THE WORLD MARKET FOR JUTE:

AN ECONOMETRIC ANALYSIS

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AN ECONOMETRIC ANALYSIS

by

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TO MY PARENTS

ABSTRACT

This study is an empirical analysis of the international market for raw jute and jute manufactures. The object of the study is to build and estimate an annual simultaneous equation model of the world jute market for the post-Second World War years. The chief purpose of the model is to determine the most important dynamic aspects of this market and, in particular, the causes of the high variability of the world jute prices.

The supply side of the model involves the specification and estimation of dynamic equations relating to the annual production of both raw jute and jute manufactures. In the case of raw jute production, equations are estimated for three major producing nations and for the "Rest-of-the-World"; in the case of jute manufactures, there are equations for six major producing nations as well as for a "Rest-of-the-World" sector. In general, jute farmers and the producers of jute manufactures are found to be responsive to economic incentives.

The demand side of the model is constructed by specifying and estimating equations explaining the annual net consumption demand of jute manufactures for Bangladesh and India. In the case of other five countries/regions, first, the total current consumption demand for jute manufactures and synthetic substitutes are estimated together and, then, the relative

shares of the two are determined. In contrast to the fairly uniform results obtained for the jute production equations, the effects of change in one of the explanatory variables on jute consumption are found to vary widely for the countries studied.

Equations explaining end-of-the-year stocks of both raw jute and jute manufactures in the major producing countries have been specified and estimated. Finally, the price equations, explaining the formation of world prices of raw jute and jute manufactures and their relationship with the domestic prices in the major producing countries, have been estimated to complete the empirical model.

The final model contains thirty-nine stochastic equations and twenty-five identities, and is decomposed into two blocks: a recursive block, which is estimated by ordinary least squares, and a simultaneous block, which is estimated by two-stage least squares. The study then proceeds to examine the qualitative characteristics of the model by conducting simulation experiments over part of the period of estimation. The model is further tested to explore some interesting hypothetical forms of international jute agreements. Moreover, simulations over future periods are also investigated in order to obtain conditional forecasts and to explore further some of the hypothetical international agreements. In general, during the sample period, the basic simulation traces quite satisfactorily, on both the aggregate and the disaggregate level, the trajectories of the important endogenous variables in the model. The simulations over the 1974-1990 period imply practically a stagnation of the position with relatively small increases in world production, consumption, and prices. Moreover, the present trend of decreasing the consumption of jute manufactures in the developed countries is expected to continue.

Finally, in respect to possible institution of various international agreements to benefit (in part, at least) the raw jute producers, it has been found that, in most cases, these programs will have very limited benefits (although both the producers and the consumers might benefit from increased price stability) due to high and increasing elasticity of substitution between jute and the synthetic substitutes.

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CHAPTER ONE

INTRODUCTORY REMARKS

1.1 Introduction

This study presents an annual model of the post-Second World War jute[1] market. The model is developed in order to analyze the dynamic inter-relationships between jute production, consumption, inventory accumulation, and prices, and thereby to explain the functioning of the world market and the fluctuations in jute prices.

There are a number of aspects of the world jute market that make it an interesting subject for analysis. Although government influence or participation in jute production and marketing occurs to varying degrees in some of the major jute producing countries, the international price of raw jute (and hence, of jute manufactures) is determined essentially by the interaction of the forces of demand and supply. Since jute is predominantly a product of subsistence agriculture in a few developing countries, for which the largest consumers are the major developed countries of the world, a very high percentage of world production of jute enters international trade either in the raw or processed form. Moreover, it is an important source of foreign exchange for the principal producing countries of Bangladesh, India, and Thailand. In the case of Bangladesh, for example, jute is by far the most important commodity exported and manufactured, accounting for more than 90 percent of total export proceeds of all merchandise in recent years. The great importance of raw jute to the major consumers is due to the fact that the cost of raw materials constitutes an unusually high proportion of the gross product of these industries. Thus, both producers and consumers are extremely interested in the high variability in world jute prices.

Unfortunately, there are very few previous important studies of this major commodity market. This is not surprising, since our understanding of the structure and operational characteristics of primary commodity markets has not kept pace with interest in their control or regulation. Knowledge in general, and quantitative information in particular, is lacking in many commodity markets in the world. However, since the surge of commodity prices in 1973-74 and the demand by the Third World countries for the creation of a "New International Economic Order" in order to "redress existing injustices" and "make it possible to eliminate the widening gap between the developed and the developing countries", a high emphasis has been placed on international commodity trade.[2] Such an emphasis is not misplaced, since given the slow rate of growth and uncertainty involved in most other foreign exchange sources, exports have been and will continue to be the major source of foreign exchange for most of the developing countries. The availability of foreign exchange has long been considered in the development literature to be one of the most important constraints in the process of development and considerable expansion of foreign exchange earnings for these countries is almost a necessity if there is to be a reasonable probability of fulfillment of their planned target of economic emancipation[3].

However, to determine the optimal strategy for the increase of export earnings for such countries requires knowledge of the prospects in the traditional (and largely primary product) export markets, since most of the developing countries depend on a few primary products for the bulk of their total export earnings (see Table 1.1). In the past, these markets have been analyzed on the basis of fairly simple models with forecasts generated basically by trend extrapolations with assumed values of the parameters. Though such methods have the advantages of simplicity and computational speed, they might often be

