinancial sector which estimates behavioural relationships in a simultaneous equation context. Sastry's general approach is similar to the one followed in Dhyrmes and Kurz (1967).

Let us start with identity (3.11).

$$(3.11) \quad \Delta EQ + \Delta LD - DIV - \Delta GFA = \Delta INV + \Delta REC + \Delta M + \Delta TGS - \Delta TDUE - \Delta SD - \Delta TAXPRO - DEPFLO - NP$$

For the purposes of the Sastry model, we can rewrite (3.11) thus:

$$(3.15) \quad \Delta EQ + (\Delta LD + \Delta SD + \Delta TDUE - \Delta M - \Delta TGS - \Delta REC) - \Delta GFA - \Delta INV = DIV - \Delta TAXPRO - DEPFLO - NP$$

Sastry defines the sum of terms in parenthesis to the left as "change in net external finance", ΔEF. i.e.

$$(3.16) \qquad \Delta EF = \Delta LD + \Delta SD + \Delta TDUE - \Delta M - \Delta TGS - \Delta REC$$

Next he defines gross profits (GP) as the sum of net profits, depreciation flow and the change in tax provision. i.e.

$$(3.17) \qquad GP = NP + DEPFLO + \Delta TAXPRO$$

Using definitions (3.16) and (3.17) in equation (3.15), we get:

$$(3.18) \qquad GP - DIV = \Delta GFA + \Delta INV - \Delta EF - \Delta EQ$$

As in the Dhrymes and Kurz model, gross profits (GP) are assumed exogenous. The jointly dependent variables include ΔGFA, ΔINV, ΔEF, DIV, and ΔEQ. Behavioural equations are postulated for ΔGFA, ΔINV, ΔEF, and DIV. ΔEQ is obtained as a residual.

Sastry's study uses cross-section data for 389 companies over the period 1953-60. The companies cover ten industries including cotton textiles, tea, sugar, jute, coal, chemicals, electricity, electrical machinery, non-electrical machinery and paper and paper products.

Sastry's model suffers from some of the same inadequacies which characterize the D-K model. Both models lump together industries which are likely to differ in terms of the elasticities of demand for their products, financing patterns, factors affecting fixed investment and inventories and so on. This aggregation is likely to be particularly unsatisfactory in the case of developing countries like India where different industries belong in different categories in terms of five year plan priorities and are, therefore, subject to different regulations and incentives. Second, both D-K and Sastry have defined variables (change in net current assets, ΔNCA, in the case of D-K and change in net external finance, ΔEF, in the case of Sastry) which are combinations of assets and liabilities with possibly different roles in business portfolios and different behavioural functions.

Cross section models such as those discussed above are also hard to interpret because coefficients in different cell regressions vary widely. This is mainly due to the exclusion of time related variables. In Sastry's model, for example, the coefficients of inventory adjustment in different cell regressions (each cell representing a year) vary widely and seem to be directly related to percentage rates of change of wholesale prices. This implies that expected prices are one of the determinants of inventories. Wide variations in coeffecients are also observed in his investment equations.

One of the most exhaustive treatments of cross-section vs. time series models is due to Kuh (1971). According to Kuh (1971 p. 187 the error variances in cross-sections over estimate the variability actually present in the independent time-series error. Also, estimation of dynamic relationships is possible only with time series data. In a short survey of investment models in the second edition of his book, Kuh concludes: "Eisner's analysis has helped to clear up some of the basic statistical properties of cross-sections and time series. Yet it seems to me that ultimately most reliance has to be placed upon time series. The heart of the investment problem is in the correct characterization of the adjustment process. Since no effective way has yet been found to estimate dynamic processes other than with time series, spurious estimates will tend to dominate wherever cross-sections are used for this purpose. Most recent investment literature has veered away from heavy reliance on cross-sections, a trend which I consider to be altogether healthy. While better statistical methods proposed by Nerlove and Balestra for combining cross-sections will prove useful in other more static econometric applications, investment studies are less likely to yield superior insights from these technical improvements."[8] Thus, in the present study we have used time series data for the period 1950-1968 (19 years).

We now outline our approach to the models of nonfinancial behaviour.

IV Our Approach in this Study

Our approach stems logically from our analysis of the Dhrymes-Kurz and Sastry models.

First we have analysed the portfolio behaviour of individual industries instead of industrial groups.. The industries we have selected for study are cotton textiles, sugar, transportation equipment, and non-electrical machinery. The former two are consumer goods industries and the latter two are capital goods industries. Another way to classify these industries is to categorize the first two as producing to stock (PTS) and the latter two as producing to order (PTO).

8E.Kuh (1971) p. XXIII

Second, we have estimated a more elaborate model than found in any other study of the Indian nonfinancial corporate sector. To sketch our approach, recall identity (3.15):

$$(3.15) \quad \Delta EQ + \Delta LD + \Delta SD + \Delta TDUE - \Delta M - \Delta TGS - \Delta REC - \Delta GFA - \Delta INV = DIV - \Delta TAXPRO - DEPFLO - NP$$

Following Sastry, we define GP (gross profits) as in (3.17) above:

$$(3.17) \quad GP = NP + DEPFLO + \Delta TAXPRO$$

We define change in total debt as:

$$(3.26) \quad \Delta DEBT = \Delta LD + \Delta SD + \Delta TDUE$$

Identity (3.26) defines change in total debt as the sum of changes in longterm debt, short-term debt and accounts payable. Our definition of change in total debt differs from Sastry's "net external finance" in that we have not netted out the change in current assets from the change in total debt. We have specified separate equations to explain changes in current assets.

Substituting (3.26) and (3.17) in (3.15), we get:

$$(3.27) \quad \Delta EQ + \Delta DEBT - \Delta M - \Delta TGS - \Delta REC - \Delta GFA - \Delta INV - DIV = GP$$

Our model specifies equations for change in assets and liabilities on the left hand side of identity (3.27). Thus, gross profits, GP, are also determined endogenously. Further, we have divided inventories into "finished and semi-finished goods", "raw materials", and "others" and have estimated separate equations for these components.

Third, we have used the time-series data published by the Reserve Bank of India. This has enabled us to assess the effects of hitherto neglected variables such as interest rates, wholesale prices, capacity utilization rates and stock price indices. The data are available on an annual basis and cover the period 1950-1968 (19 years).

We note here that the Reserve Bank do not publish data on new and unfilled orders. This has prevented a more thorough analysis of the inventory behaviour of capital goods industries.

CHAPTER 4

The Investment Behaviour of Nonfinancial Corporations

This chapter develops hypothesis and estimates ordinary least squares (OLS) equations for demand for investment by industrial corporations.

Gross investment is a better endogenous variable than net investment, as measures of depreciation given in balance sheets do not reflect the actual wear and tear of the capital stock. In specifying the function for gross investment, we must take account of the decision and production lags. The function we have specified follows the one used in the Brookings model and in Evans (1969). First, it takes account of the fact that it may take two or three years before the original decision to invest is converted into actual investment. Second, the modifying influence of recent sales experience has been explicitly introduced. Empirical verification of the modification variable has been available in Evans (1969) and in J. Linter (1967). Third, indicators of the marginal cost of funds (we start with the indicators used in the Evans equation, viz interest rate and cash flow) also affect investment. Following Evans (1969), p. 102) we write:

$$(4.1) \qquad NFA_t = \alpha_0 + \alpha_1 \Sigma\lambda^i \, SALE_{t-i-1} + \alpha_2 \Sigma\lambda^i \, SALE_{t-i-j} - \alpha_3 \Sigma\lambda^i \, NFA_{t-i-j} + \alpha_4 \Sigma\lambda^i \, IF_{t-i-j} - \alpha_5 \Sigma\lambda^i \, RC_{t-i-j}$$

where the integer J is greater than unity (explained below) and $0 < \lambda < 1$. Capital stock (NFA) is taken to depend upon factors which affect marginal efficiency - sales (SALE) and lagged stock (NFA_{t-i-j}) - and marginal cost-interest rate (RC) and cash flow (IF). Defining net investment as ΔNFA and using the Koyck transformation, we get (Evans, p.102)

$$(4.2) \qquad \Delta NFA_t = \alpha_o (1-\lambda) + \alpha_1 \; SALE_{t-1} + \alpha_2 \; SALE_{t-j} - \alpha_3 NFA_{t-j} + \alpha_4 \; IF_{t-j} - \alpha_5 RC_{t-j} - (1-\lambda) \; NFA_{t-1}$$

As our data are on an annual basis, the condition $j > 1$ implies that after the decision to invest is originally taken, it takes more than a year to implement it. The value of j will depend upon the industry in question. As our dependent variable should be gross investment, we add DEPFLO to both sides of equation (4.2). Defining gross investment, ΔGFA, as ΔNFA + DEPFLO, where $DEPFLO_t = \rho NFA_{t-j}$, $0<\rho< 1$, we get:

$$(4.3) \qquad \Delta GFA = \alpha_o (1-\lambda) + \alpha_1 \; SALE_{t-1} + \alpha_2 \; SALE_{t-j} - (\alpha_3-\rho) NFA_{t-j} + \alpha_4 IF_{t-j} - \alpha_5 RC_{t-j} - (1-\lambda) NFA_{t-j}$$

$$, \; 0<\lambda<1, \quad 0< \rho<1$$

As NFA_{t-1} and NFA_{t-j} are likely to be collinear, we introduce the following approximation (Evans, p.85)

(4.4)[1] $\alpha_1 SALE_{t-1} - (1-\lambda)NFA_{t-1} \approx \beta\ CP_{t-1} + \gamma$

where CP is capacity utilization defined as actual output/maximum output and γ is a constant. Substituting (4.4) in (4.3), we have

$$(4.5)\quad \Delta GFA = \alpha' + \beta\ (CP_{t-1}) + \alpha_2\ SALE_{t-j} - (\alpha_3 - \rho)NFA_{t-j} + \alpha_4 IF_{t-j} - \alpha_5 RC_{t-j}$$

where $\alpha' = \alpha_o(1-\lambda) + \gamma$

The coefficients of capacity utilization, the sales variables and internal funds will be positive. We expect negative coefficients for the interest rate and lagged capital stock (NFA_{t-j}), though a positive coefficient for the latter variable may be found if replacement requirements predominate ($\rho > \alpha_3$).

Finally, we note that some investment studies have used stock prices as an explanatory variable. Resek (1966), for example, has used stock prices as an index of expected output. Stock prices are, however, affected not only by long-run profitability but also by short-run speculation based on recently available data. As Keynes has pointed out, "Day-to-day fluctuations in the profits of existing investments.

[1]This approximation is based upon the following assumptions:
(1) full capacity output depends upon lagged capital stock
(2) capacity utilization equals actual output/full capacity output;
(3) the estimated value of α_1 equals the average capital/output ratio.

which are obviously of an ephemeral and non-significant character tend to have an altogether excessive and even an absurd, influence on the stock market .... The energies and skill of the professional investor and speculator ... are largely concerned, not with making superior long-term forecasts of the probable yield of an investment over its whole life, but with forecasting changes in the conventional basis of valuation a short time ahead of the general public."[2] In view of the role of short-term outlook in the determination of stock prices we might be justified in using the stock price index as a proxy for expected shortrun profitability of output and hence as a modification variable. We may note here that the stock price index as a proxy for expected short term profitability has also been used in equations for inventories and receivables.

We give below our best investment equations for each industry. Several alternative forms of equations (4.3) and (4.5) were estimated and the best equation was chosen according to the criteria given in Christ (1966), chapter X and illustrated in Chapter XI of the same book. The criteria consist of an evaluation of the following characteristics of various equations:

1) Plausibility of signs and values of coefficients
2) t values of coefficients
3) Stability of coefficients in alternative equation forms
4) The statistical significance of coefficients of variables considered important on *a priori* grounds vis-a-vis the significance of other

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[2]J.M.Keynes (1936), pp. 153-154.

coefficients.

5) Effect of multicollinearity on estimated coefficients.

6) Values of coefficient of determination and DW statistics.

The above criteria were used in selecting the preferred equations not only for gross investment but also for changes in other assets and liabilities. In some instances, application of the above criteria did not result in a clear-cut choice and two preferred equations, instead of one, had, therefore, to be chosen.

The preferred equations for the four industries under study are given below:

Equations for Gross Fixed Investment

Cotton Textiles

$$\Delta GFA = \underset{(.80)}{449.6} + \underset{(1.85)}{3339CP_{-1}} + \underset{(8.04)}{.2366NFA_{-2}} - \underset{(6.34)}{1.574LD_{-2}}$$

$$R^2 = .801, \quad DW = 1.78$$

Sugar

$$\Delta GFA = \underset{(.37)}{232.6} + \underset{(1.95)}{1014CP_{-1}} + \underset{(3.27)}{.1991NFA_{-2}} - \underset{(1.91)}{1.255LD_{-2}}$$

$$R^2 = .711, \quad DW = 1.54$$

Transport Equipment

$$\Delta GFA = -415.9 + .2062SALE_{-2} - .1423NFA_{-2} + .4337\Delta DEBT$$
$$(2.05) \quad (5.06) \quad (2.23) \quad (4.70)$$

$$R^2 = .933, \quad DW = 2.59$$

Machinery

$$\Delta GFA = -271.2 + .3419SALE_{-2} - .3605NFA_{-2} + .0004308(SLTP)_{-1} - .0163(SLRL)_{-2}$$
$$(1.11) \quad (2.99) \quad (1.99) \quad (2.84) \quad (1.93)$$

$$R^2 = .924, \quad DW = 2.02$$

(note: SLTP = SALE*STP; SLRL =SALE*RL)

It is clear that different sets of explanatory variables are needed to explain investment behaviour of different industries. This may be particularly typical of developing economies where some industries are "priority" industries under the Five Year plans.

In the case of old established industries (cotton textiles and sugar), capacity utilization represents the modification variable. The stock of long term debt outstanding also has a dampening influence on investment in these industries. This implies that debt capacity affects investment, a proposition which would tend to support the Duesenberry-Kuh theory. Also, note that capital stock at the beginning of last year has a positive sign, supporting Klein's hypothesis[3] that in a developing country like India, the existence of new capacity may promote

[3]Klein (1967)

investment instead of hinder it. Cotton textiles and sugar have been gradually undergoing modernization and once some items of fixed capital such as land, buildings and other infra-structure are acquired, it becomes possible to integrate new machinery.

For transport equipment and nonelectrical machinery, the accelerator coefficient of ($SALE_{-2}$) is significant at .01 level of significance. Debt availability increases investment by transport equipment and it is likely, therefore, that ΔDEBT represents the influence of modified expectations. Both the stock price index and the prime lending rate are significant in the equation for non-electrical machinery. Equation for machinery postulates the dependance of interest and stock price elasticity on the level of sales. Some of the recent models have made this assumption which relates the response of nonfinancial corporations to changes in interest rates to their stage of expansion.

CHAPTER 5

The Inventory Behaviour of Nonfinancial Corporations

This chapter formulates hypotheses and presents evidence on demand for inventories by nonfinancial corporations. As noted in Section II of Chapter 2, the Reserve Bank of India has classified inventories into "finished and semi-finished goods", "raw materials" and "others". This classification is unusual and does not allow a study of demand for inventories according to the stage of fabrication. We also suggested in Chapter 2 that for production-to-stock (PTS) industries such as cotton textiles and sugar, the component "finished and semi-finished goods" is likely to consist mainly of finished goods, while for production-to-order industries such as transport equipment and nonelectrical machinery, this category is likely to be dominated by inventories of semi-finished goods. In specifying demand functions for the three components classified by the Reserve Bank of India, we will assume that this is indeed so. Thus, in the case of PTS industries, demand functions for "finished goods" and "raw materials" will be specified, the behaviour of the third category ("others") being explained by whichever of the two functions applies to the data better. Similarly, in the case of PTO industries, we will specify demand functions for "semi-finished goods" and raw materials", leaving the explanation of the category "others" to whichever of the two aforementioned functions satisfies the data best. For the sake of completeness, we will also advance the following two postulates. First, we postulate that finished goods inventories with purely PTO industries are a random variable. Second, the demand function for semi-finished inventories with PTS industries includes the same explanatory variables as the demand function for finished goods inventories.

