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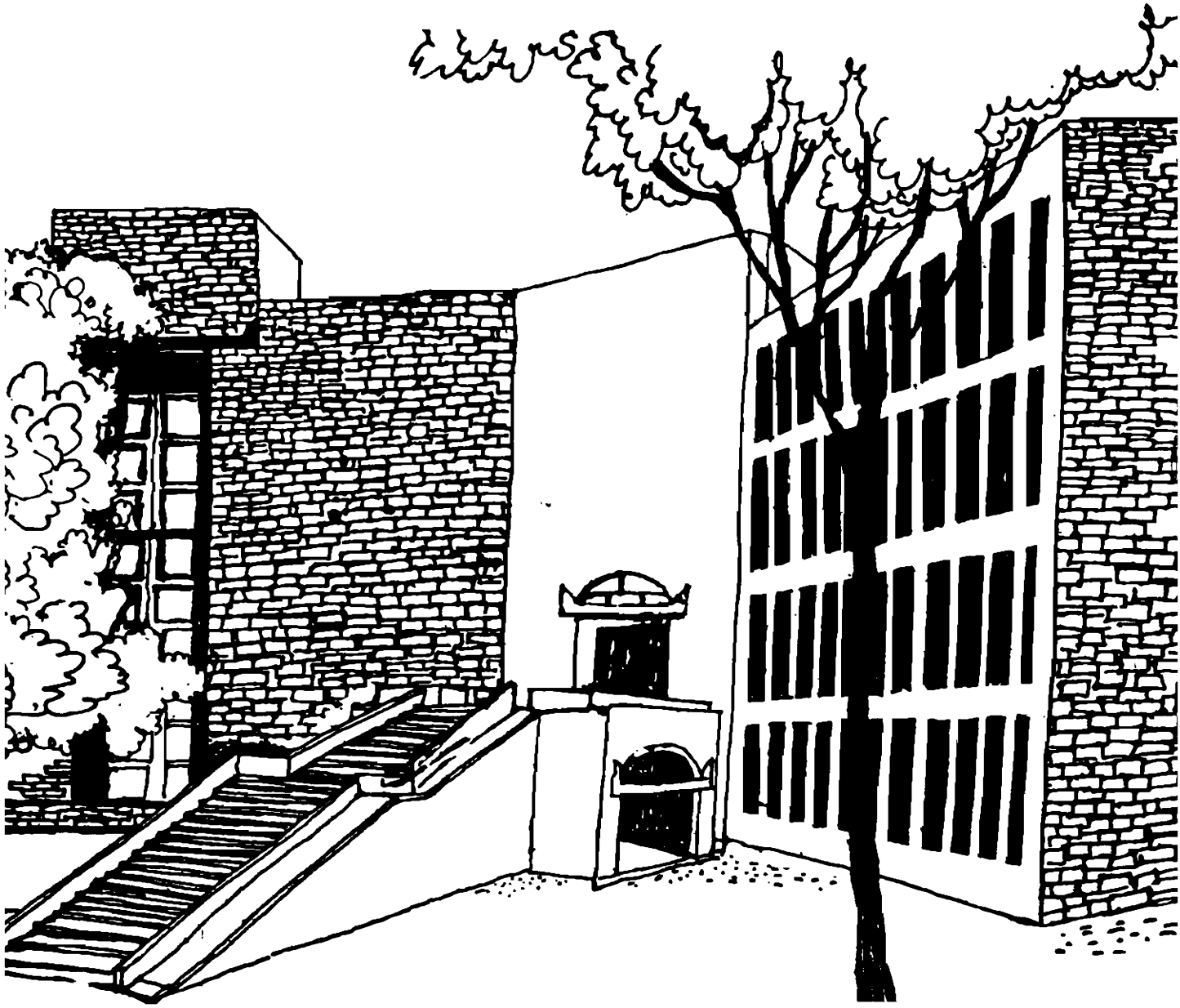

ECONOMETRIC MODELLING OF THE INDIAN COTTON SECTOR: DISAGGREGATE ANALYSIS

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Introduction

Cotton plays an important role in Indian economy as it contributes significantly to both agriculture and industry in terms of income, employment and, foreign-exchange. It accounts for over 80 per cent of the total fibre consumption in the spinning mills in India (CMIE, 1996). 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). Indian Cotton sector is characterised by a number of inter-linked sub-sectors and a large number of decision makers in different sub-sectors. Cotton sector has a strong backward linkages with a number of agro-input industries and forward linkages with dying, printing, designing and merchandising. Cotton sector is very diverse with a wide range of quality of cotton, yarn and fabric. Any change in the demand or supply related variables of any sub-sectors have influence on the variables of other sub-sectors of the industry. Therefore, decision makers of this sector as well as related industries need accurate detailed information on the short, medium and long term behaviour of major variables of this sector in order to formulate appropriate strategies, plans, policies for research and development, investment, production, procurement, financing and marketing.

Government Policies And Priorities

Central and state governments intervene and regulate from time to time the demand, supply, prices, international trade of cotton, yarn and fabric through a variety of policy measures.

Cotton

In the recent years, Cotton Corporation in India (CCI), a government owned commercial body, has been carrying out a number of extension activities including setting up a joint venture company in collaboration with several private companies in order to increase and improve the production and quality of cotton. CCI purchases cotton at minimum support price (MSP) announced by the Ministry of Textiles when market price falls below the MSP. It also undertakes domestic and international trading of cotton. Textile policy of June 1985 also assigns 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.

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

Export and import policies of the government are very 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. Ad-hoc announcement and release of quota often 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 the previous year subject to a good prospect of cotton production. 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.

Futures trading in cotton which was stopped in 1966 has been permitted and is expected to begin soon.

Yarn

The government also fixes quota and restriction on production and export of yarn in order to ensure adequate supply of yarn to the decentralised units of the fabric sector, particularly handlooms at a 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. (March 20, 1995 Notification). Export oriented units have been exempted from the export ceiling of cotton yarn. As a result, 100 per cent export oriented units have been mushrooming.

Fabric

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

Structure Of Cotton Sector

Cotton passes through a number of processes before it reaches the ultimate consumers. In the process of converting cotton into fabric, raw cotton (kapas) is first 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. In the recent years, small scale units have also been set up particularly in Tamil Nadu to produce coarse and medium counts of yarn. Four types of spinning system, i.e. ring spinning, open end rotor, air jet and friction spinning system are used in India. All these spinning system require fibre properties in different order of priorities for the production of good quality of yarn and for cost effectiveness. Therefore, upgradation in spinning technology creates new demand pattern for cotton fibre in terms of fibre properties. In fact, export oriented spinning mills which use sophisticated and modernised spinning system need fibres of specific properties for the production of high quality yarn. Cotton yarn is woven into fabric either pure or blended with man-made fibre yarn. Fabric 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 fabric, 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 produce both yarn and fabric in the composite units. Recent structural changes in the organised mill sector has resulted in the

delinking of weaving units from spinning units. Now mill sector confines itself to the production of spun yarn and high value fabrics and fabrics meant for export to the sophisticated markets.

Demand And Supply Scenario In Indian Cotton Sector

India has witnessed a phenomenal change in demand and supply of Cotton sector during the last two decades. There has been an increasing but fluctuating trend in all the major components of the Cotton sector. Major changes in the pattern of demand and supply of raw inputs and products of Cotton sector, viz., cotton staples, yarn count, types of fabric in terms of source, quality and export and import have been observed. 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 improving irrigation and marketing system, have led to changes in the supply of raw cotton. Popularisation of synthetic fibre, changing consumer preferences, 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 fabric.

Supply Of Raw Cotton

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 the early seventies. During the last two decades it has been hovering around 75 lakh hectares, and 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 practices, pest management practices, and increase in irrigated area under cotton. However, production fluctuates considerably as about 66.8 per cent area (1992-93, CMIE, 1996) is still dependent on the vagaries of the nature.

The development of high yielding varieties of larger staples of cotton, introduction of American cotton, spread of cotton cultivation in new areas and change in the area in the old cotton belt have changed the proportion of cotton of various staple length in the total production. The production of only a small quantity of long staple of cotton till early seventies had necessitated the import of long staple cotton. After the introduction of American and high yielding varieties, the share of long and extra long staple cotton in the total production has increased substantially and reached nearly 62 per cent in 1994-95. The share of the extra long cotton in the basket of long staple cotton has declined continuously from 49.67 per cent in 1985-86 to 34. 98 per cent 1995-96. The share of long staple cotton in the basket of long staple cotton had increased continuously from 1985-86 onwards and reached 25.23 per cent during 1995-96. The share of superior medium cotton remained in the range of 30 to 35 per cent of the total production till 1993-94. It had registered a declining trend during 1994-95 and 1995-96 (25 per cent of the total production). There was no significant change in the percentage share (5-6 per cent) of the medium staple cotton. The contribution of short staple cotton to the total production of cotton has registered marginal increase after 1990-91. Short staple cotton is grown in northern, central regions, north east states and some parts of U. P., Bihar and Orissa. Nearly 76 per cent of the total production of the short staple cotton came from northern region. Medium staple cotton are grown only in Rajasthan and Gujarat. Northern region dominate the production of super medium cotton. Major producers of long and extra long cotton are central and southern regions. Nearly 93 per cent of the long staple cotton was accounted by Maharashtra (1993-94) whereas, more than 50 per cent of extra long cotton is produced in southern region. Andhra Pradesh is the major producer of extra long cotton. Central region produced about 40 per cent of the total production of extra long cotton and Gujarat is the major producer in this region.

Demand For Raw Cotton

Demand for raw cotton is a derived demand which depends mainly upon the demand for cotton yarn and cotton fabric in the domestic and international market. During the last decade, spinning mills had witnessed rapid expansion of capacity and change 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. The percentage share of cotton consumption other than for yarn production, viz., khadi fabric production, surgical purposes, mattresses, etc., was very small range in all the years. However, this demand is increasing though at a slower growth rate. Inspite of the introduction of synthetic fibres, cotton fibre maintained its position and accounted for the highest percentage in the demand for total fibres. However, the percentage share of the consumption of cotton fibre in the total fibre has been continuously declining from 83 per cent in 1980-81 to nearly 66.41 per cent (provisional) during 1995-96. However, there has been a considerable increase in cotton consumption. It has increased by almost 74 per cent during one and a half decades. The increase in the consumption of man made fibres/filament yarn had been 322 per cent during 1985-86 through 1995-96.

Supply Of Cotton Yarn

The supply of cotton yarn constitutes production of cotton yarn and carried over stock of yarn. Import of yarn is not resorted to. 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 (provisional) during 1995-96. The percentage 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. In absolute terms cotton yarn production has increased by 67.57 per cent since 1980-81. The percentage share of blended yarn which was approximately 11 per cent during 1980-81 has 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. There had not been any significant change in the composition of coarse (1-20s), medium (21-40s) and fine (41 and above) count yarn. However, there have been change in the composition of cotton yarn production only within the group. It is mainly due to the intervention of the government in the production of cotton yarn to fulfil the hank yarn obligation which restrict the production of more than 40 count yarn. Medium count yarn constituted about 50 per cent and small count yarn constituted about 38 per cent of total production of cotton yarn during 1993-94. The share of fine count of yarn was 12 per cent. Within the medium count yarn, per cent share of 31-40s count of yarn has increased and reached to the level of approximately 30 per cent during 1994-95 from 22 per cent in 1980-81. Whereas, percentage share of 21- 30s count yarn in the total production had reduced to approximately 18 per cent in 1993-94 from 27 per cent in 1980-81. Contrary to this within the small count group, percentage share of 11-20 count cotton yarn had declined from 27 per cent in 1980-81 to 22 per cent in 1993-94 and cotton yarn of count 1-10 had increased from 11 per cent in 1980-81 to 16.40 per cent in 1993-94. There had not been any substantial change in the pattern of fine count group of yarn.

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, recent government policies implemented 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 of cotton yarn increased steadily and peaked up the momentum during early nineties. During 1994-95, about 10 per cent of the total consumption of cotton yarn was exported.

Supply Of Fabric

The supply of cotton fabric consists of current production and carried over stock. The share of cotton fabric in the basket of the total fabric has declined from 72.42 per cent in 1985-86 to 62.71 per cent in 1994-95 but has increased in the absolute terms. Blended and 100 per cent non cotton fabric have increased their share 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. The supply of khadi fabric has remained more or less stagnant. Before early seventies, mill fabric constituted a major share of the total fabric production in the country. The production of fabric in powerloom sector was very low. After late seventies, the share of powerloom in the production of total fabric had increased 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 fabric had reduced from 21.6 per cent in 1985-86 to 6.60 per cent in 1994-95. 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 1994-95. Hosiery fabric accounted for 17 per cent of powerloom production during nineties. The share of hosiery fabric has increased after 1990-91. More than 90 per cent of hosiery fabric is cotton. The share of handloom fabric in the total production had increased till 1990-91 and reached the level of 35.04 per cent and thereafter it has been remained less than 30 per cent. Production of khadi has been 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 fabric. The share of cotton fabric in the total production in both organised and decentralised weaving units had declined and share of blended fabric had increased substantially. There was no substantial change in the share of the 100 per cent non-cotton fabric. However, cotton fabrics dominates in the production of all the fabric.

Demand For Cotton Fabric

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

Keeping in view the magnitude, importance of Cotton sector, strong interlinkages among the variables of its sectors and the high involvement of a large number of decision makers and the intensive government intervention, this study aims at developing a comprehensive econometric model for the Indian Cotton sector to generate long run forecasts and for policy simulations.