TABLE 1.1

INDICES OF CONCENTRATION BY COUNTRIES FOR PRODUCTION, EXPORTS,

AND IMPORTS OF SOME IMPORTANT COMMODITIES

Commodities	Production in 1972-1973: Concentration Ratios[a] 4 Countries	Production in 1972-1973: Concentration Ratios[a] 8 Countries	Production in 1972-1973: Herfundahl-Hirschman Index[b]	Exports in 1970-1972: Concentration Ratios[a] 4 Countries	Exports in 1970-1972: Concentration Ratios[a] 8 Countries	Exports in 1970-1972: Herfundahl-Hirschman Index[b]	Imports in 1970-1972: Concentration Ratios[a] 4 Countries	Imports in 1970-1972: Concentration Ratios[a] 8 Countries	Imports in 1970-1972: Herfundahl-Hirschman Index[b]
1. Jute	98	100	.47	81[c]	81[c]	.29[c]	38	47	.07
2. Coffee	43	64	.07	56	71	.13	63	76	.17
3. Cocoa	73	87	.16	76	100	.19	55	73	.10
4. Tea	65	76	.20	77	92	.22	51	63	.11
5. Sugar	32	47	.03	54	71	.13	60	72	.13
6. Cotton	63	81	.12	48	67	.08	38	57	.07
7. Rubber	84	93	.26	90	96[d]	.33[d]	-	65	.04
8. Copper	56	80	.10	70	90	.14	63	82	.13
9. Tin	66	89	.14	79	94	.23	63	80	.14
10. Wheat	61	73	.12	-	-	-	-	-	-

Note: a The percentage share accounted for by 4 and 8 leading countries.
b The sum of the squares of the shares. The fewer the number of participants and the larger the share of the dominant producer, the higher the index will be. For a monopolist or monopsonist, it becomes one.
c Three countries only.
d Seven countries only.
Source: Adapted from Behrman, J.R., "International Commodity Agreements", A Development Council New International Economic Order Research Project, 30 October, 1976, Table 10.

misleading due to failure to capture the inherent characteristics of the markets. Moreover, the availability of substantial quantitative information on these markets makes possible the formulation of models incorporating their dynamic structure. As Adams and Behrman[4] have put it:

> "Models serve as a means for better understanding the structure and parameters of the behavioral relationships underlying commodity markets. At the same time, the models provide simulation instruments which can be used for analyzing market properties. They can be used for prediction and policy studies--for example, for testing the operation of stabilization schemes under alternative assumed conditions. Commodity market models can be the instrument to link the commodity markets to models of the producer and consumer countries."

Based on such advantages, econometric models of commodity markets have recently emerged as an effective new approach in this field for better understanding of the principal world markets for agricultural products and their analysis.[5]

In the case of jute, however, there has not been any comprehensive study so far, and the studies cited in the bibliography are either purely descriptive or concentrate on particular subsectors or aspects of the market. The purpose of this study is to specify and estimate the most important structural relationships in the world jute market, incorporating both the raw jute and jute manufacturing sectors. Particular emphasis is given to the distributed-lag nature of many of these relationships; in this respect, the study owes much to the pioneering work of Nerlove on agricultural markets.[6] The resulting structural model is then utilized for conditional non-stochastic forecasts. However, such a procedure has its obvious limitations, which are discussed below. Nevertheless, to quote from Behrman[7]:

> "Despite such limitations, however, in terms of understanding how the market functions and thus what are reasonable prospects, the estimation-simulation procedure seems clearly to have substantial advantages over the standard alternative. The available information is much more efficiently utilized together with a priori theorizing in the determination of the structure. Hypotheses are statistically tested at least on a single equation basis (albeit, under fairly restrictive assumptions about specification). The impacts of hypothetical changes in structural parameters are examined easily in simulations."

Although the resulting world model of jute is necessarily highly aggregated, consisting of only thirty-nine equations, and the specifications of the relationships are quite simple due to data limitations, the model does provide a useful means of analyzing the interactions of the different sectors of the market over time. In addition to the analysis of the market, the study also provides further evidence for the debate over the supply responsiveness of peasant producers since jute is primarily a product of subsistence agriculture in developing countries.[8] Another aspect of the study concerns the effects of the development of the synthetic substitutes (polypropylene and polyethylene) on the consumption of jute in the developed countries a matter of great concern for the major producing countries.

1.2 Organization of the Study

The study of the world jute market has been organized as follows. The survey of the relevant institutional, technological, and historical aspects of the world jute market, encompassing production, consumption, and trade of both raw jute and jute manufactures are described in Chapter Two. The annual model of the postwar world jute market is developed and analyzed in Chapters Three, Four, Five, and Six. Chapter Three gives some general considerations in the development of this model. The supply side of the model--consisting of equations explaining annual production of raw jute and jute manufactures in the major producing countries and a "Rest-of-the-World" sector--is developed in Chapter Four. In Chapter Five, the consumption side of the model is developed, consisting of equations explaining consumption of jute manufactures in the major consuming countries and in another "Rest-of-the-World" sector. The estimation of consumption demand for the regions, except for Bangladesh and India, is carried out first in terms of total demand for jute manufactures and synthetic substitutes together and then an attempt has been made to find the relative share of jute manufactures in the total demand. Equations explaining the accumulation of stocks of raw jute and jute manufactures by the major producing countries are also specified and estimated in Chapter Five. Finally, Chapter Five concludes with an attempt to isolate a separate world raw jute price equation which has been linked with the domestic prices of raw jute received by the farmers in the major producing countries. The world price of jute manufactures, which is hypothesized to be determined by the world price of raw jute, is similarly linked with the domestic prices of jute manufactures in the two major producing countries--India and Bangladesh. The complete model, including the definitional identities, is brought together in Chapter Six, and simulations are carried out over the 1961-1973 sample period and forecasts are generated for the 1974-1990 period under explicit assumptions about the exogenous variables. Moreover, several policy simulations over the two periods are conducted to analyze the impacts of different hypothetical international raw jute agreements for stabilization of prices. The study is concluded in Chapter Seven where a brief overview and a few important results are summarized and some indications of directions for possible future research are given.

FOOTNOTES - CHAPTER ONE

[1] The term "jute" has been used throughout the study to include other allied fibres, e.g., kenaf, roselle, etc. which are close substitutes for jute.

[2] For details of the ensuing debates between the developed and the developing countries over the call for the creation of a new international economic order, see Lewis, P., "The Have-nots are Gaining Ground in Their Drive to Gain Concessions", National Journal, June 5, 1976, pp. 774-782; Hansen, R.D. et al., The U.S. and World Development: Agenda for Action, 1976, New York/Washington (London: published for Overseas Development Council by Praeger), 1976; Erc, G.F., and V. Kallab, eds., Beyond Dependency: The Developing World Speaks Out, Washington: Overseas Development Council, 1975. Bhagwati, J.N., ed., The New International Economic Order: The North-South Debate, Cambridge, Mass.: MIT Press, 1977.