Section I comments on the classification of inventories and elaborates the PTO-PTS distinction. Section II presents the basic inventory model. The model is used as a framework to specify, in Sections III and IV, our equations for the two components of inventories. In the case of PTS industries, equations for finished goods and raw materials are specified. For PTO indusries, equations for semi-finished goods and raw materials are postulated. Section III also discusses determinants of inventories such as interest rates, prices and internal and external sources of funds. Section V tests hypotheses about holdings of "other inventories."

I The Classification of Inventories and the PTO-PTS Distinction

(a) The Classification of Components of Inventories:

The classification of inventories of a firm into raw materials, goods-in-process and finished goods is done from the viewpoint of that firm and does not describe the intrinsic qualities of commodities classified. For example, many firms sell carburators to auto manufacturers and electric motors to producers of electric fans. To the firms selling them carburators and motors are finished products but for the auto manufacturer or the fan producer, they are raw materials and will be classified as such. If any work has subsequently been done on these raw materials by the auto or the fan manufacturer, the goods will be classified under "goods in process", "work-in-progress" or semi-finished inventories.

(b) Production-to-Order and Production-to-Stock

This subsection elaborates on the distinction between production-to-order (PTO) and production-to-stock (PTS) industries.

Production-to-order industries produce only after receiving the order because they are confronted with one or more of the following situations.

First, goods to be produced may have to satisfy varying specifications of different customers. Examples are machine tools and metal products.

A second situation giving rise to production-to-order relates to goods which could physically be stored but are not because they are subject to a rapidly changing demand. A case in point is women's fashion apparel.

A third situation where production-to-order is the rule concerns goods which are technologically capital-intensive or have a sporadic demand. Non-automotive transport equipment is a case in point.

The stock-order distinction can be verified by using some indicators such as the ratio of unfilled orders to finished goods stocks, the lead of new orders before sales and the proportion of goods-in-process relative to the proportion of finished goods in total inventories. These indicators are, of course, inter-related.[1] As, for India, we have no data on any of these indicators, it may be wondered whether our classification of cotton textiles and sugar as PTS industries and of transport equipment and nonelectrical machinery as PTO industries is justified. Some relevant data we checked shows that our classification is likely to be correct. The relevant data are published by the Central Statistical Organization (CSO) and an agreeable feature of the data is that inventories are classified into "finished-goods","semi-finished goods" and "raw materials".[2] Table 5-1 gives proportions of various components in total inventories for the industries under study.

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[1]V. Zarnwitz (1962),pages 373-374, Tbles 2 and 3.

[2]We cannot use these data in our study for two reasons. First, the industrial classifications adopted by the CSO in their publications differ considerably from the classifications adopted by the Reserve Bank of India in their surveys of company finances. The latter source is used in this study. Second, the data published by the CSO up to 1958 are not comparable to their subsequent data.

Table 5.1

Proportions of Various Components in Total Inventories

	1958			1965		
	Finished Goods (%)	Semi-Finished Goods (%)	Raw Materials (%)	Finished Goods (%)	Semi-Finised Goods (%)	Raw Materials(%)
Cotton Textiles	46	11	43	40	13	47
Sugar	77	1	22	80	1	19
Transport Equipment		N.A.		8	22	70
Nonelectrical Machinery		N.A.		14	26	60

Source: Central Statistical Organization:

1) Annual Survey of Industries

2) Census of Manufacturing Industries

Table 5-1 shows the following: 1) The proportion of finished goods in total inventories is much higher for cotton textiles and sugar than for transport equipment and nonelectrical machinery; 2) The proportions of semi-finished goods and raw materials in total inventories are much higher for transport equipment and nonelectrical machinery than for cotton textiles and sugar. Also, these proportions for the two capital goods industries are higher relative to the proportion of the finished goods. These estimates show that our categorization of industries into PTS and PTO is likely to be correct.

II The Basic Inventory Model

We assume that changes in inventories held by business consist of a desired or intended component (ΔINV^*_t) and a passive or unintended component (ΔINV^p)[3].

$$(5.1.)\quad INV_t = INV_{t-1} + \Delta INV^* + \Delta INV^p$$

We can now define ΔINV^*_t and ΔINV^p. We utilize the flexible accelerator for ΔINV^*.

$$(5.2)\quad \Delta INV^* = \delta(INV^*_t - INV_{t-1}),\ 0 < \delta < 1$$

where INV^*_t refers to desired inventories. Equation (5.2) states that producers change inventories in proportion to the difference between desired inventories and inventories at the end of the previous period. The assumption of partial adjustment ($0<\delta<1$) is consistent with cost

3Eisner and Strotz (1963, p.225. Holt and Modigliani (1961) have discussed conditions under which a model incorporating intended and unintended inventories is consistent with cost minimization.

minimumization and ensures the dynamic stability of the economy.[4]

Substituting (5.2) in (5.1), we get:

$$(5.3) \quad INV_t = INV_{t-1} + \delta(INV_t^* - INV_{t-1}) + \Delta INV^p$$

We now turn to a discussion of passive inventories (ΔINV^p)

When producers decide on their optimum inventories, they decide on the basis of expected sales which, at least to PTS industries are not yet known.[5] Actually, even the level of current sales is gradually becoming known and orders for materials will be placed or the decision to increase production made before sales at the end of the current period are precisely known. If sales at the end of the current period exceed those that were expected, unintended reductions in inventories will take place. If current sales fall short of expected sales, undesired inventories will accumulate. Unless the production schedule is completely flexible, such unintended changes cannot be avoided. We should, therefore, include a passive inventory component in equation (5.3). The equation may be rewritten as:

$$(5.4) \quad INV_t = INV_{t-1} + \delta(INV_t^* - INV_{t-1}) - \Psi(SALE_t - SALE_t^e).$$

$$0 \leq \delta < 1, \quad 0 < \Psi < 1.$$

If $\Psi = 0$, production is fairly flexible. In this case, the change in inventories is entirely on the grounds of cost minimumization. If $\Psi = 1$. production is completly inflexible. Here the entire difference between

4 M. Lovell (1964)

5 We have assumed below that PTO industries can predict sales on the basis of unfilled orders outstanding.

actual and expected sales is reflected in changed inventories. As production schedules are generally partially flexible, we expect Ψ to lie between 0 and 1.

III Production-to-Stock Finished Inventories and Production-to-Order Semi-Finished Inventories

(a) Production to Stock: Finished Goods Inventories

Finished goods stocks perform the same function for PTS industries as unfilled orders do for PTO industries - viz, that of stabilizing production. As sales cannot be predicted with certainty and new orders have to be met on demand, both planned and unplanned components of our basic model are relevant. Our basic inventory model is:

$$(5.4) \quad INV^f_t = INV^f_{t-1} + \delta\,(INV^*_t - INV_{t-1}) - \Psi(SALE_t - SALE^e_t)$$

$$0 < \delta < 1, \qquad 0 < \Psi < 1$$

We further assume:

$$(5,5) \quad INV^{f*}_t = \beta_0 + \beta_1 SALE^e_{t+1}$$

$$(5.6) \quad SALE^e_{t+1} = SALE_t$$

substituting (5.5) and (5.6) into (5.4), we get:

$$(5.7) \quad INV^f_t = (1-\delta)INV^f_{t-1} + \delta\beta_0 + \delta\beta_1 SALE_t - \Psi\Delta SALE_t$$

$$0<\delta <1, \quad 0< \Psi <1$$

The above assumption ($SALE^{e}_{t+1} = SALE_t$) has been used in several well-known inventory studies.[6] The arguments for assuming the equality of current and expected sales have not generally been made clear. But they seem to run as follows: First, recent sales should carry a high weight in the calculation of expected sales. Considerations of "inventory smoothing" on the part of the buyers would reinforce this assumption. Second, anticipatory data for the U.S. show that sales forecasts are less difficult to make than inventory anticipations. Third, inventory is a short-term asset and the demand for it depends upon current sales because competitive conditions in PTS industries require that new orders be met on demand. Inventories may, therefore, be more affected by "transitory" components in sales than would, say, fixed capital, which is a long-term asset and may, therefore, depend upon permanenent sales.

Thus, sound theoretical considerations lead us to assume the equality of expected and current sales.[7]

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6 Enthoven (1956), Mills (1962), Darling (1959) and Lovell(1964) have used $SALE_{t-1}$ as a proxy for expected sales, while Lovell (1965), Darling(1965) Courchene (1967) and Belsley (1969) have used current sales to represent expected sales.

We could of course, have used a KoycK-type distributed lag function for expected sales and estimated the resulting model incorporating both adjustment and expectations mechanisms. We experimented with such a model, but the results proved unsatisfactory.

7 See also Evans (1969) p. 218, Mills (1962) calls this approach the implicit expectational approach. For an authorative discussion of this and other approaches (viz. optimal forecast models and elaborate expectations fun ctions) see chapter 3 in Mills (1962). Mills has argued in favour of the approach we have adopted and has pointed out the pitfalls in using other "explicit expectational methods such as error-learning expectations functions.

(b) Other Explanatory Variables (Prices, Interest Rates and Internal/ External Sources of Funds

So far, we have refrained from discussing the role of variables other than sales in our inventory equations. These variables are prices, interest rates and internal and external souces of funds.

(i) The Role of Price Expectations

Expected increase in finished goods prices may increase the demand for finished inventories. In the short run, product price inflation accompanied by rising new orders would lead to a fall in stocks of finished inventories.[8] The speed with which finished stocks will increase will depend upon the speed with which raw materials are replenished and production processes are completed. The consideration of these lags implies that current price change may often reflect the buffer stock motive. The coefficient of the price variable in such a case will be negative. A positive coefficient will be assumed to reflect the effect of expected prices on desired inventories.[9]

(ii) The Role Of Interest Rates

Most studies have found no role for interest rates in explaining inventory demand.[10]

8This comment of course, applies to PTS industries where a large inflow of new orders results partly in reduced finished goods stocks and partly in increased unfilled orders.

9. These statements also apply to raw materials.

10. Mr. Hamburger (1969) has summarized the relevant evidence. Out of thirteen studies he listed in his Table II, interest rate and other financial variables were statistically significant in four studies only.

We do not regard their empirical findings as conclusive as they suffer from both theoretical and econometric defects. We must, however, consider the theoretical arguments advanced to rationalize the *a priori* nonsignificance [11] of interest rates.

First, it is argued that while a large percentage of the total costs of fixed business investment may represent interest payments, this is not likely to be true of inventories. It is true that the long-term nature of fixed capital and heavy expenditures involved may sharply increase total interest payments relative to total fixed cots. Nevertheless, inventory investment may involve a continuous series of short-term loans which are regularly repaid as inventories turn over into sales. This argument implies that the interest rate which properly reflects the cost of inventory financing ought to be included in inventory equations.

Second, it is argued that inventories bear a technically fixed relationship with plant utilization and with other factors of production. Thus, if there are PTO commitments to deliver goods in future or if the PTO Industries are expecting an increase in sales, they would not risk a threat to their market position by reducing inventories in response to a rise in interest rates.

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11. Eisner and Strotz(1963), pp. 110 -111, M.Evans(1969), pp. 213 -214.

However, from an analysis of the components of inventories[12] and the PTO-PTS distinction, it appears that a mechanically rigid relationship between production and aggregate inventories cannot readily be accepted. Such an assumption denies the possibility of asset substitution. Some components of inventories may be more interest-sensitive than others. We must also note one factor favouring interest-sensitivity of inventories. "Inventory decisions in contrast to those concerning fixed investment, are divisable in nature, and this facilitates small adjustments appropriate to relatively small changes in credit conditions.[13]

Third, it is asserted that uncertainties surrounding sales and supply considerations may be so great as to swamp any cost of funds effects. It is true that the larger is the variability of sales and profits, the more steeply will the marginal cost of funds rise beyond the point at which expenditures equal depreciation plus retained earnings. The interest elasticity of demand will be very small in such a case. However, sales and profits do not fluctuate equally sharply for all industries. In spite of the fact that unfilled orders moderate the fluctuations in their output and sales, profits and sales of PTO industries generally fluctuate more sharply than those of PTS industries. This large variability of sales increases the marginal cost of funds rather sharply for any debt additions.

12Abramovitz (1950) Stanback (1961). Contributions by Abramovitz and Stanback on this point and related matters are discussed in detail in our unpublished survey of theoretical analysis of the PTO -PTS distinction. The survey is available upon request.

13S.M.Goldfield(1966) p.115

These considerations lead to the hypothesis that the interest elasticity of PTS inventory demand will be higher than the corresponding PTO demand.

To sum up our discussions of interest-elasticity of inventories, it is fair to say that the theoretical case for a zero interest elasticity is not firmly established.

(iii) Internal and External Sources of Funds

Internal and external sources of funds are often not considered as explanatory variables in inventory equations. One of the very few exceptions is the study by Paul Kuznets (1964) who found significant coefficients for the short-term interest rate and the various sources of finance. Theoretically, it seems proper to include external and internal sources for two reasons. First, our discussion of the cost of capital implies that it is unrealistic to relate specific sources of funds to specific uses. Second, in an economy like that of India where direct controls are an important instrument of monetary policy, interest rates may not adequately reflect credit availability. We may, therefore, have to include indicators of credit availability. As many industries in India have traditional links with the banking system while several others, being regarded as "priority industries" under the five year plans, receive preferential loans from government-owned financial institutions, it seems that the actual value of increase in debt (ΔDEBT) should be used as the external financing constraint in inventory equations.

To sum up, our inventory equations should include, in addition to sales, prices, interest rates and new debt finance (ΔDEBT) as explanatory variables. This conclusion applies to both the PTS and PTO industries.

We give below the OLS estimated equations for PTS finished goods inventories.

Production to Stock: Finished Goods Inventories

Cotton Textiles

$$\Delta INV^f = \underset{(1.07)}{649.2} + \underset{(2.71)}{.08137SALE} + \underset{(4.48)}{.4473\Delta DEBT} - \underset{(.178)}{.1630\ SALE} - \underset{(3.43)}{.5800INV^f_{-1}}$$

$$R = .841 \qquad DW = 2.24$$

Sugar

$$\Delta INV^f = \underset{(2.49)}{445.9} + \underset{(2.84)}{.09617SALE} + \underset{(28.25)}{.9856\Delta DEBT} - \underset{(1.93)}{.6614\Delta REC} - \underset{(2.78)}{2266\ \frac{\Delta P^f}{P^f_{-1}}}$$

$$- \underset{(2.69)}{241.2RL} - \underset{(3.27)}{.1885INV^f_{-1}}$$

$$R^2 = .996 \qquad DW = 1.98$$

The above estimates confirm the accepted role of sales in explaining inventories. Debt availability (ΔDEBT) has a positive effect on inventories for both cotton textiles and sugar.

The role of unintended inventory changes is also verified in the above equations. For cotton textiles, the equation shows that an under-estimation of sales by dollar reduces inventories by 16 cents. Also note that the coefficient of ΔSALE exceeds the coefficient of SALE implying the inverted conformity of finished goods inventories to the cyclical turns.

In the case of sugar, "buffer stock" changes in inventories are captured by the negative coefficient of the rate of change of prices. We noted above that in the short-run, product price inflation accompanied by rising new orders would lead to a fall in stocks of finished inventories.

While the coefficient of adjustment of actual to desired stocks is reasonably high (.58) for cotton textiles, it seems unduly low (.19) for sugar. This may be the result of least-square bias. To anticipate, the two-stage least squares estimate of the sugar equation gives an adjustment coefficient of .69.

The equation for sugar shows that there is substitution between inventories and receivables.

(c) Production-to-Order: Goods-in-Process Inventories

Our demand function for goods-in-process inventories held by PTO industries is based on two assumptions: First, we assume that PTO industries can predict sales, within a reasonable margin of error, on the basis of unfilled orders. Second, we assume that PTO industries are not subject to unintended inventory changes. These assumptions are discussed below.

PTO industries generally carry a backlog of orders which is quite high in relation to sales.[14] The ratio of unfilled orders to sales is a rough index of the production lag. The higher is this ratio, the longer is the lead of orders before output and sales, and the farther into the future can expected sales be known. The lead may be several quarters for such technologically heavy industries as metal products and machinery and as short as one quarter for fashion fabrics. It is clear that the longer is the production period, the more accurate will be the forecast. Even those PTO industries where the production period is not long, the production-smoothing role of unfilled orders implies that unlike the PTS industries, the PTOindustries have at least partial control over their sales.

