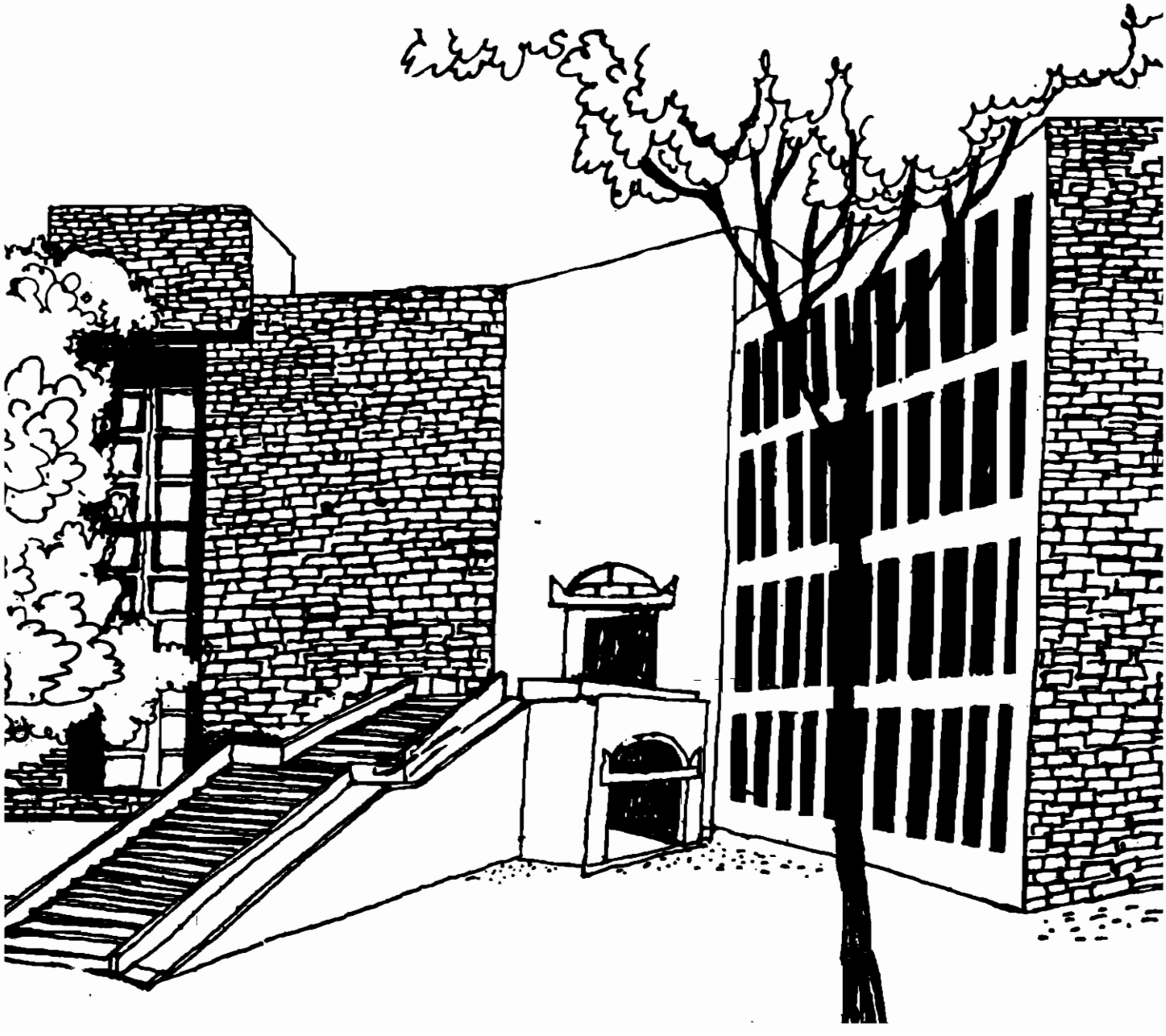
विद्याविनियोगाद्विकासः
IIM
AHMEDABAD

Working Paper



ECONOMETRIC MODE-LLING OF THE INDIAN COTTON TEXTILE INDUSTRY

By

Gopal Naik
Sudhir Kumar Jain

W.P. No. 98-03-04
March 1998

The main objective of the working paper seriess of the IIMA is to help faculty members to test out their reseach findings at the pre-publication stage

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD-380 015
INDIA

ECONOMETRIC MODELLING OF THE INDIAN COTTON TEXTILE INDUSTRY

Gopal Naik and Sudhir Kumar Jain

Abstract

Keeping in view a large number of variables and their interlinkages among them, involvement of a large number of decision makers and the government interventions in the Indian cotton textile industry, this study aims at understanding and quantifying the interrelationship among the important variables of this industry through an econometric simulation model. The model characterizes cotton farming, spinning and weaving sectors and interlinkages among the variables in these sectors through 18 equations. The estimated model performs satisfactorily in terms of goodness of fit, signs, significance of the coefficients and short and long term predictability and specification of the model. The short and long term multipliers of the exogenous variables of the model have theoretically consistent signs and magnitudes. The system is of oscillating convergence nature and can be used for long term forecasting and policy simulations. Forecasts have been made for the period 1995-96 through 2000-2001. The baseline forecasts indicate that the domestic consumption of cotton will increase at a rate higher than the total supply and production of cotton. In the spinning sector, the export of cotton yarn will increase at a high rate (11 per cent per annum). Therefore, the total demand for cotton yarn is expected to increase at a rate higher than its supply. As a result, the deflated price of cotton yarn would experience a increasing but spiral tendency. The demand for, production and price of mill cotton fabrics are expected to decline. However, the export of mill cotton fabrics will increase at a rate of 2.4 per cent per annum. The consumption, production and price of decentralized fabrics will increase at a low rate. The export of decentralized cotton fabrics will increase at a rate higher than the that of mill cotton fabrics (6.7 per cent per annum). Simulation results show that the area under hybrid cotton appears to be one of the important variables in the system through which the desired production of cotton as well as accelerated growth of cotton yarn can be achieved. Promotion of the export of cotton yarn at a high rate will lead to undue increase in the price of cotton yarn which will have an adverse impact on the decentralized weaving units. Hence, appropriate measures are required for accelerating the production of both cotton and yarn if India has to sustain high growth rate of the export of yarn and accelerate the production and the consumption of decentralized cotton fabrics.

ECONOMETRIC MODELLING OF THE INDIAN COTTON TEXTILE INDUSTRY

Gopal Naik and Sudhir Kumar Jain

Introduction

Cotton, an important natural fibre, contributes significantly to both agriculture and industry in India. Its multiple uses, high economic value, strong forward and backward linkages with the textile and agro-input sector, integrate several industries in the economy. As a result, the performance of many industries depends on the performance of cotton industry. Furthermore, growing and changing consumer demand for fabrics, growing competition with man-made fibres, expanding textile industries, fluctuating but increasing production, improved quality, changing economic environment, and varied government policies keep this industry always dynamic and vibrant. Therefore, decision makers of this industry and related industries primarily concern with obtaining accurate information about the behaviour of major variables of this industry for short, medium and long term in order to formulate appropriate strategies, policies for research and development, investment, production, procurement, financing and marketing.

Keeping in view the magnitude, importance of cotton industry, strong interlinkages among the variables of the industry, high involvement of a large number of decision makers and the intensive government intervention, this study aims at developing a comprehensive econometric model for this industry to generate long run forecasts and policy simulations. A brief description of government policies and priorities and structure of this industry is given below.

Government Policies and Priorities

Since cotton industry provides one of the basic needs of the human being, engages a large number of people with diverse background in the different sectors and earns substantial foreign exchange, governments intervention have been intensive in this industry. Central and state governments intervene and regulate from time to time the demand, supply, prices, international trade of cotton, yarn and fabric and provide protection to production units right from the cotton to fabric through a variety of policy measures.

Cotton

Production

In order to increase and improve the production and quality of cotton, Cotton Corporation in India (CCI), a government owned commercial body, has been carrying out a number of extension activities. It has also started a joint venture company in collaboration with several private companies to promote corporate cotton farming in India. Introduction of drip irrigation and acquisition of land on lease for cotton farming are other steps initiated by the corporate in an effort to increase production and productivity of cotton. Improvement in the quality of the cotton and promotion of commercial production of naturally-coloured lint are the thrust areas of the government to make India globally more competitive. The government has also placed its priority on the development and popularisation of transgenic cotton.

Marketing, Distribution and Prices of Cotton

With the objective of the safeguarding the interest of cotton growers and millers, government has been intervening in marketing, pricing and distribution of cotton. The Ministry of Textile announces the minimum support price (MSP) for various grades of cotton to protect cotton growers from undue fall in the prices. CCI purchases cotton at MSP in case market price falls below the MSP. It also undertakes domestic and international trading of cotton. Textile policy of June 1985 also assigns the

price stabilisation role to CCI through appropriate strategies such as timely market intervention, exports, imports and buffer stock operations. Cotton marketing is a state subject in India. Compulsory sale of raw cotton through regulated markets in almost all the states and monopoly procurement of cotton in Maharashtra have been in force for the last 2-3 decades.

Futures Trading

Cotton was the first commodity traded in India when East India Company established futures market in India. The future trading in cotton was banned in 1966, and recently the government has approved future trading.

Stock Limits on Ginners and Mills

Stock limit policy of the government is ad-hoc. It is frequently introduced and removed as per the prevailing situation. The December 1995 notification issued by the commissioner of textile removed stock limit restrictions on cotton held by the traders, other agencies, individuals 100 per cent export oriented units (EOU) and units in export processing zones.

Credit Control Policy

Credit Control Policy varies from year to year. Credit control is used by the government to restrict the hoarding, speculation and price manipulation in the cotton market. As a result of favourable price and supply situation, bank advances against cotton and kapas to other than cotton mills including spinning mills, were exempted from selective credit controls from October, 1996 (Economic Survey, 1996-97).

Export and Import Policy

Export and import policies of the government are ad-hoc. The decision on quota often contributes to a wide fluctuations in export and imports. The export quota is fixed and released in different instalments by the office of textile commissioner after assessing stock estimates, production forecasts, consumption and stock demand. This ad-hoc announcement and release of quota leads to under utilisation of export-quota. During the past few years government has been releasing a minimum export quota of 5 lakh bales at the onset of every cotton year from the carry over stock of previous year. During 1995-96 the government relaxed the minimum export price for cotton which was earlier used to regulate the exports of the cotton. Import of cotton has been placed under OGL.

Yarn

The government also fixes quota and restriction on production and export of yarn in order to ensure adequate supply of yarn to decentralised sector particularly the handloom sector at lower price. Under the yarn production policy, spinning mills in the organised sector are directed to produce 50 per cent of their domestic yarn supply in the form of hank to meet the raw material need of handloom sector (CMIE, 1996). This hank yarn policy of the government has been effective since 1979 and the government has announced continuation of this hank yarn obligation till March 31, 2000 AD. (1995 Notification). Export oriented units have been exempted from the export ceiling of cotton yarn. As sequel to this, the 100 per cent export oriented units have been mushrooming.

Fabrics

Multifibre agreement (MFA) and bilateral agreements determine the destination of the export of fabrics/apparel. The largest markets within quota countries are the USA and the EC (European Countries). India agreed for a phased tariff liberalisation from December, 1994 for certain items within the periods 3 to 7 years. This has helped India in increasing quota for the export of handloom and powerloom fabrics.

The government intervention at every stage of production and marketing in cotton industry requires knowledge of the interrelationship of major variables within and across the sectors. The government

aims at ensuring continuous and adequate supply of raw material to each segment of the industry, sustained high profitability and growth of all segments of the industry, meeting the national objectives and priorities for high growth of the economy as a whole. Therefore, any endeavour to understand interrelationship among the variables of various sectors in a holistic manner and to forecast these variables in order to make appropriate long, medium and short term policies is highly useful. This will also strengthen the decision making process of millers, traders and others who are associated directly or indirectly with this industry.

Econometric Modelling: A review

Several studies on agricultural commodities in India have used econometric models for understanding and projecting demand for and supply of the commodities. Some of these are only demand projection related studies (Biswas, 1959; Maddala,1960; Datta-Majumdar,1963; Patel and Vyas, 1972; Mehta and Sandhu, 1973; Sikka, 1986). Some studies have developed models for analysing demand and supply together for agricultural commodities in India (Maji, Jha and Venkataraman, 1971; Sidhu, 1974). Some studies in India had used econometric models for both projections and policy simulations. Tiwari and Rao (1994) had developed an econometric model for the international castor oil market. Naik, *et al.* (1996) had developed an econometric simulation model for the Indian silk industry for long term forecasting and simulation. Hitchings (1984) used a simultaneous equation system framework to examine the cotton sector in India for projecting supply of and demand for cotton for the period 1980 to 1990. He used the model for five and ten year projections for a given range of policy alternatives. In recent year, remote sensing techniques have also been used for forecasting of acreage and yield of cotton (Ajai and Navalgund, 1991; Space Application Centre, 1992). This technique is suitable for only short term forecasting of acreage and yield. Crop-yield model is also used for the forecasting yield of agricultural commodities in the short run (Agrawal *et al.*, 1980, 1983, 1986; Jain *et al.*, 1980, 1992 Sardana *et al.*, 1972; Singh *et al.* 1976, 1979; Jha *et al.*, 1981; Singh *et al.*, 1988, Jain ***et al.,*** 1985, 1992). A probability model using Markov chain approach and plant measurement had been successfully used in crop yield forecasting (Jain and Agrawal, 1992) in the short run. Logistic growth models had also been proposed for forecasting crop yield (Jain *et al.*, 1992). These yield forecasting models are useful in making forecast within a crop season.

The Cotton Textile Industry in India

Cotton is a major input to the textile industry in India accounting for over 70 per cent of the total fibres consumption in the spinning mills in India (IMCF, 1997). Other by-products viz., cotton seeds, leaves, cotton plant stalk are also used as inputs in the production of various products. Cotton cultivation provides substantial income and employment to people in the rural areas. Textile, its ancillaries and other industries provide employment in urban and semi-urban areas. The employment generated is to the tune of approximately 1 million people in textile sector and nearly 21 million people in supporting industries from dye production to cotton production. Handloom sector alone provides employment to over 3 million weaver households accounting for about 12.9 million weavers. Furthermore, textile industry, the largest industry in the country, accounts for about one fifth of the total industrial output, seven per cent of GDP, approximately one third of the total export earnings (Economic Survey, 1996-97). Cotton textile accounts for around five per cent of the total value of production in the organised manufacturing sector and about 10 per cent of the country's total export earnings (CMIE, 1996).