[3] The importance of foreign exchange in economic development is well-recognized in the two-gap models of Chenery and Strout and others. See, for example, Chenery, H.B., and M.A. Strout, "Foreign Assistance and Economic Development", American Economic Review, 56:4, September 1966, pp. 679-733.

[4] Adams, F.G., and J.R. Behrman, Econometric Models of World Agricultural Commodity Markets, Ballinger Publishing Company, Cambridge, Mass., 1976, p. 2.

[5] For a discussion of the state of the art in commodity model building, see, Labys, W.C., Dynamic Commodity Models: Specification, Estimation and Simulation, Lexington, Mass.: D.C. Heath, 1973, ed., Quantitative Models of Commodity Markets, Cambridge, Mass.: Ballinger, 1975, and the references cited therein.

[6] See, for example, Nerlove, M., The Dynamics of Supply: Estimation of Farmers' Response to Price, Baltimore, Md.: Johns Hopkins Press, 1958.

[7] Behrman, J.R., "Econometric Model Simulations of the World Rubber Market, 1950-1980", in L.R. Klein, ed., Essays in Industrial Econometrics, vol. III, Philadelphia: University of Pennsylvania, Economics Research Unit, 1971, p. 3. Also see his "Econometric Models of Mineral Commodity Markets: Limitations and Uses", Paper presented at Session on Economic Forecasting, Council of Economics, American Institute of Mining, Metallurgical and Petroleum Engineers, New York, February 26, 1968 (available in the Proceedings) for a discussion of the limitations and uses of such models.

[8] Summaries of the debate over supply responsiveness of subsistence farmers can be found in Behrman, J.R., Supply Response in Underdeveloped Agriculture: A Case Study of Four Major Annual Crops in Thailand, 1936-1963, Amsterdam: North-Holland Publishing Co., 1968; Krishna, R., "Agricultural Price Policy and Economic Development", in Southworth, H.M., and B.F. Johnston, eds., Agricultural Development and Economic Growth, Ithaca: Cornell University Press, 1967 and other references cited in Chapter Four.

CHAPTER TWO

SURVEY OF THE WORLD JUTE ECONOMY

2.1 Introduction

Jute is second only to cotton in its importance as a vegetable fibre and, together with kenaf and roselle, has long been of major importance to agriculture in many parts of the tropics and the subtropics as a cash crop and as raw material for agro-industries. The total value of these fibres to the developing countries in the world exceeds U.S. $1000 millions, which is about 1 percent of the value of the renewable natural resources (RNR) sector of all the developing countries. Jute accounts for 15-20 percent of the annual output of all natural industrial fibres and 10-15 percent of the total volume entering international trade.[1]

A further feature of the world jute economy is its concentration of production within two areas of low per capita income and its absolute importance to the economy of these two areas. For example, export earnings from raw jute accounted for 52.7 percent of total export earnings of Bangladesh in 1971-72. When jute manufactures are added, the share of the jute industry in the country's total export earnings rises to more than 95 percent.[2] In India, exports of jute manufactures accounted for almost 15 percent of the country's export earnings in 1971.[3] In the case of Thailand, the contribution of jute industry to the export earnings of the country has, on the average, been around 10 percent per annum.[4] The importance of jute cannot therefore be judged simply in terms of its monetary value. Jute has the advantage of being a cash crop and the basis of an important industry, especially in Bangladesh and India where subsistence farming is still the prevalent form of agriculture. In the subsistence agriculture of this region, jute is grown mainly for sale, usually for exports. The size of this cash crop, and the price it fetches, may therefore largely determine the cash income of the region and often, as is the case of Bangladesh, also the foreign exchange earning of the country as a whole.

The social importance of jute is manifested by the fact that the jute industry directly employs about 250,000 and 150,000 people in India and Bangladesh respectively. However, many more people are involved in the production of jute. Several millions are to a large extent dependent on the jute crop for their livelihood.

2.2 Sources, Uses and Characteristics of Jute

A. Growing of Jute

Jute is an annual and seasonal crop.[5] It is a bast (or inner bark) fibre produced from two annual species *Corchorus Capsularis* (white jute) and *Corchorus Olitorius* (tossa, also known as upland jute). Many other minor varieties of the two species exist, which are called by distinct names in different places. The fibre characteristics of both are very similar, though C. Olitorius produces fibre of rather better quality than C. Capsularis, because the former is finer, softer, stronger, and more lustrous than the white jute. However, both the species of jute are cultivated due to the fact that white jute, though somewhat inferior in quality, can stand adverse weather conditions and water-logging better than tossa jute and can also be harvested earlier to permit a second crop to be raised on the same field and hence preferred by the cultivators.

Both the varieties of jute are of ancient use, but jute first came into prominence as a commodity in world trade in the middle of the nineteenth century.[6] The environmental requirements for successful cultivation of jute are relatively specialized,[7] in that it typically grows best in warm, humid deltaic areas with alluvial soils periodically flooded and with high rainfall during later stages of growth. It can also be grown on upland soils with irrigation facilities. The main jute crop is planted from middle of March to middle of June, depending on location. The plants which grow to heights of from 5 to 10 feet, are ready for cutting when the blossoms have faded. In some areas crops may be harvested as early as late-June, while in other areas as late as late-October.

Jute is pre-eminently a crop of Bangladesh and India, where it is grown mainly in the states of West Bengal, Bihar, Orissa and Assam. To the north-west of this area it is grown in Nepal and to the south-east in Thailand and in the Irrawaddy delta of Burma. Of secondary importance are the alluvial soil areas of China as well as Taiwan and parts of Brazil. Attempts have been made to grow jute in the Philippines, Latin America and in West Africa, but these have not been entirely successful. Generally speaking, prospects for the further world spread of jute cultivation are not bright except in response to a major improvement in the price of the fibre.