Framework Of The Model

This study considers three major sub-sectors for the modeling purpose: cotton farming, spinning and weaving sub-sectors. Initially, on the basis of our understanding of interrelationships among the various variables, a conceptual model was developed to represent the complete structure of Indian Cotton sector. For modelling purpose, the various variables affecting demand for and supply of the products in each of the sub sectors have been identified. For this study, the data for period 1970-71 through 1992-93 has been used. Data prior to this period was not considered as significant changes have taken place in Indian agriculture since late sixties. The initial conceptual model was modified, due to lack of data availability on certain variables and small sample size. However, we have tried to retain all major equations and variables in the system which sufficiently explain the inter-linkages among the sectors. In addition, knowledge of special characteristics of the sub-sectors have been also incorporated in the models. Initial runs were made to remove the insignificant variables. The modified equations of the model are presented below.

Cotton Farming Sector

The total demand for cotton lint at time (DC_t) is the cumulative demand for cotton lint for domestic consumption (DCC_t), export of cotton lint (EC_t) and domestic stock of cotton lint (DSC_t) at time t. 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 lint at time t.

$$DCC_t = SC_t - DSC_t - EC_t \qquad 1$$

Inverse demand function for cotton lint was specified in this model instead of a normal demand function. The export an the stock of cotton have been considered as exogenous variables in this model. The price of cotton lint is a function of the domestic consumption of total cotton, the price and the export of cotton yarn.

$$PC_t = f\ (DCC_t,\ ECY_t\ \ PCY_t) \qquad 2$$

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 lint (PTC_t), import of cotton lint (IC_t). and domestic stock of cotton lint carried over from previous year (DSC_{t-1}).

$$SC_t = P_dC_t + IC_t + DSC_{t-1} \qquad 3$$

The import of cotton lint has been considered as an exogenous variable in this model.

The total production of cotton lint at time t ($P_d C_t$) is the sum of production of short ($PSSC_t$), medium ($PMSC_t$) and long staple cotton at time t ($PLSC_t$).

$$P_dC_t = PSSC_t - PMSC_t + PLSC_t \qquad 4$$

The production of cotton lint of each staple group has been explained through a separate equation. The production of short staple cotton is a function of the price of cotton lint at time t-1 (PC_{t-1}) and price of pesticide at time t (PP_t).

$$PSSC_t = f(PC_{t-1},\ PP_t) \qquad 5$$

The production of medium staple cotton ($PMSC_t$) is a function of price of cotton at the time t-1 (PC_{t-1}), the price of pesticide (PP_t) and the trend variable (TREND) which represents the improvement in technology and the price of paddy at time t-1 (PR_{t-1}).

$$PMSC_t = f(PC_{t-1}, TREND, PP_t, PR_{t-1}) \quad 6$$

The production of long staple cotton ($PLSC_t$) is a function of price of cotton at time t-1 (PC_{t-1}), the price of pesticide (PP_t)and the trend variable at time t (TREND).

$$PLSC_t = f(PC_{t-1}, TREND, PP_t) \quad 7$$

Variables such as price of fertilzers and weather variables have been tried but not found helpful in explaining the variation in the production of short, medium and long staple cotton.

Spinning Sector

Cotton fibre is used in the production of yarn, sewing thread and prin in the spinning sub-sector. Since the proportion of the total cotton fibre used in the production of sewing thread and pirns is very less, this study has confined itself to only yarn used in the production of fabric. The model also excludes blended yarn as it constitutes a small fraction of 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 stock and export. demand for total yarn.

$$DCCY_t = SCY_t - DSCY_t - ECY_t \quad 8$$

In this sector also, inverse demand function has been specified. The domestic stock of cotton yarn at time t has been considered as an exogenous variable. The price of cotton yarn (PCY_t) is a function of the domestic consumption of the total cotton yarn ($DCCY_t$), the price of cotton fabric ($PDSCF_t$) and the export of cotton fabric at time t (ECF_t). Price of decentralised cotton fabric has been used for of the price of cotton fabric.

$$PCY_t = f(DCCY_t, PDSCF_t, ECF_t) \quad 9$$

The export demand for cotton yarn at time t (ECY_t) has been specified as a function of the export price of the cotton yarn ($EPCY_t$), domestic stock of cotton yarn ($DSCY_t$) and lagged export of cotton yarn (ECY_{t-1}). World price of cotton yarn has not been considered due to its non-availability.

$$ECY_t = f(EPCY_t, DSCY_t, ECY_{t-1}) \quad 10$$

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

$$SCY_t = P_dCY_t + DSCY_{t-1} \quad 11$$

The production of cotton yarn of each count group has been specified through separate equations. The total production of cotton yarn (P_dCY_t) has been represented as an identity which is the sum of the production of coarse ($PCCY_t$), medium ($PMCY_t$) and fine count yarn ($PFCY_t$).

$$P_dCY_t = PCCY_t + PMCY_t + PFCY_t \qquad 12$$

The production of coarse count yarn is a function of the price of cotton yarn (PCY_t), total export of cotton yarn (ECY_t) and production of medium count yarn at time t ($PMCY_t$).

$$PCCY_t = f(PCY_t, \ PMCY_t, \ ECY_t) \qquad 13$$

The production of medium count yarn ($PMCY_t$) is a function of the price of cotton yarn (PCY_t), price of cotton (PC_t), total export of cotton yarn (ECY_t) at time t and production of medium count yarn at time t-1 ($PMCY_{t-1}$).

$$PMCY_t = f(PCY_t, \ PC_t, \ PMCY_{t-1}, \ ECY_t) \qquad 14$$

The production of fine cotton yarn at time t ($PFCY_t$) depends on the price of cotton (PC_t), and production of fine count yarn at time t-1 ($PFCY_{t-1}$).

$$PFCY_t = f(PFCY_{t-1}, \ PC_t) \qquad 15$$

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, decentralised and khadi units have been explained through separate equations. The market clearing conditions have been also introduced separately for each producing units. However, fabric quality has not been considered separately due to the non-availability of data.

Mills

A inverse demand function for the demand for mill cotton fabric has been specified. The price of cotton mill fabric ($PMCF_t$) is a function of demand for cotton mill fabric ($DCMF_t$), price of decentralised cotton fabric ($PDSCF_t$) and trend variable (TREND) which represents changes in the taste and preference of the consumers.

$$PMCF_t = f(DCMF_t, \ PDSCF_t, \ TREND) \qquad 16$$

The export of mill cotton fabric has been specified as a function of the world (OECD countries) per capita income (WY_t), export price of cotton mill fabric ($EPMCF_t$) at time t and export of cotton mill fabric at time t-1 ($EMCF_{t-1}$). World price of mill cotton fabric has not been considered separately due to non-availability of data.

$$EMCF_t = f(WY_t, \ EPMCF_t, \ EMCF_{t-1}) \qquad 17$$

due to lack of data on the stock of cotton fabric, the stock demand for mill fabric has been excluded assuming

the stock of fabric does not change over time. Since there is no import and stock of cotton mill fabric, the supply of cotton mill fabric is equal to the production of cotton mill fabric.

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

$$P_dMCF_t = f(PMCF_t, \ P_d MCF_{t-1}, \ EMCF_t) \qquad 18$$

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

$$DMCF_t = PMCF_t \qquad 19$$

Decentralised unit

In case of the decentralised unit also, inverse demand function has been utilised instead of normal demand function. The price of decentralised cotton fabric depends on the demand for decentralised cotton fabric ($DDSCF_{t-1}$), income (Y_t), time trend variable (TREND) and one year lagged price of decentralised cotton fabric ($PDSCF_{t-1}$).

$$PDSCF_t = f(DDSCF_t, \ PDSCF_{t-1}, \ TREND, \ Y_t) \qquad 20$$

The export demand for decentralised cotton fabric is a function of the export price of decentralised cotton fabric ($EPDSCF_t$), world (OECD countries) per capita income (WY_t) and one year lagged value of export of decentralised cotton fabric ($EDSCF_{t-1}$)

$$EDSCF_t = (EPDSCF_t, \ WY_t, \ EDSCF_{t-1}) \qquad 21$$

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

The production of decentralised cotton fabric ($P_d DSCF_t$) is a function of the price of decentralised cotton fabric ($PDSCF_t$), price of cotton yarn (PCY_t) and the export of decentralised cotton fabric ($EDSCF_t$).

$$P_d DSCF_t = f(PDSCF_t, \ DPCY_t, \ EDSCF_t) \qquad 22$$

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

$$DDSCF_t = PDSCF_t \qquad 23$$

Khadi

Demand for khadi fabric is assumed to be equal to the production of khadi fabric as data on the demand for and stock of khadi cotton fabric are not available and there is no export and import of khadi cotton fabric. The

equation for the demand for khadi cotton fabric has been explained through inverse demand equation, in which price of khadi cotton fabric ($PKCF_t$) has been specified as a function of the demand for khadi cotton fabric ($DKCF_t$) and one year lagged price of khadi cotton fabric ($PKCF_{t-1}$).

$$PKCF_t = f(DKCF_t, PKCF_{t-1}) \qquad 24$$

The production of khadi cotton fabric at time t (P_dKCF_t) is a function of the price of khadi cotton fabric ($PKCF_t$) and one year lagged production of khadi fabric ($P_d KCF_{t-1}$).

$$P_dKCF_t = f(PKCF_t, P_dKCF_{t-1}) \qquad 25$$

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

$$DKCF_t = PKCF_t \qquad 26$$

Export

Total export of cotton fabric at time t is explained through an identity

$$ECF_t = EMCF_t + EDSCF_t \qquad 27$$

Data Adjustments

Annual data for the period 1971-72 through 1992-93 were used in this study. Due to lack of the data on stock of mill and decentralised cotton fabric and no import of cotton fabric produced either in mill or decentralised units, supply is assumed to be equal to the production. The total production of cotton fabric in decentralised fabric producing units excludes the production of hosiery cotton fabric. The data on consumption of cotton fabric of mill and decentralised units were derived by subtracting export of cotton fabric of mill and decentralised units from the total supply of fabric of mill and decentralised units, respectively. As the data on demand for and stock of khadi cotton fabric was not available separately for the required period, demand for khadi cotton fabric is considered to be equal to the production of khadi fabric. The monetary values were transformed into real values by using appropriate deflators. All prices, wage and domestic income 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 fabric were deflated by the consumer price index of U.S.A (Base year 1980-81). Per capita income of OECD countries at constant prices (1987) was taken as world income. Wholesale price indices were used for all price variables except the export prices of yarn and powerloom fabric which were per unit realisation values.

Estimation Of The Model

The identification of the system was done using rank and order conditions to examine the estimabilty of the model and the equations of the system were found overidentified. Therefore, systems method was used for the estimation. The model estimated using 3SLS estimator is as follows

Cotton Farming Sector

$DPC_t = 127.82 - 1.01 * DCC_t + 0.298 * ECY_t + 0.303 * DPCY_t$ 2
(8.09) (-8.86) (6.41) (2.71)
$R^2 = 0.72$

$PSSC_t = 10.72 + 0.056 * DPC_{t-1} - 0.072 * DPP_t$ 5
(4.36) (4.06) (-4.04)
$R^2 = 0.48$

$PMSC_t = 46.46 + 0.198 * DPC_{t-1} - 0.237 * DPP_t$ 6
(2.49) (2.91) (-2.93)
$-0.085 * DPR_t + 1.214 * TREND$
(-0.574) (4.45)
$R^2 = 0.55$

$PLSC_t = 16.57 + 0.205 * DPC_{t-1} + 3.173 * TREND - 0.218 * DPP_t$ 7
(1.14) (2.20) (10.83) (-2.02)
$R^2 = 0.88$

Spinning Sector

$DPCY_t = 26.49 - 0.029 * DCCY_t + 0.957 * DPDSCF_t + 0.042 * ECF_t$ 9
(1.01) (-1.84) (4.90) (4.79)
$R^2 = 0.70$

$ECY_t = 45.079 - 16.807 * DEPCY_t + 0.495 * DSCY_t + 0.455 * ECY_{t-1}$ 10
(2.12) (-2.99) (2.21) (3.07)
$R^2 = 0.85$

$PCCY_t = 256.19 + 0.066 * DPCY_t + 0.257 * PMCY_t + 0.796 * ECY_t$ 13
(4.18) (0.16) (3.37) (4.16)
$R^2 = 0.85$

$PMCY_t = 215.86 + 1.268 * DPCY_t - 1.902 * DPC_t + 0.643 * PMCY_{t-1} +$ 14
(3.79) (2.96) (-6.58) (8.29)
$0.606 * ECY_t$
(3.50)
$R^2 = 0.91$

$PFCY_t = 95.55 + 0.782 * PFCY_{t-1} - 0.736 * DPC_t$ 15
(6.64) (17.08) (-5.79)
$R^2 = 0.94$

Weaving Sector

Mills

$$DPMCF_t = 99.103 - 0.003 * DMCF_t + 0.245 * DPDSCF_t - 2.146 * TREND \quad 17$$
$$(7.79) \quad (-1.92) \quad (3.13) \quad (-6.58)$$
$$R^2 = 0.94$$

$$EMCF_t = -851.92 + 0.141 * DWY_t - 475.71 * DEPMCF_t - 49.819 * TREND \quad 18$$
$$(-2.62) \quad (5.27) \quad (-3.76) \quad (-6.26)$$
$$R^2 = 0.56$$

$$P_d MCF_t = -2112.2 + 33.665 * DPMCF_t + 0.616 * PMCF_{t-1} + 1.081 * EMCF_t \quad 19$$
$$(-4.65) \quad (4.64) \quad (6.66) \quad (2.95)$$
$$R^2 = 0.89$$