We also assume that the long production period will negate the possibility of unintended inventory changes. It may be argued that if new orders keep coming at a faster rate, firms will expect higher sales beyond the period over which demand has been established through orders, and would, therefore, hold speculative semi-finished inventories. This will shorten the production period in future and make PTO industries

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14This assumption is difficult to verify especially when, as in the case of India, we have no data on unfilled orders. However, the nature of industries characterized as PTO is such that this assumption is not likely to be too wide off the mark. Courchene (1967) gives the following ratios of output to unfilled orders for industries he characterized as PTO: .36 (heavy transportion), .84(other capital goods) and 1.20(construction goods). The ratios are averages of quarterly observations for the period 1955-1962.

more like PTS industries. This is, however, highly unlikely. In addition to the storage costs and risks associated with a highly unstable demand, rising orders generally result in a lengthening of the market-determined delivery lag. There is, therefore, no risk of order cancellations due to lengthened delivery periods. This obviates the need to incur costs of holding speculative stocks of semi-finished inventories. Also, businessmen look favourably upon backlogs of unfilled orders.[15] These considerations rule out any possibility of unintended changes in semi-finished inventories.

The two assumptions explained above are used in the demand function for semi-finished inventories held by PTO industries. To derive the demand function, we start with the identity.[16]

$$INV^g_t = INV^g_{t-1} + MR_t + K_t - Q^f_t$$

where INV^g_t is inventories of semi-finished goods, MR_t is utilization of purchased materials, K_t is expenditure of labour and capital on these materials and Q^f_t is output of finished goods during the period. Following Holt and Modigliani (1961), we assume that $MR_t + K_t$ partly depends upon ouput expected in future time units (months, quarters, etc.) where n is the length of the production period. If the production period is two quarters, desired inventories of semi-finished goods at the end of the current quarter will depend upon output expected during the next two quarters. We, therefore, write:

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15 Zarnowitz (1962), p. 389

16 Holt and Modigliani(1961), p.35

$$(5.8) \qquad INV_t^{g*} = \varepsilon_0 + \varepsilon_1 SALE_{t+1} + \varepsilon_2 SALE_{t+2}$$

We also assume the following:

<u>Proposition 1</u> Sales during t lead to a reduction in goods-in-process inventories.

As soon as finished goods are ready for sale, the stock of semi-finished goods is reduced by the value of goods-in-process embodied in such sales. As, part of the value of sales may consist of expenditures not represented by the value of the goods-in-process, we assume that sales during t reduce goods-in-process by $\phi SALE_t$ where ϕ is the proportion of goods-in-process embodied in final sales.

Proposition 1 leads to the following adjustment mechanism for PTO semi-finished inventories:

$$(5.9) \qquad INV_t^g = INV_{t-1}^g + \delta\,(INV_{t-1}^{g*} - INV_{t-1}^g + \phi SALE_t) - \phi SALE_t$$

Equation (5.9) states that inventories at the end of t equal inventories at the beginning of the period <u>less</u> inventories reduced by final sales <u>plus</u> inventories added to bridge the gap between desired and remaining inventory stocks.

Substituting (5.8) in (5.9) we get:

$$(5.10) \qquad INV_t^g = (1-\delta) INV_{t-1}^g + \delta\varepsilon_0 + \delta\,\varepsilon_1 SALE_{t+1} + \delta\,\varepsilon_2 SALE_{t+2} + (\delta-1)\phi SALE_t$$

$$\phi,\ \varepsilon_1, \varepsilon_2 > 0;\quad 0 < \delta < 1.$$

Our chosen eqs. for goods-in-process inventories held by transport equipment and nonelectrical machinery are given below:

Transport Equipment

$$\Delta INV^g = 715.4 + .05234SALE + .1883\Delta DEBT + 3666 \frac{\Delta P^{mp}}{P^{mp}_{-1}} - .5396INV^g_{-1}$$

(2.20) (2.40) (2.34) (1.36) (3.20)

$R^2 = .68$, $DW = 2.39$

(Pmp is the price index of metal products.)

Nonelectrical Machinery

$$\Delta INV^g = -953.8 - .1013SALE + .02866SALE_{+1} + .2904\Delta DEBT + 16.71P^{mp} - 1006CP$$

(2.41) (4.92) (3.72) (4.97) (4.45) (3.29)

$R^2 = .916$ $DW = 2.51$

The above estimated equations show that only in the case of nonelectrical machinery is our hypothesis about goods-in-process verified. This equation is discussed first.

In the equation for nonelectrical machinery, current sales (SALE) have the expected negative sign and "sales expected next year" ($SALE_{+1}$) have a positive coefficient. Inventories at the beginning of the current year (INV^g_{t-1}) were not included in that equation as the coefficient δ was not significantly different from zero. Another interesting feature of the nonelectrical machinery equation is that the absolute value of the coefficient of SALE is greater than the absolute value of the coefficient of $SALE_{+1}$. This may imply that the production process in nonelectrical machinery approximately corresponds to type B described in Holt and Modigliani (1961). For type B, the average production time remains invariant with respect to the production rate. In such a case, goods--in-process inventories will vary with the production rate. In particular, the quantity of such inventories will be "a weighted average of the finished goods production in different future periods with the greatest weight going to the products that are furthest advanced in the production process" (op. cit. page 36) The inequality $\Phi > \delta \varepsilon_1$ would therefore, imply a productive process of type B.

The estimated equation for the group "transport equipment" looks like a typical equation for a PTS industry, while we have identified this group as belonging to the PTO category. Our attempts to include both current and next year's sales in the same equation were not successful. The variable $SALE_{t+1}$ became non-significant. High collinearity relative to the coefficient of determination must have been part of the problem. In the transport equipment equation, therefore, the coefficient of $SALE_t$ is likely to represent the net impact of the offsetting effects of current and next year's sales. Other variables in the equation for transport equipment - lagged inventories, new debt issues and rate of change of prices - belong in both the PTS and PTO equations.

IV Demand for Raw Materials by PTS and PTO Industries

(a) Production-to-Stock: Raw Materials

Stocks of raw materials are needed not only to meet any immediate needs of production but also to forestall any possible interruption in its continuity.

If we assume a replenishment lag (i.e. the lag between the placing of orders and arrival of supplies) of one period, we can write[17]

$$(5.12)\quad INV^r_t = INV^r_{t-1} + OP_{t-1} - MR_t$$

Where INV^r_t is inventories of raw materials at the end of t; OP_{t-1} is outstanding orders placed by the end of t-1 (these orders will result in raw material arrivals during t); MR_t is raw material consumption or usage during t. We also assume,

$$(5.13)\quad OP_{t-1} = MR^e_t + \delta\,(INV^{r*}_t - INV^r_{t-1})$$

Equation (5.13) states that orders placed during t-1 will be for supplies sufficient to cover not only their expected consumption during t (i.e., MR^e_t) but also a part of the gap between desired and actual inventories. Substituting (5.13) in (5.12), we get:

$$(5.14)\quad INV^r_t = INV^r_{t-1} + \delta\,(INV^{r*}_t - INV^r_{t-1}) + MR^e_t - MR_t$$

The difference between expected and actual raw material consumption $(MR^e_t - MR_t)$ reflects the diffence between expected and actual output. In discussing finished goods inventories we have argued that diffulties of changing production scheduling ("production smoothing") will result in unintended changes in finished goods inventories. The same consideration implies that divergences between the actual and expected usage of raw materials are likely to be of secondary importance. Even if actual raw material usage differs from the expected usage, this difference may

17 The following theoretical analysis is based on Holt and Modigliani (1961). See also T.Courchene. (1967).

not be reflected in actual material stocks if additional supplies can be acquired within a short time. To guage the importance of unintended changes in material stocks, we have used the variable "capacity utilization". A positive effect of capacity utilization (CP_t) on material stocks implies that inventory changes are intended. A negative effect will provide a measure of unintended changes. We, therefore, modify (5.14) as follows:

$$(5.15)\quad INV^r_t = INV^r_{t-1} + \delta(INV^{r*}_t - INV^r_{t-1}) + g_5 CP_t$$

where CP is the capacity utilization defined as the ratio of actual output to maximum attainable output.

As desired inventories were determined in the light of information available during t-1, we postulate:

$$(5.16)\quad INV^{r*}_t = g_0 + g_1 SALE_{t-1} - g_2 RL_{t-1} + g_3 \frac{\Delta Prm_{t-1}}{Prm_{t-2}} + g_4 STP_{t-1}$$

where RL is the prime lending rate, Prm is a price index for raw materials, STP is a stock price index. We have used the stock price index as a proxy for expected short-term profitability. Its role has also been tested in equations for gross fixed investment and accounts receivable.

Substituting (5.16) in (5.15) yields:

$$\Delta INV^r_t = \delta g_0 + \delta g_1 SALE_{t-1} - \delta g_2 RL_{t-1} + \delta g_3 \frac{\Delta Prm_{t-1}}{Prm_{t-2}} + \delta g_4 STP_{t-1} + g_5 CP_t - \delta INV^r_{t-1}$$

Cotton Textiles

$$\Delta INV^r = 3062 + .1431SALE_{-1} + 14.57STP_{-1} - 1317RL_{-1} + .1183\,\Delta Q_t - 1.171INV^r_{-1}$$
$$(4.64) \quad (7.01) \qquad (3.52) \qquad (5.05) \qquad (2.63) \qquad (7.84)$$

$$R^2 = .870, \quad DW = 2.71$$

Sugar

1. $$\Delta INV^r = 636.8 + .02264SALE + 1.263STP_{-1} - 72.01RL_{-1} + .02364\Delta DEBT -$$
$$(4.09) \quad (4.75) \quad (3.64) \qquad (3.48) \qquad (2.58)$$

$$- 744.5CP - .4095INV^r_{-1}$$
$$(3.96) \qquad (4.05)$$

$$R^2 = .801, DW = 2.09$$

2.

$$\Delta INV^r = 319.9 + .01488SALE_{-1} + 1.219STP_{-1} - 37.87RL_{-1} + .009425\Delta DEBT - 400.7CP$$
$$(2.05) \quad (3.23) \qquad (2.92) \qquad (1.90) \qquad (.84) \qquad (1.90)$$

$$- .4014INV^r_{-1}$$
$$(3.25)$$
$$R^2 = .623, \ DW = 2.11$$

The above equations verify our hypotheses for raw material demand by PTS industries. In the case of sugar, equation (2) strictly conforms to our hypothesis. The only difference between equations (1) and (2) for sugar is that in equation (1), $SALE_t$ is substituted for $SALE_{t-1}$. The coefficient of determination is significantly improved by this substitution. Theoretically, the inclusion of current sales can be justified on the ground that the demand for sugar, the classic PTS industry, can be predicted within a reasonable margin of error because of its characteristic as a necessity.

In the equations for both cotton textiles and sugar, sales, prime lending rate and the stock price index are statistically significant. Thus, our theoretical arguments above justifying the possibility of interest elasticity of demand for inventories are verified by empirical estimates. The role of the stock price index in explaining inventories suggests the importance of a variable which has, so far, been neglected in inventory equations.

There is a significant difference between the two industries in the speed of adjustment of actual raw material inventories to their desired levels. In the case of cotton textiles, the entire adjustment is completed within a year. The positive sign of ΔQ_t (change in output) in that equation corroborates the conclusion of speedy adjustment. During the Second and Third Plans, significant imports of raw cotton were allowed to bridge the gap between domestic consumption and output. Imports of raw cotton during the two Plans averaged about 14% of domestic consumption. In contrast, raw material adjustment in the sugar industry was rather slow. In the sugar industry, the raw material - mainly sugar cane - is a perishable good and caution is exercised in building inventories. Sugarcane production in India has also been marked by recurring cycles of over-production and shortages, making inventory management rather difficult. The negative co-efficient of capacity utilization in the equations for sugar corroborates the hypothesis of a low adjustment coefficient.

(b) Production-to-Order: Raw Materials

We start with identity (5.12)

(5.12) $INV^r_t = INV^r_{t-1} + OP_{t-1} - (MR)_t$

where OP = orders placed, $(MR)_t$ = raw material consumption. As in the case of goods-in-process, we assume that an increase in output reduces raw material inventories. We write:

(5.18) $(MR)_t = h_6(\Delta INV^g_t + \Delta INV^f + SALE_t)$

where the sum of terms in parentheses represents the output.

As noted above, we assume that PTO sales during the next two periods can be forecast on the basis of orders on hand and incoming orders. Thus, $(MR)_t$ in equation (5.12) is known.

If we assume a unit replacement period, orders placed last period (OP_{t-1}) should equal material arrivals during the current period. We also assume the following.[18]

(5.19) $OP_{t-1} = \delta\,(INV^{r*}_t - INV^r_{t-1} + MR^e_t)$

where $MR^e_t = MR_t$

18Implicit in the following equation is the assumption that when the orders for raw materials are placed, manufacturers have pretty good idea of how much raw material stocks will exist by the end to t-1. This assumpion rules out passive inventory changes. Such changes can arise from two sources. They can arise either from a discrepancy between expected and actual sales or from a misestimation of the replenishment period. A close look at the charateristics of PTO industries - role of unfilled orders and a long production period - suggests that unintended raw material inventories are likely to be of negligible importance.

When orders for raw materials were placed last period, sales during the current period and the next were known. Thus:

(5.20) $$INV^{r*}_t = h_0 + h_1 SALE_t + h_2 SALE_{t+1} + h_3 \Delta P^{rm}_{t-1} / P^{rm}_{t-2} - h_4 RL_{t-1}$$

Substituting (5.18), (5.19) and (5.20) we get:

(5.21)

$$INV^r_t = (1-\delta) INV^r_{t-1} + (\delta-1) h_6 (\Delta INV^g_t + \Delta INV^f) \cdot \delta h_0 + \{ \delta(h_1+h_6) - h_6 \} SALE_t$$

$$+\delta h_2 SALE_{t+1} + \delta h_3 \Delta P^{rm}_{t-1} / P^{rm}_{t-2} - \delta h_4 RL_{t-1}$$

As $0<\delta<$ and $h_6 > 0$, we expect the coefficient of $(\Delta INV^g + \Delta INV^f)$ to be negative.

An examination of the components of the coefficient of $SALE_t$ shows that the coefficient is likely to be positive. This is so because in a shortage-oriented economy like that of India's, δ is likely to be closer to unity and h_1 to be positive.

The OLS estimated equations are given below.

<u>Transport Equipment</u>

$$\Delta INV^r = -212.7 + 198721 SALE + .2367 \Delta DEBT - .4665 INV^r_{-1}$$
$$(1.09) \quad (2.64) \quad (2.76) \quad (3.13)$$

$$R^2 = .645, \quad DW = 2.75.$$

<u>Nonelectrical Machinery</u>

1. $\Delta INV^r = -458.9 + .1043 SALE + .2155 \Delta DEBT + 2.251 STP_{-1} - .5722 INV^r_{-1}$

$R^2 = .911, \quad DW = 2.04$

2.

$$\Delta INV^r = -248.2 + .1546SALE + .2221\Delta DEBT + .0003747(SLSTP)_{-1} - .77041INV^r_{-1}$$
$$(1.68) \qquad (2.70) \qquad (3.70) \qquad (4.63)$$

$R^2 = .913, \quad DW = 1.94$

In our estimated PTO equations given below, SALE is statistically significant, while $SALE_{+1}$ and ΔINV^g_t are not. In terms of equation (5.21), $h_2 = h_6 = 0$ in the above estimated equations.

The speed of adjustment (δ) of actual to desired stocks is reasonably high for both transport equipment and noneletrical machinery. The coefficient of new debt finance (ΔDEBT) is significant in both the equations.

The importance of the stock price as a measure of short-term profitability was verified in explaining investment behaviour of the nonelectrical machinery industry. The stock price index is again significant in the raw material equation for the same industry.