Structure of Cotton Textile Industry

Cotton passes through a number of processes before it reaches ultimate consumers. In the process of converting cotton into fabric, first raw cotton (kapas) is ginned to separate lint and seeds. Cotton lint is spun in different counts of yarn either pure or blended with man-made fibres and packed in the form of either cone or hank. A small part of total cotton lint produced is used for surgical purposes,

manufacturing mattresses and other domestic purposes. Cotton yarn of various counts is produced mainly in organised mills owned by public, private or co-operatives. Of late, small scale units have also been set up particularly in Tamil Nadu to produce coarse and medium counts of yarn. In India, four types of spinning systems, i.e., ring spinning, open end rotor, air jet and friction spinning are used. All four spinning system require fibre properties in different order of priorities for the production of good quality of yarn and cost effectiveness. Therefore, upgradation of spinning technology will create new demand pattern for cotton fibre in the future in terms of fibre properties. This is evident from the export oriented spinning mills which use sophisticated and modernised spinning system need fibres of specific properties for production of high quality of yarn. Fabrics production takes place in organised mill units, decentralised units which comprise powerlooms and handlooms, and khadi units. Mills and powerlooms use mainly cone yarn whereas, handlooms use exclusively hank yarn. In powerlooms, apart from the production of fabrics, hosiery items like towel, under garments, handkerchief, etc., are also produced. A small share of the total yarn is also used for the production of sewing threads. Organised mills also produce both yarn and fabrics in the composite units. Structural changes that have been taking place in the organised mill sector in the recent years have resulted in delinking of weaving units from spinning units. Now mill sector mainly confines itself to the production of spun yarn and high value fabrics and fabrics meant for export to the sophisticated market.

Demand and Supply Scenario in the Indian Cotton Textile Industry

India has witnessed a phenomenal change in demand and supply of cotton textile industry during the last two decades. There has been an increasing trend in all the major components of the cotton textile industry. However, this trend has not been steady and remains fluctuating. There have also been major changes in the pattern of demand and supply of raw inputs and products of cotton industry, viz., cotton staples, yarn count, types of fabric in terms of source, quality, export and import. Development and promotion of new high yielding varieties, new technology for cotton and other competing agricultural crops, promotion of cotton cultivation in the new areas, changing farming systems and improvement in irrigation and marketing system have been changing the supply of the raw cotton. Popularisation of synthetic fibre, structural and managerial changes in the textile industry, new industrial policy, new emerging economic environment and government priorities and targets have been influencing the demand for and supply of yarn and fabrics. Demand pattern for fabrics has been changing with the time due to changing preferences and income of the consumers and the thrust of the government on export promotion.

Supply of Raw Cotton

The need to increase the production of cotton for meeting the rapidly growing demand of raw inputs of cotton industry has been the major concern since independence. This will continue in the near future as well. In the early fifties and sixties, area was the major source of increasing the production of cotton. Therefore, area had increased substantially and reached at peak of 83.65 lakh hectares during 1964-65 and thereafter it declined till early seventies. During the last two decades it has been hovering around 75 lakh hectares. The scope of increasing the acreage under cotton is negligible due to high demand for land for foodgrains and other agricultural commodities. During the last two decades, increase in the production has come mainly from increase in the yield achieved through the development and promotion of several new high yielding varieties of cotton, improved agronomic and pest management practices. Increase in irrigated area under cotton also contributed substantially to the increase in the yield of cotton. However, production fluctuates considerably as about 66.8 per cent area (1992-93, CMIE, 1996) still depends on the vagaries of the nature.

Demand for Raw Cotton

Demand for raw cotton is a derived demand which depends mainly upon the demand for cotton yarn

which in turn depends on the demand for cotton fabric in the domestic and international market. During the last decade, spinning mills had witnessed rapid expansion of capacity and changes in the spinning system to meet the demand of the fabric sectors for yarn. This had resulted in high demand for raw cotton with changed staple size of cotton. This had created a considerable high pressure on price of cotton. The export demand for cotton constituted a very small percentage of total demand for raw cotton. There had not been any shortage of cotton during the last one and a half decades. The import of cotton remained almost negligible in comparison to the total consumption. The percentage share of cotton consumption other than for yarn production, viz., khadi fabric production, surgical purposes, mattresses, etc., was very small in all the years. However, this demand is increasing though at a slower rate. Inspite of the introduction of synthetic fibres, cotton fibre maintained its position and accounted the highest share in the demand for total fibres. The percentage share of the consumption of cotton fibre in the total fibre had been continuously declining from 83 per cent in 1980-81 to nearly 66.41 per cent (provisional) during 1995-96. The share of man made fibres/filaments has been continuously increasing with fairly high growth rate. However, there was a considerable increase in cotton consumption in absolute term. It had increased almost by 74 per cent during the last one and a half decades. Increase in the consumption of man made fibres/filament yarn had been 322 per cent during 1985-86 to 1995-96. The gap between supply of and demand for fibre was met by increasing the consumption of man made fibres, and blended.

Supply of Cotton Yarn

Supply of cotton yarn constitutes production of cotton yarn and carried over stock of yarn as import of yarn is restricted. The production of cotton yarn fluctuated due to the fluctuating supply of raw cotton and industrial problems viz., labour unrest, industrial sickness, etc. The production of man-made fibre yarn had changed the percentage share of cotton yarn in the basket of the total yarn. The supply of total spun yarn has doubled since 1980-81. Its share has reduced from 86.17 per cent during 1985-86 to 75.16 per cent during 1995-96. The shares of blended and 100 per cent man made fibre yarn have been increasing continuously since late seventies. During 1995-96, blended and 100 per cent non cotton yarn accounted for 24.84 per cent of the total spun yarn. The cotton yarn production had increased by 67.57 per cent since 1980-81. The share of blended yarn which was approximately 11 per cent during 1980-81 had increased to 16.60 per cent in 1995-96 with a growth rate of 8.6 per cent whereas, there has been no substantial increase in the percentage share of 100 per cent of non-cotton yarn during this period. However, there has been a substantial increase in the production of 100 per cent non cotton yarn during 1995-96.

Demand for Cotton Yarn

Demand for cotton yarn comprises demand for the domestic consumption of yarn for the production of fabric, hosiery goods, sewing threads, export demand and stock of cotton yarn. The consumption pattern of cotton yarn can be captured from the civil deliveries of cotton yarn. The expansion of the export oriented spinning units which are free from ceiling limits provides larger scope for increasing the export of cotton yarn. Furthermore, changing government policy in favour of increasing the export of value added products is encouraging the export of cotton yarn. Before eighties the export of cotton yarn was almost negligible. After eighties, the export increased steadily and peaked up during early nineties. During 1994-95, about 10 per cent of the total production of cotton yarn was exported.

Supply of Fabrics

The supply of cotton fabric consists of production and carried over stock. The share of cotton fabric in the basket of total fabric had declined from 72.42 per cent in 1985-86 to 62.71 per cent in 1994-95 but had increased in the absolute terms. The share of the blended and 100 per cent non cotton fabric had increased in total fabric from 9.64 and 17.92 per cent during 1985-86 to 12.88 and 24.4 per cent during 1994-95, respectively. There is no substantial change in the supply of khadi fabric. Its

production has remained more or less stagnant. Before early seventies, mill fabrics constituted a major share of the total fabrics production in the country. The production of fabrics in powerloom sector was very low. After late seventies, the share of these sectors in the production of total fabrics had changed drastically due to structural and managerial changes, cost of production and government policies and priorities. As a result of these changes the share of mill fabrics had reduced from 21.6 per cent in 1985-86 to 6.60 per cent in 1994-95. Absolute quantity of the mill fabrics had also declined during this period. The share of the powerloom fabric in the total production had increased steadily from 45.53 per cent in 1985-86 to approximately 62 per cent during 1994-95. The share of handloom fabrics in the total production had increased till 1990-91and reached 35.04 per cent and thereafter it had been remained less than 30 per cent. Production of khadi had remained stagnant and contributed less than 1 per cent to the total production. There had been also changes in the relative shares of different fibres in the production of fabrics. The share of cotton fabric in the total production in both organised and decentralised weaving units had declined and share of blended fabrics during had increased substantially. There was no substantial change in the share of the 100 per cent non-cotton fabrics. However, cotton fabrics dominates in the production of all the fabrics.

Demand for Cotton Fabrics

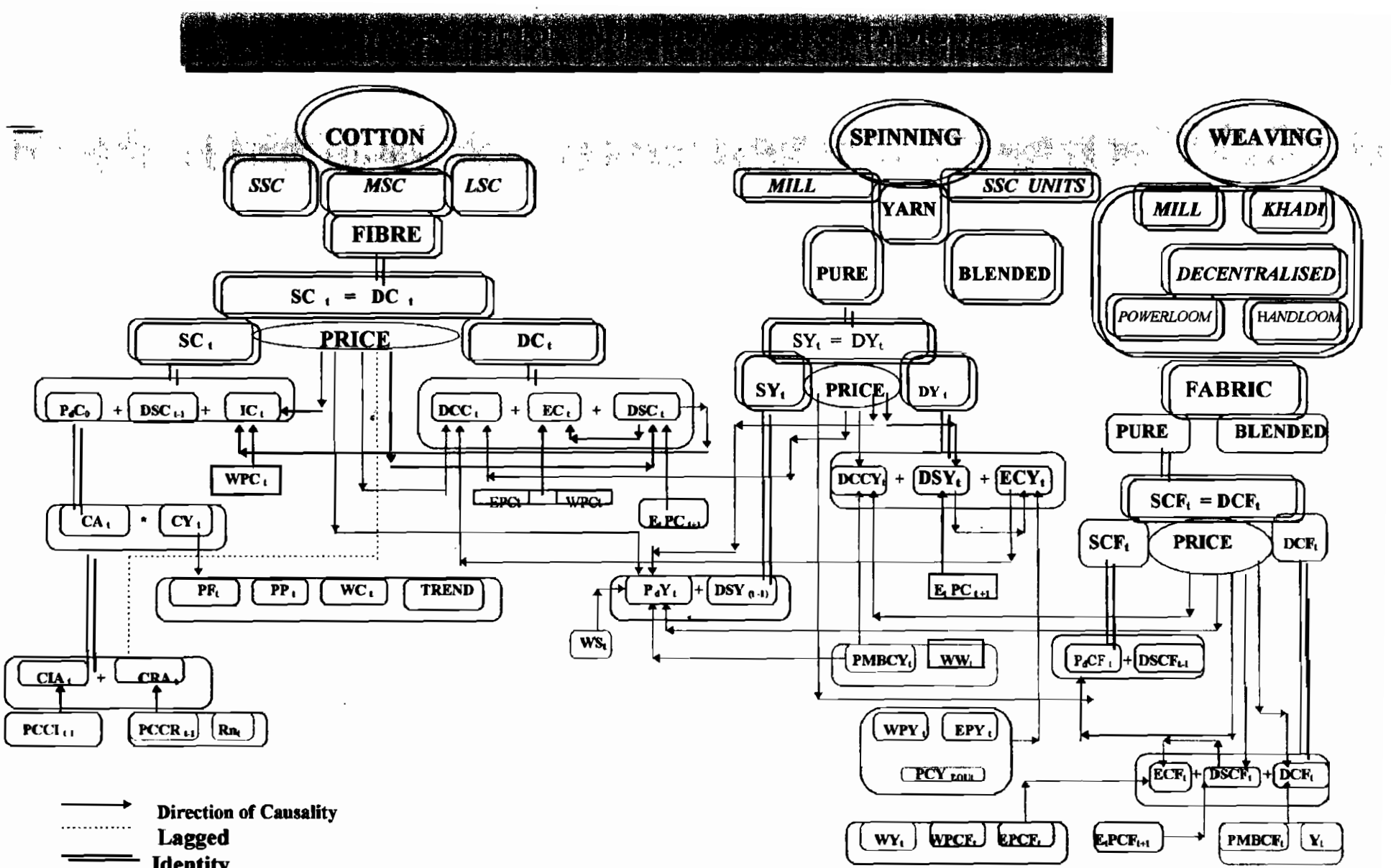
Demand for cotton fabric comprises mainly demand for domestic consumption and export demand. Trend and pattern of domestic demand for fabrics can be captured through supply of fabrics of different fibres. Price reflects the demand supply situation for different types of fabrics. Continuously increasing price of fabrics of different fibres and looms indicates increasing demand for fabrics. In India, increase in income of household will also generate high demand for fabrics as the prevailing per capita consumption is low. Consumers' preferences will be also guided by price, fashion, durability and health concerns. Growing export demand for Indian fabric will also increase the total demand for fabric. Furthermore, government's thrust to export value added product will further encourage the export of fabrics, garments and made-up in future. Past export pattern of fabrics shows that in the early seventies the export was dominated by mill sector and the share of decentralised sector was almost negligible. After late seventies, export of decentralised fabric has been increasing and the export of mill fabrics has been declining. Though, the export of mill fabrics has declined in absolute terms, the share of export of mill fabrics in the total production of mill fabrics has remained more or less constant. In the recent years, the export of mill fabrics has also started to increase. High demand for pure cotton and blended cotton fabrics is expected to sustain in future also.

Framework of the Model

This study considers three major sectors for the modelling purpose: cotton farming, spinning and weaving sectors. Initially, on the basis of our understanding of interrelationships among the various variables, conceptual model was developed to represent the complete structure of Indian Cotton Industry (Flow Chart). Various variables affecting demand for and supply of the products in each of the sectors have been identified. Data used in this study pertain to the period 1970-71 through 1994-95. The conceptual model has been modified due to lack of data on certain variables. However, we have tried to retain all major equations and variables in the system which sufficiently explain the inter-linkages among the sectors. Knowledge of the special characteristics of the sectors has been also incorporated in the model. Initial runs were made to remove some insignificant variables. The modified equations of the model are presented below.

Cotton farming sector

The total demand for cotton lint at time t (DC_t) is the cumulative demand for domestic consumption (DCC_t), export of cotton lint (EC_t) and domestic stock of cotton lint (DSC_t) at time t. The domestic consumption of total cotton has been explained as a difference between the total supply of cotton and the domestic stock plus the total export demand for cotton at time t.