Decentralised units

$$DPDSCF_t = -25.62 - 0.001 * DY_t + 1.732 * TREND - 0.0016 * DDSCF_t + \quad 21$$
$$(-1.83) \quad (5.59) \quad (2.25) \quad (-1.78)$$
$$0.68 * DPDSCF_{t-1}$$
$$(6.77)$$
$$R^2 = 0.81$$

$$EDSCF_t = -287.46 - 140.51 * DEPPF_t + 0.028 * WY_t + 0.809 EDSCF_{t-1} \quad 22$$
$$(-2.26) \quad (-2.06) \quad (3.29) \quad (10.73)$$
$$R_2 = 0.96$$

$$P_d DSCF_t = 6779.9 + 26.627 * DPDSCF_t - 53.60 * DPCY_t + 10.807 * EDSCF_t \quad 23$$
$$(5.60) \quad (1.28) \quad (-3.15) \quad (12.54)$$
$$R^2 = 0.91$$

Khadi

$$DPKCF_t = 30.63 - 0.126 * DKCF_t + 0.674 * DPKCF_{t-1} \quad 25$$
$$(2.68) \quad (-1.63) \quad (6.35)$$
$$R^2 = 0.69$$

$$P_d KCF_t = 2.01 + 0.042 * DPCKF_t + 0.962 * PCKF_{t-1} \quad 26$$
$$(0.23) \quad (0.49) \quad (16.66)$$
$$R^2 = 0.93$$

(Figures in the parenthesis are asymptotic t-values)

Identities

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

$SC_t = P_dC_t + IC_t + DSC_{t-1}$ 3

$P_dC_t = PSSC_t + PMSC_t + PLSC_t$ 4

$DCCY_t = SCY_t - DSCY_t - ECY_t$ 8

$SCY_t = P_dCY_t + DSCY_{t-1}$ 11

$P_dCY_t = PCCY_t + PMCY_t + PFCY_t$ 12

$DMCF_t = P_dMCF_t$ 16

$DDSCF_t = P_dDSCF_t$ 20

$DKCF_t = P_dKCF_t$ 24

$ECF_t = EDSCF_t + EMCF_t$ 27

Definitions Of Variables Used

Endogenous Variables

DPC	Deflated Wholesale Price Index of Cotton	
DCC	Domestic Consumption of Cotton	(Lakh Bales)
SC	Supply of Cotton	(Lakh Bales)
P_dC	Production of Cotton	(Lakh Bales)
PSSC	Production of Short Staple Cotton	(Lakh Bales)
PMSC	Production of Medium Staple Cotton	(Lakh Bales)
PLSC	Production of Long Staple Cotton	(Lakh Bales)
DPCY	Deflated Wholesale Price Index of Cotton Yarn	
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)
PCCY	Production of Coarse Count Yarn	(Thousand Tonnes)
PMCY	Production of Medium Count Yarn	(Thousand Tonnes)
PFCY	Production of Fine Count Yarn	(Thousand Tonnes)
DPMCF	Deflated Wholesale Price Index of Mill Cotton Fabric	
DMCF	Demand for Mill Cotton Fabric	(Million Square Metres)
EMCF	Export of Mill Cotton Fabric	(Million Square Metres)
SMCF	Supply of Mil Cotton Fabric	(Million Square Metres)

P_d MCF	Production of Mill Cotton Fabric	(Million Square Metres)
DPDSCF	Deflated Wholesale Price Index of Decentralised Cotton Fabric	
DDSCF	Demand for Decentralised Cotton Fabric	(Million Square Metres)
EDSCF	Export of Decentralised Cotton Fabric	(Million Square Metres)
SDSCF	Supply of Decentralised Cotton Fabric	(Million Square Metres)
P_dDSCF	Production of Decentralised Cotton Fabric	(Million Square Metres)
DPKCF	Deflated Wholesale Price Index of Khadi Cotton Fabric	
DKCF	Demand for Khadi Cotton Fabric	(Million Square Metres)
SKCF	Supply of Khadi Cotton Fabric	(Million Square Metres)
P_dKCF	Production of Khadi Cotton Fabric	(Million Square Metres)
ECF	Export of Cotton Fabric	(MillionSquare 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	Domestic Stock of Cotton Yarn	(Thousand Tonnes)
DPP	Deflated Wholesale Price Index of Pesticides	
DPR	Deflated Wholesale Price Index of Paddy	
DEPCY	Deflated Export Price of Cotton Yarn	(Dollar/Kg)
DY	Deflated Annual Domestic Income	(Crores Rs./Annum)
WY	Per Capita Income of OECD Countries at constant prices	(US Dollars)
DEPMCF	Deflated Export Price of Mill Cotton Fabric	(U.S. Dollar/Sq. Metre)
DEPPCF	Deflated Export Price of Powerloom Cotton Fabric	(US Dollar/Sq. Metre)
TREND	Time 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 are high except in case of a few endogenous variables, i.e. production of short staple cotton (48 per cent), production of medium

staple cotton (55 per cent) and export of mill cotton fabric (56 per cent). The regression coefficients of all the explanatory variables have expected signs.

The total consumption of cotton, export of cotton yarn and the deflated price of cotton yarn have been identified as significant explanatory variables which explain 72 per cent variations in the deflated price of cotton. One year lagged value of deflated price of cotton and the deflated price of pesticides are significant variables in explaining variations in the production of short, medium and long staple of cotton. Trend variable, used to capture the technological improvement, has been a significant variable in explaining the variations in the production of medium and long staple cotton. In the equation of the production of medium staple cotton the deflated price of rice, a competitive crop in many cotton growing areas was also used but none of them was found to be significant. The explanatory variables explain high variation in case of long staple of cotton followed by medium and short staple cotton.

The domestic consumption of cotton yarn, deflated price and export of cotton fabric are the important variables which explain 70 per cent variation in the deflated price of cotton yarn. The estimate indicates that price of cotton yarn is highly influenced by the price of cotton fabric. In case of export of cotton yarn, the export price of cotton yarn, domestic stock of cotton yarn and one year lagged export of cotton yarn are the major significant explanatory variables. The estimated equation for the production of coarse count cotton yarn shows that the production of medium count yarn, deflated price of cotton yarn and export of cotton yarn explain together about 85 per cent of its variations. Deflated price of cotton yarn does not have any significant influence on the production of coarse count yarn. In the case of medium count yarn, deflated price of cotton yarn, deflated price of cotton, one year lagged production of medium count yarn and export of cotton yarn together explain about 91 per cent variation. All the explanatory variables are significant at one per cent level. In case of fine count yarn, one year lagged value of the production of fine count yarn and deflated price of cotton are the major explanatory variables which explain together about 94 per cent of variation. Influence of lagged values of their production in case of medium and fine count yarn highlights the asset fixity nature of the yarn industry.

The total demand for mill cotton fabric, deflated price of decentralised cotton fabric and trend have been identified as significant explanatory variables which explain 94 per cent variations in the deflated price of cotton. The time trend variable has been used to account for the changes in taste and preference of the consumers. In case of export of mill cotton fabric, per capita income of OECD countries, deflated export price of mill cotton fabric and trend are significant explanatory variables which explain about 56 per cent variability. The estimated equation for the production of mill cotton fabric has a reasonably good fit. The deflated price of mill cotton fabric, one year lagged production of mill cotton fabric and export of mill cotton fabric have been identified as important explanatory variables which explain jointly about 90 per cent of variation.

The total demand for decentralised cotton fabric, one year lagged deflated price of decentralised cotton fabric, deflated domestic income and time trend are important explanatory variables which explain together about 81 per cent variation in the deflated price of decentralised cotton fabric. About 96 per cent variation in the export of decentralised cotton fabric has been explained by deflated export price of decentralised cotton fabric, per capita income of OECD countries and one year lagged value of the export of decentralised cotton fabric. The deflated price of decentralised cotton fabric, export of decentralised cotton fabric and deflated price of cotton yarn explains about 91 per cent variation in the total production of decentralised cotton fabric. The deflated price of the decentralised cotton fabric is insignificant.

About 69 per cent variation in the deflated price of khadi cotton fabric has been explained by demand for the khadi cotton fabric and the one year lagged deflated price of khadi cotton fabric. The estimated equation of production of khadi cotton fabric has a good fit. The deflated price of khadi cotton fabric and one year lagged value of khadi cotton fabric explain about 93 per cent its variation. The deflated price of khadi cotton fabric is insignificant.

Overall, the signs and significance of coefficients are consistent with the theory. The empirical disaggregate model provides more detailed representation of the structure of the Indian Cotton sector. Therefore, the estimated coefficient can be used for disaggregated 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 validating the model as a dynamic system, evaluation of the stability of the model, 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 (-0.94), the system will show oscillating convergence.

Predictive Performance Of The Model

For the validation of the performance of the model both the static and dynamic simulations[1] were done. Static simulation was done for the period 1972-73 to 1992-93. Dynamic simulation was done for two periods: a twenty one-year period (1972-73 to 1992-93) and a eleven-year period (1982-83 to 1992-93). Dynamic simulation using forecasted values of exogenous variables was also done for a eleven year period (1982-83 to 92-93).

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 of all price variables are sufficiently low. The PRMSE of quantity variables are also sufficiently low except export variables. PRMSE value of export of cotton yarn is very high because of small quantity of export in the early periods and varying government policies. The PRMSE of the production of cotton of different staple categories remain relatively high and for short staple cotton it is substantially high. This is mainly due to high fluctuation in the production of

[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 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 actual values.

short staple cotton during recent years. In spinning sector, PRMSE values of the production of cotton yarn of different count groups are substantially low. PRMSE values of the endogenous variables in dynamic simulations for the complete historical period are similar to the PRMSE values in the static simulations. However, PRMSE values of PSSC, ECYand EDSCF are relatively very high in the dynamic simulation. In case of dynamic simulation for the last 11 years of the historical period (1982-83 to 92-93), PRMSE values of the most of the endogenous variables are either lesser or slightly higher than the corresponding PRMSE values of the simulation for the complete historical period. This further supports the model's tracking ability of the actual values of endogenous variables. However, The PRMSE values of the endogenous variables, namely, PSSC, PMSC, ECY and EDSCF are relatively very high. PRMSE values of most of the endogenous variables in dynamic simulation for the current 11 years using

Table 1: PRMSE Values of Static and Dynamic Simulations

Endogenous Variables	Types of Simulations			
		Dynamic Simulation		
	Static Simulation	21 Yrs. (a)	11 Yrs (a)	11 Yrs (b)
DCC	7.72	8.66	11.12	11.25
SC	5.90	6.66	8.71	8.71
P_1C	7.62	8.80	11.44	11.12
PSSC	38.02	41.73	58.99	64.83
PMSC	16.89	19.10	24. 88	27.06
PLSC	15.71	14.36	14.13	14.37
DPC	14.85	13.99	16.88	18.54
DCCY	5.53	6. 47	6.89	8. 38
ECY	113.96	122.85	129.73	149 .72
SCY	5.39	5.78	5.77	7.62
P_1 CY	5.54	5.95	5. 98	7.95
PCCY	6.91	6.41	6.37	7.63
PMCY	6.80	8.86	4.92	6.80
PFCY	9.89	17.03	15.25	18.31
DPCY	8.12	9.82	10.96	12.75
DMCF	8.87	9.80	9.58	11.71
EMCF	17.52	17.52	9 . 68	27.85
P_1MCF	8.87	9. 80	9.58	11.71
DPMCF	4.37	4.57	4.79	5.27
DDSCF	9.02	7.94	7.24	8.28
EDSCF	25.13	51.34	33.60	43.09
P_1DSCF	9. 02	7.94	7. 24	8.28
DPDSCF	4.79	5.05	3.29	8.30
ECF	14.96	15. 33	12. 98	31.10
DKCF	6.52	10.77	4.67	4.47
P_1KCF	6.53	10.77	4.67	4.47
DPKCF	9.52	14.69	16.10	16.10

Note: (a) Dynamic simulation with actual values of exogenous variables
(b) Dynamic simulation with forecasted values of exogenous variables

the forecasted values of exogenous variables are almost equal to the their PRMSE values in the dynamic simulation for 11 years using actual values. However, in case of PSSC, ECY, EMCF, EDSCF, and ECF, PRMSE values remain high. 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 simulation (Table 2). Theil's

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

Endogenous Variables	Types of Simulations			
		Dynamic Simulation		
	Static Simulation	21 Yrs (a)	11 Yrs (a)	11 Yrs (b)
DCC	0.71	1.01	1.70	1.72
SC	0.16	0.22	0.25	0.26
P_dC	0.17	0.23	0.25	0.26
PSSC	0.58	0.67	0.71	0.77
PMSC	0.18	0.25	0.21	0.23
PLSC	0.30	0.29	0.28	0.33
DPC	0.30	0.24	0.35	0.41
DCCY	0.36	0.54	0.95	1.47
ECY	0.28	0.27	0.24	0.33
SCY	0.29	0.37	0.44	0.88
P_dCY	0.31	0.39	0.45	0.90
PCCY	0.29	0.26	0.27	0.46
PMCY	0.36	0.37	0.30	0.69
PFCY	0.43	1.34	1.66	2.40
DPCY	0.23	0.32	0.34	0.58
DMCF	0.28	0.32	0.24	0.11
EMCF	0.15	0.15	0.20	0.27
P_dMCF	0.28	0.32	0.24	0.11
DPMCF	0.29	0.33	0.41	0.52
DDSCF	0.21	0.19	0.17	0.22
EDSCF	0.24	0.56	0.33	0.48
P_dDSCF	0.22	0.19	0.17	0.22
DPDSCF	0.19	0.20	0.16	1.27
ECF	0.38	0.23	0.23	0.47
DKCF	0.38	1.25	0.47	0.47
P_dKCF	0.38	1.25	0.47	0.47
DPKCF	0.43	0.92	1.18	1.18

Note: (a) Dynamic simulation with actual values of exogenous variables
(b) Dynamic simulation with forecasted values of exogenous variables

values of almost all endogenous variables in dynamic simulation except DCC, PFCY, DKCF and P_dKCF are less than one. It indicates that the model performs reasonably well and are consistent with the findings of the PRMSE statistics. Furthermore, Theil's values of most of the endogenous variables in dynamic simulation for 11year period using actual values and forecasted values of exogenous variables are also less than one. In case of dynamic simulation using actual values of exogenous variables, DCC and PFCY and DPKCF have their Theil's Coefficients higher than one whereas, in case of dynamic

simulation using forecasted values, DCC, DCCY, PFCY and DPKCF have their Theil's Coefficients higher than one.