There are also a number of substitutes for jute, the chief of these being kenaf (also called mesta, Siam jute, Ambari hemp, stockroos, etc.) obtained from *Hibiscus cannabinus*, roselle obtained from *Hibiscus sabdariffa*, and urena fibre (also called Congo jute or paka) obtained from *Urena lobata*. The climatic and soil requirements of kenaf and roselle are less exacting than those of jute. This property, together with the fact that they are more suited to processing by mechanical labor-saving techniques, has caused a number of tropical and sub-tropical countries to promote these fibres, which resemble true jute very closely, although they are shorter and coarser. Except for the finest qualities, which resemble medium quality jute, kenaf and roselle are used in a mixture with jute. Kenaf, or one or more of the jute-like fibres, can be grown in almost any tropical countries of the world. However, it is only in a limited number of countries that production is commercially important. The major producers among these countries are India, Thailand, Vietnam, Brazil and Zaire. Some kenaf, although on a much smaller scale, is also produced in countries like Iran, Spain and the Soviet Union.[8] Hibiscus fibre production in many countries of Africa is relatively modest, but is being actively promoted in West Africa, notably in Nigeria, Ghana and Cameroon. Interest in the U.S.A. has centred on the potential of kenaf as an indigenous source of pulp for paper making.

B. Grading of Jute

Jute is graded on the basis of the quality of the fibre. The grading of jute, as with other vegetable fibres, presents considerable problems since the quality of fibre varies with growing conditions and genetic strains. Even the fibre from the same area can vary in quality from season to season and from farmer to farmer. The main constituents of the "quality" of jute fibre are its (i) length, (ii) strength, (iii) color, (iv) lustre, (v) weight,

(vi) cleanness, (vii) percentage of cutting and (viii) proportion of faults, such as "specks", "roots", and "knots". In addition, such general features as fineness, smoothness, hardness, and stiffness of the fibre are also taken into consideration.

The need has long been recognized, particularly by the Food and Agricultural Organization of the United Nations for a purely objective grading system, and, as a result, Bangladesh, India and Thailand have formulated official standards for grading jute and kenaf. The revised Bangladesh system, for example, which was introduced in 1968-69 to replace the earlier arbitrary marking system by a new and considerably improved system of grading of jute exported from Bangladesh, recognizes six grades for both white and tossa long jute based on color, lustre, cleanliness, freedom from retting defects and pest attack. The definitions of the different grades are descriptive in nature and no quantitative values have been assigned to these parameters. Many of these qualities are judged by sight and feel of the hand rather than by any objective or scientific method. However, this attempt can be considered as the first step towards a totally objective grading system based on spinning quality.

C. Uses of Jute

Jute is used in the manufacture of a wide variety of products with applications in industry, agriculture, transport and the household. As a yarn, it goes into carpets, cables and cordage. As cloth it is sewn into sacks for moving and storing a number of foodstuffs and raw materials, as well as some industrial products like fertilizer and cement. Jute fabric also serves as wrapping material (hessian) and is used in furniture webbing, upholstery, for backing linoleum and in several other applications, especially after treatment against moisture, mildew, rot, insect damage, fire and acid fumes. Nevertheless, its end-uses may be conveniently classified into four major groups: sacking, carpet backing, hessian, and a fourth miscellaneous group consisting mainly of cordage and felting.

Sacking remains the predominant end-use despite the fact that it was possibly the first market to suffer competition primarily as a result of the introduction of bulk-handling techniques and use of sacks made from alternative materials (e.g., cloth, paper, synthetic materials, etc.). During the last decade the amount of jute used for sacking remained relatively steady at around 2.5 million metric tons, which is almost two-thirds of total world consumption.

The second most important outlet of jute is carpet-backing. Together, backing cloth and carpet yarn absorb some 400,000 metric tons of raw jute annually, nearly all in the developed countries. The third major end-use market for jute is as cloth for a variety of packaging, industrial and household uses. Finally, the manufacture of cordage and felts utilizes perhaps around 200,000 metric tons of raw jute annually.

2.3 Internal Marketing of Jute

As has been emphasized earlier, jute is cultivated on relatively small holdings by peasant farmers who sell the season's crop as soon as the fibre is ready for baling and transport.

The small size of the jute producing units seems to have important repercussions upon the market and possibly the transportation of the product. Internal marketing arrangements involve a number of operations, like assembling, transporting, storing, grading and processing of jute. It appears that most of the smallholdings lack the ability to perform even a primitive assembling and grading of jute. Thus a chain of middlemen have inevitably developed in the three major producing countries.[9] In 1960, it was estimated that about 90 percent of the jute was sold by the growers to intermediaries in primary markets -- and only 1 percent was sold directly to pucca balers, shippers and jute mills in Bangladesh.[10] Although the middlemen render an important service in the trade and bear considerable risks, they have been criticized in various circles as being responsible for a variety of abuses and for charging excessive prices for their services. It seems, also, that a major source of profit for these middlemen is undergrading of jute at various stages of the marketing chain.[11] Moreover, it has been estimated that price fluctuations are much wider at the growers' than the exporters' level,[12] although the price control and support policies adopted by the governments of the major producing countries help to ensure for the growers a higher minimum level of prices than they otherwise have received.[13]

There is no precise information available regarding the costs of the internal market chain. It has been estimated however, that these account for a substantial part of the f.o.b. prices.[14] The above information suggests the need for an efficient distribution and marketing system in the producing countries which might allow the increase in the growers' price of jute even without affecting the f.o.b. price of raw jute.

2.4 International Trade in Jute

Jute and kenaf are known in the trade as "soft" fibres in contrast to the "hard" fibres such as sisal and manila.

The difference is basically due to the difference in fineness of their individual fibre strands. Jute is shipped in the form of hydraulically pressed bales (in Bangladesh, it is called Pucca bale), which weigh about 400 pounds (180 kilograms) each and measure about 10.8 cubic feet. It is significant that at least 70 percent of total jute production enters international trade either in the raw or processed form.