V <u>Demand for "Other Inventories"</u>

(a) <u>Production-to-Stock: "Other" Inventories</u>

It is difficult to specify *a priori* testable hypotheses for demand for "other inventories" because it is not clear what is included in this component. It was, therefore, argued above that the behaviour of this category of inventories will be explained by which of the two functions already specified for PTS and PTO industries applies to the data on "other inventories". Our empirical testing led to the following conclusion about PTS industries: The component "others" in the case of cotton textiles consists mainly of raw materials. In the case of sugar, it is dominated by finished goods. We, therefore, estimated equations, using as dependant variables, the sum of raw materials and "others" in the case of cotton textiles and the sum of finished goods and "others" in the case of sugar. The estimated equations for "other inventories" and the sums defined above are given below:

Cotton Textiles: "Other Inventories"

$$\Delta INV^{other} = 462 + .01742SALE_{-1} + 4.340STP_{-1} - 0.652P^{rm} - .2662INV^{other}_{-1}$$

(1.50) (2.84) (4.92) (3.36) (2.17)

$R^2 = .738$, DW = 1.94

Cotton Textiles: Raw Materials and Other Inventories

$$\Delta INV^{r} + \Delta INV^{other} = 2354 + .1647SALE_{-1} + 20.93STP_{-1} - 1043RL_{-1} + .1388\Delta Q_t$$

(3.86) (7.62) (5.22) (4.34) (1.96)

$$-1.085(INV^{r}_{-1} + INV^{other}_{-1})$$

(2.31)

$R^2 = .880$, DW = 2.49

Sugar: Other Inventories

$$\Delta INV^{other} = 43.04 + .03505SALE + .01675\Delta DEBT - .231\Delta REC - .0201\Delta SALE$$

(1.53) (3.18) (3.23) (5.35) (2.08)

$$- .4235INV^{other}_{-1}$$

(2.51) $R^2 = .734$, DW = 3.13

Sugar: Finished Goods and Other Inventories

1. $\Delta INV^{f} + \Delta INV^{other} = .368.3 + .05679SALE - .4912\Delta REC + 1.01\Delta DEBT - 132.4RL$

(1.78) (1.66) (1.40) (25.89) (1.36)

$-.1393(INV^{f} + INV^{other})_{-1}$

(2.31)

$R^2 = .994$, DW = 2.05

2. $\Delta INV^{f} + \Delta INV^{other} = 404.0 + .1144SALE - .8703\Delta REC + .9852\Delta DEBT - 208.9RL$

(2.43) (3.43) (2.81) (30.37) (2.54)

$-2304\frac{\Delta P^{f}}{P^{f}_{-1}} - .2045(INV^{f} + INV^{other})_{-1}$

(3.05) (3.86)

$R^2 = .997$, DW = 1.98

(b) Production-to-Order: Other Inventories

Equations chosen for transport equipment and nonelectrical machinery are given below:

Transport Equipment

$\Delta INV^{other} = 198.62 + .06001SALE + .0857\Delta DEBT + .8528STP_{-1} - .8142INV^{other}_{-1}$

(1.20) (3.70) (3.58) (1.86) (4.82)

$R^2 = .700$, DW = 2.17

Nonelectrical Machinery

$$\Delta INV^{other} = 18930 + .3112SALE - 61.46P^{mp}_{-1} - 12820CP - 1.074INV^{other}_{-1}$$
$$(5.56) \quad (2.51) \quad (2.42) \quad (6.85)$$

While we treated "other inventories" held by PTO as raw materials and the results, as shown above, are quite good, we decided not to aggregate "raw materials" and "other inventories" because, unlike the PTS industries, there is a good deal of heterogenity in the industries comprising the groups transport equipment and nonelectrical machinery.[21]

21Belsley (1969) has pointed out that this heterogeneity should be scrutinized before using data on unfilled orders. After all, PTO industries produce according to specifications submitted by buyers.

CHAPTER 6

The Demand for Current Assets by Nonfinancial Corporations

This Chapter derives and estimates demand functions for current assets. Current assets include money, government and semi-government securities and accounts receivable. The demand function for money is derived first. The next two sections specify functions for government bonds and receivables.

I Demand for Money

The theory of demand for money has been extensively discussed by Friedman, Tobin and others. Theoretically, one can analyse the role of money as a productive asset in several alternative ways. For our purposes we shall regard money as a productive asset, the demand for which should be considered in the context of the entire portfolio of assets and liabilities. In other words, money will be regarded as a substitute not only for current assets but also for fixed capital. The incorporation of this view leads to a demand function for money which is similar to that in F de Leeuw (1965). We assume the following: (i) desired money balances depend upon expected sales and the rates of return on alternative assets, (ii) a short-run constraint represented by internal funds affects monetary adjustments and (iii) the change in money stock is partly a reaction to the gap between the desired and actual money holdings. These assumptions lead to the following two equations (comments on equations will follow):

(6.1) $\Delta M = \delta(M^* - M_{t-1}) + k_8 IF$

where M is money stock (currency plus total deposits) and IF is internal funds.

(6.2)

$$M^* = k_0 + k_1 SALE - k_2 \Delta INV - k_3 \Delta GFA - k_4 \Delta REC - k_5 RG - k_6 RC - k_7 \frac{\Delta P^t}{P_{t-1}}$$

Equation (6.1) states that the actual change in money is partly the result of a cost-minimizing decision and partly to provide a temporary abode for internal funds. It is reasonable to assume that undistributed profits will first be reflected in holdings of cash before decision about their allocation is taken.

Equation (6.2) states that desired balances are determined by expected sales (which equal actual sales) and the rates of return on alternative assets - government bonds, inventories, receivables and gross investment. The unobservable rates of return on the last three assets have been represented by changes in stocks of the corresponding assets.[1]

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1. The use of changes in stocks of assets as proxies for the rates of return on these assets has been made in Dhyrmes and Kurz (1967). De Leeuw(1965) has also made an extensive use of this procedure in his model of the U.S.financial sector. He argues (p.489):"the use of actual capital spending figures may have the advantage of reflecting any factors which influence the choice between real and financial investment but which are difficult to represent explicitly. " For a model which recognizes the possibility of substitution along the entire spectrum of assets and liabilities in the context of sectoral balance-sheet identities see Tobin and Brainhard (1967).

It may be noted that the inclusion of changes in current and fixed assets can also be rationalized in terms of the budget constraint and the theory of cost of capital.

First, if the portfolio decisions are interrelated, it is clear from the budget constraint that, ceteris paribus, an increase in nonliquid assets (REC, INV and GFA) may lead to a decrease in liquid assets.

Second, current assets like inventories and receivables are less liquid than either cash or government bonds. Inventories, whether in the form of raw materials, semi-finished goods or finished goods cannot easily be sold. Fluctuations in their prices increase their riskiness and hence the riskiness of the firm's portfolio. Receivables arise out of purchases charged by customers and they cannot easily be converted into cash before they become due. Even if they can be so converted, the conversion is likely to be at a discount.

Thus an increase in inventories and receivables to cash balances adversely affects the liquidity of the portfolio. The third non-financial asset-fixed investment is even more risky. It may, therefore, be concluded that other things (e.g., internal funds and liquid assets) remaining the same, an increase in nonfinancial assets adversely affects the debt-liquidity position of the portfolio and raises the marginal cost of funds. This rise in the marginal cost of funds decreases cash balances held.[2]

Substituting equation (6.2) into equation (6.1) we get:

$$(6.4)\quad \Delta M = \delta k_0 + \delta k_1 SALE - \delta k_2 \Delta INV - \delta k_3 \Delta GFA - \delta k_4 \Delta REC - \delta k_5 RG - \delta k_6 RC - \delta k_7 \frac{\Delta P_t}{P_{t-1}} - \delta M_{t-1} + k_8 IF$$

II <u>Demand for Government Bonds</u>

The demand for government bonds can be treated in the same way as the demand for money except that the bond yield will have a positive effect on the demand for bonds. We can, therefore, write down the following equations:

$$(6.5)\quad \Delta TGS = \delta\,(TGS^{*} - TGS_{t-1}) + m_8 IF$$

2J. Tobin (1956) and M. Sidrauski (1967) have discussed the substitutability between cash balances and investment. They argue that substitution between liquid assets is greater than between money and physical assets.

$$(6.6) \quad TGS^* = m_0 + m_1 SALE + m_2 RG - m_3 \Delta INV - m_4 \Delta REC - m_5 \Delta GFA - m_6 \frac{\Delta P_t}{P_{t-1}} - m_7 RC$$

$$(6.7) \quad \Delta TGS = \delta m_0 + \delta m_1 SALE + \delta m_2 RG - \delta m_3 \Delta INV - \delta m_4 \Delta REC - \delta m_5 \Delta GFA - \delta m_6 \frac{\Delta P_t}{P_{t-1}} - \delta m_7 RC + m_8 IF - \delta TGS_{-1}$$

Our evidence on demand for money and government bonds is described below. We have assumed that the demand functions developed above apply both to the PTO and PTS industries. While the behaviour of inventories is affected by the different characteristics of productive processes implicit in the PTO-PTS distinction, cash and liquidity management is likely to be affected by current sales and rates of interest on alternative assets and liabilities. We first discuss the evidence on demand for money.

Cotton Textiles

$$\Delta M = 5138 + .04491 SALE - .02908 \Delta REC + .1665 IF - 58.13 P^f - .3766 M_{-1}$$

(5.46) (5.60) (2.15) (5.37) (5.40) (3.68)

$R^2 = .702 \quad DW = 2.39$

Sugar

$$\Delta M = 177.5 + .009758 SALE + .1312 IF - .1320 \Delta GFA - .9334 M_{-1}$$

(3.14) (2.32) (2.64) (2.07) (4.70)

$R^2 = .677, \quad DW = 1.78$

Transport Equipment

$$\Delta M = 1753 + .02947SALE - .1388\Delta REC - 441.2RG - .5924M_{-1}$$
$$(1.86) \quad (1.72) \qquad (1.50) \qquad (1.62) \qquad (2.92)$$

$$R^2 = .392, \qquad DW = 1.65$$

Nonelectrical Machinery

$$1.\ \Delta M = 312.1 + .01147SALE - 1157\frac{\Delta Pi,s}{Pi,s_{-1}} - .88335M_{-1}$$

$$(3.73) \qquad (2.42) \qquad (1.75) \qquad (3.91)$$

$$R^2 = .500, \qquad DW = 2.03$$

$$2.\ \Delta M = 3.2.9 + .01857SALE - 1515\frac{\Delta Pi,s}{Pi,s_{-1}} - .1530\,REC - .8089M_{-1}$$

$$(4.02) \qquad (2.93) \qquad (2.30) \qquad (1.56) \qquad (4.06)$$

$$R^2 = .560, \qquad DW = 1.95$$

The estimated equations given above generally support our hypothesis (equation 6.4) about demand for money.

Sales income is significant in the money equations for all four industries.

Another common feature of the results is the existence of substitution between assets. Except in the case of sugar, accounts receivable are a substitute for money. This confirms our *a priori* hypothesis that substitution between current and liquid assets is, in general, more common than that between fixed and liquid assets.

The role of internal funds (IF) as a temporary abode of purchasing power is verified in the case of sugar and cotton textiles. Prices affect the demand for money by cotton textiles and nonelectrical machinery.

We now turn to the estimates of bond equations:

Transport Equipment

1. $\Delta TGS = 102.2 + .005644SALE - .00002189SLSTP - 549.3RC - .4865TGS_{-1}$

$$(5.46) \quad (2.32) \quad (3.03) \quad (3.61) \quad (3.35)$$

$$R^2 = .980 \qquad DW = 1.58$$

2. $\Delta TGS = 66.45 + .008517SALE - .00002296SLSTP - .03645SLRC - .5363TGS_{-1}$

$$(3.53) \quad (2.28) \quad (2.54) \quad (2.56) \quad (3.31)$$

$$R^2 + .979 \qquad DW = 1.70$$

Nonelectrical Machinery

$$\Delta TGS = 329.4 + .00650SALE - 5490RC - 1.120TGS_{-1}$$

$$(3.14) \quad (.153) \quad (2.38) \quad (5.28)$$

$$R^2 = .706 \qquad DW = 2.01$$

We could not estimate any sensible equations for demand for government bonds by sugar and cotton textiles. There was a continuous decline, over the sample period, in the holdings of government bonds by cotton textiles. The behaviour of such holdings in the sugar industry was highly erratic. Failing to get plausible estimated equations, we decided to assume bond holdings in PTS industries to be exogenous. Given the relative insignificance of bond holdings in total assets of these industries, we are not compromising the usefulness of our model by doing so. For example, in 1959, the midpoint of our time-series data (1950-1968), government and semi-government bonds accounted for less than 1% of total assets for both cotton textiles and sugar.

The evidence relating to transport equipment and nonelectrical machinery shows that sales income and the rate of interest on corporate debt (RC) are important determinants of demand for government bonds. In equation (2) for transport equipment, both stock price and interest elasticities of demand for bonds are assumed to depend upon sales income.

III Demand for Accounts Receivables

The terms on which credit is granted are usually fixed in the short-run. As a result of the automaticity which characterizes receivables, we can safely postulate that desired receivables increase with sales. As in the case of money and government bonds, we must also allow for substitution between receivables and other assets. Thus we write:

$$(6.8) \quad REC_t^* = \eta_0 + \eta_1 SALE_t - \eta_2 \Delta M - \eta_3 \Delta TGS - \eta_4 \Delta GFA - \eta_5 \Delta INV$$

Receivables are also related to credit conditions. When the rate of interest rises, customers who generally do not charge their purchases will probably do so.

> "Those customers who have for convenience paid invoices early upon their arrival are led, by the higher costs of cash, to consider delaying payment until the tenth of the month. Some customers may not take cash discount if paying for purchases by the tenth of the month requires securing a bank loan. These actions by customers in response to interest rate changes may cause quite a large increase in accounts receivable." [4]

We, therefore, postulate a positive relation between interest rates and receivables.

The effect of current price change is analogous to the effect of a change in the rate of interest. Higher prices of products increase the financial liabilities of customers who are likely to delay payment. Those who did not charge their purchase may now do so. This behaviour on the part of customers will lead to an increase in receivables outstanding.

Our discussion so far leads to the following function for desired receivables:

$$(6.9)\quad REC^{*}_{t} = \eta_0 + \eta_1 SALE_t - \eta_2 \Delta M - \eta_3 \Delta TGS - \eta_4 \Delta GFA - \eta_5 \Delta INV + \eta_6 RC + \eta_7 \frac{\Delta P_t}{P_{t-1}}$$

We have noted that the granting of credit is almost automatic. However, the existence of factoring institutions and debt collection agencies implies that actual receivables may not always equal the desired amount. Our empirical equations must, therefore, specify an adjustment mechanism such as (6.10) below:

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4 A. Heston (1962), p. 125

(6.10) $REC_t = REC_{t-1} + \delta(REC^*_t - REC_{t-1})$

Substituting (6.9) into (6.10) we get:

(6.11)

$$\Delta REC_t = \delta\,\eta_0 + \delta\,\eta_1 SALE_t - \delta\,\eta_2 \Delta M - \delta\,\eta_3 \Delta TGS - \delta\,\eta_4 \Delta GFA - \delta\eta_5 \Delta INV + \delta\,\eta_6 RC + \delta\,\eta_7 \frac{\Delta P_t}{P_{t-1}} - \delta REC_{-1}$$

The OLS estimates of equation (6.11) are given below:

Cotton Textiles

1. $\Delta REC = -1670 + .07559 SALE + 7.507 STP - .4983 REC_{-1}$

(2.74) (2.24) (2.56) (1.84)

$R^2 = .658$, DW = 2.18

2. $\Delta REC = -2316 + .09725 SALE + 7.941 STP + 190.8 RL - .7406 REC_{-1}$

(3.12) (2.85) (2.85) (1.38) (2.39)

$R^2 = .720$, DW = 2.30

Sugar

1. $\Delta REC = -33.73 - .4629 \Delta GFA + .04269 SALE$

(.31) (2.52) (3.92)

$R^2 = .492$ DW = 1.72

2. $\Delta REC = -496.5 - .4087 \Delta GFA + 7.544 P^f$

Transport Equipment

$\Delta REC = -273.5 + .07266 SALE - .6792 \Delta M - 3.118 \Delta GFA$

(1.14) (2.98) (1.49) (1.98)

$R^2 = .459$, DW = 1.92

Nonelectrical Machinery

1. $\Delta REC = -2218 + .1720SALE + 39880RC \quad -.7225\Delta M - .6248REC_{-1}$

$$(3.81) \quad (6.05) \quad (3.43) \quad (2.36) \quad (4.65)$$

$$R^2 = .867, \quad DW = 2.35$$

2. $REC = -112.6 \quad .0767SALE \quad 2.654SLRC \quad -.7893\Delta M - .8530REC_{-1}$

$$(1.51) \quad (3.83) \quad (5.96) \quad (3.54) \quad (7.34)$$

$$R^2 = .849, \quad DW = 2.15$$

Our estimated equations above broadly confirm our hypothesis (equation 6.11). We note that the adjustment coefficient is zero in equations for sugar and transport equipment. According to these equations gross investment requirements lead to a reduction in accounts receivable. In the case of these two industries, there was a declining trend in the ratio of receivables to sales. Part of the explanation of this trend can, therefore, be traced to asset substitution.