Adequacy Of Model Specifications

The mean square simulation error is decomposed into bias, variance and covariance components to examine the adequacy of the model specifications. The values of these components indicate reasonably good specification of the model (Table 3). The bias components of the most of the endogenous variables in static and dynamic simulation are almost zero. However, bias components of PSSC and PCCY are

Table 3: Components of Mean Squared Error for Static and Dynamic Simulation as Proportion of Total

Endogenous Variable	Static Simulation			Dynamic Simulation		
	Ubias	Uvar	Ucov	Ubias	Uvar	Ucov
DCC	0.00	0.04	0.96	0.00	0.08	0.92
SC	0.00	0.00	1.00	0.00	0.00	1.00
P_dC	0.00	0.02	0.98	0.00	0.01	0.99
PSSC	0.14	0.18	0.68	0.12	0.17	0.71
PMSC	0.02	0.05	0.93	0.01	0.03	0.96
PLSC	0.00	0.08	0.92	0.00	0.07	0.93
DPC	0.00	0.06	0.94	0.01	0.04	0.95
DCCY	0.05	0.12	0.83	0.05	0.36	0.60
ECY	0.00	0.04	0.96	0.00	0.02	0.98
SCY	0.05	0.06	0.89	0.06	0.28	0.66
P_dCY	0.05	0.06	0.89	0.06	0.29	0.65
PCCY	0.14	0.10	0.76	0.16	0.14	0.70
PMCY	0.00	0.04	0.96	0.02	0.15	0.83
PFCY	0.00	0.10	0.90	0.00	0.56	0.44
DPCY	0.02	0.10	0.88	0.02	0.08	0.90
DMCF	0.02	0.01	0.97	0.06	0.11	0.83
EMCF	0.01	0.28	0.71	0.00	0.28	0.72
P_dMCF	0.02	0.01	0.97	0.06	0.11	0.83
DPMCF	0.10	0.01	0.89	0.06	0.01	0.93
DDSCF	0.00	0.01	0.99	0.02	0.04	0.94
EDSCF	0.02	0.05	0.93	0.05	0.01	0.94
P_dDSCF	0.00	0.01	0.99	0.02	0.04	0.94
DPDSCF	0.02	0.16	0.82	0.01	0.00	0.99
ECF	0.00	0.00	1.00	0.04	0.05	0.91
DKCF	0.00	0.00	1.00	0.13	0.43	0.44
P_dKCF	0.00	0.00	1.00	0.13	0.43	0.44
DPKCF	0.00	0.11	0.89	0.00	0.09	0.91

Note: (a) Dynamic simulation with actual values of exogenous variables
(b) Dynamic simulation with forecasted values of exogenous variables

slightly higher than zero in both static and dynamic simulations whereas, the bias components of the demand for and production of khadi cotton fabric are slightly higher than zero in dynamic simulation. The variance components of most of the endogenous variables in both static and dynamic simulations are close to zero. The variance components of PSSC, DCCY, PCCY, PFCY, DPCY, EMCF, DPDSCF and DPKCF are slightly higher than zero in static simulation whereas, the bias components of PSSC, DCCY, SCY, P_dCY, PCCY, PMCY, PFCY, DMCF, EMCF, P_dMCF, DKCF, P_dKCF are relatively higher in the dynamic simulation. In case of most of the endogenous variables the proportion of the systematic error accounts for most of the inequality of the predicted and the actual values.

Expost Forecast Performance

Expost predictive performance of the model was evaluated to assess out of sample performance of the model. Predictions of the endogenous variables were made for the year 1993-94 by updating the exogenous variables

Table 4 : Ex-post Forecast Performance of the Disaggregate Model for the Year 1993-94

Endogenous Variables	Values of Endogenous Variables			Deviation from Actual Values in Per cent	
	Actual	Sim-A	Sim-B	Sim-A	Sim-B
DCC	127.0	153.02	139.1	20.48	9.5
SC	157.6	183.62	157.6	16.51	0.0
PC	123.3	143.22	214.5	16.15	73.9
PSSC	6.7	7.52	9.3	12.23	39.1
PMSC	51.4	55.22	93.4	7.43	81.5
PLSC	65.2	80.48	102.7	23.43	37.5
DPC	76.7	37.10	96.6	-46.7	19.8
DCCY	1464.6	1503.96	1109.3	2.2	-24.2
ECY	178.8	118.96	229.9	-31.2	28.5
SCY	1729.0	1708.72	1235.3	-1.32	-28.5
PCY	1622.0	1600.92	1103.9	-1.46	-31.9
PCCY	633.0	556.78	390.5	-10.4	-38.3
PMCY	770.0	815.36	606.4	4.3	-21.2
PFCY	219.0	228.79	105.9	4.0	-51.6
DPCY	111.9	93.97	203.3	-11.9	81.6
DMCF	1356.0	1207.75	1210.7	-9.9	-10.0
EMCF	413.0	309.34	977.2	-9.1	136.6
PMCF	1356.0	1207.75	1210.7	-9.9	-10.0
DPMCF	72.0	62.79	43.6	12.9	-39.4
DDSCF	13077.0	12690.21	10256.1	-6.4	-21.5
EDSCF	908.9	825.91	1021.4	-10.6	12.3
PDSCF	13077.0	12690.21	10163.6	-6.4	-21.5
DPDSCF	68.1	68.42	106.3	1.0	56.0
ECF	1322.8	1135.24	1994.4	-10.2	50.7
DKCF	80.8	90.78	65.9	12.4	-18.4
PKCF	80.8	90.78	65.9	12.4	-18.4
DPKCF	66.6	48.40	21.6	-28.2	-67.5

Note: Sim-A: Static simulation using actual values of lagged endogenous and exogenous variables
Sim-B: Static simulation of unrestricted reduced form coefficients using actual values of exogenous and endogenous variables

and lagged endogenous variables. The actual and predicted values of endogenous variables and their difference (per cent) are presented in table 4. The accuracy of prediction of the endogenous variables of spinning sector and decentralised weaving sector is sufficiently high. The difference between the actual and predicted values of the production of medium and fine count yarn in the spinning sector and the production of medium and long staples cotton remains relatively low. The difference between the actual and predicted values of the endogenous variables of mill unit, export of decentralised and total cotton fabric, deflated price of cotton yarn and the production of coarse count yarn remain around 10 per cent. The errors in the simulated values of the deflated price of decentralised and mill cotton fabric are very small. However, the accuracy of the prediction of the export of cotton yarn, deflated price of cotton and khadi and the production of long staple cotton is relatively low. These forecast out performed the forecast obtained from unrestricted reduced form coefficients.

Multipliers

The short term multiplier of domestic stock of cotton has a highly significant negative impact on the consumption, supply and production of cotton yarn, the production of medium count yarn and the demand for, supply and production of decentralised cotton fabric (Table 5). It has a relatively lesser negative impact on the production of fine and coarse count yarn. Negligible impact is noticed on the demand for, supply, production and deflated price of mill cotton fabric. It has higher positive impact on the deflated price of cotton compared to deflated price of yarn and decentralised cotton fabric. Supply and production of cotton, export of cotton yarn, export of mill and decentralised cotton fabric, deflated price of mill cotton fabric and khadi sector variables are not affected by the change in domestic stock in the short run. The long term multiplier of the domestic stock of cotton has an equal or relatively higher impact on almost all the endogenous variables of cotton, yarn and fabric sectors except domestic consumption of cotton and the deflated price of cotton (Table 6). The domestic consumption, supply and production of cotton yarn would decline by an amount equal to 6.36 units as a result of one unit increase in the domestic stock of cotton in the long run. The production of medium and fine count yarn has higher negative impact compared to coarse count yarn. The long term multiplier has a substantially higher impact on the endogenous variables of decentralised unit. The short run elasticities (appendix 1(a)) show that the deflated price of cotton has a relatively high responsiveness (0.36) to the domestic stock of cotton followed by the consumption of cotton (-0.31) and the production of fine count yarn (-0.13). The production of fine count yarn has a high negative responsiveness (-0.42) to the domestic consumption of cotton in the long run. Other endogenous variables also respond to the change in the domestic consumption in the long run.

The impact of the short and long run multiplier 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 impacts on the endogenous variables similar to short and long term impact multipliers of domestic stock and export of cotton in term of magnitude but in opposite direction except for supply of cotton.

Short run multiplier of deflated price of pesticides has relatively higher negative impact on the demand for and production of decentralised cotton fabric and domestic consumption, supply and production of cotton yarn among all the endogenous variables. The long term multiplier of the deflated price of pesticides has a high impact on the endogenous variables of spinning and weaving sectors and less impact on the endogenous variables of cotton sector. The long term multiplier of the deflated price of the pesticides has a larger impact on the demand for and production of decentralised cotton fabric in comparison to the other endogenous variables. However, elasticities indicate that the cotton and yarn sector variables are sensitive to pesticides especially in the long run. There would be a small reduction in the domestic consumption, supply and production of small, medium and long staple cotton due to increase in the real prices of pesticides in the long run.

Short run impact multiplier of deflated price of paddy indicate that a unit change in the deflated price of paddy would bring relatively higher change in the domestic consumption, supply and production of cotton yarn followed by demand for and production of decentralised cotton fabric. The multiplier impact on the domestic consumption, supply and production of cotton is relatively less in the short run. The impact in the long run remains relatively higher on the consumption, supply and production of cotton yarn followed by demand for and production of decentralised cotton fabric.

Short run multiplier of domestic stock of yarn has large positive impacts on the export, supply, production of cotton yarn and the production of coarse count yarn. It has a large negative impact on the domestic consumption of cotton yarn, and demand for and production of decentralised cotton fabric. The short term multiplier of the stock of yarn has no impact on the domestic consumption, supply, production of cotton, the production of short, medium and long staple cotton. It has a marginal impact on the production of medium and fine count yarn and the endogenous variables of mill unit. The price variables of cotton and yarn also remain less affected by the impact of short run multiplier of stock of cotton yarn. The long term multiplier impact of stock of cotton yarn increases in case of domestic consumption of cotton yarn, export, supply and production of yarn, production of coarse and medium count yarn, demand for and production of decentralised cotton fabric in comparison to the short term multiplier impact. The impact declines more in case of fine count yarn in comparison to the short term multiplier impact. The elasticity also shows that the export of cotton yarn is highly responsive to the change of stock of cotton yarn in the long run in comparison to the short run.

The short term multiplier of the deflated export price of cotton has larger negative impact on the export of cotton yarn, production of coarse count yarn, total supply and production of cotton yarn and the deflated price of cotton. There is no substantial impact of short term multiplier of deflated price of export of cotton yarn on the endogenous variables of mill sector and the deflated price of cotton yarn. Positive impact are noticed on the demand and production of decentralised cotton fabric and domestic consumption of cotton yarn. The long term multiplier of deflated export price of cotton has a larger negative impact on the export, supply, production of cotton yarn, production of coarse and medium count yarn. The increase in the multiplier impact in the long run is maximum in case of the production of medium count yarn in comparison to short term. The long term multiplier of the deflated export price of cotton yarn also has negative influence on the domestic consumption, supply of cotton, production of short, medium and long staple cotton. The multiplier of the deflated export price of cotton has a negative impact on the endogenous variables of mill and decentralised units in the long run instead of the positive impact as observed in the short run. The production of fine count yarn has a positive long term multiplier impact of the deflated export price of cotton yarn. The export of cotton yarn is highly responsive to the change in the deflated export price of cotton among all the endogenous variables in the both short and long run. The production of fine, medium and coarse count cotton yarn and the deflated price of cotton have higher elasticity in the long run in comparison to the short run.

The multiplier of the lagged stock of cotton yarn influences positively the domestic consumption, supply of cotton yarn and demand for and production of decentralised cotton fabric in the both short and long run. The impact of the multiplier of lagged stock of cotton yarn remains high only in case of consumption and supply of cotton yarn in the both short and long run. The impact is very less in case of other endogenous variables in the both short and long run.

Both short and long term multipliers of the per capita income of OECD countries would not bring any substantial change in the endogenous variables of decentralised unit. The multiplier impact of the per capita income of OECD countries is also marginal on the endogenous variables of mill units and the total export of cotton fabric in both short and long run. The short run elasticities show that the export of total cotton fabric is highly responsive to the change in the per capita income of OECD countries followed by export of mill cotton fabric and the export of decentralised cotton fabric but in the long run the elasticity of the export of decentralised cotton fabric is relatively higher than those of total cotton fabric or mill

cotton fabric. The responsiveness of the export of mill cotton fabric remains same in both short and long run.

The short run multiplier of deflated export price of mill cotton fabric has a negative impact on the demand for and production of mill cotton fabric and positive impact on the demand for and production of decentralised cotton fabric. In terms of magnitude it has higher impact on the endogenous variables of decentralised unit in comparison to mill unit. It also has a negative impact on the total export of cotton fabric in the short run. In the long run its impact increases on the demand for and production of mill cotton fabric and remain more or less constant in case of endogenous variables of decentralised unit, export of mill cotton fabric and the total export of cotton fabric in comparison to short run multipliers. Its impact also increases substantially in case of domestic consumption, supply, production and deflated price of cotton yarn and the production of medium count yarn in the long run. It has also negative impact on the consumption, supply, production and deflated price of cotton and the production of short, medium and long staple cotton. The export of mill cotton fabric is highly responsive to the changes in the deflated export price of mill cotton fabric in both short and long run. The export of decentralised cotton fabric is inelastic to the deflated price of mill cotton fabric in both short and long run.