COTTON
SSC
MSC
LSC
FIBRE
SC t = DC t
SC t
PRICE
DC t
PoC0 + DSC t-1 + IC t
WPC t
CA t * CY t
PF t
PP t
WC t
TREND
CIA t + CRA t
PCCI t-1
PCCR t-1
Rn t
DCC t + EC t + DSC t
EPC t
WPC t
E t PC t+1
SPINNING
MILL
YARN
SSC UNITS
PURE
BLENDED
SY t = DY t
SY t
PRICE
DY t
DCCY t + DSY t + ECY t
E t PC t+1
PoY t + DSY (t-1)
WS t
PMBCY t
WW t
WPY t
EPY t
PCY ZOU
WY t
WPCF t
EPCF t
WEAVING
MILL
KHADI
DECENTRALISED
POWERLOOM
HANDLOOM
FABRIC
PURE
BLENDED
SCF t = DCF t
SCF t
PRICE
DCF t
PoCF t + DSCF t-1
ECF t + DSCF t + DCF t
E t PCF t+1
PMBCF t
Y t
Direction of Causality
Lagged
Identity

FLOW- CHART

$$DCC_t = SC_t - DSC_t - EC_t \quad (1)$$

Inverse demand function of cotton is specified, therefore, price of cotton as a function of domestic consumption of cotton, price of cotton yarn and lagged price of cotton.

$$PC_t = f(DCC_t, PC_{t-1}, PCY_t) \quad (2)$$

The export and the stock of cotton have been considered as exogenous variables in this model.

Supply identity has been explained as the sum of production of cotton (PTC_t), import of cotton (IC_t) and one year lagged domestic stock of cotton (DSC_{t-1}).

$$SC_t = P_dC_t + IC_t + DSC_{t-1} \quad (3)$$

The total production of cotton at time t ($P_d C_t$) is specified as a function of one year lagged price of cotton at time t (PC_{t-1}) and the percentage area under hybrid cotton ($PHVCA_t$), Price of fertilizers (PF_t) and trend variables. Variables such as price of pesticide, weather variables and the one year lagged deflated price of the competing crops have also been tried but they were not found significant for this equation.

$$P_dC_t = f(PC_{t-1}, PHVCA_t, PF_t, TREND) \quad (4)$$

Spinning Sector

Cotton fibre is used in the production of yarn, sewing thread and pirns. Due to a small share of consumption of cotton fibre in the production of sewing thread and pirns, this study confines to only pure cotton yarn. Blended cotton yarn is also excluded from the model due to its small share in the total production of cotton yarn.

Since cotton yarn is an input in the production of cotton fabric, the demand for yarn can be represented by a factor demand equation. The total demand for cotton yarn at time t (DCY_t) is the cumulative demand for the domestic consumption of cotton yarn ($DCCY_t$), the domestic stock of cotton yarn (SCY_t) and the export of cotton yarn at time t (ECY_t). The total domestic consumption of yarn has been explained as the difference between the total supply of yarn and sum of domestic yarn and export demand for total yarn.

$$DCCY_t = SCY_t - ECY_t - DSCY_t \quad (5)$$

The price of cotton yarn at time t is specified as a function of domestic consumption of total cotton yarn, price of decentralised cotton fabrics and export of cotton yarn at time t.

$$PCY_t = f(DCCY_t, PDSCF_t, ECY_t) \quad (6)$$

The export demand for cotton yarn at time t has been specified as a function of the price of export of cotton yarn and the stock of cotton yarn, and the dummy variable using logarithm trend from the year 1992-93 to represent the phenomenal growth of export of yarn due to opening of export oriented units. World price of cotton yarn has not been considered due to its non availability.

$$ECY_t = f(EPCY_t, DSCY_t, DV_t) \quad (7)$$

The supply identity has been explained as the sum of the production of cotton yarn (P_dCY_t) and the domestic stock of cotton yarn carried over from the previous year at time t ($DSCY_{t-1}$).

$$SCY_t = P_dCY_t + DSCY_{t-1} \quad (8)$$

The production of cotton yarn at time t has been explained as the function of the price of cotton (PCt), price and export of cotton yarn and one year lagged value of production of cotton yarn at time t.

$$P_dCY_t = (PCY_{t-1}, PC_t, ECY_t PCY_t) \quad 9$$

Weaving Sector

Cotton fabric comprises pure and blended. This study confines to only pure cotton fabric. The demand for and supply of fabric produced in mill, and decentralised units have been explained through separate equations. The market clearing conditions have also been introduced separately.

Mills

An inverse demand function of the demand for mill cotton fabric has been specified. The price of cotton mill fabrics (PMCF $_t$) is a function of demand for cotton mill fabrics ($DCMF_t$), lagged price of decentralised cotton fabrics ($PMCF_{t-1}$) and price of blended and mixed nylon fabrics ($DNTMC_t$).

$$PMCF_t = f(DCMF_t, PMCF_{t-1}, DNTMC_t) \quad 10$$

The export of mill cotton fabrics has been specified as a function of the logarithm of world (OECD countries) per capita income ($LNWY_t$), export price of mill cotton fabrics ($EPMCF_t$) at time t and logarithm of trend (LNTREND). World price of mill cotton fabrics has not been considered due to the non-availability of its data.

$$EMCF_t = f(LNWY_t, EPMCF_t, LNTREND) \quad 11$$

Due to lack of data on the stock of cotton fabrics, supply of mill cotton fabrics is considered equal to the production of cotton mill fabrics.

The production of mill cotton fabrics at time t ($P_d MCF_t$) depends on the price of mill cotton fabrics ($PMCF_t$), one year lagged production of mill cotton fabrics (P_dMCF_{t-1}) and the export of mill cotton fabrics ($EMCF_t$) at time t.

$$P_dMCF_t = f(PMCF_t, PdMCF_{t-1}, EMCF_t) \quad 12$$

Market for mill cotton fabric is in equilibrium when demand for mill cotton fabrics equals to its supply. Since supply is considered to be equal to the production, market equilibrium condition is expressed as follows:

$$DMCF_t = PMCF_t \quad 13$$

Decentralised Units

In case of the decentralised unit also, inverse demand function has been utilised instead of normal demand function. The price of decentralised cotton fabrics at time t depends on the consumption of decentralised cotton fabrics ($DCDSCF_{t-1}$), difference of domestic incomes of the two consecutive periods (GY_t), export of cotton fabrics (ECF_t) and one year lagged price of decentralised cotton fabrics at time t ($PDSCF_{t-1}$).

$$PDSCF_t = f(DCDSCF_t, PDSCF_{t-1}, ECF_t, Gy_t) \quad 14$$

The export demand for decentralised cotton fabrics at time t is a function of the logarithm of export price of decentralised cotton fabrics ($LNEPDSCF_t$), logarithm of world (OECD countries) per capita income ($LNWY_t$) and logarithm of trend as a dummy variable (DV_t) representing changes in the export pattern of decentralised fabrics after 1992.

$EDSCF_t = (LNEPDSF_{t-1}, LNWY_t, DV_t)$ 15

There is no import of cotton fabrics. Furthermore due to lack of data on the stock of decentralised fabrics, supply of the decentralised cotton fabrics has been assumed to be equal to its production at time t.

The production of decentralised cotton fabrics at time t ($PdDSCF_t$) is a function of the price of decentralised cotton fabrics (PDSCFt), price of cotton yarn (PCY_t), the export of decentralised cotton fabrics ($EDSCF_t$) and square root of trend as a dummy variable (DV) representing the change in the economic policies.

$P_dDSCF_t = f(PDSCF_t, PCY_t, EDSCF_t, DV)$ 16

Market for decentralised cotton fabrics is in equilibrium when demand for decentralised cotton fabrics equals to its supply. Since supply is considered to be equal to the production, market equilibrium condition is expressed as follows:

$DCDSCF_t = PDSCF_t - EDSCF_t$ 17

Export of cotton fabrics at time t is explained through an identity.

$ECF_t = EMCF_t + EDSCF_t$ 18

The identification of the system was done using rank and order conditions to examine the estimability of the model and the equations of the system were found over identified. Therefore, system method was used for the estimation. Conditioning index was calculated to examine the presence of multicollinearity between explanatory variables in the equations.

Data Adjustments

The data on consumption of mill and decentralised cotton fabric were derived by subtracting export of mill and decentralised cotton fabric from the total supply of mill and decentralised cotton fabric, respectively. All price variables were deflated by the wholesale price index (WPI) of all commodities (base year 1970-71). The export prices of yarn and fabric which were adjusted by the exchange rate of rupees versus U.S. dollar (ER). Adjusted export prices of yarn and fabrics were deflated by the consumer price index of USA (base year 1980-81). Per capita income of OECD countries at constant prices (1987) was taken as world income. Domestic income at constant price was taken as income. Wholesale price indices were used for all price variables except for the export prices of yarn, mill and powerloom fabric which were per unit realisation values.

Estimation of the Model

Cotton Farming Sector

$DPC_t = 34.26 - 0.328 * DCC_t + 0.890 * DPCY_t - 0.123 * DPC_{t-1}$ 2
(2.13) (-3.51) (6.60) (-1.14)
$R^2 = 0.68$

$P_dC_t = 55.84 + 0.231 * DPC_{t-1} + 1.231 * PHVA_t - .247 * DPFT + 1.438 * TREND$ 4
(3.15) (1.78) (3.00) (-1.96) (1.82)
$R^2 = 0.92$

Spinning Sector

$DPCY_t = 60.37 - 0.034 * DCCY_t + 0.828 * DPDSCF_t + 0.182 * ECY_t$ **6**
(2.37) (-2.61) (4.26) (6.07)
$R^2 = 0.70$

$ECY_t = 17.27 - 9.311 * DEPCY_t + 0.947 * DSCY_t + +110.67 * DV1$ **7**
(0.73) (-1.39) (6.09) (6.86)
$R^2 = 0.92$

$P_dCY_t = 590.18 + 0.706 * PCY_{t-1} - 5.222 * DPC_t + 0.951 * ECY_t + 1.552 * DPCY_t$ **9**
(3.99) (7.43) (-6.88) (2.86) (1.39)
$R^2 = 0.95$

Weaving Sector

Mills

$DPMCF_t = 13.27 - 0.0007 * DMCF_t + 0.706 * DPMCF_{t-1} + 0.230 * DNTMC_t$ **11**
(1.70) (0.354) (4.27) (1.42)
$R^2 = 0.92$

$EMCF_t = -10247.0 - 20.560 * DEPMCF_t + 1164.9 * LNWY_t - 230.09 * LNTREND$ **12**
(-3.397) (-0.11) (3.66) (-4.60)
$R^2 = 0.46$

$P_d MCF = -1530.6 + 26.02 * DPMCF_t + 0.677 * PMCF_{t-1} + 0.659 * EDPCMF_t$ **13**
(-3.23) (3.51) (7.89) (1.78)
$R^2 = 0.92$

Decentralised units

$DPDSCF_t = 49.69 - 0.0026 * DCDSF_t + 0.000083 * GY_t + 0.0149 * EDPCFt +$ **15**
(-4.24) (-3.22) (0.56) (2.14)
$0.59 * DPDSCF_{t-1}$
(5.45)
$R^2 = 0.72$

$EDSCF_t = -13597 + 1435.7 * LNWY_t - 81.86 * LNDEPPCF_t + 472.12 * DV_t$ **16**
(-6.40) (6.28) (-0.81) (5.68)
$R^2 = 0.91$

$P_d DSCF_t = 9236.2 + 24.55 * DPDSCF_t - 75.97 * DPCYT_t + 0.453 * PdDSCF_{t-1}$ **17**
(4.40) (1.17) (-5.32) (3.44)
$3.630 * EDSCFt + 1500.8 * DV$
(-3.24) (4.09)
$R^2 = 0.97$

Identities

$DCC_t = SC_t - DSC_t - EC_t$ **1**
$SC_t = P_dC_t + IC_t + DSC_{t-1}$ **3**
$DCCY_t = SCY_t - DSCY_t - ECY_t$ **5**

$SCY_t = P_dCY_t + DSCY_{t-1}$ 8

$DMCF_t = P_d MCF_t$ 10

$DCDSF_t = P_dDSCF_t - EDSCF_t$ 14

$ECF_t = EDSCF_t + EMCF_t$ 18

Definitions of the Variables Used

Endogenous Variables

DCC	Total Domestic Consumption of Cotton	(Lakh bales)
P_dC	Production of Cotton	(Lakh bales)
SC	Supply of Cotton	(Lakh bales)
DPC	Deflated Wholesale Price Index of Cotton	
DCCY	Domestic Consumption of Cotton Yarn	(Thousand tonnes)
ECY	Export of Cotton Yarn	(Thousand tonnes)
SCY	Supply of Cotton Yarn	(Thousand tonnes)
P_dCY	Production of Cotton Yarn	(Thousand tonnes)
DPCY	Deflated Wholesale Price of Cotton Yarn	
DPMCF	Deflated Wholesale Price Index of Mill Cotton Fabrics	
DMCF	Demand for Mill Cotton Fabrics	(Million square metres)
EMCF	Export of Mill Cotton Fabrics	(Million square metres)
SMCF	Supply of Mill Cotton Fabrics	(Million square metres)
P_dMCF	Production of Mill Cotton Fabrics	(Million square metres)
DPDSCF	Deflated Wholesale Price Index of Decentralised Cotton Fabrics	
DCDSCF	Domestic Consumption of Decentralised Cotton Fabrics	(Million square metres)
EDSCF	Export of Decentralised Cotton Fabrics	(Million square metres)
SDSCF	Supply of Decentralised Cotton Fabrics	(Million square metres)
P_d DSCF	Production of Decentralised Cotton Fabrics	(Million square metres)
ECF	Export of Cotton Fabrics	(Million square metres)

Exogenous Variables

DSC	Total Domestic Stock of Cotton	(Lakh bales)

EC	Total Export of Cotton	(Lakh bales)
IC	Total Import of Cotton	(Lakh bales)
DSCY	Total Domestic Stock of Cotton Yarn	(Thousand tonnes)
PHVA	Area under Hybrid Cotton	(In per cent)
DPF	Deflated Wholesale Price Index of Fertilizers	
DEPCY	Deflated Export Price of Cotton Yarn	(Dollar / Kg)
GY	Difference of Domestic Incomes of two consecutive periods (at constant price)	(Crores./ Annum)
DNTMC	Deflated Wholesale Price of Blended Mixed and Nylon Terylene Cloth	
LNWY	Logarithum of Per Capita Income of OECD Countries (at constant price)	(US Dollars)
DEPMCF	Deflated Export Price of Mill Cotton Fabrics	(U.S.Dollar/Sq. metres)
LNDEPPCF	Logarithm of Deflated Export Price of Powerloom Cotton Fabrics	(U.S. Dollar / Sq. metres)
TREND	Time Trend	
LNTREND	Logarithm of Trend	
DV	Dummy Variable using square root of trend	
DV_t	Dummy Variable using logarithum of trend	

R^2 values of the equations of the model show that the estimated equations have reasonably good fits. The extent of variation in the dependent variables explained by explanatory variables is high except in case of export demand of mill cotton fabric. The regression coefficients of the explanatory variables have expected signs.