Exports of raw jute by the major producing countries is shown in Table 2.1. It indicates wide fluctuations and a declining trend following a steady expansion which continued until the mid-sixties. Exports were badly affected by the 1971 Independence War and its aftermath in Bangladesh, when exports from Bangladesh were greatly reduced. It is now estimated that approximately 750,000 metric tons of raw jute and kenaf fibre are exported, of which two-thirds are jute, mainly from Bangladesh, and the remaining one-third kenaf, the major source being Thailand.

Much of the decline in raw jute exports can be attributed to reduced imports by Western Europe, which have declined by almost 40 percent since 1968, although this tendency has been partly offset by increased imports by other developing countries (see Table 2.2).

Jute is exported in a variety of quality grades.

TABLE 2.1

EXPORTS[a] OF JUTE AND ALLIED FIBRES FROM MAJOR PRODUCING COUNTRIES

(In '000 long tons)

Countries	Average 1951-52 to 1955-56	Average 1956-57 to 1960-61	Average 1961-62 to 1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75
Bangladesh	931	753	749	602	689	576	639	404	352	509	482	279
Thailand	1	38	203	437	232	284	268	238	271	250	268	161
India	-	7	18	37	15	9	26	13	63	9	36	72
Other Countries[b]	12	16	12	21	26	25	30	35	40	60	75	67
Total	944	814	982	1097	962	894	963	690	726	829	862	581

Note: a. Exports from Bangladesh, Thailand and India are shown on a seasonal basis (July-June), except for Thailand from 1955-56 to 1958-59, for which period figures relate to the calendar year, first of two shown.

b. Other countries include Nepal, Congo (Democratic Republic), Brazil, and China. Some of the figures in this category are estimates by the sources.

Sources:

1. Commonwealth Economic Committee, London, "Industrial Fibres" 1971 and previous issues.
2. FAO, Commodity Review and Outlook 1975-76 and previous issues.

TABLE 2.2

IMPORTS OF RAW JUTE AND ALLIED FIBRES
(In thousand long tons)

Countries	Average 1951-55	Average 1956-60	Average 1961-65	1966	1967	1968	1969-70[a] to 1971-72 (average)	1972-73[a]	1973-74[a]	1974-75[a]	1975-76[a]	Average Rate of Growth 1965-66 to 1975-76 (% per annum)
India	275	109	74	349	83	47	36	54	45	18	76	2.9
Other developing countries[b]	-	-	-	-	-	-	93	117	171	199	207	13.4
United Kingdom[c]	129	139	132	115	134	134	-	-	-	-	-	
Japan[d]	27	41	77	88	114	116	-	-	-	-	-	
U.S.A.[d]	70	59	58	51	44	51	-	-	-	-	-	
Other developed countries	-	-	-	-	-	-	161	129	130	102	74	-8.0
EEC[e]	302	295	259	299	314	339	319	266	216	185	120	-10.8
Other Western Europe	-	-	-	-	-	-	75	61	46	27	31	-9.8
Other countries[f]	121	195	260	297	321	339	-	-	-	-	-	
Centrally Planned Countries	-	-	-	-	-	-	134	161	199	95	117	-2.4
Total	924	838	860	1199	1010	1019	818	788	805	626	625	-5.2

Source: 1. Industrial Fibres, op.cit., 1971 and previous issues.
2. FAO Commodity Review and Outlook 1975-76 and other issues

Note:
a. July-June season.
b. Included in Other countries Category before 1969-70 and 1971-72.
c. Included in EEC countries after 1969-70 to 1971-72.
d. Included in other developed countries after 1969-70 to 1971-72.
e. Includes Belgium, France, Italy, the Netherlands and West Germany.
f. These countries include mainly the centrally planned and developing countries.

Changes in the composition of jute exports, according to grades from Bangladesh is shown in Table 2.3. The table indicates that during 1971-72, around 65 percent of exports consisted of relatively low grades of jute (BWC, BWD, BTD and BWCB) and an additional 10 percent of even lower grades. This suggests the need for improving the quality grades of exports to improve the prospect of jute in the world market.

Jute is traded through an open market system, the main centre being London. Dealings are mostly done between shippers in the exporting countries and dealers abroad, who function as middlemen between shippers and the ultimate consumers.

As a result of this traditional trade organization, the chain linking the producers and the ultimate consumer is very lengthy. Besides, the operation of an open market is, often, associated with large fluctuations in prices, which is further accentuated by speculative behavior and withholding supplies until prices rise.

The government of Bangladesh operates a price control policy which comprises: (a) statutory minimum prices paid to jute growers, (b) measures tending to influence the volume of annual supply of jute, and (c) the Export Price Check (EPC) system. According to the EPC system, all export sales are effected on the basis of f.o.b. EPC

TABLE 2.3

COMPOSITION OF EXPORT PRICE CHECK SALES,

ACCORDING TO GRADES, FROM BANGLADESH
(Percentages in relation to total sales)

Grades	1964-65	1966-67	1968-69	1970-71	1971-72
BWSpl.	-	-	0.01	-	-
BWA	0.06	0.09	0.95	1.65	1.21
BWB	0.76	0.63	5.42	3.83	3.51
BWC	3.00	1.82	23.54	23.44	24.79
BWD	27.55	20.19	16.44	19.88	23.53
BWE	15.91	25.09	0.36	0.43	0.81
BTSpl.	-	-	-	0.01	0.05
BTA	0.03	0.51	1.27	1.00	0.61
BTB	1.34	0.57	7.69	7.24	5.52
BTC	8.02	7.50	17.20	18.41	16.60
BTD	14.63	19.90	8.54	8.08	6.25
BTE	9.69	11.30	0.16	0.41	0.20
BWCA	1.74	2.12	2.53	3.62	2.13
BWCB	11.96	5.32	12.78	8.37	10.59
BTCA	3.49	0.64	0.32	1.14	0.59
BTCB	0.69	3.71	2.60	2.02	3.18
BWR	0.34	0.16	0.05	0.26	0.19
BTR	-	0.07	-	0.03	-
BWH	0.36	0.14	0.12	0.02	0.07
BTH	-	0.01	-	0.10	0.09
BCR	0.43	0.03	0.02	0.06	0.08

Note: '-' indicates nil or negligible quantity. The grades refer to six different grades of Bangladesh white or tossa jute. The other nine grades are for cuttings and other inferior qualities of jute.