The short run multiplier of deflated export price of decentralised cotton fabric has a negative impact on the demand for production and export of decentralised cotton fabric and positive impact on the demand for and production of mill cotton fabric. In terms of magnitude it has a substantially higher impact on the endogenous variables of decentralised unit in comparison to mill unit. It also has a negative impact on the total export of cotton fabric in the short run. In the long run its impact increases on the demand for and production of decentralised and mill cotton fabric and the export of decentralised and total cotton fabric. The deflated price of powerloom fabric has negative impact on the domestic consumption, supply, production and deflated price of cotton yarn and the production of coarse and medium count yarn and the deflated price of cotton in the short run. However, these variables experiences positive impact in the long run. The export of decentralised cotton fabric has high responsiveness to the changes in the deflated export price of powerloom cotton fabric in both short and long run. The export of mill cotton fabric is highly inelastic to the deflated price of powerloom cotton fabric in both short and long run.

The multiplier impact of the deflated domestic income on the consumption of cotton fabric is almost negligible in the both short and long run. The low elasticity of demand, supply and production of decentralised cotton fabric in the short run shows less responsiveness of these variables to change in the deflated domestic income. The demand for and production of mill cotton fabric and production of medium count yarn have relatively high elasticity in the long run.

Simulation Of The Model

Given the satisfactory performance of the model as a dynamic system, dynamic simulation was generated for the period 1992-93 to 2001-02. The actual values of the endogenous variables for the year 1991-92 were used as values for initial year lagged endogenous variables. Forecasts of the exogenous variables were made using the best fit trend regression. However, the values of domestic stock of cotton , export of cotton, import of cotton and deflated wages in the textile mills were set at the mean value of the period from 1988-89 to 1992-93 as the trend regression for the variable had a poor fit. Different policy scenarios were also simulated to assess their impact on the Indian Cotton sector.

Table 5: Short Run Multiplier of the Exogenous Variables for the Endogenous Variables

Endogenous Variables	Exogenous Variables												
	DSC	EC	IC	DSCt-1	DPPT	DPRT	SCY	DEPC	SCY_{t-1}	WY	DEPMF	DEPPF	DY
DCC	-1	-1	1	1	-0.53	-0.09	0	0	0	0	0	0	0
SC	0	0	1	1	-0.53	-0.09	0	0	0	0	0	0	0
PC	0	0	0	0	-0.53	-0.09	0	0	0	0	0	0	0
PSSC	0	0	0	0	-0.07	0	0	0	0	0	0	0	0
PMSC	0	0	0	0	-0.24	-0.09	0	0	0	0	0	0	0
PLSC	0	0	0	0	-0.22	0	0	0	0	0	0	0	0
DPC	1.04	1.04	-1.04	-1.04	0.55	0.09	0.16	-5.07	-0.01	0	-6.12	-1.09	0
DCCY	-3.11	-3.11	3.11	3.11	-1.64	-0.28	-1.16	6.03	0.98	0	-11.82	-2.11	0
ECY	0	0	0	0	0	0	0.50	-16.81	0	0	0	0	0
SCY	-3.11	-3.11	3.11	3.11	-1.64	-0.28	0.34	-10.78	0.98	0	-11.82	-2.11	0
PCY	-3.11	-3.11	3.11	3.11	-1.64	-0.28	0.34	-10.78	-0.02	0	-11.82	-2.11	0
PCCY	-0.49	-0.49	0.49	0.49	-0.26	-0.04	0.41	-13.66	0	0	-2.25	-0.4	0
PMCY	-1.85	-1.85	1.85	1.85	-0.98	-0.17	0.05	-0.87	-0.02	0	-14.1	-2 52	0
PFCY	-0.77	-0.77	0.77	0.77	-0.41	-0.07	-0.12	3.75	0.01	0	4.53	0.81	0
DPCY	0.1	0.01	-0.1	-0.1	0.05	0.01	0.04	-0.19	-0.03	0.01	-20.26	-3.62	0
DMCF	-0.06	0-06	-0.06	-0.06	0.03	0.01	0.02	-0.12	-0.02	0.14	-478.57	15.14	0.01
EMCF	0	0	0	0	0	0	0	0	0	0.14	-475.2	0	0
PMCF	-0.06	0.06	-0.06	-0.06	0.03	0.01	0.02	-0.12	-0.02	0.14	-478.57	15.14	0.01
DPMCF	0	0	0	0	0	0	0	0	0	0	1 03	0.45	0
DDSCF	-5.01	-5.01	5.01	5.01	--2.64	-0.45	-1.87	9.71	1.58	-0.06	1036.65	-1263.58	-0.02
EDSCF	0	0	0	0	0	0	0	0	0	0.03	0	-140.5	0
PDSCF	-5.01	-5.01	5.01	5.01	-2.64	-0.45	-1.87	9.71	1.58	-0.06	1036.65	-1263.58	-0.02
DPDSCF	0.01	0.01	-0.01	-0.01	0	0	0	-0.02	0	0	-1.66	2.02	0
ECF	0	0	0	0	0	0	0	0	0	0.17	-475.2	-140.5	0
DKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
PKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
DPKCF	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6: Long- Run Multiplier of the Exogenous Variables for the Endogenous Variables														
Endogenous Variables	Exogenous Variables													
	DSC	EC	IC	DSC_{t-1}	DPPT	DPRT	TREND	SCY	DEPC	SCY_{t-1}	WY	DEPMF	DEPPF	DY
DCC	-0.66	-0.66	0.66	0.66	-0.35	-0.06	3.16	0.09	-2.92	0	0	-2.12	0.33	0
SC	0.34	0.34	0.66	0.66	-0.35	-0.06	3.16	0.09	-2.92	0	0	-2.12	0.33	0
P_dC	0.34	0.34	-0.34	-0.34	-0.35	-0.06	3.16	0.09	-2.92	0	0	-2.12	0.33	0
PSSC	0.04	0.04	-0.04	-0.04	-0.05	0	-0.16	0.01	-0.38	0	0	-0.28	0.04	0
PMSC	0.15	0.15	-0.15	-0.15	-0.16	-0.08	0.68	0.04	-1.27	0	0	-0.92	0.14	0
PLSC	0.15	0.15	-0.15	-0.15	-0.14	0.01	2.64	0.04	-1.27	0	0	-0.92	0.14	0
DPC	0.74	0.74	-0.74	-0.74	0.39	0.07	-2.65	0.2	-6.36	-0.01	0	-4.62	0.71	0
DCCY	-6.36	-6.36	6.36	6.36	-3.36	-0.57	34.41	-1.01	2.94	0.92	0.01	-51.73	7.96	0.01
ECY	0	0	0	0	0	0	0	0.93	-31.13	0	0	0	0	0
SCY	-6.36	-6.36	6.36	6.36	-3.36	-0.57	34.41	0.92	-28.19	0.92	0.01	-51.73	7.96	0.01
P_dCY	-6.36	-6.36	6.36	6.36	-3.36	-0.57	34.41	0.92	-28.19	-0.08	0.01	-51.73	7.96	0.01
PCCY	-0.81	-0.81	0.81	0.81	-0.43	-0.07	5.16	0.91	-29.99	-0.02	0	-12.64	1.94	0
PMCY	-3.06	-3.06	3.06	3.06	-1.62	-0.28	20.34	0.67	-19.58	-0.08	0.01	-54.63	8.4	0.01
PFCY	-2.48	-2.48	2.48	2.48	-1.31	-0.22	8.91	-0.66	21.38	0.02	0	15.53	-2.39	0
DPCY	0.24	0.24	-0.24	-0.24	0.12	0.02	1.8	0.04	-0.11	-0.03	0.01	-22.39	3.44	0
DMCF	0.92	0.92	-0.92	-0.92	0.49	0.08	-176.71	0.15	-0.42	-0.13	0.22	-1154.26	593.93	0.05
EMCF	0	0	0	0	0	0	-49.82	0	0	0	0.14	-475.2	0	0
P_dMCF	0.92	0.92	-0.92	-0.92	0.49	0.08	-176.71	0.15	-0.42	-0.13	0.22	-1154.26	593.93	0.05
DPMCF	0.01	0.01	-0 01	-0.01	0.01	0	-0.4	0	0	0	0	2.22	6.71	0
DDSCF	-11.06	-11.06	11.06	11.06	-5.84	-1	51.31	-1.75	5.11	1.6	1.11	1049.48	-7144.57	-0.06
EDSCF	0	0	0	0	0	0	0	0	0	0	0.15	0	-739.47	0
P_dDSCF	-11.06	-11.06	11.06	11.06	-5.84	-1	51.31	-1.75	5.11	1.6	1.11	1049.48	-7144.57	-0.06
DPDSCF	0.05	0.05	-0.05	-0.05	0.03	0	4.99	0.01	-0.02	-0.01	-0.01	-5.09	34.64	0
ECF	0	0	0	0	0	0	-49.82	0	0	0	0.29	-475.2	-739.47	0
DKCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_dKCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DPKCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Base Line Simulation Of The Model

The domestic consumption of cotton will increase at a compound growth rate of 3.13 per cent per annum and will reach a level of 160.3 lakh bales by 2001-2002 (Table 7). Total supply of cotton will increase at a growth rate of 2.45 per cent per annum which is less than the growth rate of the consumption. Total production of cotton will grow at a growth rate of 2.98 per cent per annum which is slightly higher than that of total supply of cotton but remains lower than the growth rate of consumption. It is expected that the production of cotton would reach the level of 167.2 lakh bales by 2001-2002. The forecast of the production of cotton staple-wise shows that the production of short staple cotton would decline at slower growth rate (-0.10) from 7 to 6.5 lakh bales. The production of medium staple cotton will grow at a rate of 2.21 per cent per annum. The production of long staple cotton will increase relatively at a higher growth rate (3.75 per cent per annum) compared to the production of medium staple cotton. The deflated price of cotton is expected to grow at a growth rate of 1.20 per cent during the simulation period. The export of cotton yarn will increase at a high growth rate (9.60 per cent per annum) during the simulation period. It would reach 263.3 thousand tonnes by 2001-2202 AD. High growth rate of export of cotton yarn is achieved mainly due to the setting up of a large number of export oriented units in the spinning sector. The supply and production of cotton yarn would grow at a higher growth rate in comparison to the growth rate of the consumption of the cotton yarn. The supply and production of cotton yarn would increase at a compound growth rate of 3.30 and 2.75 per cent per annum, respectively whereas, the consumption of cotton yarn would increase at a growth rate of 1.89 per cent per annum. Count-wise forecast of the production of cotton yarn shows that the production of coarse and medium count yarn would grow almost at the same growth rate (3.29 and 3.21 per cent per annum, respectively) during the simulation period whereas, the production of fine count yarn would experience a declining trend. The deflated price of cotton yarn would increase at a growth rate of 1.13 per cent per annum. In the weaving sector, the demand for and the production of mill cotton fabric will decline at a high rate (10.09 per cent per annum). The export of mill cotton fabric is expected to increase at the growth rate of 1.58 per cent per annum. Due to changes in the consumer preferences, government policies and other external and internal factors, mill units are either producing the high quality fabric for the export purpose or shifting from fabric production to strictly yarn production. It is predicted that the deflated price of mill cotton fabric will decline at the growth rate of 3.36 per cent per annum. The demand for and the production of decentralised cotton fabric will increase at the growth rate of 3.63 per cent per annum and the export of decentralised cotton fabric will also increase at the relatively higher growth rate of 5.33 per cent per annum. The deflated price of decentralised cotton fabric will decline slowly during the simulation period. The export of total cotton fabric will increase at the growth rate of 3.95 per cent per annum. The demand for and the production of khadi fabric will increase at very slow rate of 0.70 per cent per annum. These results indicate that the decentralised sector would be the key in the weaving sector and the share of the mill fabric in the total demand and the production of cotton fabric would decline further in the future.