For cotton textiles and nonelectrical machinery, the ratio of receivables to sales increased between 1950 and 1968. According to the equations for these industries, this trend can partly be explained by movements in sales and rates of interest. Also, unlike sugar and transport equipment, the adjustment coefficient δ for these two industries is significantly different from zero.

CHAPTER 7

The Dividend and External Financing Behaviour of Nonfinancial Corporations

This chapter develops hypotheses and presents evidence on the dividend policies and external financing behaviour of industrial corporations. As noted in Chapter 1, in the case of the industries under study, there has been a continuous decline in the proportion of gross fixed investment financed by internal funds.

Section I discusses various hypotheses advanced in the literature to explain dividend pay-out policies of industrial corporations. In particular, we have discussed the views of Modigliani-Miller, Lintner and Kuh. Sections II and III formulate hypotheses and present estimated equations to explain debt and equity financing policies of industries under study.

I Dividend Behaviour

The effect of dividend policy on the market value of owner's equity has been a subject of considerable debate amongst security analysts as well as finance theorists.

The Modigliani-Miller thesis that the value of a firm in a risk-class is invariant with respect to the finance mix implies that the particular dividend policy chosen does not affect either the probability distribution of earnings or the cost of capital. Planned investment flows will not be affected by higher dividend payouts because investment funds could be replenished by debt finance which does not, according to their thesis, affect the marginal cost of funds. All that the dividend policy does is to determine the temporal distribution of realization of the firm's value into dividends now and capital gains later.[1]

Lintner (1956: 1967) has argued that investment depends upon expected sales and financial risk, subject to the short-run constraint of stable dividend behaviour. The Lintner formulation, which was based upon interviews with businessmen, consists of the following two equations:

(7.1) $DIV_t^* = \upsilon_0 + \upsilon_1 NP_t$

(7.2) $DIV_t = DIV_{t-1} + \delta(DIV_t^* - DIV_{t-1})$

where DIV_t^* is desired dividend pay-out and NP is net profits (retained earnings plus dividends). Equations (7.1) and (7.2) imply the following:

(7.3) $DIV_t = \delta\upsilon_0 + \delta\upsilon_1 NP_t + (1-\delta)DIV_{t-1}$

Kuh (1971) has found extensive support for the above Lintner hypothesis. He has also derived some results which follow from the assumption that investment policy is not seperable from the dividend policy. Assuming (i) the Chenery capital stock adjustment principle, (ii) the Lintner dividend equations (7.1) and (7.2), (iii) net profits proportional to

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1. For an algebric representation of the MM dividend model, see Mossin (1973).

sales and (iv) availability of external finance for rapidly growing firms, Kuh (1971) has derived the following qualitative conclusions about dividend policy: (a) rapidly growing firms retain a large fraction of their profits, and (b) the greater is the availability of external funds, the higher is the dividend adjustment coefficient δ. While these results are by no means startling, it should be noted that they are based on the premise that dividend policy and investment policy are interrelated, a premise which is at variance with that underlying the Miller-Modigliani thesis. Also, in the (long-run,) Kuh model, desired dividends depend not only upon profits but also upon the rate of growth of real assets, which may be regarded as a proxy for the expected rate of return on assets. The Lintner formulation on the other hand, hypothesizes that desired dividends depend only upon net profits.

The dividend equation we have tested is based upon three assumptions: (1) desired dividends depend upon gross profits (net profits plus depreciation) and expected rates of return on assets (as noted in previous discussions, the expected rates are represented by changes in these assets): (2) actual dividends paid depend partly upon the availability of external debt: (3) a part of the change in dividend pay-out reflects the adjustment of actual dividends to their desired values. These assumptions lead to the following equations:

$$(7.12) \quad DIV_t^* = \upsilon_0 + \upsilon_1 GP - \upsilon_2 \Delta GFA - \upsilon_3 \Delta INV - \upsilon_4 \Delta REC$$

$$(7.13) \quad DIV_t = DIV_{t-1} + \delta(DIV_t^* - DIV_{t-1}) + \upsilon_5 \Delta DEBT$$

where GP is gross profits, ΔGFA is change in gross fixed assets(or gross fixed investment), ΔINV is change in aggregate inventories, ΔREC is change in accounts receivable, and $\Delta DEBT$ is change in debt defined to include short debt, long debt, and accounts payable (i.e. $\Delta DEBT = \Delta SD + \Delta LD + \Delta TDUE$)

Equation (7.12) describes desired dividends. We have used gross profits instead of net profits because provision for depreciation is more an internal source of funds than an indicator of capital consumption. If stable dividend behaviour is regarded as a constraint on investment policy, gross profits instead of net profits seem to be the appropriate determinant of desired dividends. In his study of U.S. corporations for the period 1942-1960, J. Brittain (1966) tested the relative importance of the two measures of profit and found that the depreciation-inclusive measure invariably performed better than the reported net profit.

The reason for including the measures of growth for all the three assets is to explore the possibility of their differential impact on dividend disbursements. In his study, Brittain used change in sales to represent the growth factor. As in the Kuh model discussed above, the growth variable is negatively related to dividend payouts.

Equation (7.13) implies that dividend payments depend upon the gap between desired and actual dividends and also the availability of debt finance. An easy access to lending institutions enables firms to maintain dividends at established rates during periods of low profits.

Substituting equation (7.12) into equation (7.13) we get:

$$(7.14)\quad DIV_t = \delta\upsilon_0 + \delta\upsilon_1 GP - \delta\upsilon_2 \Delta GFA - \delta\upsilon_3\, \Delta INV - \delta\upsilon_4 \Delta REC + \upsilon_5 \Delta DEBT + (1-\delta) DIV_{t-1}$$

Alternative versions of equation (7.14) were estimated. Our preferred equations are given as follows:

Cotton Textiles

$$DIV = \underset{(4.42)}{256.} + \underset{(8.23)}{.0821GP} + \underset{(7.31)}{.516DIV_{-1}}$$

$$R^2 = .947 \quad DW = 1.91$$

Sugar

1. $$DIV = \underset{(1.58)}{39.08} + \underset{(5.55)}{.1148GP} - \underset{(2.73)}{.08153\Delta GFA} - \underset{(1.74)}{.06585\Delta INV} + \underset{(1.73)}{.06592\Delta DEBT} + \underset{(7.69)}{.8002DIV_{-1}}$$

$$R^2 = .866, \quad DW = 1.65$$

2. $$DIV = \underset{(1.25)}{31.63} + \underset{(5.32)}{.09966GP} - \underset{(1.94)}{.94815\Delta GFA} + \underset{(7.25)}{.8053DIV_{-1}}$$

$$R^2 = .860, \quad DW = 1.50$$

Transport Equipment

$$DIV = \underset{(2.99)}{485.1} + \underset{(4.13)}{.3351GP} - \underset{(2.31)}{.03428\Delta SALE} + \underset{(2.44)}{132.0RL} + \underset{(1.50)}{.2687DIV_{-1}}$$

$$R^2 = .805, \quad DW = 1.81$$

Machinery

$$DIV = \underset{(2.32)}{97.00} + \underset{(3.42)}{.1468GP} - \underset{(2.00)}{28.62RL} + \underset{(4.52)}{.7472DIV_{-1}}$$

$$R^2 = .960, \quad DW = 1.75$$

The evidence presented above shows that while gross profits(GP) is significant in all equations, the Lintner hypothesis of stable dividend policy is found to be supported only in the case of cotton textiles. In the case of sugar and transport equipment, the evidence shows that requirements of growth lead to a curtailment of dividend payments. Also, while availability of external debt (ΔDEBT) affects dividend payments by the sugar industry, cost (RL) of credit seems more important for dividend decisions of transport equipment and non-electrical machinery.

The evidence seems to indicate that the shortrun marginal payout ratio (the coefficient of GP) is lower for cotton textiles and sugar than for transport equipment and machinery. The rate of adjustment of actual dividends to their desired level is faster for transport equipment than for the other three industries.

II <u>Change in External Debt</u>

We have followed the approach in Sastry(1967) in specifying our demand function for new external debt. External debt is defined to include loans from banks and nonbank financial institutions and accounts payable.

Changes in external debt (ΔDEBT) is assumed to depend directly upon gross fixed investment (ΔGFA), the change in inventories, (ΔINV) and the change in receivables (ΔREC). As noted above, changes in stocks of these assets may capture expectational factors influencing rate of return on these assets. Internal funds (IF) can be expected to have a negative effect on external debt.

The stock of debt at the beginning of the period must also be included in our equation. The direction of influence of the variable is, however, not very clear. As Sastry notes, "If this variable is considered to be representing an element of habit persistence or of credit availability, it should have a positive influence on the current demand for external funds, for then the firms which are likely to borrow more would be those which have done so in the past. On the other hand, it may be argued no less convincingly, that since borrowing involves an element of risk and since the risk increases with the amount of debt already outstanding, this should have a negative influence on borrowings." This uncertainty about the role of lagged stock of external debt makes it difficult to cast our equation in the familiar stock-adjustment framework. We have, therefore, tested the following general relationship:

$$(7.15)\ \Delta DEBT = \pi_1 \Delta GFA + \pi_2 \Delta INV + \pi_3 \Delta REC - \pi_4 IF - \pi_5 DEBT_{-1} + constant$$

Our experimentation yielded the following preferred equations:

Cotton Textiles

$$\Delta DEBT = 98.68 + .6871\Delta GFA + .8944\Delta INV - .92071IF$$

$$(.36) \quad (11.38) \quad (13.01) \quad (10.16)$$

$$R^2 = .950 \quad DW = 2.15$$

Sugar

$$\Delta DEBT = -56.65 + 1.022\Delta REC + .7189\Delta GFA + .9641\Delta INV - .730IF - .02826DEBT_{-1}$$

$$(.79) \quad (4.63) \quad (4.84) \quad (48.74) \quad (5.59) \quad (1.44)$$

$$R^2 = .996, \quad DW = 1.78$$

Transport Equipment

$$\Delta DEBT = 44.88 + .6404\Delta REC + .8035\Delta GFA + .8728\Delta INV - .9333IF - .03388DEBT_{-1}$$

$$(.38) \quad (5.01) \quad (9.42) \quad (11.30) \quad (4.81) \quad (1.35)$$

$$R^2 = .965, \quad DW = 2.21$$

Nonelectrical Machinery

$$\Delta DEBT = -73.17 + 2.209\Delta GFA - 1.498IF - .07733DEBT_{-1}$$

$$(.38) \quad (7.51) \quad (2.35) \quad (3.04)$$

$$R^2 = 879 \quad DW = 2.39$$

The evidence presented above is consistent with our hypothesis (equation 7.15). In particular, in all the estimated equations, investments in fixed capital and inventories have a significant positive impact on demand for new external debt. Internal funds have the expected negative effect. In general, lagged stock of debt ($DEBT_{-1}$) is either not significant or barely so (at a 10% level of significance). The nonsignificance of $DEBT_{-1}$ is likely to be due to the offsetting effects of the roles played by this variable. On the one hand, outstanding external debt reduces the mean and increases the variance of expected rates returns. On the other, outstanding debt serves as a proxy for credit worthiness or debt capacity.

If the coefficient of $DEBT_{-1}$ is interpreted as a coefficient of adjustment of actual debt to its desired or "maximum capacity" level, the evidence above would imply reluctance on the part of industries to borrow. Interpreting the nonsignificance of lagged debt as very slow adjustment, our results would suggest that only the short-run elasticity of debt with respect to the various assets is relevant.

III Change in Equity Capital

The general procedure seems to be to determine the change in equity capital (new equity issues) endogenously as a residual or to assume it exogenous. The reason seems to be that new equities are not sold on a regular basis. Over a period, offerings of new shares tend to be "bunched" in a few years. Statistically, this makes it difficult to obtain a good fit for the relevant equity issues equation.

We have assumed that the value of new equity issues is determined positively by gross fixed investment, rate of interest on borrowings and the stock price index. We assume a negative impact of internal funds and the outstanding stock of equity capital. As in the case of new debt issues, the negative "risk" effect of outstanding equity capital may be offset by the positive effect of "habit persistence."

We postulate:

$$(7.16)\quad \Delta EQ = \xi_o + \xi_1 \Delta GFA + \xi_2 RC + \xi_3 STP - \xi_4 IF - \xi_5 EQ_{-1}$$

Our preferred equations, reported below, show that gross fixed investment is a principal determinant of new equity issues. Except in the case of nonelectrical machinery, the evidence shows that higher rates of interest on borrowings lead to a substitution of equities for debt issues. In the case of sugar and transport equipment, favourable stock market conditions (STP) are shown to lead to an increase in equity offerings.

Cotton Textiles

$$\Delta EQ = \underset{(3.10)}{2918} + \underset{(2.52)}{.0867\Delta GFA} + \underset{(3.48)}{.2678(SLRC)} - \underset{(3.17)}{.3728EQ_{-1}}$$

$$R^2 = .926, \quad DW = 1.96$$

Sugar

1. $$\Delta EQ = \underset{(1.83)}{-66.19} + \underset{(5.23)}{.2034\Delta GFA}$$

2. $$\Delta EQ = \underset{(1.21)}{221.9} + \underset{(1.92)}{.1356\Delta GFA} + \underset{(1.39)}{.001927SLRL} + \underset{(1.64)}{.00006506STP} - \underset{(1.73)}{.1839EQ_{-1}}$$

$$R^2 = .637 \quad DW = 1.88$$

Transport Equipment

$$\Delta EQ = \underset{(1.40)}{227} + \underset{(1.82)}{.0978\ FA} - \underset{(2.14)}{.441F} + \underset{(3.14)}{.199SLRC} + \underset{(1.94)}{.000114SLSTP} - \underset{(1.42)}{.117EQ_{-1}}$$

$$R^2 = .759 \quad DW = 2.38$$

Machinery

$$\Delta EQ = \underset{(3.03)}{170.5} + \underset{(3.35)}{.1422\Delta GFA}$$

$$R^2 = .617 \quad DW = 1.62$$

CHAPTER 8

The 2SLS Estimation of the Complete Model

This chapter presents two-stage least square estimates of our preferred equations for the flows of various assets and liabilities. Section I discusses the modified two-stage least squares method used to take account of simultaneity and interdependence in corporate decisions. Variables used during the first stage to derive calculated values of jointly dependent variables are listed. Sections II - V present estimates of elasticities for various assets and liabilities, viz, fixed capital (section II), inventories (section III), current assets (section IV) and dividend and external financing behaviour (section V).

I The Modified Two-Stage Least Squares Method

This section briefly discusses the method used to derive simultaneous equation estimates of our equations chosen on the basis of ordinary least squares.