The consumption of cotton, the deflated price of cotton yarn and lagged price of cotton explain 68 per cent variation in the deflated price of cotton. In case of cotton production, one year lagged deflated price of cotton, the percentage area under hybrid cotton, deflated price of fertilizers and trend explain 92 per cent variation in production of cotton.

The domestic consumption of cotton yarn, deflated price of decentralised cotton fabric and export of cotton yarn are important variables which explain 70 per cent variation in deflated price of cotton yarn. These variables are significant at one per cent level. In case of export of cotton yarn, deflated export price of cotton yarn, domestic stock of cotton yarn, and dummy variable using logarithm of trend are the major significant explanatory variables. Dummy variable is used to explain the changes in the export of cotton after 1992 due to rapid expansion of export oriented units. The deflated price of

export of cotton yarn is not significant. The estimated equation of production of cotton yarn shows that one year lagged value of production of cotton yarn, deflated price of cotton and deflated price and export of cotton yarn explain together about 95 per cent variability in the production of cotton yarn. All explanatory variables except deflated price of cotton yarn in this equation are statistically significant at 5 per cent level.

Lagged price of mill cotton fabrics and the deflated price of blended mixed fabrics are important explanatory variables in the inverse demand function of mill cotton fabrics. These variables explain together 91 per cent variation in the deflated price of mill cotton fabrics. Only lagged deflated price of mill cotton fabrics is significant. In case of export of mill cotton fabrics, per capita income of OECD countries, export price of mill cotton fabrics and logarithm of trend explain about 46 per cent variability. The estimated equation for production of mill cotton fabrics has a good fit. The deflated price, one year lagged production and export of mill cotton fabrics have been identified as important explanatory variables which explain jointly about 92 per cent variations in production of mill cotton fabrics. All explanatory variables in this equation except export demand for mill cotton fabrics are significant at one per cent level. The export demand for mill cotton fabric is significant at 10 per cent level.

The consumption of decentralised cotton fabric, one year lagged deflated price of decentralised cotton fabrics, difference of domestic incomes of two consecutive periods and export of total cotton fabrics explain together about 76 per cent variations of the deflated price of decentralised cotton fabrics. All explanatory variables except the difference of domestic incomes of two consecutive periods in this equation are significant at one per cent level. About 91 per cent variations in export of decentralised cotton fabrics has been explained by deflated export price of decentralised cotton fabrics, per capita income of OECD countries and the dummy variable. The deflated price of decentralised cotton fabrics, export of decentralised cotton fabrics and deflated price of cotton yarn and lagged production of decentralised cotton fabrics explain about 97 per cent variations in the total production of decentralised cotton fabrics. The deflated price of the decentralised cotton fabrics is not significant.

Overall, the signs and significance of coefficients are consistent with the theory. The results reveal that the empirical model is a proper representation of the structure of the Indian cotton industry. Therefore, the estimated coefficients can be used for further analysis of the industry.

Validation of the Model

The main purpose of the validation of the model is to ascertain the ability of the model to replicate the real world situation accurately. For the present model, appropriateness of the theoretical specifications and the statistical tests of the estimated equations/parameters along with the performance of the model in tracking the historical period of fit have been used to test its validity. For examining the validity of the model as a dynamic system, the stability of the model and its ability to simulate historical data have been examined. Stability condition of the model was examined by computing the latent roots of the matrix of the reduced form coefficients of the lagged endogenous variables. None of the latent roots of the matrix is having a value more than one which indicates that the system is stable. Since the dominant root of this matrix is negative (-0.92), the system will show oscillating convergence.

Predictive Performance of the Model

For the validation of the performance of the model both static and dynamic simulations[1] were done.

[1] Static simulation generates one year ahead predictions of the endogenous variables for a given set of conditions, i.e., the values of the predetermined variables. In static simulation, the values of the exogenous variables and lagged

Static simulation was done for the period 1972-73 to 1994-95. Dynamic simulation was done for two periods: twenty three-year period (1972-73 to 1994-95) and five-year period (1990-91 to 1994-95) using both actual and forecasted values of exogenous variables.

The model generated historical predictions was compared with the actual values of the endogenous variables using the following criteria.

(a) Percentage Root Mean Square Error (PRMSE)
(b) Theil Inequality Coefficients (U_2)

PRMSE

The PRMSE values show that the model gives reasonably good forecast of the endogenous variables for the historical period (Table 1). PRMSE values of all price variables in the static simulation for the complete historical period are sufficiently low except price of cotton. The PRMSE values of quantity

Table 1: PRMSE Values of Static and Dynamic Simulations

Endogenous Variables	Types of Simulations			
	Static Simulation	Dynamic Simulation		
		23 Yrs (a)	5 Yrs (a)	5 Yrs (b)
DCC	7.07	7.69	9.06	9.14
SC	5.30	5.95	5 .92	6.44
P_dC	6.92	7.88	7.19	7.79
DPC	18.35	16.43	16.27	12.66
DCCY	7.09	6.53	4.37	3.99
ECY	116.79	116.79	14.99	19.05
SCY	6 .57	6.72	4 .09	5.49
P_dCY	6.75	6.90	4 30	4.73
DPCY	10.79	11.67	9.49	11.71
DMCF	9.12	11.24	14 .13	14.72
EMCF	17.61	17. 61	4 .98	7.71
P_d MCF	9.12	11.24	14. 13	14.72
DPMCF	4.57	5.06	5.09	4.61
DCDSF	0.89	0.91	1.04	1.05
EDSCF	50.57	50. 57	16.23	16.73
P_dDSCF	7.09	6. 91	6.06	4.75
DPDSCF	5.92	8.28	4.63	4.24
ECF	20. 55	20. 55	10. 54	11 .62

variables in static simulation are also sufficiently low except export variables. High PRMSE values of the export of cotton yarn and decentralised cotton fabric are mainly due to small quantities of exports in the early periods. PRMSE values of all the endogenous variables except demand for and production of mill cotton fabric and the deflated price of decentralised cotton fabric in the dynamic simulation for the complete historical period remain either close to or lower than PRMSE values of static simulation. In case of dynamic simulation using actual values of exogenous variables for the last five year period historical period (1990-91 to 94-95), PRMSE values of all the endogenous variables except domestic consumption of cotton, demand for and production of mill cotton fabrics are either low or close to the corresponding PRMSE values of the static and dynamic simulations for the complete historical period.

---

endogenous variables are set at their actual values for each period. Dynamic simulation involves generating solutions for a system for a period of time. The values of exogenous variables and the initial period lagged endogenous variables are set at their values.

This supports the model's tracking ability of the actual values of endogenous variables. PRMSE values of most of the endogenous variables in the dynamic simulation for the current five-year period using the forecasted values of exogenous variables are also either low or close to their PRMSE values in the dynamic simulation for five year period using actual values. However in case of ECY, SCY, DPCY EMCF, and ECF, PRMSE values have increased marginally. It shows that the performance of these variables are more sensitive to the forecasted values of exogenous variables. Therefore, effort should be made to obtain more accurate forecasts of the exogenous variables if the objective is to obtain more accurate forecasts of these endogenous variables.

Theil's Coefficient

Theil's coefficients of all the endogenous variables are less than one in static, dynamic simulations for complete historical period and five year period using actual and forecasted values of exogenous variables (Table 2). It indicates that the model performs reasonably well and are consistent with the findings of the PRMSE values.

Table 2: Theil's Inequality Coefficients (U_2) of Static and Dynamic Simulations

Endogenous Variable	Types of Simulation			
	Static Simulation	Dynamic Simulation		
		23 Yrs (a)	5 Yrs (a)	5 Yrs (b)
DCC	0.75	0.86	0. 77	0.46
SC	0.14	0.17	0. 11	0.10
P_dC	0.13	0.16	0. 10	0.09
DPC	0.45	0.33	0. 34	0.23
DCCY	0.54	0.45	0. 37	0.31
ECY	0.23	0. 23	0. 16	0.29
SCY	0.41	0.42	0. 33	0.57
P_dCY	0. 45	0.45	0. 34	0.41
DPCY	0. 36	0.37	0. 26	0.34
DMCF	0.31	0 . 43	0.56	0.60
EMCF	0. 19	0. 19	0. 17	0.384
P_dMCF	0.31	0.43	0.56	0.60
DPMCF	0.40	0.49	0.85	0.70
DCDSF	0.006	0.009	0.005	0.007
EDSCF	0.57	0.57	0.39	0.41
P_dDSCF	0.29	0.31	0.22	0.15
DPDSCF	0. 36	0. 65	0.44	0.37
ECF	0. 31	0.31	0. 34	0.40

Adequacy of the Model Specifications

The mean square simulation error is decomposed into bias, variance and covariance components [1] to examine the adequacy of the model specifications. The values of these components indicate reasonably good specifications of the model (Table 3). In the static and dynamic simulations for the complete historical period, the bias components of all endogenous variables except DMCF and P_dMCF in the dynamic simulation are almost equal to zero. The variance components of most of the endogenous variables in both static and dynamic simulations are also close to zero. However, the variance components of PC, ECY, DPCY, EMCF and ECF are slightly higher than zero in both static and dynamic simulations. The variance components of PC, DPCY in the dynamic simulation are higher than those of in the static simulation.

[1] The bias proportion (Ubias) gives the systematic error. The variance proportion (Uvar) indicates the ability of the model to replicate the variation in the historical values of the variables and the covariation proportion measures the unsystematic error. The value of bias and variance proportion closer to zero indicates the adequacy of the model's specifications (see Pindyck and Rubinfeld, 1991 for details)

Furthermore, variance components of DCCY, DPDSCF are also slightly higher than zero in the dynamic simulation. Overall, results show that the proportion of unsystematic error accounts for the most of the inequality between the predicted and the actual values.

Table 3: Components of Mean Square Error for Static and Dynamic Simulations as Proportion of Total

Endogenous Variable	Static Simulation			Dynamic Simulation		
	Ubias	Uvar	Ucov	Ubias	Uvar	Ucov
DCC	0.00	0.07	0.93	0.01	0.06	0.93
SC	0.00	0.00	1.00	0.00	0.01	0.99
P_dC	0.00	0.03	0.97	0.00	0.04	0.96
DPC	0.00	0.11	0.89	0.00	0.28	0.72
DCCY	0.00	0.01	0.99	0.00	0.13	0.87
ECY	0.00	0.16	0.84	0.00	0.16	0.84
SCY	0.01	0.03	0.96	0.00	0.00	1.00
P_dCY	0.01	0.03	0.96	0.00	0.00	1.00
DPCY	0.02	0.25	0.73	0.01	0.40	0.59
DMCF	0.03	0.04	0.93	0.28	0.08	0.64
EMCF	0.01	0.25	0.74	0.01	0.25	0.74
P_dMCF	0.03	0.04	0.93	0.28	0.08	0.64
DPMCF	0.03	0.00	0.97	0.03	0.03	0.94
DCDSF	0.00	0.06	0.94	0.00	0.03	0.97
EDSCF	0.00	0.08	0.92	0.00	0.08	0.92
P_dDSCF	0.00	0.01	0.99	0.02	0.04	0.94
DPDSCF	0.00	0.01	0.99	0.01	0.14	0.85
ECF	0.00	0.11	0.89	0.00	0.11	0.89

Ex-post Forecast Performance

The ex-post forecasts of the model for the year 1995-96 could not be examined due to non-availability of data on some variables. However, we have tried to find out the differences in per cent terms between actual and forcasted values for only those variables for which we have the actual data. This result also shows that model's performance is satisfactory (Table 4).

Multipliers

Multipliers are potentially useful tools for the impact analysis of a definite change in the exogenous variable on the values of the endogenous variables in a dynamic system. The short term multiplier of domestic stock of cotton has a negative impact on the domestic consumption of cotton, consumption, supply and production of cotton yarn, and consumption and production of decentralised cotton fabric (Table 5). It has a relatively high positive impact on deflated price of cotton as compared to deflated price of cotton yarn and decentralised cotton fabric. Whereas, other endogenous variables have almost no impact in the short run. The long term multiplier of the domestic stock of cotton has relatively higher impact on almost all the endogenous variables of cotton farming, spinning and fabric sectors except domestic consumption of cotton as compared to its short term multiplier. The supply and the production of cotton also experience positive impact of domestic stock of cotton in the long run (Table 6). The results of the short and long run elasticity show that the domestic consumption of cotton has a relatively high responsiveness (0.30) to the domestic stock of cotton followed by the deflated price of cotton (-0.14) in the short run, whereas, in the long run, deflated price of cotton responds to domestic stock of cotton more than domestic consumption of cotton. Domestic consumption and production of cotton has elasticity more than one. It implies that a unit change in the domestic stock of cotton will

Table 4 : Ex-post Forecast Performance of the Model for the Year 1995-96			
Endogenous Variables	Values of Endogenous Variables		Deviation from Actual Values in Per cent
	Actual	Sim-A	Sim-A
DCC	152.5	142.54	-6.53
SC		178.83	
P_dC	161.5	151.14	-6.41
DPC		83.94	
DCCY	1464.6	1438.71	-1.76
ECY	262.61	293.21	11.65
SCY		1878.15	
P_dCY	1788	1748.09	-2.23
DPCY		123.53	
DMCF	1159	1395.27	20.38
EMCF	466.83	469.64	0.60
P_dMCF	1159	1395.27	20.38
DPMCF		68.12	
DCDSCF	16683.0	15447.67	-7.40
EDSCF	1058.44	1303.41	23.14
PsDSCF	17741.0	16751.09	-5.58
DPDSCF		69.88	
ECF	1525.27	1773.05	16.24
Note: Simulated values for 1995-96 has been obtained through base line dynamic simulation			

bring more than a unit change in the domestic consumption and production of decentralised cotton fabric. (appendix 1(a) and 1(b)). Other endogenous variables of the system also respond higher to the changes in the domestic stock of cotton in the long run than in the short run.

The impact of short and long run multipliers of the export of cotton is same as the impact of short and long run multiplier of domestic stock of cotton in the system. The short and long run impact multiplier of the lagged domestic stock and import of cotton also have impact on the endogenous variables similar to short and long term impact multipliers of domestic stock and export of cotton in terms of magnitude but with opposite signs. All endogenous variables in the system are almost inelastic to export and import of cotton in both short and long run. All endogenous variables in the system show responsiveness to lagged domestic stock of cotton similar to domestic stock of cotton in terms of magnitude in both short and long run.