The Effect Of Change In The Export Of Cotton On The Indian Cotton Sector

The export policy of cotton has been always been ad-hoc. The quota of export of cotton is either increased or decreased as per the production performance of cotton, lobbying of the potential cotton growers and millers. Therefore, the impact of the decrease/increase of cotton from the average level of export of cotton on the Indian Cotton sector was assessed. Simulations were carried out to ascertain the impact of the policies intended towards increase/decrease in the export of cotton under three scenarios. For these simulation, the exogenous export variables was increased/decreased by the desired amount. The simulation results shows that the change in the export of cotton has marginal influence the endogenous variables of weaving sector but it influences significantly the endogenous variables of cotton farming and spinning sector (appendix 2). The simulation results shows that a decline in the export of cotton by 5 lakh bales from its average export of cotton during 1988 to 1992 would bring a

Table 7: Base-line Simulation Values of the Endogenous Variables of the Disaggregate Model for the period 1992-93 to 2001-2002

Year	DCC	SC	P_dC	PSSC	PMSC	PLSC	DPC	DCY	ECY	SCY	P_dCY	PCCY	PMCY	PFCY	DPCY
1992	124.8	163.0	131.7	7.0	51.8	72.8	69.4	1345.5	119.6	1561.6	1474.1	535.9	736.4	201.7	106.0
1993	121.5	159.8	128.4	6.0	49.7	72.6	73.8	1365.3	123 9	1595.5	1499.0	544.6	756.1	198.3	105.1
1994	127.9	166.1	134.8	6.3	51.8	76.7	70.1	1394.1	133.7	1644.9	1538.6	558.9	781.3	198.4	105.0
1995	130.7	168.9	137.5	6.1	52.4	79.1	71.4	1417.8	146.6	1693.4	1576.3	575.1	803.8	197.4	105.7
1996	135.7	173.9	142.5	6.1	53.9	82.5	71.2	1444.9	161.7	1748.8	1619.8	593.7	829.2	196.8	106.8
1997	140.0	178.2	146.8	6.1	55.1	85.6	72.4	1472.0	178.6	1807.2	1665.1	614.0	855.6	195.5	108.3
1998	144.9	183.2	151.8	6.2	56.6	89.0	73.4	1500.6	197.2	1870.3	1713.7	636.0	883.9	193.8	110.0
1999	149.8	188.1	156.7	6.3	58.0	92.4	75.1	1529.7	217.4	1937.2	1764.7	659.8	913.7	191.1	112.0
2000	155.0	193.2	161.9	6.4	59.6	95.9	77.0	1559.5	239.4	2008.3	1818.2	685.5	945.1	187.6	114.0
2001	160.3	198.6	167.2	6.5	61.3	99.4	79.5	1589.5	263.3	2083.6	1874.1	713.0	978	183.1	116.3
GR	3.13	2.45	2.98	-0.1	2.21	3.75	1.20	1.89	9.60	3.30	2.75	3.29	3.21	-0.91	1.13

Note: GR= Growth rate in per cent per annum

Continue...Table 7: Base-line Simulation Values of the Endogenous Variables of the Disaggregate Model for the period 1992-93 to 2001-2002

Year	DMCF	EMCF	PMCF	DPMCF	DDSCF	EDSCF	PDSCF	DPDSCF	ECF	DKCF	PKCF	DPKCF
1992	1698.3	546.0	1698.3	65.3	11825.0	809.5	11825.0	67.0	1355.5	90.3	90.3	50.7
1993	1647.1	551.9	1647.1	62.7	12268.8	852.7	12268.8	64.6	1404.5	90.9	90.9	53.1
1994	1547.5	558.3	1547.5	60.5	12735.8	899.2	12735.8	63.1	1457.5	91.6	91.6	54.7
1995	1425.7	565.2	1425.7	58.5	13204.6	948.5	13204.6	62.2	1513.8	92.3	92.3	55.6
1996	1295.3	573.2	1295.3	56.6	13689.4	1000.4	13689.4	61.7	1573.6	93.0	93.0	56.2
1997	1163.7	582.8	1163.7	54.8	14185.5	1054.5	14185.5	61.4	1637.3	93.6	93.6	56.5
1998	1032.7	592.5	1032.7	53.0	14696.0	1110.6	14696.0	61.4	1703.0	94.3	94.3	56.6
1999	904.4	603.7	904.4	51.2	15217.5	1168.4	15217.5	61.4	1772.2	94.9	94.9	56.6
2000	778.9	615.7	778.9	49.5	15750.8	1227.9	15750.8	61.5	1843.6	95.5	95.5	56.5
2001	656.4	628.8	656.4	47.7	16294.0	1288.9	16294 2	61.6	1917.7	96.0	96.0	56.4
GR	-10.09	1.58	-10.09	-3.36	3.63	5.33	3.63	-0.77	3.95	0.70	0.70	0.99

Note: GR= Growth rate in per cent per annum

decline in the supply and production of cotton by 1 lakh bales. As a result of decline in the export of cotton by 5 lakh bales, deflated price of cotton would also decline by 4 units. It would bring an increase in the supply, production and consumption of cotton yarn by 37 thousand tonnes. The export of cotton yarn would not be influenced by the change in the export of cotton. Similarly, an increase in the export of cotton would bring reverse result in the cotton farming and spinning sector. Staple-wise forecast of the production of cotton shows that there is no significant change in the production of any staple group of cotton. Forecasts of the different counts of yarn shows that the impact of a decline inthe export of cotton would be high on medium count yarn followed by fine count yarn. The coarse count would experience a smaller amount of increase in its production as a result of decrease in export of cotton. The change in the export of cotton would bring a larger change in the demand for and the production of decentralised cotton fabric in comparison to mill cotton fabric.

Effect Of The Change In The Export Of Cotton Yarn On Indian Cotton Sector

The export of cotton yarn is another policy variable in the Cotton sector which government regulates through ceiling of the export of cotton yarn. Therefore, the impact of the increase of the export of cotton yarn on the Indian Cotton sector was assessed. Simulations were carried out to ascertain the impact of the policies intended towards increase in the export of cotton yarn under two scenarios. For these simulations, the intercepts of the export of cotton yarn equation were modified. The increase in the export of cotton yarn from its base level would bring an increase in all the endogenous variables of cotton farming and spinning sub-sectors except the deflated price of the cotton (appendix 3). The endogenous variables of weaving sector would remain unchanged. The staple-wise forecast shows that the change in the export of yarn would bring a larger change in the medium staple of cotton in comparison to other staples of cotton. Changes in the export of cotton yarn would bring larger changes in the coarse count of yarn followed by medium count yarn. The fine count yarn would experience the change of equal magnitude in the reverse direction.

Conclusions And Policy Implications

The econometric model developed for the Indian Cotton sector performs satisfactorily in terms of goodness fit, sign and significance of the coefficients. This model incorporates all major equations and variables in the system which explain the inter-linkages among the sectors in detail considering the quality of cotton, yarn, and fabric. It also explains the theoretical economic relationships among the variables and incorporates all important information gathered from our understanding of the Cotton sector. 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 simulation shows 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 simulation for the complete historical series as well as the recent past 11 year period historical series using actual and forecasted values of the exogenous variables. The performance of the export of yarn and mill and decentralised fabric are more sensitive to the forecasted values of exogenous variables. The Theil's values of the all endogenous variables in the static simulation, almost all endogenous variables in dynamic simulation for the complete historical period and dynamic simulations for 11 year period for both actual and forecasted values of exogenous variables are less than one. Theil's values of production of fine count yarn and demand for and production of khadi cotton fabric are greater than one in the dynamic simulation for the complete historical period. Theil's values of domestic consumption of cotton production of fine count yarn and deflated price of khadi cotton fabric are also more than one in both dynamic simulation of 11 year using actual and forecasted values of exogenous variables. The Ubias and Vbias values show that the model has been adequately specified.

The ex-post forecasts of the model for the year 1993-94 are also better for most of the endogenous variables particularly for the endogenous variables of spinning sector and weaving sector. The ex-post

forecasts for the endogenous variables of cotton farming sector are not very accurate due to abnormal fall of the production and supply of cotton in that year. Overall the equations of the systems would provide better ex-post forecasts for most of the endogenous variables of the systems.

The short-run multipliers of the lagged endogenous and exogenous variables and the long-run multipliers of the exogenous variables of the model have theoretically consistent signs and magnitudes.

The base-line simulation results of the endogenous variables in the model reveal that the domestic consumption of cotton will grow faster rate than the production of cotton. Staple-wise baseline simulation shows that the production of coarse staple will hover around 6-6.5 lakh bales. The production of long staple cotton will increase faster than the medium staple cotton. Base line results also showed that the price of the cotton would have a spiral tendency. In the spinning sector, the export of cotton yarn would increase with a substantially high growth rate (9.60 per cent per annum) during the simulation period. It is expected that it would reach a level of 263.3 thousand tonnes by 2001-2002 AD. The supply and production of cotton yarn would increase at a high growth rate compared to the growth rate of the consumption of the cotton yarn. Count-wise base line simulation shows that the production of coarse and medium count yarn will increase at almost same growth rate (3.2) during the simulation period. The production of fine count yarn will experience a marginal decline. It is expected that the deflated price of cotton yarn would increase at very slow growth rate. There would be a declining trend in the demand for, production and deflated price of mill fabric whereas, export of mill fabric will increase with a slow growth rate. Demand for and the production of decentralised fabric will increase at the growth rate of 3.63 per cent. The export of decentralised fabric will increase at a higher growth rate compared to the its demand and production. The deflated price of decentralised cotton fabric will decline at very low growth rate. The demand for, production and the price of khadi cotton fabric will remain more or less stagnant.

The simulation results shows that the endogenous variables of weaving sector would remain unchanged due to change in the export of both cotton and yarn. The change in the export of both cotton and yarn would influence the endogenous variables of cotton farming and spinning sector. The simulation results of two different policy variables shows that the promotion of export of yarn is more beneficial for the Indian Cotton sector than the export of cotton.

The results from the study reveal that the growth in the cotton sector would be low. The reasons may be the high growth of the consumption of man-made fibre and blended yarn and fabrics. The slow expansion of area of high yielding varieties under cotton, dependency of a larger percentage of area on the vagaries of the nature and high competition with other agricultural crops for the land keep the growth of the production of cotton at a slower rate. The structural analysis of aggregate model (Naik, Jain and Singh, 1997) shows that the expansion of area under high yielding varieties can accelerate the growth of the endogenous variables of cotton farming sector. Therefore, government should give a high thrust for the expansion of acreage under high yielding varieties. More liberal approach could be followed with respect to export of raw cotton as it does not have any adverse impact on the export of fabric. The export of yarn is another variable which needs more judicious treatment for the overall growth of the industry. The simulation results also give an indication that weaving sectors would experience a slower growth rate in comparison to the industrial growth rate. Therefore, appropriate measures should be taken to accelerate the growth of the weaving sector.

Appendix 1 (a): Short Run Elasticities of the Exogenous Variables for the Endogenous Variables													
Endogenous Variables	Exogenous Variables												
	DSC	EC	IC	DSC_{t-1}	DPPT	DPRT	SCY	DEPC	SCY_{t-1}	WY	DEPMF	DEPPF	DY
DCC	-0.310	-0.05	0.016	0.305	-0.739	-0.090	0	0	0	0	0	0	0
SC	0	0	0.012	0.223	-0.541	-0.066	0	0	0	0	0	0	0
P_dC	0	0	0	0	-0.707	-0.086	0	0	0	0	0	0	0
PSSC	0	0	0	0	-1.325	0	0	0	0	0	0	0	0
PMSC	0	0	0	0	-0.722	-0.195	0	0	0	0	0	0	0
PLSC	0	0	0	0	-0.603	0	0	0	0	0	0	0	0
DPC	0.360	0.064	-0.019	-0.354	0.854	0.101	0.091	-0.179	-0.005	0	-0.042	-0.005	0
DCCY	-0.076	-0.013	0.004	0.075	-0.180	-0.022	-0.047	0.015	0.036	0	-0.006	-0.001	0
ECY	0	0	0	0	0	0	0.672	-1.408	0	0	0	0	0
SCY	-0.071	-0.013	0.004	0.070	-0.168	-0.021	0.013	-0.025	0.033	0	-0.005	-0.001	0
P_dCY	-0.074	-0.013	0.004	0.072	-0.174	-0.021	0.013	-0.026	-0.001	0	-0.006	-0.001	0
PCCY	-0.031	-0.005	0.002	0.030	-0.073	-0.008	0.042	-0.088	0	0	-0.003	-0.0004	0
PMCY	-0.090	-0.016	0.005	0.089	-0.215	-0.027	0.004	-0.004	-0.001	0	-0.014	-0.002	0
PFCY	-0.131	-0.023	0.007	0.129	-0.314	-0.039	-0.034	0.065	0.003	0	0.015	0.002	0
DPCY	0.029	0.005	-0.002	-0.028	0.064	0.009	0.019	-0.006	-0.013	1.556	-0.114	-0.015	0
DMCF	0.0005	0.95	-0.290	-0.0005	0.001	0.000	0.0003	-0.0001	-0.0003	0.688	-0.085	0.002	0.147
EMCF	0	0	0	0	0	0	0	0	0	5.326	-0.655	0	0
P_dMCF	0.001	0.955	-0.290	-0.001	0.001	0.0003	0.0003	-0.0001	-0.0003	0.688	-0.085	0.002	0.147
DPMCF	0	0	0	0	0	0	0	0	0	0	0.007	0.002	0
DDSCF	-0.020	-0.004	0.001	0.020	-0.048	-0.006	-0.012	0.004	0.009	-0.133	0.083	-0.074	-0.133
EDSCF	0	0	0	0	0	0	0	0	0	1.724	0	-0.215	0
P_dDSCF	-0.020	-0.004	0.001	0.020	-0.048	-0.006	-0.012	0.004	0.009	-0.133	0.083	-0.074	-0.133
DPDSCF	0.003	0.001	-0.0002	-0.003	0	0	0	-0.001	0	0	-0.011	0.010	0
ECF	0	0	0	0	0	0	0	0	0	3.891	-0.394	-0.086	0
DKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
P_dKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
DPKCF	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1 (b): Long Run Elasticities of the Exogenous Variables for the Endogenous Variables													
	Exogenous Variables												
Endogenous Variables	DSC	EC	IC	DSC_{t-1}	DPPT	DPRT	SCY	DEPC	SCY_{t-1}	WY	DEPMF	DEPPF	DY
DCC	-0.205	-0.036	0.011	0.201	-0.4871	-0.060	0.046	-0.093	0	0	-0.013	0.001	0
SC	0.077	0.014	0.008	0.147	-0.357	-0.044	0.034	-0.068	0	0	-0.010	0.001	0
P_dC	0.101	0.018	-0.005	-0.099	-0.467	-0.058	0.044	-0.089	0	0	-0.012	0.001	0
PSSC	0.169	0.030	-0.009	-0.166	-0.946	0	0.069	-0.164	0	0	-0.023	0.002	0
PMSC	0.101	0.018	-0.005	-0.099	-0.482	-0.173	0.044	-0.087	0	0	-0.012	0.001	0
PLSC	0.092	0.016	-0.005	-0.09	-0.384	0.020	0.040	-0.079	0	0	-0.011	0.001	0
DPC	0.256	0.045	-0.014	-0.252	0.605	0.0781	0.1141	-0.225	-0.005	0	-0.032	0.003	0
DCCY	-0.155	-0.028	0.008	0.153	-0.369	-0.045	-0.040	0.007	0.033	0.133	-0.025	0.003	0.401
ECY	0	0	0	0	0	0	1.2491	-2.606	0	0	0	0	0
SCY	-0.145	-0.026	0.008	0.143	-0.345	-0.042	0.034	-0.065	0.031	0.125	-0 023	0.003	0.375
P_dCY	-0.150	-0.027	0.008	0.148	-0.357	-0.044	0.0357	-0.068	-0.003	0.129	-0.024	0.003	0 388
PCCY	-0.051	-0.009	0.003	0.050	-0.121	-0.014	0 094	-0.1927	-0.002	0	-0.016	0 002	0
PMCY	-0.150	-0.026	0.008	0.147	-0.355	-0.044	0.054	-0.098	-0 006	0.267	-0.053	0.006	0 800
PFCY	-0.423	-0.075	0.023	0.416	-1.003	-0.121	-0.185	0.373	0.005	0	0.052	-0.006	0
DPCY	0.068	0.012	-0.004	-0.067	0.153	0.018	0.019	-0.003	-0.013	1.556	-0.126	0.014	0
DMCF	0.008	0.001	-0.0004	-0.008	0.020	0.002	0.002	-0.0004	-0.002	1.081	-0.206	0.078	0.737
EMCF	0	0	0	0	0	0	0	0	0	5.326	-0.655	0	0
P_d MCF	0.008	0.001	-0.0004	-0.008	0.020	0.002	0.002	-0.0004	-0.002	1.081	-0.206	0.078	0.737
DPMCF	0.003	0.0006	-0.0002	-0.003	0.048	0	0	0	0	0	0.015	0.032	0
DDSCF	-0.045	-0.008	0.002	0.044	-0.106	-0.013	-0.012	0.002	0.010	2.453	0.084	-0.420	-0.398
EDSCF	0	0	0	0	0	0	0	0	0	8.620	0	-1.130	0
P_dDSCF	-0.045	-0.008	0.002	0.044	-0.106	-0.013	-0.012	0.002	0.010	2.453	0.084	-0.420	-0.398
DPDSCF	0.017	0.003	-0.001	-0.017	0.047	0	0.006	-0.001	-0.005	-1.910	-0.035	0.176	0
ECF	0	0	0	0	0	0	0	0	0	6.638	-0.394	-0.450	0
DKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
P_dKCF	0	0	0	0	0	0	0	0	0	0	0	0	0
DPKCF	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 2 (a) : Simulated Values of the Endogenous Variables of *Cotton Farming Sector* for the Period 1992-93 to 2001-2002 (Base-run, decrease of export of Cotton (a) 5 lakh bales and increase of export of cotton (b) 5 and (c) 10 lakh bales)