As we noted in Chapter 3, in connection with the discussion of Dhrymes and Kurz (1967), OLS results are sometimes substantially altered when estimation methods taking cognisance of interdependence of decisions are used. This is partly because the least squares estimates of structural parameters are biased and inconsistent if the disturbances are not independent of the explanatory variables. The latter occurs in simultaneous systems. In such cases, it becomes necessary to use one of the several simultaneous estimation methods. While a clear-cut choice between the various methods is difficult to make, it seems that the use of two-stage least squares (2SLS) is adequate for most purposes.[1]

In estimating an overidentified equation using the 2SLS method, one can encounter a situation in which the number of predetermined variables in the complete model is equal to or greater than the number of observations. In such a case, it is not possible to use all the predetermined variables in the model to derive the "calculated" values of the remaining jointly dependent variables appearing in the equation. Arthur S. Goldberger (1959) has used a modified version of the 2SLS method in which the choice of predetermined variables to be included in the first stage is determined by the following criteria:

(1) Include all the predetermined variables appearing in the equation to be estimated.

(2) Choose one variable from amongst a group of highly correlated variables.

(3) Include variables with relatively high variances.

(4) Include variables which, on a priori grounds, seem more important

1. For a description of this method, see Christ (1966), pp. 432-453. For a description of the statistical properties of 2SLS estimators, see Ibid, p.466

than others.

These criteria are not necessarily mutually consistent and reconciliation amongst them is likely to involve subjective judgements. In this study, therefore, we experimented with three sets each of predetermined variables in estimating equations for the four industries. In general, the values of estimated parameters did not seem to be significantly affected by the particular set chosen. We list below the predetermined variables selected for use in the first stage to derive the 2SLS estimates of equations for the four industries,

Cotton Textiles

$SALE_{-1}$, INV^{f}_{-1}, NFA_{-2}, EQ_{-1}, LD_{-2}, DIV_{-1}, STP_{-2}, RL_{-1}

Sugar

$SALE_{-1}$, STP_{-1}, RL_{-1}, $(INV^{f}_{-1} + INV^{other}_{-1})$, DIV_{-1}, LD_{-2}, NFA_{-2}, CP_{-1}

Transport Equipment

$SALE_{-2}$, NFA_{-2}, TGS_{-1}, INV^{f}_{-1}, INV^{r}_{-1}, EQ_{-1}, STP, $\frac{\Delta P^{mp}}{P^{mp}_{-1}}$

Nonelectrical Machinery

SALE, NFA_{-2}, $DEBT_{-1}$, DIV_{-1}, M_{-1}, RL, INV^{r}_{-1}, STP_{-1},

We now turn to the discussion of 2SLS estimates of our preferred OLS equations for changes in assets and liabilities. In each section, differences and similarities between OLS and 2SLS estimates are noted. Estimates of elasticities for different assets and liabilities are also given. We begin with a discussion of gross fixed investment.

iI Gross Fixed Investment

Areview of our preferred fixed investment equations for the four industries shows that with the exception of the equation for transport equipment, all other investment equations contain only predetermined variables. It is, therefore, necessary to re-estimate only the equationfor transport equipment.

The 2 SLS version of that equation is as follows:

Transport Equipment

$$\Delta GFA = -439.9 - .1365NFA_{-2} + .1967SALE_{-2} + .5179\Delta DEBT$$
$$(2.12) \quad (2.09) \quad (4.67) \quad (4.85)$$

A comparison with the OLS version of the above equation shows that the coefficients of NFA_{-2} and $SALE_{-2}$ are practically identical in the two methods, while the 2SLS coefficient of ΔDEBT at .52 is higher than the OLS counterpart (.43). In order to estimate the long run sales elasticities, recall parts of equation (4.1), (4.3) and (4.5)

(4.1)

$$NFA_t = \alpha_0 + \alpha_1 \Sigma\lambda^i SALE_{t-i-1} + \alpha_2\Sigma\lambda^i SALE_{t-i-j} - \alpha_3\Sigma\lambda^i NFA_{t-i-j} + \text{OTHER TERMS}$$

(4.3)

$$\Delta GFA = \alpha_1 SALE_{t-1} - (1-\lambda)NFA_{t-1} - (\alpha_3-\delta)NFA_{t-j} + \text{OTHER TERMS}$$

(4.5)

$$\Delta GFA = \beta\, CP_{t-1} - (\alpha_3 - \delta) NFA_{t-j} + \text{OTHER TERMS}$$

We also use the following approximation in Evans (1969), p. 86.

$$\beta\,(CP) \cong \beta\left(\frac{SALE}{\overline{NFA}} - \frac{\overline{SALE}}{\overline{NFA}^2} \cdot NFA + \text{constant}\right)$$

Where the bars indicate mean values of the variables.

Comparing equations (4.3) or (4.5) with the above approximation we get:

$$\alpha_1 = \frac{\beta}{\overline{NFA}}$$

$$(1-\lambda) = \beta \frac{\overline{SALE}}{\overline{NFA}^2}$$

Using the Koyck transformation to simplify (4.1) and substituting the values of $\alpha 1$ and $(1-\lambda)$ as above, we get:

(8.1)

$$NFA = \frac{(\alpha_1 + \alpha_2)\ SALE}{1-\lambda+\alpha 3}$$

where the values of α_1 and $(1-\lambda)$ can be calculated according to the formualae given above. Equation (8.1) leads to:

$$\frac{\delta\, NFA}{\delta\, SALE} = \frac{\alpha_1 + \alpha_2}{1-\lambda+\alpha_3}$$

so that the long-run mean elasticity of net capital stock or fixed assets (NFA) with respect to sales is:

$$\frac{\alpha_1 + \alpha_2}{1-\lambda+ \alpha_3} \times \frac{\overline{SALE}}{\overline{NFA}}$$

Similarly, the long run mean elasticity of capital stock with respect to interest rate is:

$$\frac{\text{the co-efficient of interest rate}}{1-\lambda +\alpha_3} \times \frac{\text{mean of interest rate}}{\overline{NFA}}$$

Other long run elasticities can be calculated in a similar way.

TABLE 8.5

Equation: ΔGFA

Industry	Long Run Elasticity of Capital Stock(NFA) Demand W.R.T.				
	SALE	LD	RL	STP	[illegible]BT
Cotton Texiles	3.10	-5.01			
Sugar	3.23	-3.29			
Nonelectrical Machinery	1.26		-.53	.42	
	1.20		-.26	.29	1.987
			(at SALE)		

Transport Equipment

The accelerator provide the common element in the explanation of investment behaviour of the four industries.

In the case of cotton textiles and sugar, the large accelerator effect is moderated by a large negative (risk) effect of long debt outstanding. The importance of debt capacity in the case of these old established industries seems to be due to the fact that in comparison with the two capital goods industries, debt(bank plus nonbank) forms a higher proportion of total liabilities.

The importance of the prime lending rate and stock price index in the investment equations for nonelectrical machinery implies that Klein's hypothesis[2] about the interest-insensitivity of investment in India should be tested by application to several individual industries. Such testing will be very helpful in assessing the differential impacts of monetary policies on various industries.

To sum up, while the sales variable is perhaps the most important determinant of investment demand, the evidence also underlines the relevance of variables such as debt outstanding, interest rates, and stock prices.

III Inventories

As noted in Chapter 5, we have assumed that in the case of PTS industries, the category "finished and semi-finished goods" consists mainly of finished goods. In the case of PTO industries, the category is dominated by semi-finished inventories. We also decided that the

2Klein (1967)

contents of the category "other inventories" would be determined by empirically verifiying the applicability of equations for the two components to the data on this variable.

Section (a) discusses the 2SLS estimates of equations for PTS finished and PTO semi-finished inventories. Sections (b) and (c) discuss, respectively, raw materials and "other inventories".

(a) Finished and Semi-Finished Inventories:

The two-stage least squares estimates of our preferred equations for this category and the estimated elasticities are given below on pages 109 and 111.

A comparison of the 2SLS estimates with the corresponding OLS estimates for the four industries shows that the broad conclusions derived on the basis of OLS estimates in Chapter 5 are not altered by the 2SLS estimates. The variables which are significant in the OLS equations are significant also in the 2SLS equations. Some of the features of estimated equations common to both OLS and 2SLS estimation are;

1. The absolute value of the coefficient of the sales forecasting error ($\Delta\dot{S}ALE$) for cotton textiles is greater than the coefficient of $SALE_{\hat{t}}$, implying an inverted conformity of finished goods inventories to the cyclical turns;
2. The absolute value of the coefficient of $SALE_t$ in the question for non-electrical machinery exceeds the value of the coefficient of

The 2SLS Estimates of Demand for Finished Goods Inventories

Cotton Textiles

$$\Delta INV^{f} = \underset{(.68)}{470.3} + \underset{(2.43)}{.1053SALE} + \underset{(1.87)}{.3310\Delta DEBT} - \underset{(1.77)}{.194\Delta SALE} - \underset{(3.43)}{.6667INV^{f}_{-1}}$$

Sugar

$$\Delta INV^{f} = \underset{(.64)}{373.7} + \underset{(2.89)}{.3597SALE} + \underset{(4.94)}{.8094\Delta DEBT} - \underset{(2.33)}{3.827\Delta REC} - \underset{(1.82)}{439.7RL} - \underset{(2.30)}{6584\frac{\Delta P^{f}}{P^{f}_{-1}}} - \underset{(2.39)}{.6029INV^{f}_{-1}}$$

The 2SLS Estimates of Demand for Semi-Finished Inventories

Transport Equipment

$$\Delta INV^{g} = \underset{(2.17)}{732.0} + \underset{(2.84)}{.06331SALE} + \underset{(1.08)}{.09959\Delta DEBT} + \underset{(1.60)}{4342\frac{\Delta P^{mp}}{P^{mp}_{-1}}} - \underset{(3.33)}{.5780INV^{f}_{-1}}$$

Nonelectrical Machinery

$$\Delta INV^{g} = \underset{(1.27)}{-723.3} - \underset{(3.42)}{.09458SALE} + \underset{(5.79)}{.05286SALE_{+1}} + \underset{(1.40)}{.1153\Delta DEBT} + \underset{(3.17)}{15.59P^{rm}} - \underset{(2.54)}{1221CP}$$

$SALE_{t+1}$, implying that the production process is of type B described in Hold and Modigliani (1961).

Some differences in the values of coefficient estimated may also be noted:

1. In the case of cotton textiles, while the coefficients of $SALE_t$, ΔSALE and INV^f_{-1} do not differ very much, the 2SLS coefficient of ΔDEBT is about 25% lower than the corresponding OLS coefficient.

2. In the case of sugar, the most significant difference relates to the coefficient of lagged inventories. The coefficient of adjustment at .69, estimated by the 2SLS method, is much higher than the corresponding coefficient of .19 estimated by the OLS method. However, as the absolute values of 2SLS coefficients of other explanatory variables are also two to three times the corresponding values estimates by OLS, the long run elasticities of demand will not be substantially different between the two methods.

3. In the case of transport equipment, the 2SLS coefficient of ΔDEBT is about half the corresponding OLS coefficient. The same phenomenon is observed in the case of nonelectrical machinery.

Table 8.6 gives the longrun elasticities of demand for finished and semi-finished inventories. The value of the coefficient of adjustment (δ) is also given in each case. Some implications of the results in Table 8.6 are discussed below.

Table 8.6

Equations: ΔINV^{f} and ΔINV^{g}

Industry		Longrun Elasticity of Demand for INV^{f} and INV^{g} W.R.T.								
		SALE	CP	DEBT	P^{rm}	REC	RL	ΔSALE	$SALE_{+1}$	δ
Cotton Textiles										
	(INV^{f})	0.96		1.29				1.13		.67
Sugar	(INV^{f})	1.73		1.90		– 2.07		–.72		.69
Transport Equipment	(INV^{g})	.54								.58
Noneletrical Machinery	(INV^{g})	.42	–.49						.24	0

Note: A zero coefficient of adjustment is interpreted to imply that only short run (impact) elasticities are relevant.

Cotton Textiles and Sugar:

As noted in Chapter 2, the finished goods/sales ratio for cotton textiles fluctuated in the narrow range of 14% - 17% over the period 1950-1968. Our results show that this stability in the ratio can be explained by a moderately high coefficient of adjustment coupled with the availability of debt finance.

In contrast, there were wide fluctations in this ratio for sugar. The evidence in Table 8.6 shows that a part of the explanation for this variability has to be found in the need for financing accounts receivables which, as a proportion to sales, increased from 7% in 1958 to 13% in 1968. Also note that the sales elasticity of demand for the finished inventories of sugar is high at 1.73. This elasticity implies that the inventories/sales ratio varies directly with the business cycle.

Transport Equipment and Nonelectrical Machinery:

For the two PTO industries, the ratio of semi-finished inventories to sales registered a decline during 1950-68, the decline being more pronounced for transport equipment. According to Table 8.6, the latter industry achieved economies of scale in its holdings of such inventories.

In the case of nonelectrical machinery, the decline in the ratio seems mainly due to the extremely slow inventory adjustment. The slow adjustment of inventories is corroborated by the negative elasticity of inventories with respect to capacity utilization.

(b) Raw Materials

The two-stage least squares estimates of our preferred equations for raw materials demand are given below on page 114.

A comparison of the 2SLS estimated equations with their OLS counterparts shows that there is little substantive difference between the two sets of estimates.

Table 8.7 on page 115 gives long run elasticities of demand for raw material inventories. The coefficients of adjustment are also given. The elasticities in Table 8.7 are discussed below.

Cotton Textiles and Sugar

The ratio of purchased material inventories to sales declined over the period 1950-68 for both textiles and sugar. In both cases, higher costs of financing seem to have had an adverse effect on inventory buildup.

In the case of sugar, unexpected depletions of inventories (the negative elasticity of INV^r w.r.t. to CP) coupled with a slow adjustment of actual stocks further reduced the inventories/sales ratio.

Transport Equipment and Nonelectrical Machinery

For PTO industries, the ratio of raw material inventories to sales increased over the period 1951-68, the increase being more

The 2SLS Estimates of Demand for Raw Material Inventories

Cotton Textiles

$$\Delta INV^{r} = 3039 + .1481SALE_{-1} + 15.38STP_{-1} - 1330RL_{-1} + 1059\Delta Q_{t} - 1.211INV^{r}_{-1}$$

(4.48) (7.28) (3.73) (5.08) (2.15) (8.13)

Sugar

1.

$$\Delta INV^{r} = 664.1 + .02031SALE + .02178\Delta DEBT + 1.462STP_{-1} - 57.83RL_{-1} - 834.3CP - .4272INV^{r}_{-1}$$

(3.57) (4.04) (2.00) (3.72) (2.64) (3.54) (3.89)

2.

$$\Delta INV^{r} = 377.8 + .01425SALE_{-1} + .0077\Delta DEBT + 1.421STP_{-1} - 3108RL_{-1} - 521.7CP - .4092INV^{r}_{-1}$$

(2.00) (2.96) (0.65) (3.06) (1.47) (1.98) (3.15)

Transport Equipment

$$\Delta INV^{r} = -233.4 + .07822SALE + .3423\Delta DEBT - .4534INV^{r}_{-1}$$

(1.08) (2.32) (3.51) (2.97)

Nonelectrical Machinery

1.

$$\Delta INV^{r} = -495.8 + .1212SALE + 2.279STP_{-1} + .1836\Delta DEBT - .6362INV^{r}_{-1}$$

(2.77) (1.89) (2.09) (2.37) (2.42)

2.

$$\Delta INV^{r} = -178.4 + .0927SALE + .0002704(SLSTP)_{-1} + .1993\Delta DEBT - .7235INV^{r}_{-1}$$

(1.45) (1.84) (2.28) (2.28) (3.05) (3.68)

Table 8.7

Equation: ΔINV^r

Elasticity of demand for INV^r W.R.T.

Industry	SALE	DEBT	STP	RL	CP	δ
Cotton textiles	1.04		.24	-.72		1.21
Sugar (1)	1.41	0.74	1.18	-1.38	-4.06	.43
Sugar (2)	1.03	0.27	1.20	-0.78	-2.65	.41
Transport Equipment	0.97	2.46				.45
Nonelectrical Machinery(1)	0.71	1.11	0.34			0.72
Nonelectrical Machinery (2)	1.01	1.17	.33			.64

pronounced for non-electrical machinery than for transport equipment. The evidence in Table 8.7 shows that the more pronounced rise in the ratio for nonelectrical machinery was mainly due to the higher speed of adjustment of actual stocks to their desired levels.