The short run multiplier of the percentage area under hybrid cotton indicates a positive impact on the consumption, supply, production of cotton and yarn and consumption and production of decentralised cotton fabric. It has a negative impact on the price of cotton, yarn and decentralised cotton fabric in the short run. However, it has relatively large impact on the consumption and production of decentralised cotton fabric in the short run. In the long run, it has a smaller impact on the consumption, supply and production of cotton as compared to in the short run. Consumption, supply and production of yarn, consumption and production of decentralised cotton fabric experience a large positive multiplier impact as a result of the change in the percentage area under hybrid cotton as compared to its impact on these

Table 5 Short Run Multiplier of the exogenous Variables for the Endogenous Variables

Endogenous Variables	Exogenous Variables																	
	DSC	EC	IC	DSC_{t-1}	PHYVA	DPF_t	SCY	DEPCY	SCY_{t-1}	WY	DEPMF	DEPPF	GI	LNTREND	DNTMC	TREND	DV1	DV
DCC	-1	-1	1	1	1.23	-0.25	0	0	0	0	0	0	0	0	0	1.44	0	0
SC	0	0	1	1	1.23	-0.25	0	0	0	0	0	0	0	0	0	1.44	0	0
P_dC	0	0	0	0	1.23	-0.25	0	0	0	0	0	0	0	0	0	1.44	0	0
DPC	0.4	0.4	-0.4	-0.4	-0.49	0.1	0.25	-2.05	-0.04	10.83	0	-0.62	0	0	0	-0.57	27.94	-3.65
DCCY	-1.95	-1.95	1.95	1.95	2.4	-0.48	-1.92	7.6	1.14	-37.68	0	2.15	0	0	0	2.81	-102.71	12.7
ECY	0	0	0	0	0	0	0.95	-9.31	0	0	0	0	0	0	0	0	110.67	0
SCY	-1.95	-1.95	1.95	1.95	2.4	-0.48	0.03	-1.71	1.14	-37.68	0	2.15	0	0	0	2.81	7.96	12.7
P_dCY	-1.95	-1.95	1.95	1.95	2.4	-0.48	0.03	-1.71	0.14	-37.68	0	2.15	0	0	0	2.81	7.96	12.7
DPCY	0.08	0.08	-0.08	-0.08	-0.1	0.02	0.28	-2.3	-0.05	12.17	0	-0.69	0	0	0	-0.11	31.39	-4.1
DCDSCF	-5.52	-5.52	5.52	5.52	6.79	-1.36	-20.01	164.53	3.22	3174.76	0	-180.98	0	0	0	7.94	-912.35	1703.91
EDSCF	0	0	0	0	0	0	0	0	0	1436	0	-81.86	0	0	0	0	472	0
P_d DSCF	-5.52	-5.52	5.52	5.52	6.79	-1.36	-20.01	164.53	3.22	4610.76	0	-262.84	0	0	0	7.94	-440.35	1703.91
DPDSCF	0.01	0.01	-0.01	-0.01	-0.02	0	0.05	-0.43	-0.01	13.14	0	-0.75	0	0	0	-0.02	9.4	-4.43
DMCF	0	0	0	0	0	0	0	0	0	752.6	-13.29	0	0	5.87	-148.71	0	0	0
EDMCF	0	0	0	0	0	0	0	0	0	1164	-20.56	0	0	0	-230	0	0	0
P_d MCF	0	0	0	0	0	0	0	0	0	752.6	-13.29	0	0	5.87	-148.71	0	0	0
DPMCF	0	0	0	0	0	0	0	0	0	-0.56	0.01	0	0	0.23	0.11	0	0	0
ECF	0	0	0	0	0	0	0	0	0	2600	-20.56	-81.86	0	0	-230	0	472	0

Table 6 Long Run Multiplier of the exogenous Variables for the Endogenous Variables

Endogenous Variables	Exogenous Variables																	
	DSC	EC	IC	DSC_{t-1}	PHYVA	DPF_t	SCY	DEPCY	SCY_{t-1}	WY	DEPMF	DEPPF	GI	LNTREND	DNTMC	TREND	DV1	DV
DCC	-0.77	-0.77	0.77	0.77	0.94	-0.19	0.14	-1.03	-0.03	0.8	0	-0.05	0	0	0	1.1	12.45	-11.66
SC	0.23	0.23	0.77	0.77	0.94	-0.19	0.14	-1.03	-0.03	0.8	0	-0.05	0	0	0	1.1	12.45	-11.66
P_dC	0.23	0.23	-0.23	-0.23	0.94	-0.19	0.14	-1.03	-0.03	0.8	0	-0.05	0	0	0	1.1	12.45	-11.66
DPC	1.02	1.02	-1.02	-1.02	-1.25	0.25	0.6	-4.44	-0.15	3.47	0	-0.2	0	0	0	-1.46	53.89	-50.45
DCCY	-12.96	-12.96	12.96	12.96	15.94	-3.2	-5.36	26.74	2.63	-37.5	0	2.14	-0.01	0	0	18.63	-330.19	544.96
ECY	0	0	0	0	0	0	0.95	-9.31	0	0	0	0	0	0	0	0	110.67	0
SCY	-12.96	-12.96	12.96	12.96	15.94	-3.2	-3.41	17.43	2.63	-37.5	0	2.14	-0.01	0	0	18.63	-219.52	544.96
P_dCY	-12.96	-12.96	12.96	12.96	15.94	-3.2	-3.41	17.43	1.63	-37.5	0	2.14	-0.01	0	0	18.63	-219.52	544.96
DPCY	1	1	-1	-1	-1.23	0.25	0.81	-5.98	-0.2	4.68	0	-0.27	0	0	0	-1.44	72.59	-67.96
DMCF	-107.82	-107.82	107.82	107.82	132.62	-26.63	-87.55	643.44	21.89	7579.62	0	-432.08	-0.08	0	0	155.05	-5157.37	9443.15
EMCF	0	0	0	0	0	0	0	0	0	1436	0	-81.86	0	0	0	0	472	0
P_dMCF	-107.82	-107.82	107.82	107.82	132.62	-26.63	-87.55	643.44	21.89	9015.62	0	-513.94	-0.08	0	0	155.05	-4685.37	9443.15
DPMCF	0.68	0.68	-0.68	-0.68	-0.84	0.17	0.56	-4.08	-0.14	4.12	0	-0.23	0	0	0	-0.98	49.86	-59.88
CDSCF	0	0	0	0	0	0	0	0	0	1946.23	-34.38	0	0	50.58	-384.57	0	0	0
EDSCF	0	0	0	0	0	0	0	0	0	1164	-20.56	0	0	0	-230	0	0	0
P_dDSCF	0	0	0	0	0	0	0	0	0	1946.23	-34.38	0	0	50.58	-384.57	0	0	0
DPDSC	0	0	0	0	0	0	0	0	0	-4.8	0.08	0	0	0.64	0.95	0	0	0
ECF	0	0	0	0	0	0	0	0	0	2600	-20.56	-81.86	0	0	-230	0	472	0

variables in the short rum. Similarly, the prices of cotton, yarn and decentralised cotton fabric experience a larger negative impact in the long run than in the short run. In the long run also, it has larger impact on the consumption and production of decentralised cotton fabrics than its impact on the endogenous variables in the system. The results of the elasticities also corroborates this findings.

The deflated price of fertilizers has negative impact on the consumption, supply, production of cotton, domestic consumption, supply and production of cotton yarn and consumption and production of decentralised cotton fabrics in the short run. It has a positive impact on the price of cotton and yarn in the short run. Consumption and production of decentralised cotton fabrics experience its multiplier impact more than other endogenous variables in the short run. In the long run, its multiplier impact declines marginally on consumption, supply and production of cotton and increases substantially on the consumption, supply and production of yarn and consumption and production of decentralised cotton fabrics. Prices of cotton and yarn also experience marginally large multiplier impact of deflated price of fertilizers in the long run. The results of the elasticity show that response of consumption, supply and production of cotton to the change in the deflated price of fertilizers is larger than other endogenous variables in the short run. In the long run, the responsiveness of these variables to the change in the deflated price of fertilizers declines and the elasticities of other endogenous variables increases.

Short run multiplier of domestic stock of cotton yarn shows a positive impacts on the export, supply, production of cotton yarn and deflated price of cotton, cotton yarn and decentralised cotton fabric. It has a relatively large negative impact on the domestic consumption of cotton yarn, and consumption and production of decentralised cotton fabric. The multiplier impact of stock of cotton yarn increases on these variables in the long run as compared to the short run. The domestic consumption, supply and production of cotton also experiences its positive multiplier impact in the long run. The short term multiplier of the stock of yarn has no impact on the other endogenous variables of the system. Endogenous variables of mill unit and export of decentralised cotton fabric do not experience any impact of stock of cotton yarn even in the long run. The elasticity also shows that the export of cotton yarn responds relatively high to the change in the stock of cotton yarn as compared to the other endogenous variables in the short run. In the long run, the consumption and the production of decentralised cotton fabrics are highly elastic to the change in the stock of cotton yarn as compared to other endogenous variables in the long run. Export of cotton yarn also shows high responsiveness to the change in the stock of cotton yarn in the long run.

The short term multiplier of the deflated export price of cotton has a large negative impact on deflated price of cotton and yarn, supply, production and export of cotton yarn. Its impact on the decentralise cotton fabrics is relatively small. It has a substantial high positive impact on the consumption, production of decentralised cotton fabric and domestic consumption of cotton yarn. The endogenous variables of mills and cotton farming sector are not affected in the short run. In the long run, its impact on these endogenous variables increases. The endogenous variables domestic consumption, supply and production also experience negative impact in the long run. Export of cotton yarn is highly responsive to the changes in the deflated export price of cotton as compared to other endogenous variables in the systems in the short run. Consumption and production of decentralised cotton fabric shows marginally high responsiveness to the change in the deflated export price of cotton as compared to the export of cotton yarn in the long run.

Lagged stock of cotton yarn influences positively the domestic consumption, supply of cotton yarn and consumption and production of decentralised cotton fabric in the short run. It has a marginal positive impact on the production of cotton yarn in the short run. In long run, its impact increases on these endogenous variables. However, extent of increase in its impact on consumption and production of decentralised cotton fabrics is higher than on other endogenous variables.

World per capita income has a large positive impact on the endogenous variables of decentralised and mill units in both short and long run. It also influences positively the price of cotton and cotton yarn. It has a negative impact on the consumption, supply and production of cotton yarn. Its impact on the endogenous variables of decentralised and mill unit increases considerably in the long run. The domestic consumption, supply and production of cotton also experience positive impact in the long run and no impact on these endogenous variables in the short run. The results of elasticities in the both short and long run corroborate this findings. The elasticities of endogenous variables show that the exports of decentralised and mill cotton fabrics respond significantly to the changes in the world per capita income in both short and long run. The response of export of mill cotton fabrics is marginally high as compared to that of decentralised cotton fabric. The responsiveness of the export of decentralised cotton fabrics increases in the long run.

The export price of mill cotton fabrics has negative impact on the demand for, production and export of mill cotton fabrics in both short and long run. It has no influence on other endogenous variables of the system in both short and long run.

The export price of decentralised cotton fabrics has a large negative impact on the consumption, production and export of decentralised cotton fabrics and marginal negative impact on prices of cotton, yarn and decentralised cotton fabrics in both short and long run. It has positive impact of equal amount on the consumption, supply and production of cotton yarn in both short and long run and no impact on the other endogenous variables in the short run. Its multiplier impact increases substantially on consumption, production of decentralised cotton fabrics in the long run. The impact on price of cotton, yarn and decentralised cotton fabrics declines in the long run. The results of elasticities also show that the export of decentralised cotton fabrics have high responsiveness to the changes in the export price of powerloom cotton fabrics in both short and long run.

Domestic income has almost no impact on the endogenous variables of the system in the both short and long run. The results of elasticities also corroborates this findings..

The trend influences positively demand for and production of mill cotton fabrics in both short and long run. It has marginal influences on the deflated price of mill cotton fabrics in both short and long run. However in the long run, its multiplier impact on demand for and production of mill cotton fabrics increases considerably.

The price of blended and nylon cloth has a high negative multiplier impact on the demand for and production of mill cotton fabrics and marginal positive impact on the price of mill cotton fabrics in both short and long run. However, its multiplier impact on these variables increases in the long run. It does not have any impact on the other endogenous variables of the system. The results of elasticities also corroborate this findings.

The trend variable has a relatively high positive impact on consumption and production of decentralised cotton fabrics followed by domestic consumption, supply and production of cotton yarn and

consumption, supply and production of cotton in both short and long run. It has almost negligible negative impact on the price of cotton and decentralised cotton fabrics and no impact on the endogenous variables of mill in both short and long run. Its multiplier impact on demand for and production of decentralised cotton fabrics and consumption, supply and production of cotton yarn increases substantially in the long run. The extent of increase in the impacts on the demand for and production of decentralised cotton fabrics are higher than other endogenous variables in the long run.

Simulation of the Model

Given the adequate performance of the model as a dynamic system, dynamic simulation was carried out for the period 1995-96 to 2000-01. The actual values of the endogenous variables for the year 1994-95 were used as values for initial year lagged endogenous variables. Forecasts of the exogenous variables were made using the best fit trend equations. However, the values of domestic stock of cotton, export of cotton, and import of cotton were set at the mean value of the period from 1990-91 to 1994-95 as the trend regressions for the aforesaid variables had poor fit. Dynamic simulations for different policy scenarios were also carried out to assess the impact of the different policy options on the Indian cotton textile industry.

Base-line Simulation of the Model

Base-line simulation of the forecasts of the endogenous variables reveals that the domestic consumption of cotton will increase at a rate of 3.1 per cent per annum and will reach a level of 163.66 lakh bales by 2000-2001 (Table 7). The supply of cotton will increase at a rate of 2.5 per cent per annum during the simulation period which is slightly lower than the rate of the consumption of cotton.