Source: Jute Season, op. cit., Table 12A, pp. 84-87.

prices, published by the Bangladesh Jute Association. These prices vary according to grades, but not with respect to destinations of the jute exported. The EPC prices are considered to be the world f.o.b. prices for jute since the exporters have to register their export sales with the central bank (Bangladesh Bank) of the country, and prices so registered cannot be lower than the EPC level. This arrangement implies that the c.i.f. prices in the consuming countries should vary correspondingly with the ocean transportation costs involved. However, it should be noted in practice there are no means of ensuring that the exporters register the actual prices with the central bank when these are higher than the EPC prices. Besides, the shippers may sell at a secret discount but register a price equal to EPC level as long as they are in a position to import into the country the amount of foreign exchange corresponding to the EPC prices by using other sources of foreign exchange.[15] Moreover, some exports might be under-graded which, in practical terms, would also mean a discount on EPC prices.

It seems, therefore, that though formally there is a world f.o.b. price for jute, in practice the actual sales prices may be quite different. The volume of discount on EPC prices would depend, presumably, upon the market situation and the comparative negotiating power of the shippers and the importers.

Jute is shipped from Bangladesh and Thailand by authorized exporters. In Bangladesh, there were about 116 firms with licenses as exporters of raw jute during 1971-72. The number of licensed exporters were about 60 in Thailand during 1970. These include firms owned by or associated with foreign firms. Although the foreign participation is very small in the case of Bangladesh, about one-third of the export-houses are associated with foreign firms in Thailand. In the absence of any precise information regarding the volume of jute shipped by each exporting house in Thailand, estimates are that only 20 of the firms are active and six of them account for about 80 percent of total exports.[16] In Bangladesh, 10 out of 95 private firms which participated in the export of raw jute during 1971-72 accounted for more than 43 percent of total exports by private firms. In addition, there are two government sponsored corporations involed in large scale shipments of jute.[17] It seems, therefore, although a large number of shippers are engaged in the export trade of jute, in practice it is controlled by a fairly small number of big exporters.

2.5. Trends in Production and Consumption of Jute and Jute Manufactures

A. Trends in Production of Jute and Allied Fibres:

The world production of jute has been increasing since World War II. The annual supply levels, however, have been characterized by substantial fluctuations. The unstable climatic conditions in the "jute-belt" of Bangladesh and India, which is by far the largest supplier of jute in the world market, constitute one of the most important factors in these fluctuations. However, the principal determinant of acreage and hence production in this area seems to be the fact that jute happens to be the cash crop in the region where intense population pressure and subsistence rice farming are the dominant features of a small-holding agriculture. Thus the supply of jute in terms of the acreage planted is very sensitive to the relative prices of jute and rice in the preceding season.[18]

In Table 2.4, the annual production of jute and allied fibres is shown for the main producing countries as well as the trends regarding the share of each during the post World War II period. It is interesting to note that more than 95 percent of the world's jute is produced in developing countries. Although during 1952-55, Bangladesh, India and Thailand accounted together for about

[redacted]

CONTRIBUTION OF PRODUCING COUNTRIES IN WORLD SUPPLY
(In thousand long tons)

	BANGLADESH				INDIA				THAILAND				REST OF THE WORLD				WORLD TOTAL			
Periods	Jute	Allied Fibres	Total	% of World Total	Jute	Allied Fibres	Total	% of World Total	Jute	Allied Fibres	Total	% of World Total	Jute	Allied Fibres	Total	% of World Total	Jute	Allied Fibres	Total	Index of World Total 1949-52 = 100
1949-52	948	-	948	51.9	670	-	670	36.6	2	9	11	0.6	72	128	200	11.9	1692	137	1829	100
1952-55	727	-	727	41.0	672	142	814	45.9	1	12	13	0.7	81	138	219	12.4	1481	292	1773	97
1955-56	1015	-	1015	43.1	751	210	961	40.9	3	10	13	0.6	132	231	363	15.4	1901	451	2352	129
1956-57	1001	-	1001	40.7	778	267	1045	42.5	2	17	19	0.8	143	250	393	16.0	1924	534	2458	134
1957-58	1034	-	1034	42.1	722	237	595	39.1	3	21	24	1.0	152	283	435	17.8	1911	541	2452	134
1958-59	1080	-	1080	38.8	936	270	1206	43.3	3	29	32	1.2	164	302	466	16.7	2183	601	2784	152
1959-60	1008	-	1008	38.7	835	203	1038	39.8	4	51	55	2.1	188	317	505	19.4	2035	571	2606	143
1960-61	1020	30	1050	39.5	722	205	927	34.9	6	181	187	7.0	193	301	494	18.6	1941	717	2658	145
1961-62	1264	40	1304	36.2	1151	309	1460	40.6	12	339	351	9.8	184	299	483	13.4	2611	987	3598	197
1962-63	935	40	975	33.6	980	306	1286	44.3	12	136	148	5.1	183	308	491	17.0	2110	790	2900	159
1963-64	1054	40	1094	334	1043	332	1375	41.9	12	208	220	6.7	237	354	591	18.0	2346	934	3280	179
1964-65	973	33	1006	31.7	933	281	1214	38.3	12	298	310	9.8	252	389	641	20.2	2170	1001	3171	173
1965-66	1189	54	1243	35.1	826	220	1046	29.6	9	511	520	14.7	290	434	724	20.5	2314	1219	3533	193
1966-67	1143	65	1208	32.0	948	215	1163	30.8	11	640	651	17.2	329	429	758	20.0	2431	1349	3780	207
1967-68	1200	23	1223	32.3	1120	225	1345	35.5	10	335	345	9.1	282	593	875	23.1	2612	1176	3788	207
1968-69	1028	23	1051	39.1	541	161	702	26.1	9	162	171	6.4	294	471	765	28.4	1872	817	2689	147
1969-70	1290	40	1330	36.3	994	202	1195	33.1	10	346	356	9.9	268	460	728	21.7	2562	1048	3610	197
1970-71	1191	23	1214	36.7	1034	220	1254	37.9	10	290	300	9.1	-	-	539	15.5	-	-	3307	181
1971-72	755	17	772	23.5	1022	203	1225	37.4	10	340	350	10.6	-	-	932	30.0	-	-	3279	179
1972-73	1170	22	1192	30.1	877	221	1098	28.1	-	-	441	11.3	-	-	1180	30.5	-	-	3911	214
1973-74	1062	18	1080	23.7	1167	216	1383	30.3	-	-	590	12.9	-	-	1510	33.1	-	-	4563	250
1974-75	708	18	726	19.2	867	180	1047	27.7	-	-	360	9.6	-	-	1638	43.5	-	-	3771	206