(c) Other Inventories

In Chapter 5, we found that in the case of cotton textiles, the equation specified for raw materials applied to the data on "other inventories" as well. For sugar, the equation for finished goods explained the behaviour of "other inventories". We, therefore, estimated not only separate equations for "other inventories" for these two industries but also equations using aggregates as dependent variables. In the case of cotton textiles, data on raw materials and "other inventories" were combined. In the case of sugar, data on finished goods and "other inventories" were added together. We give below (page 117) the 2SLS estimates of the relevant equations. Note that the equation for ΔINV^{other} in the case of cotton textiles contains only predetermined variables.

In the case of cotton textiles, the 2SLS estimates of the equation for the sum ($\Delta INV^{r} + \Delta INV^{other}$), is almost identical with its OLS counterpart.

In the case of sugar, there are no significant differences between the 2SLS and OLS estimates of the equation for "other invent-

Cotton Textiles

1.

$$\Delta INV^{other} = 462 + .01742SALE_{-1} + 4.340STP_{-1} + 9.652P^{m}_{-1} - .2662INV^{other}_{-1}$$
(1.50) (2.84) (4.92) (3.36) (2.17)

2.

$$\Delta INV^{r} + \Delta INV^{other} = 2322 + .1705SALE_{-1} + 21.79STP_{-1} - 1051RL_{-1} + .1266\Delta Q_{t}$$
(3.86) (7.62) (5.22) (4.34) (2.78)

$$- 1.120(INV^{r} + INV^{other})_{-1}$$
(8.25)

Sugar

1.

$$\Delta INV^{other} = 63.87 + .04320SALE - 0.2014\Delta REC + .02029\Delta DEBT - .02638\Delta SALE -$$
(2.21) (3.87) (3.30) (3.74) (2.48)

$$- 0.5447INV^{other}_{-1}$$
(3.28)

2.

$$\Delta INV^{f} + \Delta INV^{other} = 795.9 + .1458SALE - 1.248\Delta REC + 1.062\Delta DEBT - 405.1RL$$
(2.93) (3.20) (2.12) (16.65) (3.34)

$$-.2077(INV^{f} + INV^{other})_{-1}$$
(1.98)

3.

$$\Delta INV^{f} + \Delta INV^{other} = 439.3 + .3473SALE - 3.324\Delta REC + .8499\Delta DEBT - 391.4RL$$
(.96) (3.34) (2.68) (6.67) (2.02)

$$- 5823\frac{\Delta P^{f}}{P^{f}_{-1}} - .5886(INV^{f} + INV^{other})_{-1}$$
(2.56) (2.63)

Transport Equipment

$$\Delta INV^{other} = -113.4 + .06806SALE + .08339\Delta DEBT + 0.8590STP_{-1} - .9040INV^{other}_{-1}$$
(1.37) (4.25) (3.17) (1.85) (5.37)

Nonelectrical Machinery

$$INV^{other} = 25210 + .5222SALE - 110.8P^{mp}_{-1} - 14320CP - 1.153INV^{other}_{-1}$$
(4.71) (3.81) (3.67) (4.91) (6.13)

Table 8.8

Equations: ΔINV^{other}; $(\Delta INV^{r} + \Delta INV^{other})$ and $(\Delta INV^{f} + \Delta INV^{other})$

Industry	Longrun Elasticity of Demand W.R.T.								
	SALE	REC	DEBT	ΔSALE	P^{rm}	STP	CP	RL	δ
Cotton Textiles									
1. INV^{other}	1.29				-1.55	0.77			.27
2. $INV^{other}+INV^{r}$	0.91					0.28		-.43	1.12
Sugar									
1. INV^{other}	1.00	-0.53	0.23	-.052					0.54
2. $INV^{other}+INV^{f}$	1.86	-1.79	6.16					-1.77	.21
3. $INV^{other}+INV^{f}$	1.56	-1.68	1.89					-0.60	.59

Table 8.9

Equation: ΔINV^{other}

Industry	Longrun Elasticity of Demand for INV^{other} W.R.T.					
	SALE	DEBT	P^{rm}	STP	CP	δ
Transport - Equipment	0.85	0.61		0.16		0.90
Nonelectrical Machinery	2.30		-7.43		-5.73	1.15

ories". There are, however, signifant differences between the two sets of estimates for the composite category "finished and other inventories." With the exception of the coefficient of ΔDEBT, the 2SLS estimates of the coefficients(equations (2) and (3) for sugar) are two to three times as large as the corresponding OLS estimates.

In the case of transport equipment, the 2SLS and OLS estimates of the coefficients are almost identical.

For nonelectrical machinery, the 2SLS estimates of the coefficients of sales income and the price level are about 50% higher than the OLS counterparts.

Tables 8.8 and 8.9 (page118) give long run mean elasticities of demand for"other inventories" and sums of components already described.

IV Current Assets

This section discusses 2SLS estimates of our preferred equations for money, government bonds, and accounts receivables. The evidence on liquid assets (money and government bonds) is discussed first. Recall that we could not get any sensible equations for government bond demand by the PTS industries.

(a) Money and Government Bonds

The 2SLS estimates of demand for money and government bonds by the four industries are given below.

The 2SLS Estimates of Demand for Money and Government

Cotton Textiles

$$\Delta M = 5920 + .05440SALE + .2133IF - .4969\Delta REC - 67.86P^{f} - .465M_{-1}$$
(4.45) (4.49) (3.12) (1.87) (4.27) (3.50)

Sugar

$$\Delta M = 282.4 + .01392SALE + .2216IF - .2463\Delta GFA - 1.338M_{-1}$$
(3.44) (2.27) (2.15) (2.43) (4.36)

Transport Equipment

$$\Delta M = 1558 + .02611SALE - .1402\Delta REC - 384.4RG - .5717M_{-1}$$
(1.69) (1.57) (1.28) (1.45) (2.80)

Nonelectrical Machinery

$$1.\ \Delta M = 312.1 + .01147SALE - 1157\frac{\Delta P_{i,s}}{P_{i,s_{-1}}} - .8335M_{-1}$$
(3.73) (2.42) (1.75) (3.91)

$$2.\ \Delta M = 312.0 + .01918SALE - 1534\frac{\Delta P_{i,s}}{P_{i,s_{-1}}} - .1667\Delta REC - .8055M_{-1}$$
(4.00) (2.70) (4.03) (1.39) (4.03)

Transport Equipment

$$1.\ \Delta TGS = 102.2 + .005644SALE - .00002189(SLSTP) - 549.3RC - .465TGS_{-1}$$
(5.45) (2.32) (3.03) (3.61) (3.35)

$$2.\ \Delta TGS = 66.45 + .008517SALE - .00002296(SLSTP) - .03645(SLRC) - .5363TGS_{-1}$$
(3.53) (2.28) (2.54) (2.56) (3.31)

Nonelectrical Machinery

$$\Delta TGS = 329.4 + .006650SALE - 5490RC - 1.120TGS_{-1}$$
(314) (1.53) (2.38) (5.28)

The 2SLS estimates of demand for money by the four industries corroborate the conclusions derived on the basis of OLS estimates, viz, the importance of sales income, the more common subsitutability between current and liquid assets than between fixed and liquid assets, and the role of internal funds as a temporary abode of purchasing power.

Our preferred equations for government bonds held by transport equipment and nonelectrical machinery contain predetermined variables only. Hence, no 2SLS estimation is necessary.

The long run mean elasticities of demand for money and bonds are given in Tables 8.10 and 8.11 (page 122).

The evidence in Table 8.10 shows that for sugar and nonelectrical machinery, economies of scale are realized in the management of cash balances.

As in the case of demand for money, the sales elasticity of demand for government bonds (Table 8.11) is much lower and the speed of adjustment much higher for nonelectrical machinery than for transport equipment.

Table 8.10

Equation: ΔM

Industry	Longrun Mean Elasticity of Demand for M W.R.T.						
	SALE	RRC	IF	GFA	P^f	RC	δ
Cotton textiles	4.83	-5.16	0.56		-13.35		0.42
Sugar	0.51		0.32	-8.09			1.34
Transport Equipment	1.27	- .42				-5.06	0.62
Nonelectrical Machinery	0.57	-1.36					0.81

Table 8.11

Equation: ΔTGS

Industry	Longrun Mean Elasticity of Demand for TGS W.R.T.			
	SALE	RC	STP	δ
Transport Equipment (1)	1.76	- 0.81	1.77 (at SALE)	0.49
(2)	2.40	-0.84 (at SALE)	1.69	0.54
Nonelectrical Machinery	0.80	-4.06		1.12

(b) Receivables

Accounts receivable are, by far, the most important of the current assets. In Chapter 6, we gave our preferred equations to explain the holdings of this asset by the four industries under study. We recall here that the equations chosen for cotton textiles included predetermined variables only. We give below the OSL estimate of the equation for cotton textiles and the 2SLS estimates of equations for the other three industries.

A comparison of the OLS and 2SLS estimates for the three industries shows that the latter estimates are slightly higher than the former.

As noted in Chapter 6, the coefficient of adjustment is zero for industries (sugar and transport equipment) for which the ratio of receivables to sales declined over the period 1950-68. Our overall results also show that while sales income is, in general, a significant determinant of accounts receivable, there is also considerable substitution between receivables and other assets.

Table (8.12) (page 125) below gives the estimated longrun elasticities of demand for receivables.

V Dividend and External Financing Behaviour

This section presents and interprets 2SLS equations for dividends

Cotton Textiles

1. $\Delta REC = -1670 + .07559SALE + 7.507STP - .4983REC_{-1}$

(2.74) (2.24) (2.56) (1.84)

2. $\Delta REC = -2316 + .09725SALE + 7.941STP + 190.8RL - .7406REC_{-1}$

(3.12) (2.74) (2.85) (1.38) (2.39)

Sugar

1. $\Delta REC = 6.364 + .05161SALE - .6448\Delta GFA$

(.054) (3.64) (2.46)

2. $\Delta REC = -499.0 + 7.822P^{f} - .4474\Delta GFA$

(3.68) (4.93) (2.69)

Transport Equipment

$\Delta REC = -297.8 + .08618SALE - .4129\Delta GFA - 1.123\Delta M$

(1.20) (3.06) (2.19) (1.93)

Nonelectrical Machinery

1. $\Delta REC = -2346 + .1737SALE - .9246\Delta M + 42700RC - .6468REC_{-1}$

(3.87) (6.02) (2.40) (3.50) (4.68)

2. $\Delta REC = -121.3 + 07969SALE - .7578\Delta M + 2.486SLRC - .8147REC_{-1}$

(1.61) (3.97) (2.86) (5.65) (7.07)

Table 8.12

Equation: ΔREC

Industry	Longrun Mean Elasticity of Demand for REC W.R.T.							
	SALE	GFA	M	STP	RL	RC	P^f	δ
Cotton Textiles (1)	1.31			0.31				0.50
Alternative (2)	1.12			0.22	0.17			0.74
Sugar (1) (Short run Elasticities)	0.46	-5.11						0.0
Alternative(2)		-3.55					0.71	0.0
Transport Equipment (Shortrun Elasticities)	0.53	-2.06	-.20					0.0
Nonelectrical Machinery(L)	0.98		-.22			1.46		0.65
Alternative(2)	0.36		-.14			0.65 (at SALE)		0.81

(DIV), new debt issues(ΔDEBT) and new equity issues(ΔEQ). We start with a discussion of dividend equations.

(a) Dividends

We noted in Chapter 7 that the Lintner hypothesisof stable dividend policy (that is, a policy not affected by requirements of capital expansion or availability of external finance) was found to be valid only in the case of cotton textiles. This broad conclusion, based on OLS estimates of equations, is also supported by 2SLS estimates which are given below on page 127.

A comparison of the OLS and 2SLS estimates for the four industries shows that the most significant differences are observed in equations for sugar and transport equipment.

In the case of sugar, the 2SLS coefficients of ΔGFA, ΔINV and ΔDEBT in equation (1) are about twice as high as the corresponding OLS estimates.

In the case of transport equipment, the 2SLS estimates of the coefficents of GP and ΔSALE are about 50% higher than the corresponding OLS estimates, while the coefficient of RL is about 50% lower.

We note some of the implications of 2SLS dividend equations and the estimated elasticities (table 8.13):

Table 8.13

Equation: DIV

Industry	Longrun Mean Elasticity of DIV W.R.T.					
	GP	GFA	INV	DEBT	RL	δ
Cotton Textiles	0.45					0.46
Sugar	1.71	-23.43	-13.93	4.2		0.24
Transport - Equipment	1.42				-1.37	0.61
Nonelectrical Machinery	1.67				-1.54	0.35

Cotton Textiles

$$DIV = \underset{(4.60)}{257.6} + \underset{(5.32)}{.07467GP} + \underset{(7.34)}{.5371DIV_{-1}}$$

Sugar

1. $$DIV = \underset{(1.47)}{52.31} - \underset{(2.55)}{0.1343\Delta GFA} - \underset{(2.01)}{.1729\Delta INV} + \underset{(1.99)}{.1778\Delta DEBT} + \underset{(4.49)}{.1459GP} + \underset{(5.43)}{.7556DIV_{-1}}$$

2. $$DIV = \underset{(0.81)}{22.04} - \underset{(1.72)}{0.05563\Delta GFA} + \underset{(4.80)}{.1254GP} + \underset{(6.42)}{.7927DIV_{-1}}$$

Transport Equipment

$$DIV = \underset{(2.04)}{320.7} - \underset{(1.52)}{.02243\Delta SALE} - \underset{(1.49)}{79.56RL} + \underset{(3.06)}{.2406GP} + \underset{(2.17)}{.3923DIV_{-1}}$$

Nonelectrical Machinery

$$DIV = \underset{(2.06)}{88.44} - \underset{(1.91)}{28.02RL} + \underset{(3.84)}{.1847GP} + \underset{(3.67)}{.6481DIV_{-1}}$$

(i) Except in the case of cotton textiles, the elasticity of dividends with respect to gross profits is greater than unity.

(ii) All the equations, except those for sugar, have statistically significant positive intercepts implying that the industries which they represent are generally willing to distribute dividends.

(iii) For the faster growing industries, viz, transport equipment and noneletrical machinery, the cost of financing represented by the prime lending rate (RL) has a significant impact on dividend disbursements. The growth variable, change in sales, suggested in Brittain(1966), is also significant in the equation for transport equipment.

(b) Change in Debt

We have postulated that new debt issues depend positively upon the growth of fixed investment, inventories and accounts receivables and negatively upon the availablity of internal funds. The direction of influence of outstanding debt was considered uncertain in view of the fact that on the one hand, the outstanding stock represents a measure of risk, and on the other, it represents debt capacity or credit worthiness. Our OLS estimates of the suggested equations corroborated our hypotheses about the positive effects of asset expansion and the negative effects of the availability of internal funds. The coefficient of lagged stock ($DEBT_{-1}$) was, however, not very small or not

The 2SLS Estimates of Supply of New Debt and Equity Issues

Cotton Textiles

$$\Delta DEBT = 5.751 + 0.6888\Delta GFA + 0.9189\Delta INV - 0.8895IF$$
$$(.023) \quad (11.05) \quad (11.05) \quad (6.71)$$

Sugar

$$\Delta DEBT = -63.0 + 0.4745\Delta GFA + 0.9628\Delta INV - 0.1341IF$$
$$(1.35) \quad (3.39) \quad (34.41) \quad (0.75)$$

Transport Equipment

$$\Delta DEBT = 51.77 + 0.8579\Delta GFA + 9.981\Delta INV + 1.034\Delta REC - 1.057IF - 0.0595DEBT_{-1}$$
$$(0.32) \quad (6.30) \quad (6.51) \quad (3.19) \quad (3.27) \quad (1.20)$$

Nonelectrical Machinery

$$\Delta DEBT = -128.6 + 2.139\Delta GFA - 1.204IF - 0.07943DEBT_{-1}$$
$$(0.64) \quad (6.28) \quad (1.67) \quad (2.92)$$

Table 8.14

Equation: ΔDEBT

Industry	Impact (Short Run) Elasticities of DEBT W.R.T				
	GFA	INV	IF	REC	δ
Cotton Textiles	1.60	0.70	-.062		0.0
Sugar	0.86	0.81	-.011		0.0
Transport Equipment	1.19	0.80	-.011	0.29	0.0
Nonelectrical Machinery	2.49		-0.079		0.08

significantly different from zero. We give below the 2SLS estimates of our preferred equations for ΔDEBT.