Table 7: Base-line Simulation Values of the Endogenous Variables of the Aggregate System of Cotton Industry for the Period 1995-96 to 2000-2001

Year	DCC	SC	PdC	DPC	DCY	ECY	SCY	PdCY	DPCY	DCDSCF
1995	142.54	178.83	151.45	83.94	1438.71	293.21	1878.15	1748.09	123.53	15447.67
1996	141.15	177.44	150.06	93.14	1511.39	335.43	2011.17	1864.94	129.78	16114.74
1997	147.9	184.19	156.81	94.85	1589.91	376.49	2151.15	1986.8	135.45	16680.62
1998	152.95	189.24	161.86	97.6	1665.63	415.5	2288.81	2104.06	140.64	17107.78
1999	158.28	194.57	167.19	100.46	1737.75	454.99	2426.2	2218.52	146.2	17431.98
2000	163.66	199.95	172.57	104.29	1804.05	497.49	2563.98	2330.52	152.88	17623.04
CGR	3.1	2.5	2.9	3.9	4.7	11.0	6.4	5.9	4.3	2.7

Note: CGR = Compound Growth Rate

The production of cotton will increase at a rate of 2.9 per cent per annum and would reach a level of 172.57 lakh bales during 2000-2001. The deflated price of cotton is expected to have a spiral tendency and will grow at a rate of 3.9 per cent per annum during the simulation period. In the spinning sector, export of cotton yarn would increase with a substantial high rate (11.0 per cent per annum). The high growth rate of export of cotton yarn can be attributted to the setting up of a large number of export oriented units in the spinning sector through which near about 60 per cent cotton yarn is exported. The supply and production of cotton yarn would increase at a rate of 6.4 and 5.9 per cent per annum, respectively whereas, the consumption of cotton yarn would increase at a slower rate (4.9 per cent per annum) than supply and production. The deflated price of cotton yarn would increase at a rate of 4.3 per cent per annum. The spiral tendency in the cotton yarn during simulation period inspite of low growth of consumption than that of supply may be attributed to the high growth of export of cotton yarn. In the weaving sector the demand for and the production of mill cotton fabrics will decline at a rate of 2.3 per cent per annum. The export of mill cotton fabrics is expected to increase at the rata of 2.4 per cent per annum. Due to changes in the consumer performances, government policies and other external and internal factors, mill units are either producing the high quality fabrics for the export purpose or

Continue....Table 7: Base-line Simulation Values of the Endogenous Variables of the Aggregate System of Cotton Industry for the Period 1995-96 to 2000-2001

Year	EDSCF	PdDSCF	DPDSCF	DMCF	EMCF	PdMCF	DPMCF	ECF
1995	1303.41	16751.09	69.88	1395.27	469.64	1395.27	68.12	1773.05
1996	1436.3	17551.05	71.07	1433.21	484.03	1433.21	65.78	1920.33
1997	1555.03	18235.65	72.08	1418.78	498.66	1418.78	63.88	2053.68
1998	1640.43	18748.22	72.83	1370.49	502.1	1370.49	62.31	2142.53
1999	1730.68	19162.65	73.78	1313.52	517.39	1313.52	60.97	2248.07
2000	1821	19444.04	75.19	1255.83	532.93	1255.83	59.83	2353.94
CGR	6.7	3.0	1.4	-2.3	2.4	-2.3	-2.5	5.7

Note: CGR: Compound Growth Rate in per cent per annum

shifting from fabrics production to strictly yarn production. It is predicted that the deflated price of mill cotton fabrics will also decline at a rate of 2.5 per cent per annum. The consumption and the production of decentralised cotton fabrics will increase at the rate of 2.7 and 3.0 per cent per annum, respectively during simulation period. The export of decentralised cotton fabrics is expected to increase relatively higher rate (6.7 per cent per annum) than the export of mill cotton fabrics. The deflated price of decentralised cotton fabrics will show spiral tendency during the simulation period. The export of the total cotton fabrics will increase at the rate of 5.7 per cent per annum.

Effect of Changes in the Acreage Under Hybrid Cotton

The efforts of the government to bring larger area under the high yielding varieties of cotton would play a vital role in increasing the total production in the country as the scope of increasing the acreage under cotton is almost negligible. Therefore, an effort has been made to assess the impact of changes in the area under hybrid cotton from the base level. The policy simulations under three different scenarios were carried out, i.e., (a) 5 per cent (b) 10 per cent and (c) 15 per cent increase in the area under hybrid cotton over the base level for the simulation period (1995-96 to 2000-01).

Policy simulations reveal that increase in the area under hybrid cotton would have a substantial positive impact on all the endogenous variables of cotton farming, spinning and weaving sectors (only decentralised unit). Changes are larger for the endogenous variables of cotton farming than the endogenous variables of spinning and decentralised weaving unit. The endogenous variables of the mill weaving unit- export related variables in the system would remain unchanged (Appendix 2). The results indicate that the area under hybrid cotton is an important variables in the system through which the desired production of cotton as well as accelerated growth of cotton yarn can be achieved.

The Effect of Changes in the Export of Cotton

The export policy of cotton has always been ad-hoc. The quota of export of cotton is either increased or decreased as per the estimated production level of cotton. Therefore, the impact of the change from the average level of export of cotton on the Indian cotton textile industry was assessed. Simulations were carried out to ascertain the impact of the policies intended towards increase/decrease in the export of cotton. For these simulations, the exogenous export variables was increased/decreased by the desired amount. The simulation results show that the change in the export of cotton does not influence the endogenous variables of weaving sector (appendix 3). The change in the amount of export of cotton also brings only very marginal change in the endogenous variables of yarn sector. Change in the supply and production of cotton as a result of change in the export of cotton is also small. The change in the quantity of export of cotton does not have any impact on the quantity of the export of cotton yarn.

Effect of Changes in the Export of Cotton Yarn

The export of cotton yarn is another policy variable in the cotton industry which the government regulates through ceiling on the export. In the past a few years, due to a rapid increase in the export of cotton yarn through export oriented units, the quantity of cotton yarn which government permits under the export ceiling is relatively small as compared to the quantity of cotton yarn exported through export oriented units. However, we have assessed the impact of increase in the export of cotton yarn on the Indian cotton textile industry because of significant increase in the export of cotton yarn. Although the forecast of the export of cotton yarn during 1995-96 almost matches with the actual values, it was underestimated during 1996-97. Therefore, simulation was carried out to ascertain the impact of the increase in the export of cotton yarn on the system. For this simulation, changes in the intercepts of the export of cotton yarn equation was made. The increase in the export of cotton yarn from its base level would increase all the endogenous variables of cotton farming and spinning sub-sectors (appendix4). The consumption and production of decentralised cotton fabrics will experience a decline as a result of increase in the export of cotton yarn.

The Effect of Changes in the Price of Fertilizers

Since fertilizer is an important input for the cotton crop and constitute a good share in the total cost of the cultivation, change in the price of the fertilizers may encourage/discourage the farmers from its optimum level of application. Therefore, an effort has been made to assess the percentage change in the price of fertilizers from the base level. The simulations were carried out for decrease and increase in the deflated price of fertilizers by 10 per cent over the base level for the simulation period (1995-96 to 2000-01). Simulations result reveal that the changes in the deflated price of fertilizers will influence all the endogenous variables of cotton farming, spinning and decentralised weaving unit. Changes in the endogenous variables of spinning and weaving decentralised unit are almost negligible whereas the changes in the endogenous variables in the cotton farming sector is relatively high.

Conclusions and Policy Implications

The econometric model developed for the Indian cotton textile industry performs satisfactorily in terms of goodness fit, signs and significance of the coefficients. The model incorporates all major equations and variables in the system which sufficiently explains the inter-linkages among the sectors. The system is of oscillating convergence nature and can be used for long term forecasting and policy simulations. The PRMSE values of the endogenous variables of the model in both static and dynamic simulations show that the model gives reasonably good forecast of the endogenous variables for the historical period. Model tracking ability of historical data is good for both static and dynamic simulations for the complete historical series as well as the recent past five year period using actual and forecasted values of the exogenous variables. Theil's values of all the endogenous variables in the static, dynamic simulations for the complete historical period and dynamic simulations using actual and forecasted values of exogenous variables for five year period are less than one. The Ubias and Vbias values show that the model has been specified adequately.

The ex-post forecasts of the model for the year 1995-96 for those variables for which we have the actual data shows that model's performance is satisfactory. The short and long run multipliers of the exogenous variables of the model have theoretically consistent signs and magnitudes.

The base-line simulation of the endogenous variables reveals that the domestic consumption of cotton will grow at a rate faster than the production of cotton during the simulation period. Therefore, for meeting the growing demand for cotton, corrective measures are required to accelerate the growth of cotton. Higher demand than supply of cotton will lead to spiral tendency in deflated price of cotton. In the spinning sector, the export of cotton yarn would increase substantially (11.00 per cent per annum) during the simulation period. It is expected that it would reach a level of 497.49 thousand tonnes by

2000-2001 AD. The supply and production of cotton yarn would increase at a rate higher than the increasing rate of consumption of cotton yarn. It is expected that deflated price of cotton yarn would experience a high spiral tendency during the simulation period. The weaving sector would experience a low growth in all the major endogenous variables in comparison to those of cotton farming and spinning sectors. There would be a declining trend in the demand for, production and deflated price of mill fabric whereas, export of mill fabric will increase at a rate of 2.4 per cent per annum. The consumption and production of decentralised cotton fabric would also increase at a rate of 2.7 and 3.0 per cent per annum, respectively. The export of decentralised cotton fabric would increase at a rate higher than the export of mill cotton fabric during the simulation period. The deflated price of decentralised cotton fabric would also experience a spiral tendency.

The simulation results show that area under hybrid cotton appears to be one of the important variables in the system through which the desired production of cotton as well as accelerated growth of cotton yarn can be achieved. Therefore, resolute effort should be made for the expansion of area under hybrid cotton. The simulations for the different scenarios of the export of cotton indicate that the endogenous variables of weaving sector would remain unchanged with respect to changes in the quantity of export of cotton. The changes in the export of cotton would influence the endogenous variables of cotton farming and spinning sectors. However, impact of the change in the quantity of export of cotton would be marginal on the endogenous variables of spinning sector. Increase in the export of cotton yarn will bring in a relatively large change in the endogenous variables of all the sectors except mill unit. A large increase in the export of cotton yarn will have a high positive impact on the endogenous variables of cotton farming and spinning sectors. Due to high demand for the export of cotton, the total supply of cotton yarn will lag behind the total demand for cotton yarn which will increase prices. As a result, production and consumption of decentralised fabrics will experience a decline. Therefore, for a balanced growth of all the sectors, the growth of the production of cotton yarn should be accelerated. This requires increase in the supply of cotton to keep up with the increasing rate of export of cotton yarn. Hence, co-ordinated policy measures are required for accelerating the production of both cotton and yarn if we have to sustain high growth of export of yarn.

Overall results indicate that the growth rates of most of the endogenous variables except the export of yarn and to some extent export of decentralised fabric are not highly satisfactory. Continuously declining trend in the demand for and production of mill fabric is another matter of concern in this industry. There is a need to develop appropriate policies to check the declining trend in the consumption and production of mill cotton fabrics. Furthermore, the growth of the weaving sector is expected to be lower than the industrial growth rate. Therefore, an appropriate measures should also be taken to accelerate the growth of consumption, production and export of decentralised cotton fabrics. A balanced approach needs to be followed with respect to the export of raw cotton and cotton yarn to facilitate the export of high value added items.

Appendix 1 (a) : Short Run Elasticity of the Exogenous Variables for the Endogenous Variables																		
Endogenous Variables	Exogenous Variables																	
	DSC	EC	IC	DSC_{t-1}	PHYVA	DPF	SCY	DEPCY	SCY_{t-1}	LNWY	DEPMF	LNDEPPF	GI	DNTMC	LNTREND	TREND	DV1	DV
DCC	-0.302	-0.051	0.019	0.298	0.248	-0.234	0	0	0	0	0	0	0	0	0	0.206	0	0
SC	0	0	0.014	0.220	0.182	-0.172	0	0	0	0	0	0	0	0	0	0.151	0	0
P_dC	0	0	0	0	0.238	-0.224	0	0	0	0	0	0	0	0	0	0.198	0	0
DPRC	0.139	0.023	-0.009	-0.137	-0.114	0.107	0.130	-0.072	-0.023	1.316	0	0.008	0	0	0	-0.094	0.027	-0.012
DCCY	-0.047	-0.008	0.003	0.046	0.038	-0.036	-0.069	0.018	0.045	-0.317	0	-0.002	0	0	0	0.032	-0.007	0.003
ECY	0	0	0	0	0	0	0.816	-0.537	0	0	0	0	0	0	0	0	0.178	0
SCY	-0.0447	-0.007	0.003	0.043	0.036	-0.033	0.001	-0.004	0.043	-0.294	0	-0.002	0	0	0	0.030	0.0005	0.003
P_dCY	-0.045	-0.008	0.003	0.045	0.037	-0.034	0.001	-0.004	0.005	-0.305	0	-0.002	0	0	0	0.030	0.001	0.003
DPCY	0.023	0.004	-0.002	-0.023	-0.019	0.018	0.120	-0.066	-0.024	1.216	0	0.007	0	0	0	-0.015	0.025	-0.011
DCDSCF	-0.016	-0.003	0.001	0.016	0.013	-0.012	-0.088	0.048	0.016	3.252	0	0.019	0	0	0	0.011	-0.007	0.048
EDSCF	0	0	0	0	0	0	0	0	0	42.435	0	0.252	0	0	0	0	0.112	0
P_dDSCF	-0.016	-0.003	0.001	0.015	0.013	-0.012	-0.085	0.047	0.015	4.567	0	0.027	0	0	0	0.017	-0.003	0.047
DPDSCF	0.004	0.001	-0.0002	-0.004	-0.005	0	0.027	-0.015	-0.006	1.643	0	0.010	0	0	0	-0.003	0.009	-0.015
DMCF	0	0	0	0	0	0	0	0	0	2.524	-0.002	0	0	0.102	-0.124	0	0	0
EMCF	0	0	0	0	0	0	0	0	0	28.426	-0.028	0	0	0	-1.392	0	0	0
P_dMCF	0	0	0	0	0	0	0	0	0	2.524	-0.002	0	0	0.102	-0.124	0	0	0
DPMCF	0	0	0	0	0	0	0	0	0	-0.067	0.006	0	0	0.142	0.003	0	0	0
ECF	0	0	0	0	0	0	0	0	0	34.764	-0.015	0.114	0	0	-0.762	0	0.051	0