Year	DCC	DCCa	DCCb	DCCc	SC	SCa	SCb	SCc	P_dC	P_dCa	P_dCb	PCc	PSS C	PSS Ca	PSS Cb	PSS Cc	PMS C	PMS Ca	PMS Cb	PMS Cc	PLS C	PLS Ca	PLSC b	PLSC c	DP C	DP Ca	DP Cb	DP Cc
1992	124.8	129.8	119.8	114.8	163.0	163.0	163.0	163.0	131.7	131.7	131.7	131.7	7.0	7.0	7.0	7.0	51.8	51.8	51.8	51.8	72.8	72.8	72.8	72.8	69	64	75	80
1993	121.5	124.1	118.9	116.3	159.8	157.4	162.1	164.5	128.4	126.0	130.8	133.2	6.0	5.7	6.4	6.7	49.7	48.7	50.7	51.8	72.6	71.6	73.7	74.7	74	71	77	79
1994	127.9	131.6	124.2	120.5	166.1	164.8	167.4	168.7	134.8	133.5	136.1	137.4	6.3	6.1	6.5	6.6	51.8	51.2	52.4	52.9	76.7	76.1	77.2	77.8	70	66	74	78
1995	130.7	133.8	127.5	124.3	168.9	167.1	170.7	172.6	137.5	135.7	139.4	141.2	6.1	5.8	6.3	6.5	52.4	51.6	53.1	53.9	79.1	78.3	79.9	80.7	71	68	75	78
1996	135.7	139.1	132.3	128.9	173.9	172.3	175.5	177.1	142.5	140.9	144.1	145.7	6.1	5.9	6.4	6.6	53.9	53.2	54.6	55.3	82.5	81.8	83.2	83.9	71.	66	75	79
1997	140.0	143.3	136.7	133.4	178.2	176.5	179.9	181.6	146.8	145.1	148.5	150.3	6.1	5.9	6.4	6.6	55.1	54.3	55.8	56.6	85.6	84.9	86.4	87.1	72	69	76	80
1998	144.9	148.3	141.6	138.3	183.2	181.5	184.8	186.5	151.8	150.1	153.4	155.1	6.2	6	6.4	6.6	56.6	55.8	57.3	58	89	88.3	89.7	90.5	73	70	77	81
1999	149.8	153.1	146.5	143.2	188.1	186.4	189.7	191.4	156.7	155.0	158.4	160.1	6.3	6	6.5	6.7	58	57.3	58.8	59.5	92.4	91.6	93.1	93.9	75	71	79	82.
2000	155.0	158.3	151.7	148.4	193.2	191.6	194.9	196.6	161.9	160.2	163.5	165.2	6.4	6.1	6.6	6.8	59.6	58.9	60.4	61.1	95.9	95.1	96.6	97.3	77	73	81	84
2001	160.3	163.6	157.0	153.7	198.6	196.9	200.2	201.9	167.2	165.5	168.9	170.6	6.5	6.2	6.7	6.9	61.3	60.5	62	62.7	99.4	98.7	100.2	100.9	80	76	83	87

Appendix 2 (b) : Simulated Values of the Endogenous Variables of *Spinning Sector* for the Period 1992-93 to 2001-2002 (Base -run, decrease of export of cotton (a) 5 lakh bales and increase of export of cotton (b) 5 (c) 10 lakh bales)

Year	DCCY	DCCYa	DCCYb	DCCYc	ECY	ECYa	ECYb	ECYc	SCY	SCYa	SCYb	SCYc	P_dCY	P_dCYa	P_dCYb	P_dCYc
1992	1345.5	1361	1330	1314.4	119.6	119.6	119.6	119.6	1561.6	1577.1	1546	1530.5	1474.1	1489.6	1458.5	1443
1993	1365.3	1383.6	1346.9	1328.5	123.9	123.9	123.9	123.9	1595.5	1613.8	1577.1	1558.7	1499	1517.4	1480.7	1462.3
1994	1394.1	1417.8	1370.4	1346.7	133.7	133.7	133.7	133.7	1644.9	1668.6	1621.2	1597.5	1538 6	1562.3	1514.9	1491.2
1995	1417.8	1443.4	1392.2	1366.5	146.6	146.6	146.6	146.6	1693.4	1719	1667.8	1642.1	1576.3	1601.9	1550.7	1525.1
1996	1444.9	1472.6	1417.2	1389.5	161 7	161.7	161.7	161.7	1748.8	1776.4	1721.1	1693.4	1619.8	1647.4	1592.1	1564.4
1997	1472	1500.7	1443.2	1414.5	178.6	178.6	178.6	178.6	1807.2	1835.9	1778.5	1749.7	1665.1	1693.8	1636.3	1607.6
1998	1500.6	1530.2	1471	1441.4	197.2	197.2	197.2	197.2	1870.3	1899.9	1840.7	1811.1	1713.7	1743.3	1684.1	1654.5
1999	1529.7	1559.9	1499.5	1469.4	217.4	217.4	217.4	217.4	1937.2	1967.4	1907	1876.9	1764.7	1794.8	1734.5	1704.3
2000	1559.5	1590.1	1528.9	1498.3	239.4	239.4	239.4	239.4	2008.3	2038.9	1977.7	1947.1	1818.2	1848.8	1787.6	1757
2001	1589.5	1620.4	1558.6	1527.7	263.3	263.3	263.3	263.3	2083.6	2114.5	2052.7	2021.8	1874.1	1905	1843.2	1812.3

....continue appendix 2 (b) : Simulated Values of the Endogenous Variables of *Spinning Sector* for the Period 1992-93 to 2001-2002 (Base-run, decrease of export of cotton (a) 5 lakh bales and increase of export of cotton (b) 5 (c) 10 lakh bales)

Year	PCCY	PCCYa	PCCYb	PCCc	PMCY	PMCYa	PMCYb	PMCYc	PFCY	PFCYa	PFCYb	PFCYc	DPCY	DPCYa	DPCYb	DPCYc
1992	535.9	538.4	533.5	531.1	736.4	745.6	727.1	717.9	201.7	205.6	197.9	194	106	105.5	106.5	107
1993	544.6	547.3	541.8	539	756.1	766.6	745.6	735.1	198.3	203.4	193.3	188.2	105.1	104.5	105.7	106.3
1994	558.9	562.4	555.4	551.9	781.3	794.6	768.1	754.8	198.4	205.3	191.4	184.5	105	104.2	105.8	106.6
1995	575.1	578.8	571.4	567.7	803.8	817.8	789.8	775.9	197.4	205.4	189.5	181.5	105.7	104.8	106.5	107.4
1996	593.7	597.6	589.8	585.9	829.2	844	814.4	799.6	196.8	205.8	187.9	178.9	106.8	105.8	107.7	108.7
1997	614	617.9	610	606	855.6	870.6	840.5	825.4	195.5	205.2	185.9	176.2	108.3	107.3	109.3	110.3
1998	636	640.1	632	627.9	883.9	899.2	868.6	853.3	193.8	204	183.5	173.2	110	108.9	111.1	112.1
1999	659.8	663.9	655.8	651.7	913.7	929.1	898.3	883	191.1	201.9	180 4	169.7	112	110.9	113	114.1
2000	685.5	689.6	681.4	677.3	945.1	960.6	929.7	914.3	187.6	198.7	176.5	165.5	114	112.9	115.2	116.3
2001	713	717.1	708.9	704.8	978	993.5	962.6	947.2	183.1	194.5	171.7	160.4	116.3	115.1	117.4	118.5

Appendix 2 (c) : Simulated Values of the Endogenous Variables of *Mill Unit* for the Period 1992-93 to 2001-2002 (Base- run, decrease of export of cotton (a) 5 lakh bales and increase of export of cotton (b) 5 and (c) 10 lakh bales)

Year	DCMF	DCMFa	DCMFb	DCMFc	ECMF	ECMFa	ECMFb	ECMFc	P_dMCF	P_dMCFa	P_dMCFb	P_dMCFc	DPMCF	DPMCFa	DPMCFb	DPMCFc
1992	1698.3	1698	1698.6	1698.9	546	546	546	546	1698.3	1698	1698.6	1698.9	65.3	65.3	65.3	65.3
1993	1647.1	1646.3	1647.8	1648.5	551.9	551.9	551.9	551.9	1647.1	1646.3	1647.8	1648.5	62.7	62.7	62.7	62.7
1994	1547.5	1546.2	1548.7	1550	558.3	558.3	558.3	558.3	1547.5	1546.2	1548.7	1550	60.5	60.4	60.5	60.5
1995	1425.7	1423.9	1427.5	1429.2	565.2	565.2	565.2	565.2	1425.7	1423.9	1427.5	1429.2	58.5	58.4	58.5	58.5
1996	1295.3	1293	1297.6	1299.9	573.2	573.2	573.2	573.2	1295.3	1293	1297.6	1299.9	56.6	56.5	56.6	56.7
1997	1163.7	1160.9	1166.4	1169.1	582.8	582.8	582.8	582.8	1163.7	1160.9	1166.4	1169.1	54.8	54.7	54.8	54.8
1998	1032.7	1029.5	1035.8	1038.9	592.5	592.5	592.5	592.5	1032.7	1029.5	1035.8	1038.9	53	52.9	53	53.1
1999	904.4	901	907.9	911.3	603.7	603.7	603.7	603.7	904.4	901	907.9	911.3	51.2	51.2	51.3	51.3
2000	778.9	775.2	782.6	786.3	615.7	615.7	615.7	615.7	778.9	775.2	782.6	786.3	49.5	49.4	49.5	49.6
2001	656.4	652.6	660.3	664.2	628.8	628.8	628.8	628.8	656.4	652.6	660.3	664.2	47.7	47.7	47.8	47.8

Appendix 2 (d) : Simulated Values of the Endogenous Variables of ***Decentralised Units*** for the Period 1992-93 to 2001-2002 (Base- run, decrease of export of cotton (a) 5 lakh bales and increase of export of cotton (b) 5 and (c) 10 lakh bales)

Year	DCDSCF	DCDSCF a	DCDSCF b	DCDSCF c	EDSCF	EDSCFa	EDSCFb	EDSCFc	P_dDSCF	P_dDSCFa	P_dDSCFb	P_dDSCFc	DPDS CF	DPDS CFa	DPDS CFb	DPD SCFc
1992	11825	11850	11800	11774.9	809.5	809.5	809.5	809.5	11825	11850	11800	11774.9	67	67	67.1	67.1
1993	12268.8	12299	12238.6	12208.4	852.7	852.7	852.7	852.7	12268.8	12299	12238.6	12208.4	64.6	64.6	64.7	64.8
1994	12735.8	12775.1	12696.5	12657.2	899.2	899.2	899.2	899.2	12735.8	12775.1	12696 5	12657.2	63.1	63	63.2	63 4
1995	13204.6	13247.6	13161.6	13118.7	948.5	948.5	948.5	948.5	13204.6	13247.6	13161.6	13118.7	62.2	62.1	62.4	62.5
1996	13689.4	13736.2	13642.7	13595.9	1000.4	1000.4	1000.4	1000.4	13689.4	13736.2	13642.7	13595.9	61.7	61.5	61.9	62
1997	14185.5	14234.4	14136.7	14087.8	1054.5	1054.5	1054.5	1054.5	14185.5	14234.4	14136.7	14087.8	61.4	61.3	61.6	61.8
1998	14696	14746.7	14645.4	14594.7	1110.6	1110.6	1110.6	1110.6	14696	14746.7	14645.4	14594.7	61.4	61.2	61.6	61 8
1999	15217.5	15269.3	15165.7	15113.9	1168.4	1168.4	1168.4	1168.4	15217.5	15269.3	15165.7	15113.9	61.4	61.2	61.6	61.8
2000	15750.8	15803.5	15698.1	15645.4	1227.9	1227.9	1227.9	1227.9	15750.8	15803.5	15698.1	15645.4	61.5	61.3	61.7	62
2001	16294.2	16347.5	16240.9	16187.6	1288.9	1288.9	1288.9	1288.9	16294.2	16347.5	16240.9	16187.6	61.6	61.4	61.9	62.1