A major difference between the OLS and 2SLS estimates relates to the equation for sugar. While in the OLS estimates of the debt equation for sugar, gross fixed investment (ΔGFA), inventory investment (ΔINV), the change in accounts receivable (ΔREC) and internal funds(IF) were significant, only the first two variables are significant in the 2SLS version of the equation.

Another difference between the estimates by two methods relates to the coefficient of ΔREC in the equation for transport equipment. The 2SLS estimate of the coefficient is about 75% higher than its OLS counterpart.

Table 8.14 below gives the estimates of mean elasticities. As the coefficient of $DEBT_{-1}$ is approximately zero in all equations, the only relevant elasticities are the impact elasticities.

The estimates of elasticities in Table 8.14 imply that the growth of capital (fixed plus working) has a quantitatively significant impact on borrowings by industrial corporations. The evidence also shows that outstanding debt does not act as a deterrent to new debt issues.

(c) Change in Equity Capital

We have postulated that new equity issues are related directly to gross fixed investment, the stock price index and rates of interest on borrowings and inversely to internal funds and the stock of equity outstanding. As in the case of the equation for new debt issues, the direction of influence of lagged stock of equity is not certain and the interpretation of the coefficient of EQ_{-1} cannot be determined *a priori*.

The 2SLS estimates of our preferred OLS equations are given below (page 131A).

A major difference between the OLS and 2SLS estimates for the four industries relates to the equation for sugar. Equation (2) for sugar given below does not contain ΔGFA as an explanatory variable because the 2SLS estimate of its coefficient is not significantly different from zero. The coefficient was significant in the OLS version of that equation.

Another significant difference between the OLS and 2SLS estimates relates to the equation for transport equipment. The absolute values of the 2SLS coefficients of internal funds (IF) and sales times the stock price index (SLSTP) are about twice those in the OLS version.

Table 8.15 below gives the long run mean elasticities of supply of equity capital. In deriving the long run mean elasticities, we have assumed that the coefficient of lagged stock of equity capital represents

Cotton Textiles

$$\Delta EQ = \underset{(3.20)}{3038} + \underset{(2.71)}{.09694\Delta GFA} + \underset{(3.55)}{0.2738SLRC} - \underset{(3.28)}{0.3907EQ_{-1}}$$

Sugar

1. $$\Delta EQ = \underset{(1.75)}{-68.73} + \underset{(4.83)}{.2063\Delta GFA}$$

2. $$\Delta EQ = \underset{(2.53)}{421.7} + \underset{(3.21)}{.003688(SLRL)} + \underset{(2.10)}{.00008793(SLSTP)} - \underset{(2.64)}{0.2759EQ_{-1}}$$

Transport Equipment

$$\Delta EQ = \underset{(1.57)}{233.5} + \underset{(2.11)}{.11134\Delta GFA} - \underset{(0.83)}{.2388IF} + \underset{(3.33)}{0.1832(SLRC)} + \underset{(1.51)}{.00007427(SLSTP)} - \underset{(1.69)}{0.1159EQ_{-1}}$$

Nonelectrical Machinery

$$\Delta EQ = \underset{(2.95)}{169.5} + \underset{(3.28)}{0.1431\Delta GFA}$$

Table 8.15

Equation: ΔEQ

Industry.	Longrun Mean Elasticity of EQ W.R.T.				
	GFA	RC	RL	STP	δ
Cotton textiles	1.21	0.20 (at SALE)			0.39
Sugar (1) Shortrun Elasticity	0.87				.0
(2) Shortrun Elasticity			0.27	0.22	0.28
Transport Equipment	2.82	0.46 (at SALE)		0.59	0.12
Nonelectrical Machinery (Short Elasticity)	0.29				0.0

the speed of adjustment of the actual equity capital to its desired level.

The low values of δ , in Table 8.15, imply that the speed of adjustment of equity capital is, in general, quite low. In equation (1) for sugar and the equation for nonelectrical machinery, $\delta = 0$ so that only impact elasticities are relevant.

In the case of cotton textiles and transport equipment, impact elasticities can be calculated by multiplying the tabulated elasticities by the relevant values of δ . As the relevant values of δ are low (.39 and .12, respectively), the estimated impact elasticities for the two industries would be significantly less than unity.

The elasticity estimates in Table 8.15 also provide an explanation for the observed decline in the proportion of equity capital in total liabilities over the period 1950-68. The evidence indicates that the decline was mainly caused by a general reluctance to offer equity issues (probably for fear of dilution of control) coupled with the favourable loan market conditions.

CHAPTER 9

Summary and Conclusions

This study has presented models of portfolio behaviour for cotton textiles, sugar, transport equipment and nonelectrical machinery. The industries were selected not only for their size, but also for their characteristics and their importance in the Indian economy. Cotton textiles and sugar are the oldest industries in India. They are consumer goods industries and therefore, produce to stock (PTS). Transport equipment and nonelectrical machinery are relatively newer industries. They are classified as capital goods industries and produce to order (PTO). While an attempt was made to note any differences in behaviour between the two groups of industries, the main reason for the study was to develop models of nonfinancial corporate behaviour in order to gain an understanding of the portfolio behaviour of the particular industries.

Specification of the model began by defining the following identity:

The sum of changes in gross fixed assets, inventories, accounts receivables, money balances, government bonds and other assets equals the sum of changes in total debt (bank and nonbank debt plus trade dues) and equity capital plus the difference between gross profits and dividends.

Behavioural equations were then specified for gross fixed investment, inventory investment, changes in current assets (receivables, money balances and government bonds), the change in debt capital (defined above), the change in common equity capital and dividend payout. Changes in miscellaneous assets and liabilities were assumed exogenous. Gross profits (retained earnings plus depreciation flow plus change in tax liabilities) were obtained endogenously as a residual.

The data were drawn from annual balance-sheets and income-expenditure statements published by The Reserve Bank of India. The data we have used cover the period 1950 - 1968.

I <u>Gross Fixed Investment</u>:

The equation specified for gross fixed investment draws upon the specifications used in the Brookings model and in Evans (1969). Gross fixed investment is assumed to be determined by expected sales (represented by an exponentially decling weighted average of past sales), a modification variable represented either by capacity utilization or the stock price index, and variables describing the marginal cost of funds. The marginal cost of funds was represented by a combination of variables such as interest rates, lagged stock of debt outstanding and internal funds.

Our results show that different sets of explanatory variables are needed to explain investment behaviour of different industries. This may be particularly typical of developing economies like that of India, where some industries are "priority industries" under the five year plans.

In the case of cotton textiles and sugar, recent capacity utilization and lagged stock of debt outstanding were significant in explaining investment expenditures. Our results on these two industries bear out Klein's hypothesis that the existence of new capacity may stimulate rather than discourage investment in a developing economy like that of India.

In the case of transport equipment and nonelectrical machinery, the accelerator represented by sales lagged two years was significant at .01 level of significance. Both the prime lending rate and the stock price index were significant in the equation for nonelectrical machinery. This result casts doubt upon Klein's hypothesis about the interest insensitivity of demand in a country like India, where opportunities for investment are so immense that cold calculations of profitability are unnecessary. Clearly, the application of our investment model to several more industries is necessary to gauge the sensitivity of business investment expenditures to monetary policies.

II <u>Inventories</u>:

The Reserve Bank of India has classified inventories into "finished, and semi-finished goods" "raw materials" and "other inventories."

We have assumed that in the case of production-to-stock industries, the category "finished and semi-finished goods" consisted mainly of finished goods. In the case of production-to-order industries, the category was assumed to be dominated by semi-finished goods. For PTS industries, therefore, demand functions for "finished goods" and"raw materials" were specified, the behaviour of the category "others" being explained by which ever of the two functions applied to the data better. Similarly, in the case of PTO industries, demand functions for "semi-finished goods" and "raw materials" were specified, leaving the explanation of the category "others" to which ever of the two afore-mentioned functions satisfied the data best.

(a) Production-to-Stock Inventories: Production-to-Stock inventories of finished goods were assumed to have "planned" and "unplanned" components. Planned inventories were determined by expected sales (represented by current sales), the rate of change of product price and the rate of interest on borrowings. Unplanned (or unintended) inventories resulted from sales forcasting errors. The impact of the latter was measured by the coefficient of the variable "change in sales". As, a large immediate surge in demand for a PTS product is likely to be reflected partly in a price rise and partly in depleted inventories, a negative relationship between current price change and finished inventories was also regarded as measuring the quantitative significance of unintended inventory changes. The foregoing approach for specifying demand for finished goods was also applied, with necessary modifications, in specifying demand for raw material stocks.

Our results confirmed the accepted role of sales in determining planned inventories.

The more interesting result, of course, was the empirical verification of unintended inventory changes. Whereas, in the case of cotton textiles, buffer stock changes were represented by the coefficient of "change in sales", in the case of sugar, such changes were represented by the negative coefficient of current price change. Also, in the case of one of the PTS industries (cotton textiles), the absolute value of the coefficient of sales forecasting error was larger than that of expected sales, implying an inverted conformity of finished inventories to cyclical turns.

(b) Production-to-Order Inventories: In postulating equations for production-to-order industries (for which no data on new and unfilled orders were available), it was assumed that they can forecast, fairly precisely, sales on the basis of unfilled and new orders. This was done by introducing next year's sales as an explanatory variable. Such industries were also assumed to be relatively free from unintended inventory changes.

Our hypothesis that PTO industries know their future sales with reasonable certainty was verified in the case of nonelectrical machinery. The evidence on this industry also enabled us to identify its production process as one in which semi-finished inventories increased proportionately with sales. It is clear, however, that for a more thorough analysis of PTO inventories, the Reserve Bank of India ought to collect and publish data on new and unfilled orders.

Overall, our evidence on inventory behaviour underlined the importance of several hitherto neglected variables. Studies by Eisner and Strotz, Lovell , Evans and others have neglected variables other than sales income. The evidence we have presented implies that variables such as sales forecasting errors, interest rates, price changes, stock price indices and rates of capacity utilization belong in properly specified industry inventory equations. Also, the fact that even with imprecisely classified inventory data, we were [illegible]ly successful in specifying and estimating separate behaviour equations for different components suggests the need to specify separate functions for finished, semi-finished and raw material inventories.

iii <u>Current Assets</u>:

The demand functions we have specified for money, government bonds and accounts receivable are similar to those postulated by F. De Leeuw (1965) in his model for the U.S. financial sector.

Demand for any current asset is assumed to depend upon sales income, lagged stock of the asset, borrowing rates, the relevant industrial stock price index (a measure of expected short term profitability) and rates of return on alternative assets. Following F. De Leeuw (1965) and Dhyrmes and Kurz (1967) we have represented rates of return on assets by changes in stocks of these assets. In the equation for money demand, for example, expected rates of return on fixed capital, inventories and receivables are represented, respectively, by gross fixed investment, inventory investment and the change in the stock of accounts receivable. We have summarized below our evidence on demand for current assets.

(a) Money:

Sales income was significant in the money equations for all four industries.

Another feature common to all industries (except sugar) was the existence of asset substitution. The evidence seemed to conform Tobin's hypothesis that substitution between current and liquid assets is, in general, more common than that between fixed and liquid assets.

(b) Government Bonds:

We could not estimate demand functions for holdings of government bonds by PTS industries. The latter were, therefore, assumed exogenous.

In the case of PTO industries, sales income and rate of interest on corporate debt explained demand for government bonds.

(c) Receivables:

Demand for accounts receivable was assumed to depend positively upon sales income, borrowing rates, and the rate of change of product price, and negatively upon rates of return on alternative assets (represented by changes in stocks of these assets) and the lagged stocks of receivables.

The coefficient of sales was significantly different from zero in the case of all four industries. The evidence also showed that money is a more common substitute for receivables than fixed capital. Another interesting finding related to the speed of adjustment of desired receivables to their actual levels. The speed of adjustment was zero in the case of industries (sugar and transport equipment) for which the ratio of receivables to sales declined over the sample period.

The variety of evidence on current assets throws useful light on the role played by each asset, the nature of asset sustitution and the relative speeds of adjustment of actual stocks to their desired levels.

IV Dividend and External Financing Behaviour

The structure of liabilities was explained in the framework of portfolio theory. Behavioural equations were specified for dividend disbursement, the change in debt liabilities and the change in equity capital. The specificationsand results are summarized below.

(a) Dividend Behaviour:

According to Linter (1967), investment is determined by expected sales and financial risk subject to the short run constraint of stable dividend behaviour. According to the Linter formulation, dividend disbursements depend upon last year's dividends and net profits. Studies by Dhyrmes and Kurtz (1967) and Kuh (1971) for the U.S. and that by Sastry (1967) for India, have, however, found that high rates of gross capital formation lead to a reduction in dividend disbursement. We, therefore, postulated an equation according to which dividend pay-out depends positively upon gross profits[1] (net-profits plus depreciation flow), debt availability and past dividends, and negatively upon gross capital formation (gross fixed investment plus inventory investment.)

Gross profits was significant in all four equations. The Linter hypothesis of stable dividend was, however, supported only in the case of cotton textiles. The general evidence shows that requirements of capital growth and also cost and availability of credit affect dividend pay-out.

(b) Change in Debt:

Our definition of debt includes loans from banks and nonbank financial institutions and accounts payable. In specifying our equation for change in debt, we have followed the approach in Sastry (1967).

1 "Gross profits" was used instead of net profits because depreciation is more a source of funds than an indicator of wear and tear of capital stock.

Change in debt was assumed to depend positively upon gross fixed investment, inventory investment and the change in receivables, and negatively upon the availability of internal funds (retained earnings plus depreciation). While lagged stock of external debt was used as an explanatory variable, its sign could not be ascertained a priori. This is so because on the one hand, debt outstanding is a measure of risk (negative effect) and on the other it could represent credit worthiness or debt capacity (positive effect).

There was a substantial uniformity in the empirical results for external debt. Gross fixed investment, inventory investment and internal funds were significant in all four equations. The coefficient of lagged stock of debt was uniformity nonsignificant. If the coefficient of lagged debt is interpreted as a coefficient of adjustment of actual debt to its "maximum capacity" level, the result would imply reluctance on the part of industries to borrow. Given the negative impact of past debt on gross fixed investment by the two PTS industries in our study and also the statistical significance of other risk variables (cost and availability of debt and stock price index) in equations for several assets, this interpretation would appear to be reasonably correct. The empirical validation of risk variables would tend to support the Duesberry-Kuh-Linter theory that cost of capital depends upon financial policies.

(c) Change in Equity Capital:

In most models of nonfinancial corporate behaviour, new equity finance is determined either as a residual or treated as exogenous. We have decided to specify a behaviour equation for the change in equity capital in order to get a more complete view of business financial policies.

The equation specified for the change in equity capital is similar to that specified for the change in debt capital. Thus, the value of new equity issues is assumed to depend positively upon gross fixed investment, rate of interest on borrowing and the stock price index, and negatively upon the available internal funds and the stock of equity outstanding.

As in the case of evidence on change in debt, there was substantial uniformity in the estimated equity equations for the four industries. The coefficient of gross investment was significantly different from zero in all the four equity equations. The evidence also shows that the rate of interest on borrowings affects the supply of equities by industries.

The coefficient of adjustment of actual equity capital to its desired level was generally quite low, implying a general reluctance to offer equity issues. Our evidence indicates, therefore, that the observed decline in equity/debt ratios of the industries under study was caused by a general reluctance to offer new equity issues coupled with favourable loan market conditions.

Miller (1963) has interpreted the Modigliani-Miller invariance hypothesis to imply that the debt-equity ratio is not sensitive to changes in interest rate. The evidence above, would, therefore, tend to contradict the Modigliani-Miller Theory.

DATA SOURCES

Data for the period 1950-62 were taken from Financial Statistics of Joint Stock Companies In India, 1950-62 (Bombay: Tata Press Limited). Data for the subsequent period were from various issues of the Reserve Bank of India Bulletin (monthly).

The complete set of data is available from the author upon request.

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