Appendix 1(b): Long-run Elasticities of the Exogenous Variables for the Endogenous Variables																		
Endogenous Variables	Exogenous Variables																	
	DSC	EC	IC	DSC_{t-1}	PHYVA	DPF	SCY	DEPCY	SCY_{t-1}	LNWY	DEPMCF	LNDEPPCF	GY	DNTMC	LNTREND	TREND	DV1	DV
DCC	-0.233	-0.039	0.015	0.230	0.189	-0.177	0.063	-0.031	-0.015	0.084	0	0.001	0	0	0	0.157	0.011	-0.034
SC	0.051	0.009	0.011	0.169	0.139	-0.130	0.047	-0.023	-0.011	0.062	0	0.0004	0	0	0	0.116	0.008	-0.025
P_dC	0.067	0.011	-0.004	-0.066	0.182	-0.170	0.061	-0.030	-0.014	0.081	0	0.001	0	0	0	0.151	0.010	-0.033
DPRC	0.354	0.059	-0.022	-0.350	-0.290	0.268	0.312	-0.155	-0.086	0.422	0	0.003	0	0	0	-0.240	0.052	-0.170
DCCY	-0.312	-0.053	0.020	0.308	0.255	-0.237	-0.193	0.065	0.104	-0.315	0	-0.002	-0.056	0	0	0.212	-0.022	0.127
ECY	0	0	0	0	0	0	0.816	-0.537	0	0	0	0	0	0	0	0	0.178	0
SCY	-0.289	-0.048	0.018	0.286	0.237	-0.220	-0.114	0.040	0.100	-0.293	0	-0.002	-0.052	0	0	0.197	-0.014	0.118
P_dCY	-0.300	-0.050	0.019	0.297	0.246	-0.229	-0.118	0.041	0.062	-0.304	0	-0.002	-0.054	0	0	0.204	-0.014	0.123
DPCY	0.286	0.048	-0.018	-0.282	-0.234	0.22	0.347	-0.172	-0.094	0.468	0	0.003	0	0	0	-0.195	0.058	-0.189
CDSCF	-0.316	-0.053	0.020	0.312	0.259	-0.241	-0.384	0.190	0.105	7.765	0	0.046	-0.054	0	0	0.215	-0.042	0.269
EDSCF	0	0	0	0	0	0	0	0	0	42.435	0	0.252	0	0	0	0	0.112	0
P_dDSCF	-0.305	-0.051	0.019	0.302	0.250	-0.233	-0.371	0.183	0.102	8.931	0	0.053	-0.053	0	0	0.208	-0.037	0.260
DPDSCF	0.243	0.041	-0.015	-0.240	-0.200	0.187	0.301	-0.147	-0.082	0.515	0	0.003	0	0	0	-0.166	0.050	-0.208
DMCF	0	0	0	0	0	0	0	0	0	6.527	-0.006	0	0	0.882	-0.320	0	0	0
EMCF	0	0	0	0	0	0	0	0	0	28.426	-0.028	0	0	0	-1.392	0	0	0
P_dMCF	0	0	0	0	0	0	0	0	0	6.527	-0.006	0	0	0.882	-0.320	0	0	0
DPMCF	0	0	0	0	0	0	0	0	0	-0.570	0.001	0	0	0.395	0.028	0	0	0
ECF	0	0	0	0	0	0	0	0	0	34.764	-0.015	0.114	0	0	-0.762	0	0.051	0

Appendix 2 (a): Simulated Values of the Endogenous Variables of *Cotton Farming Sector* for the Period 1995-96 to 2000-2001 (Base run and Increase in percent area under hybrid cotton by 5 and 10 units)												
Year	DCC	DCCa	DCCb	SC	SCa	SCb	PdC	PdCa	PdCb	DPC	DPCa	DPCb
1995	142.5	148.7	154.8	178.8	185	191.1	151.4	157.6	163.7	83.9	81.5	79.1
1996	141.2	146.7	152.3	177.4	183	188.6	150.1	155.6	161.2	93.1	90.9	88.6
1997	147.9	153.5	159.1	184.2	189.8	195.4	156.8	162.4	168.1	94.8	92.2	89.5
1998	152.9	158.5	164	189.2	194.8	200.3	161.9	167.4	172.9	97.6	94.7	91.8
1999	158.3	163.8	169.2	194.6	200.1	205.5	167.2	172.7	178.2	100.5	97.3	94.1
2000	163.7	169.1	174.5	199.9	205.4	210.8	172.6	178	183.4	104.3	100.9	97.5

Appendix 2(b): Simulated Values of the Endogenous Variables of *Spinning Sector* for the Period 1995-96 to 2000-2001
(Base run and increase in the percent area under hybrid cotton by 5 and 10 units)

Year	DCCY	DCCYa	DCCYb	ECY	ECYa	ECYb	SCY	SCYa	SCYb	PdCY	PdCYa	PdCYb	DPCY	DPCYa	DPCYb
1995	1438.7	1450.7	1462.7	293.2	293.2	293.2	1878.2	1890.2	1902.2	1748.1	1760.1	1772.1	123.5	123.1	122.6
1996	1511.4	1530.5	1549.6	335.4	335.4	335.4	2011.2	2030.3	2049.4	1864.9	1884.1	1903.2	129.8	128.9	128.1
1997	1589.9	1615.4	1641	376.5	376.5	376.5	2151.2	2176.7	2202.2	1986.8	2012.3	2037.8	135.4	134.2	133
1998	1665.6	1696.4	1727.2	415.5	415.5	415.5	2288.8	2319.6	2350.4	2104.1	2134.9	2165.7	140.6	139.1	137.5
1999	1737.7	1773.1	1808.5	455	455	455	2426.2	2461.6	2496.9	2218.5	2253.9	2289.3	146.2	144.3	142.3
2000	1804	1843.4	1882.8	497.5	497.5	497.5	2564	2603.3	2642.7	2330.5	2369.9	2409.2	152.9	150.6	148.4

Appendix 2(c): Simulated Values of the Endogenous Variables of Weaving Sector (Decentralised unit) for the Period 1995-96 to 2000-2001
(Base run and increase in percent area under hybrid cotton by 5 and 10 units)

Year	DCDSF	DCDSFa	DCDSFb	ECDSF	EDSCFa	EDSCFb	PdDSCF	PdDSCFa	PdDSCFb	DPDSCF	DPDSCFa	DPDSCFb
1995	15447.67	15481.61	15515.55	1303.41	1303.41	1303.41	16751.09	16785.03	16818.97	69.88	69.79	69.7
1996	16114.74	16188.03	16261.32	1436.3	1436.3	1436.3	17551.05	17624.34	17697.63	71.07	70.83	70.59
1997	16680.62	16795.58	16910.54	1555.03	1555.03	1555.03	18235.65	18350.61	18465.57	72.08	71.64	71.19
1998	17107.78	17263.56	17419.33	1640.43	1640.43	1640.43	18748.22	18903.99	19059.77	72.83	72.17	71.5
1999	17431.98	17626.72	17821.46	1730.68	1730.68	1730.68	19162.65	19357.4	19552.14	73.78	72.88	71.98
2000	17623.04	17854.43	18085.82	1821	1821	1821	19444.04	19675.43	19906.82	75.19	74.06	72.92

Appendix 2(d): Simulated Values of the Endogenous Variables of Weaving *Sector* (Mill unit) for the Period 1995-96 to 2000-2001
(Base run and increase in the percent area by 5 and 10 units)

Year	DMCF	DMCFa	DMCFb	EMCF	EMCFa	EMCFb	PdMCF	PdMCFa	PdMCFb	DPMCF	DPMCFa	DPMCFb	ECF	ECFa	ECFb
1995	1395.3	1395.3	1395.3	469.6	469.6	469.6	1395.3	1395.3	1395.3	68.1	68.1	68.1	1773	1773	1773
1996	1433.2	1433.2	1433.2	484	484	484	1433.2	1433.2	1433.2	65.8	65.8	65.8	1920.3	1920.3	1920.3
1997	1418.8	1418.8	1418.8	498.7	498.7	498.7	1418.8	1418.8	1418.8	63.9	63.9	63.9	2053.7	2053.7	2053.7
1998	1370.5	1370.5	1370.5	502.1	502.1	502.1	1370.5	1370.5	1370.5	62.3	62.3	62.3	2142.5	2142.5	2142.5
1999	1313.5	1313.5	1313.5	517.4	517.4	517.4	1313.5	1313.5	1313.5	61	61	61	2248.1	2248.1	2248.1
2000	1255.8	1255.8	1255.8	532.9	532.9	532.9	1255.8	1255.8	1255.8	59.8	59.8	59.8	2353.9	2353.9	2353.9

Appendix 3(a): Simulated Values of the Endogenous Variables of Cotton Farming *Sector* for the Period 1995-96 to 2000-2001 (Base run and decrease by 5 lakh bales and increase by 5 and 10 lakh bales in the export of cotton)

Year	DCC	DCCa	DCCb	DCCc	SC	SCa	SCb	SCc	PdC	PdCa	PdCb	PdCc	DPC	DPCa	DPCb	DPCc
1995	142.5	147.5	137.5	132.5	178.8	178.8	178.8	178.8	151.4	151.4	151.4	151.4	83.9	82	85.9	87.9
1996	141.2	145.7	136.6	132.1	177.4	177	177.9	178.3	150.1	149.6	150.5	151	93.1	91.3	95	96.8
1997	147.9	152.5	143.3	138.7	184.2	183.8	184.6	185	156.8	156.4	157.2	157.7	94.8	92.7	97	99.2
1998	152.9	157.4	148.4	143.9	189.2	188.7	189.7	190.2	161.9	161.4	162.4	162.8	97.6	95.2	100	102.3
1999	158.3	162.7	153.8	149.4	194.6	194	195.1	195.7	167.2	166.6	167.7	168.3	100.5	97.9	103	105.6
2000	163.7	168.1	159.2	154.8	199.9	199.3	200.5	201.1	172.6	172	173.2	173.7	104.3	101.5	107	109.8

Appendix 3(b): Simulated Values of the Endogenous Variables of Spinning *Sector* for the Period 1995-96 to 2000-2001 (Base run and decrease by 5 lakh bales and increase by 5 and 10 lakh bales in the export of cotton)

Year	DCCY	DCCYa	DCCYb	DCCYc	ECY	ECYa	ECYb	ECYc	SCY	SCYa	SCYb	SCYc	PdCY	PdCYa	PdCYb	PdCYc	DPCY	DPCY a	DPCY b	DPCY c
1995	1438.7	1448.5	1429	1419.2	293.2	293.2	293.2	293.2	1878.2	1887.9	1868.4	1858.6	1748.1	1757.8	1738.3	1728.6	123.5	123.2	123.9	124.3
1996	1511.4	1526.9	1495.8	1480.3	335.4	335.4	335.4	335.4	2011.2	2026.7	1995.6	1980.1	1864.9	1880.5	1849.4	1833.8	129.8	129.1	130.5	131.2
1997	1589.9	1610.7	1569.2	1548.4	376.5	376.5	376.5	376.5	2151.2	2171.9	2130.4	2109.7	1986.8	2007.5	1966	1945.3	135.4	134.5	136.4	137.4
1998	1665.6	1690.7	1640.6	1615.5	415.5	415.5	415.5	415.5	2288.8	2313.8	2263.8	2238.7	2104.1	2129.1	2079	2054	140.6	139.4	141.9	143.2
1999	1737.7	1766.5	1709	1680.2	455	455	455	455	2426.2	2454.9	2397.4	2368.7	2218.5	2247.3	2189.8	2161	146.2	144.6	147.8	149.3
2000	1804	1836	1772.1	1740.1	497.5	497.5	497.5	497.5	2564	2596	2532	2500	2330.5	2362.5	2298.5	2266.5	152.9	151.1	154.7	156.6

Appendix 3(c): Simulated Values of the Endogenous Variables of Weaving *Sector* (Decentralised unit) for the Period 1995-96 to 2000-2001 (Base run and decrease by 5 lakh bales and increase by 5 and 10 lakh bales in the export of cotton)

Year	DCDSF	DCDSFa	DCDSFb	DCDSFc	ECDSF	EDSCFa	EDSCFb	EDSCFc	PdDSCF	PdDSCFa	PdDSCFb	PdDSCFc	DPDSCF	DPDSCFa	DPDSCFb	DPDSC Fc
1995	15447.7	15475.3	15420.1	15392.5	1303.4	1303.4	1303.4	1303.4	16751.1	16778.7	16723.5	16695.9	69.9	69.8	70	70
1996	16114.7	16174.3	16055.2	15995.6	1436.3	1436.3	1436.3	1436.3	17551	17610.6	17491.5	17431.9	71.1	70.9	71.3	71.5
1997	16680.6	16774.1	16587.2	16493.7	1555	1555	1555	1555	18235.7	18329.1	18142.2	18048.7	72.1	71.7	72.4	72.8
1998	17107.8	17234.4	16981.1	16854.5	1640.4	1640.4	1640.4	1640.4	18748.2	18874.9	18621.6	18494.9	72.8	72.3	73.4	73.9
1999	17432	17590.3	17273.7	17115.3	1730.7	1730.7	1730.7	1730.7	19162.7	19321	19004.3	18846	73.8	73	74.5	75.2
2000	17623	17811.2	17434.9	17246.8	1821	1821	1821	1821	19444	19632.2	19255.9	19067.8	75.2	74.3	76.1	77

Appendix 3(d): Simulated Values of the Endogenous Variables of Weaving *Sector (Mill Unit)* for the Period 1995-96 to 2000-2001 (Base run and decrease by 5 lakh bales and increase by 5 and 10 lakh bales in the export of cotton)

Year	DMCF	DMCF a	DMCF b	DMCF c	EMCF	EMCFa	EMCFb	EMCFc	PdMCF	PdMCF a	PdMCF b	PdMCF c	DPM CF	DPM CFa	DPM CFb	DPM CFc	ECF	ECFa	ECFb	ECFc
1995	1395.3	1395.3	1395.3	1395.3	469.6	469.6	469.6	469.6	1395.3	1395.3	1395.3	1395.3	68.1	68.1	68.1	68.1	1773	1773	1773	1773
1996	1433.2	1433.2	1433.2	1433.2	484	484	484	484	1433.2	1433.2	1433.2	1433.2	65.8	65.8	65.8	65.8	1920.3	1920.3	1920.3	1920.3
1997	1418.8	1418.8	1418.8	1418.8	498.7	498.7	498.7	498.7	1418.8	1418.8	1418.8	1418.8	63.9	63.9	63.9	63.9	2053.7	2053.7	2053.7	2053.7
1998	1370.5	1370.5	1370.5	1370.5	502.1	502.1	502.1	502.1	1370.5	1370.5	1370.5	1370.5	62.3	62.3	62.3	62.3	2142.5	2142.5	2142.5	2142.5
1999	1313.5	1313.5	1313.5	1313.5	517.4	517.4	517.4	517.4	1313.5	1313.5	1313.5	1313.5	61	61	61	61	2248.1	2248.1	2248.1	2248.1
2000	1255.8	1255.8	1255.8	1255.8	532.9	532.9	532.9	532.9	1255.8	1255.8	1255.8	1255.8	59.8	59.8	59.8	59.8	2353.9	2353.9	2353.9	2353.9