Note: '__________' indicates no separate data are available.

Source: 1. The Jute Season, op. cit., Table 24
2. Industrial Fibres, Op. cit., different issues
3. FAO, Commodity Review and Outlook, op. cit.,different issues
4. FAO, The Statistical Situation, CCP: JU 74/6, 1974.

88 percent of the world supply of jute on the average, their share is reduced to only about 46 percent during 1974-75. It should be noted in this connection that Indian production aims mainly at satisfying domestic demand for its jute manufacturing industry (until 1966-67, India was a net importer of raw jute). Similarly the supply of jute in smaller producing countries is generally absorbed by local consumption. Thus almost all the raw jute (including allied fibres) that is traded in the world market originates in only two developing countries -- Bangladesh and Thailand.

The long-term trend of world jute production is upwards. From an average of 1.83 million tons in the period of 1948-52, it increased to 3.77 million tons in the 1974-75 season. It can be seen from Table 2.4, however, that much of the expansion occurred before the early sixties and since then the rate of increase in production has been diminished. Also there have been changes in the shares of the major producers during the period. For example, the share of Bangladesh, the biggest producer, declined from an average of 51.9 percent during 1948-52 to only 19.2 percent of total supply in 1974-75. However, true jute is produced mostly in Bangladesh and India. The aggregate contribution of all other countries to world true jute supply was less than 12 percent during 1969-70 (see Table 2.4). The developments in the production of kenaf and allied fibres were most spectacular. From an average of 137 thousand tons during 1948-52, the output increased to 1048 thousand tons in 1968-70. Higher rates of growth in the production of kenaf have the direct result of increasing the proportion of allied fibres in the world supply of jute and allied fibres from about 7.6 percent in 1948-52 to about 29 percent during 1968-70 (calculated from Table 2.4).

B. Trends in Production of Jute and Allied Fibres Manufactures

The production of jute manufactures in the world depends not only on the supply of raw jute, but also on the processing capacities of the industry and their competitive position in the world market.

The world jute manufacturing industry is fairly well spread. It is located not only in the countries where jute and allied fibres are grown, but in a number of countries that do not grow jute at all. From Table 2.5, it can be seen that, with respect to jute manufactures, India is by far the biggest supplier to the world market, with an average production of about 1 million tons currently. However, its share in world production is progressively declining. In the period 1951-52 to 1955-56 India

TABLE 2.5

PRODUCTION[a] OF JUTE, KENAF AND ALLIED FIBRES MANUFACTURES

(In thousand metric tons)

Countries	Average 1955-56 to 1957-58[b]	Average 1961 to 1965	Average 1964 to 1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[e]	Avg. rate of growth 1965-1975 (% per annum)
India	1076	1200	1223	1138	1085	894	954	1087	1110	1037	947	990	-2.0
Bangladesh[c]	147	306	367	445	543	551	609	294	436	467	489	445	0.3
Thailand	-	-	-	-	-	-	-	-	102	126	164	146	11.4
Other developing countries	-	-	-	-	-	-	-	-	41	48	52	50	17.8
EEC countries[d]	537	468	464	436	417	409	302	254	223	201	178	142	-4.6
Other Western Europe	-	-	-	-	-	-	62	63	50	39	30	25	-21.1
World Total	1760	1974	2054	2019	2045	1854	1927	1698	1962	1918	1860	1798	-1.9

Note: a Total of countries shown. For Western Europe, countries reported in the Statistics of Association of European Jute Industries (AEJI) only. For other developing countries, Nepal and Pakistan only.

b For India-Bangladesh, July-June season. For others calendar year of first year shown.

c Including Pakistan until 1970.

d Till 1969, includes production in other Western Europe also.

e Preliminary.

Source: FAO Commodity Review and Outlook, op. cit., different issues.

accounted, on the average, for 51.2 percent of world production of jute manufactures. The corresponding share for the period 1966-67 to 1968-69 was about 35 percent of the average world supply of 3.2 million tons.[19] The share of Bangladesh over the same period rose steadily from 2.8 percent to about 15 percent.

Western Europe is also an important supplier of jute manufactures. However, the jute manufacturing industry in this region caters mainly for domestic demand, while the jute manufacturing industries of both India and Bangladesh are export-oriented. Among the other developed countries only in Japan has the production of jute manufactures increased substantially and there only until the sixties, after which a declining trend has been prominent. Production of jute goods in developing countries, other than India and Bangladesh, involves relatively small, although increasing, quantities. For example, according to FAO estimates, production of jute goods in Africa and Latin America increased from about 140,000 tons in 1961-63 to about 170,000 tons in 1968-69.[20]

No precise figures are available for the production of jute goods in the centrally planned countries. It seems reasonable to assume, however, that they account for the largest part of the production of jute manufactures outside India, Bangladesh and Western Europe, estimated at 1.1 million tons for the year 1969.[21]

2.6. Trends in World Trade in Jute and Jute Manufactures (Including Allied Fibres) and Their Geographic Distribution

Discussion in the above sections indicate that although the number of countries producing jute is few, in recent years their number has been increasing. Some of the countries which previously used to import jute for their domestic consumption, are now trying to achieve self-sufficiency. Moreover, there is also a strong tendency in the main producing countries to expand their jute manufacturing industries and utilize more raw jute in their own domestic markets and export jute manufactures.[22] Thus although the total supply of jute increased from an average level of 1.8 million tons during 1949-52 to 3.7 million tons during 1974-75, jute exports in the period 1974-75 stood at only 581 thousand tons as against an average of 944 thousand tons during 1951-52 to 1955-56.