Appendix 2 (e) : Simulated Values of the Endogenous Variables of *Khadi Sector* for the Period 1992-93 to 2001-2002 (Base run, decrease of export of cotton (a) 5 lakh bales and increase of export of cotton (b) 5 (c) 10 lakh bales)

Year	ECF	ECFa	ECFb	ECFc	DCKC F	DCKC Fa	DCKC Fb	DCKC Fc	P_dKCF	P_dKCF a	P_dKCF b	P_dKCF c	DPKC F	DPKC Fa	DPKC Fb	DPKC Fc
1992	1355.5	1355.5	1355.5	1355.5	90.3	90.3	90.3	90.3	90.3	90.3	90.3	90.3	50.7	50.7	50.7	50.7
1993	1404.5	1404.5	1404.5	1404 5	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	53.1	53.1	53.1	53.1
1994	1457.5	1457.5	1457.5	1457.5	91.6	91.6	91.6	91 6	91.6	91.6	91.6	91.6	54.7	54.7	54.7	54.7
1995	1513.8	1513.8	1513.8	1513.8	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	55.6	55.6	55.6	55.6
1996	1573.6	1573.6	1573.6	1573.6	93	93	93	93	93	93	93	93	56.2	56.2	56.2	56.2
1997	1637.3	1637.3	1637.3	1637.3	93.6	93.6	93.6	93.6	93.6	93.6	93 6	93.6	56 5	56.5	56 5	56 5
1998	1703	1703	1703	1703	94.3	94.3	94.3	94 3	94 3	94.3	94 3	94.3	56.6	56.6	56.6	56 6
1999	1772.2	1772.2	1772.2	1772.2	94.9	94.9	94.9	94.9	94.9	94.9	94.9	94.9	56.6	56.6	56.6	56.6
2000	1843.6	1843.6	1843.6	1843.6	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	56 5	56.5	56.5	56.5
2001	1917.7	1917.7	1917.7	1917.7	96	96	96	96	96	96	96	96	56.4	56.4	56.4	56.4

Appendix 3 (a) : Simulated Values of the Endogenous Variables of *Cotton Farming* sub- sector for the Period 1992-93 to 2001-2002 (Base run and Increase of export of cotton yarn (a) 25 and (b) 50 thousand tonnes

Year	DCC	DCCa	DCCb	SC	SCa	SCb	P_dC	P_dCa	P_dCb	PSSC	PSSCa	PSSCb	PMSC	PMSCa	PMSCb	PFSC	PFSCa	PFSCb	DPC	DPCa	DPCb
1992	124.8	124.8	124.8	163	163	163.0	131.7	131.7	131.7	7.0	7.0	7.0	51.8	51.8	51.8	72.8	72.8	72.8	69.4	77.0	84.5
1993	121.5	125	128.5	159.8	163.2	166.7	128.4	131.8	135.3	6.0	6.5	6.9	49.7	51.2	52.7	72.6	74.1	75.7	73.8	81.2	88.6
1994	127.9	131.3	134.8	166.1	169.6	173.0	134.8	138.2	141.6	6.3	6.7	7.2	51.8	53.3	54.8	76.7	78.1	79.6	70.1	79.2	88.2
1995	130.7	134.8	139	168.9	173.1	177.2	137.5	141.7	145.8	6.1	6.6	7.2	52.4	54.2	56.0	79.1	80.9	82.7	71.4	80.4	89.4
1996	135.7	139.8	144	173.9	178	182.2	142.5	146.7	150.8	6.1	6.7	7.2	53.9	55.7	57.5	82.5	84.3	86.1	71.2	80.6	89.9
1997	140	144.3	148.6	178.2	182.5	186.8	146.8	151.1	155.4	6.1	6.7	7.3	55.1	57.0	58.8	85.6	87.5	89.4	72.4	81.7	91
1998	144.9	149.2	153.5	183.2	187.5	191.7	151.8	156.1	160.4	6.2	6.8	7.3	56.6	58.4	60.3	89.0	90.9	92.7	73.4	82.8	92.2
1999	149.8	154.2	158.5	188.1	192.4	196.7	156.7	1610	165.3	6.3	6.8	7.4	58	59.9	61.8	92.4	94.3	96.1	75.1	84.5	93.9
2000	155	159.3	163.7	193.2	197.6	201.9	161.9	166 2	170.5	6.4	6.9	7.5	59.6	61.5	63.4	95 9	97.8	99.6	77.0	86 5	95.9
2001	160.3	164.7	169	198 6	202.9	207.2	167.2	171.5	175.8	6.5	7.0	7.6	61.3	63 2	65	99.4	101.3	103.2	79.5	88.9	98.3

Appendix 3 (b) : Simulated Values of the Endogenous Variables of *Yarn sub- sector* for the Period 1992-93 to 2001-2002 (Base run and Increase of export of cotton yarn (a) 25 and (b) 50 thousand tonnes)

Year	DCCY	DCCY a	DCCY b	ECY	ECYa	ECYb	SCY	SCYa	SCYb	P_dCY	P_dCYa	P_dCYb	PCCY	PCCY a	PCCY b	PMCY	PMCY a	PMCY b	PFCY	PFCY a	PFCY b	DPC Y	DPC Ya	DPC Yb
1992	1345.5	1336.5	1327.6	119.6	144.6	169.6	1561.6	1577.6	1593.6	1474.1	1490.1	1506.1	535.9	556.3	576.6	736.4	737.7	739.0	201.7	196.2	190.6	106	106	107
1993	1365.3	1359.7	1354.2	123.9	160.4	196.9	1595.5	1626.4	1657.3	1499.0	1530.0	1560.9	544.6	576.1	607.7	756.1	765.3	774.5	198.3	188.5	178.6	105	105	106
1994	1394.1	1389.5	1384.9	133.7	175.5	217.3	1644.9	1682.1	1719.3	1538.6	1575.8	1613.0	558.9	596.1	633.3	781.3	795.7	810.1	198.4	184.0	169.6	105	105	105
1995	1417.8	1415 2	1412.7	146.6	190.8	235.1	1693.4	1735.1	1776.8	1576.3	1618.0	1659.7	575.1	615.4	655.8	803.8	823.0	842 2	197.4	179.5	161.7	106	106	106
1996	1444.9	1443.0	1441.2	161.7	207.1	252.4	1748.8	1792.2	1835.7	1619.8	1663.2	1706.7	593.7	636.8	677.8	829.2	851.5	873.8	196 8	176.0	155.1	107	107	107
1997	1472.0	1470.6	1469.2	178.6	224.5	270.3	1807.2	1851.6	1896.1	1665.1	1709.5	1754.0	614.0	657.0	700.1	855.6	880.1	904.7	195.5	172.4	149.2	108	108	108
1998	1500.6	1499 1	1497.7	197.2	243.3	289.3	1870.3	1914.9	1959.5	1713.7	1758.3	1802.9	636.0	679.7	723.3	883.9	909.9	936.0	193.8	168.7	143.7	110	110	110
1999	1529.7	1528.0	1526.3	217.4	263.6	309.8	1937.2	1981.7	2026.2	1764.7	1809.2	1853.7	659.8	703.8	747.8	913.7	940.7	967.8	191.1	164.6	138.1	112	112	112
2000	1559.5	1557.4	1555.4	239.4	285.7	331.9	2008.3	2052.6	2096.8	1818.2	1862.5	1906.7	685.5	729.7	773.9	945.1	972.8	1000.5	187.6	160.0	132.3	114	114	114
2001	1589.5	1587.1	1584.8	263.3	309.6	355.9	2083.6	2127.5	2171.4	1874.1	1918.1	1962.0	713.0	757.3	801.6	978.0	1006.2	1034.3	183.1	154.6	126.0	116	116	116

Appendix 3 (c): Simulated Values of the Endogenous Variables of *Mill sub-sector* for the Period 1992-93 to 2001-2002 (Base run and increase of export of cotton yarn (a) 25 and (b) 50 thousand tonnes)

Year	DCMCF	DCMCFa	DCMCFb	EMCF	EMCFa	EMCFb	P_dMCF	P_dMCFa	P_dMCFb	DPMCF	DPMCFa	DPMCFb
1992	1698.3	1698.4	1698.6	546	546	546	1698.3	1698.4	1698.6	65.3	65.3	65.3
1993	1647.1	1647.4	1647.7	551.9	551.9	551.9	1647.1	1647.4	1647.7	62.7	62.7	62.7
1994	1547.5	1547.9	1548.3	558.3	558.3	558.3	1547.5	1547.9	1548.3	60.5	60 5	60.5
1995	1425.7	1426.1	1426.6	565.2	565.2	565.2	1425.7	1426.1	1426.6	58.5	58 5	58.5
1996	1295.3	1295.8	1296.2	573.2	573.2	573.2	1295.3	1295.8	1296.2	56.6	56.6	56.6
1997	1163.7	1164.1	1164.5	582.8	582.8	582.8	1163.7	1164.1	1164.5	54.8	54.8	54.8
1998	1032.7	1033	1033.4	592.5	592.5	592.5	1032.7	1033	1033.4	53	53	53
1999	904.4	904.8	905.1	603.7	603.7	603.7	904.4	904.8	905.1	51.2	51.2	51.2
2000	778.9	779.3	779.6	615.7	615.7	615.7	778.9	779.3	779.6	49.5	49.5	49.5
2001	656.4	656.8	657.1	628.8	628.8	628.8	656.4	656.8	657.1	47.7	47.7	47.7

Appendix 3 (d): Simulated Values of the Endogenous Variables of *Decentralised sub-sector* for the Period 1992-93 to 2001-2002 (Base run and increase of export of cotton yarn (a) 25 and (b) 50 thousand tonnes)

Year	DCDSCF	DDSCFa	DDSCFb	EDSCF	EDSCFa	EDSCFb	P_dDSCF	P_dDSCFa	P_dDSCFb	DPDSCF	DPDSCFa	DPDSCFb
1992	11825	11810.6	11796.1	809.5	809.5	809.5	11825	11810.6	11796.1	67	67	67.1
1993	12268.8	12259.5	12250.2	852.7	852.7	852.7	12268 8	12259.5	12250 2	64 6	64 7	64.7
1994	12735.8	12727.9	12720	899.2	899.2	899.2	12735.8	12727.9	12720	63.1	63 2	63.2
1995	13204.6	13200	13195.5	948.5	948.5	948.5	13204.6	13200	13195.5	62.2	62.2	62.3
1996	13689.4	13686	13682.5	1000.4	1000.4	1000.4	13689.4	13686	13682.5	61.7	61.7	61.8
1997	14185.5	14182.9	14180.2	1054.5	1054.5	1054.5	14185.5	14182.9	14180.2	61.4	61.5	61.5
1998	14696	14693.3	14690.6	1110.6	1110.6	1110.6	14696	14693.3	14690.6	61.4	61.4	61.4
1999	15217.5	15214.5	15211.5	1168.4	1168.4	1168.4	15217.5	15214.5	15211.5	61.4	61.4	61.4
2000	15750.8	15747.3	15743.8	1227.9	1227.9	1227.9	15750.8	15747.3	15743.8	61.5	61.5	61.5
2001	16294.2	16290.2	16286.1	1288.9	1288.9	1288.9	16294.2	16290.2	16286.1	61.6	61.7	61.7

Appendix 3 (e): Simulated Values of the Endogenous Variables of *Khadi* sub-sector for the Period 1992-93 to 2001-2002 (Base run and Icrease of export of cotton yarn (a) 25 and (b) 50 thousand tonnes)

Year	ECF	ECFa	ECFb	DKCF	DKCF a	DKCF b	P_dKCF	P_dKCF a	P_dKCF b	DPKCF	DPKCFa	DPKCFb
1992	1355.5	1355.5	1355.5	90.3	90.3	90.3	90.3	90.3	90.3	50.7	50.7	50.7
1993	1404.5	1404.5	1404.5	90.9	90.9	90.9	90.9	90.9	90.9	53.1	53.1	53.1
1994	1457.5	1457.5	1457.5	91.6	91.6	91.6	91.6	91.6	91.6	54.7	54.7	54.7
1995	1513.8	1513.8	1513.8	92.3	92.3	92.3	92.3	92.3	92.3	55.6	55.6	55.6
1996	1573.6	1573 6	1573.6	93	93	93	93	93	93	56.2	56.2	56.2
1997	1637.3	1637.3	1637.3	93.6	93.6	93.6	93.6	93.6	93.6	56.5	56.5	56.5
1998	1703	1703	1703	94.3	94.3	94.3	94.3	94.3	94.3	56.6	56.6	56.6
1999	1772.2	1772.2	1772 2	94.9	94.9	94.9	94.9	94 9	94.9	56.6	56 6	56.6
2000	1843.6	1843.6	1843 6	95 5	95.5	95 5	95.5	95.5	95.5	56 5	56.5	56.5
2001	1917.7	1917 7	1917.7	96	96	96	96	96	96	56.4	56 4	56.4

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