Appendix 4 (a) : Simulated Values of the Endogenous Variables of *Cotton Farming and Spinning Sectors* for the Period 1995-96 to 2000-2001 (Base run and increase in the export of cotton yarn by 75 million kgs)

Year	DCC	DCCa	SC	SCa	PdC	PdCa	DPC	DPCa	DCCY	DCCYa	ECY	ECYa	SCY	SCYa	PdCY	PdCYa	DPCY	DPCY a
1995	142.5	142.5	178.8	178.8	151.4	151.4	83.9	100.5	1438.7	1377.5	293.2	368.2	1878.2	1891.9	1748.1	1761.9	123.5	142.1
1996	141.2	145	177.4	181.2	150.1	153.9	93.1	108.7	1511.4	1469.2	335.4	410.4	2011.2	2044	1864.9	1897.8	129.8	150.9
1997	147.9	151.5	184.2	187.8	156.8	160.4	94.8	112.9	1589.9	1551.9	376.5	451.5	2151.2	2188.1	1986.8	2023.8	135.4	159.2
1998	152.9	157.1	189.2	193.4	161.9	166	97.6	117.3	1665.6	1625.9	415.5	490.5	2288.8	2324.1	2104.1	2139.3	140.6	166.8
1999	158.3	162.8	194.6	199.1	167.2	171.7	100.5	121.7	1737.7	1692	455	530	2426.2	2455.4	2218.5	2247.7	146.2	174.5
2000	163.7	168.6	199.9	204.8	172.6	177.5	104.3	126.9	1804	1749.9	497.5	572.5	2564	2584.8	2330.5	2351.4	152.9	183

Appendix 4(b) : Simulated Values of the Endogenous Variables of Weaving *Sector Decentralised unit)* for the Period 1995-96 to 2000-2001 (Base run and increase in the exportof cotton yarn by 75 million Kgs)

Year	DCDSF	DCDSFa	EDSCF	EDSCFa	PdDSCF	PdDSCFa	DPDSCF	DPDSCF a
1995	15447.7	14122.2	1303.4	1303.4	16751.1	15425.6	69.9	73.3
1996	16114.7	14093.3	1436.3	1436.3	17551	15529.6	71.1	78.4
1997	16680.6	14225.9	1555	1555	18235.7	15780.9	72.1	82.8
1998	17107.8	14345.8	1640.4	1640.4	18748.2	15986.2	72.8	86.3
1999	17432	14428.5	1730.7	1730.7	19162.7	16159.2	73.8	89.5
2000	17623	14417.6	1821	1821	19444	16238.6	75.2	92.8

Appendix 4(c): Simulated Values of the Endogenous Variables of Weaving *Sector (Mill Unit)* for the Period 1995-96 to 2000-2001 (Base run and increase in the export of cotton yarn by 75 million Kgs.)

Year	DMCF	DMCFa	EMCF	EMCFa	PdMCF	PdMCFa	DPMCF	DPMCFa	ECF	ECFa
1995	1395.3	1395.3	469.6	469.6	1395.3	1395.3	68.1	68.1	1773.0	1773.0
1996	1433.2	1433.2	484.0	484.0	1433.2	1433.2	65.8	65.8	1920.3	1920.3
1997	1418.8	1418.8	498.7	498.7	1418.8	1418.8	63.9	63.9	2053.7	2053.7
1998	1370.5	1370.5	502.1	502.1	1370.5	1370.5	62.3	62.3	2142.5	2142.5
1999	1313.5	1313.5	517.4	517.4	1313.5	1313.5	61.0	61.0	2248.1	2248.1
2000	1255.8	1255.8	532.9	532.9	1255.8	1255.8	59.8	59.8	2353.9	2353.9

Appendix 5(a): Simulated Values of the Endogenous Variables of Cotton Farming *Sector* for the Period 1995-96 to 2000-2001 (Base run and decrease and increase in the deflated price of fertilizers by 10 per cent)

Year	DCC	DCCa	DCCb	SC	SCa	SCb	P_dC	P_dCa	P_dCb	DPC	DPCa	DPCb
1995	142.5	144.1	141.0	178.8	180.4	177.3	151.4	153.0	149.9	83.9	83.3	84.5
1996	141.2	142.6	139.8	177.4	178.8	176.1	150.1	151.4	148.7	93.1	92.6	93.7
1997	147.9	149.3	146.5	184.2	185.6	182.8	156.8	158.2	155.4	94.8	94.2	95.5
1998	152.9	154.3	151.6	189.2	190.6	187.9	161.9	163.2	160.5	97.6	96.9	98.3
1999	158.3	159.6	157.0	194.6	195.9	193.3	167.2	168.5	165.9	100.5	99.7	101.2
2000	163.7	164.9	162.4	199.9	201.2	198.7	172.6	173.8	171.3	104.3	103.5	105.1

Appendix 5(b): Simulated Values of the Endogenous Variables of Spinning *Sector* for the Period 1995-96 to 2000-2001 (Base run and decrease and increase in the deflated price of fertilizers by 10 per cent)

Year	DCCY	DCCYa	DCCYb	ECY	ECYa	ECYb	SCY	SCYa	SCYb	PdCY	PdCYa	PdCYb	DPCY	DPCYa	DPCYb
1995	1438.7	1441.7	1435.7	293.2	293.2	293.2	1878.2	1881.2	1875.2	1748.1	1751.1	1745.1	123.5	123.4	123.7
1996	1511.4	1516.1	1506.7	335.4	335.4	335.4	2011.2	2015.9	2006.4	1864.9	1869.7	1860.2	129.8	129.6	130
1997	1589.9	1596.2	1583.6	376.5	376.5	376.5	2151.2	2157.4	2144.9	1986.8	1993.1	1980.5	135.4	135.2	135.7
1998	1665.6	1673.1	1658.1	415.5	415.5	415.5	2288.8	2296.3	2281.3	2104.1	2111.6	2096.6	140.6	140.3	141
1999	1737.7	1746.3	1729.2	455	455	455	2426.2	2434.7	2417.7	2218.5	2227.1	2210	146.2	145.7	146.7
2000	1804	1813.5	1794.6	497.5	497.5	497.5	2564	2573.4	2554.6	2330.5	2339.9	2321.1	152.9	152.3	153.4

Appendix 5(c): Simulated Values of the Endogenous Variables of Weaving *Sector (Decentralised Unit)* for the Period 1995-96 to 2000-2001 (Base run and decrease and increase in the deflated price of fertilizers by 10 per cent)

Year	DCDSCF	DCDSCFa	DCDSCFb	EDSCF	EDSCFa	EDSCFb	PdDSCF	PdDSCFa	PdDSCFb	DPDSCF	DPDSCF	DPDSCF
1995	15447.67	15456.16	15439.19	1303.41	1303.41	1303.41	16751.09	16759.57	16742.6	69.88	69.85	69.9
1996	16114.74	16132.94	16096.55	1436.3	1436.3	1436.3	17551.05	17569.24	17532.85	71.07	71.01	71.13
1997	16680.62	16708.96	16652.27	1555.03	1555.03	1555.03	18235.65	18263.99	18207.3	72.08	71.97	72.19
1998	17107.78	17145.94	17069.63	1640.43	1640.43	1640.43	18748.22	18786.37	18710.07	72.83	72.67	73
1999	17431.98	17479.35	17384.6	1730.68	1730.68	1730.68	19162.65	19210.03	19115.28	73.78	73.56	74
2000	17623.04	17678.95	17567.13	1821	1821	1821	19444.04	19499.95	19388.13	75.19	74.91	75.46

Appendix 5(d): Simulated Values of the Endogenous Variables of Weaving *Sector (Mill Unit)* for the Period 1995-96 to 2000-2001 (Base run and decrease and increase in the deflated price of fertilizers by 10 per cent)

Year	DMCF	DMCF	DMCF	EMCF	EMCFa	EMCFb	PdMCF	PdMCF	PdMCF	DPM	DPM	DPM	ECF	ECFa	ECFb
1995	1395.3	1395.3	1395.3	469.6	469.6	469.6	1395.3	1395.3	1395.3	68.1	68.1	68.1	1773	1773	1773
1996	1433.2	1433.2	1433.2	484	484	484	1433.2	1433.2	1433.2	65.8	65.8	65.8	1920.3	1920.3	1920.3
1997	1418.8	1418.8	1418.8	498.7	498.7	498.7	1418.8	1418.8	1418.8	63.9	63.9	63.9	2053.7	2053.7	2053.7
1998	1370.5	1370.5	1370.5	502.1	502.1	502.1	1370.5	1370.5	1370.5	62.3	62.3	62.3	2142.5	2142.5	2142.5
1999	1313.5	1313.5	1313.5	517.4	517.4	517.4	1313.5	1313.5	1313.5	61	61	61	2248.1	2248.1	2248.1
2000	1255.8	1255.8	1255.8	532.9	532.9	532.9	1255.8	1255.8	1255.8	59.8	59.8	59.8	2353.9	2353.9	2353.9

References

Agrawal, R., R. C. Jain and M. P. Jha (1983). Joint Effects of Weather Variables in Rice Yield, *Mausam*,34: 189-94.

Agrawal, R., R. C. Jain and M..P. Jha (1980). Forecasting Rice Yields Using Climatic Variables, *Indian journal of Agricultural Science*, 50: 680-684.

Agrawal, R., R. C. Jain and M. P. Jha (1986). Models for Studying Rice Crop Weather Relationship, *Mausam*, 37: 67-70.

Biswas, A. K. (1959). Estimation of Increase in Demand for Food and Cereals During the Third Five Year Plan Period, *ISIPD*, W. P. No.- 167.

Coleman J. and M. E. Thigpen (1991). An Econometric Model for the World Cotton and Cellulosic Fibres Markets, *World Bank Staff Commodity Working Paper*, No.- 24, World Bank, Washington, D.C. 20433, U.S.A.

CMIE (1995). *Agricultural Compendium*, Centre for Monitering Indian Economy Pvt. Ltd., Bombay.

CMIE (1996). *Indian Economy*, Centre for Monitering Indian Economy Pvt. Ltd., Bombay.

Government of India (1995). *Economic survey*, Economic Division, Ministry of Finance, Government of India, New Delhi.

Hamdy, M. E., S. Barghouti, F. Gillham and M. T. Al-Saffy (1994). Cotton Production Prospects for the decade to 2005, *World Bank Technical Paper* number 231,The world Bank,Washington, D.C.

Hitchings, J. A. (1985). The Economics of Cotton Cultivation in India: Supply and Demand for 1980-90, *Staff Working Papers*, The World Bank, No 618, Washington, D.C.

Jain, R. C., R. Agarwal and M. P. Jha (1985). Use of Growth Indices in Yield Forecasts, *Biom. J.* , 27: 435-439.

Jain, R. C. and R. Agrawal (1992). Probability Model for Crop Yield Forecasting, *Biom.J.* 34: 501-511.

Jain, R. C., R. Agrawal and K. N, Singh. (1992). A Within Year Growth Model for Crop Yield Forecasting, *Biom. J.*, 34 (7): 789-799.

Jain, R. C., R. Agarwal and M. P. Jha (1980). Effects of Climatic Variables on Rice Yield and its Forecast, *Mausam*, 31:591-596.

Jha, M. P. , R. C. Jain and D. Singh (1981). Preharvest Forecasting of Sugarcane Yield, *Indian Journal of Agricultural Science*, 51: 757-761.

Kmenta, J. (1971). Elements of Econometrics, Macmillan Publishing Company, New York.

Maddala, G. S.(1960). Demand for Foodgrain During the Third Five Year Plan, *Indian Journal of Agricultural Economics*, 15: 69-73.

Maji, C.C. , D. Jha and L. S. Venkataraman (1971). Dynamic Supply and Demand Models for Better Estimation and Projections- An Econonmetric Study for Major Food Grains in the Punjab Region , *Indina Journal of Agricultural Economics*, 26 (1) : 21-34.

Mehta, P.and P. S. Sandhu (1973). Demand Projections for Potatoes, *Indian journal of economics.* No. 54: 245-252.

Naik, G., S. K. Singh and N. Govind (1996). Econometric Modelling of the Indian Silk Industry, CMA, Monograph 172, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Naik, G. S. K. Jain and S. K. Singh (1997). Econometric Modelling of the Indian Cotton Industry, Report, IIM ,Ahmedabad

NCAER (1959). Demand Forecasts for Consumers Goods-Toilet and Washing Soaps, Milk, Ghee, Vanaspati, Butter and Other Milk Products, National Council of Applied Economic Research, New Delhi.

Navalgund, R.R., J. S. Parihar, Ajai Nageshwara and P. P. Rao (1991). Crop Inventory Using Remotely Sensed Data, *Current Science*, 61, 3 & 4 .

Pate, A. S. and V. S.Vyas (1972). An Estimate of Demand for Cereals and Pulses in the Coming Decade, Seminar on Demand and Supply Projections for Agricultural Commodities, seminar series-11, Indian Society of Agricultural Economics, Bombay.

Pindyck, R.S. and D. L. Rubinfeld (1991). Econometric Models and Economic Forecasts, IIIrd Edition, McGraw Hill International Edition, New York.

Reutlinger, S. (1966). Analysis of a Dynamic Model with Particular Emphasis on Long Run Prodjections, *Journal of Farm Economics*, 48(1): 88-106.

Sardana, M. G., Khosla, R. K., Ohri, N. K. and Mitra, P. C. (1972). Pre-harvest Forecasting of Yield Rate of Jute, *Jute Bulletin* 35: 1-5.

Sidhu, D. S. (1974). *Demand and Supply of Eggs- An econometric analysis*, S.Chand & Co., New Delhi.

Sikka, B. (1986). *Demand for Fresh Fruits*, B.R. Publishing Co, Delhi.

Singh, D., H. P. Singh and P. Singh (1976). Pre-harvest Forecast of Wheat Yield, *Indian Journal of Agricultural Science*, 46: 445-450.

Singh, B. H., and S. R. Bapat (1988). Pre-harvest Forecast Models for Prediction of Sugarcane Yield, *Indian Journal of Agricultural Science*, 58: 465-469.

Singh, D., H. P. Singh, P. Singh and M. P. Jha (1979). A Study of Pre-harvest Forecast of Yield of Jute,*Indian Journal of Agricultural Research*, 13: 167-179.

Space Application Centre (ISRO) (1992). Cotton Acreage and Condition Assessment in Vidarbha Region of Maharashtra, Ahmedabad.

Tiwari, D. D. and V. M.Rao (1994). International Castor Oil Market- An Econometric Analysis, Oxford & IBH Publishing Co. Pvt. Ltd. , New Delhi.