Clearly, a decline in the jute export/production ratio is discernable in the long run, particularly in the case of Bangladesh. At present, only slightly more than 15 percent (calculated from Tables 2.1 and 2.4) of the world's total jute production enters the international trade as compared with an average of 52 percent during 1952-55. In the case of Bangladesh, the corresponding figures would be about 39 percent and close to 100 percent. As an exception, in Thailand the export/production ratio increased from about 23 percent in 1955-56 to around 45 percent in 1974-75. One of the most important factors that contributed to the decline in ratio of total exports/production is the evolution of the jute economy in India. Until the mid-fifties, India was a major importer of jute. However, India, following an active policy to expand jute production, achieved self-sufficiency by the 1960's. As a result, there is a noticeable shift of world trade from raw jute to jute manufactures, as reflected in the following figures:

	Exports of	
	Raw Jute	Jute Manufactures
Average 1951-55	944	930
Average 1970-74	738	1298
Percentage increase/ decrease	-21.82	39.57

Note: Figures calculated from Tables.

With respect to geographic distribution of world trade in jute and jute manufactures, we first consider the case of jute.

It is estimated that more than 75 countries in the world participate in the trade in jute. It is remarkable, however, that about half of the exports from Bangladesh, the chief exporting country, consists of shipments to only five countries (the U.K., China, Belgium, West Germany, France) and at least another 20 percent of these exports are destined to five additional countries (Japan, Poland, Netherlands, Portugal and Egypt).[23] Similar trends are also noticed in the case of Thailand. However, in recent years there has been an increase in the share of countries other than the ten traditional major importing countries mentioned above. Also, significant changes have occurred, during the period under review, in the relative importance of the major exporting and importing countries. For example, Bangladesh, which in the 1950's was practically the only jute exporting country, now accounts for less than 50 percent of world exports (see Table 2.1). Thailand has emerged in the 1960's as the other major exporting country. Western Europe, as a region, is still the most important market for jute exported from Bangladesh and Thailand. At present it absorbs more than 40 percent of total shipments.

The world exports of jute manufactures was 1.4 million tons in 1974 of which almost 1.1 million tons, or 79 percent, were exported from India and Bangladesh. Complete data are not available to show the geographic distribution of the world trade in jute manufactures. However, the figures presented in Table 2.6 can be considered fairly representative of world trends in exports of jute manufactures since it covers almost all the major exporting countries.

With regards to imports, it can be seen from Table 2.7 that the share of developed countries in total imports has been decreasing steadily. The biggest single importer of jute manufactures is the United States which accounts for around 30 percent of total world imports. However, a steady decline in its imports are observed. A similar trend is observed in the case of Western Europe as a whole. The total shares of centrally planned countries and the developing countries in world imports have been rising, though modestly. In this category, it is the Asian countries where imports have been rising fast.

If any conclusions can be drawn from the discussions above, regarding the general trends and pattern of international trade in jute and jute manufactures, these can be summarized as follows:

(a) Exports of jute to developed market economy countries have been declining rapidly. Western Europe as a whole, which was one of the biggest importing areas, now accounts for only about 25 percent of the world trade in jute.

TABLE 2.6

EXPORTS OF JUTE MANUFACTURES FROM MAJOR EXPORTING COUNTRIES
(Thousand metric tons)

Countries	1955-56 to 1957-58	1961 to 1965	1964 to 1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[e]	Average rate of growth 1965-1975 Percent per annum
India	856	874	928	769	671	570	549	641	640	591	619	450	-4.6
Bangladesh[b]	93	238	288	371	454	495	488	239	333	410	457	466	1.3
Thailand	-	-	-	-	-	-	-	-	43	88	108	97	64.5
Other developing countries[c]	-	22	20	30	52	41	41	83	22	36	47	45	4.1
EEC countries[d]	99	155	167	154	169	186	147	143	106	101	87	63	-5.9
Other developed countries	-	-	-	-	-	-	35	40	30	30	23	18	-3.7
Centrally planned countries	-	22	33	80	82	77	62	54	56	86	56	55	0.8
World Total	1048	1311	1436	1404	1430	1371	1322	1200	1230	1342	1397	1094	-1.7

Note: a For India and Bangladesh, July-June season. For other countries, calendar year of first year shown.

b Including Pakistan until 1970.

c Includes Thailand until 1971.

d Includes other Western Europe till 1969.

e Preliminary

Source: FAO Commodity Review and Outlook, op. cit., 1975-76 and previous issues.

TABLE 2.7

IMPORTS OF JUTE MANUFACTURES BY MAJOR COUNTRIES AND REGIONS[a]

(Thousand Metric Tons)

Countries/ Regions	Average 1948-52	Average 1953-57	Average 1963-67	Average 1966-70	1972	1973	1974	1975[b]	Average rate of growth 1965-1975 (Percent per annum)
Developed countries: of which	551 (58)	587 (56)	857 (60)	877 (63)	735 (60)	727 (55)	735 (57)	509 (47)	-
U.S.A.	-	-	-	416 (30)	406 (34)	386 (29)	351 (27)	220 (21)	-3.4
E.E.C.	-	-	-	217 (16)	151 (13)	149 (11)	122 (10)	103 (10)	-6.6
Other Western	-	-	-	48 (4)	18 (2)	22 (2)	18 (1)	16 (2)	-7.3
Centrally planned countries	14 (1)	19 (2)	148 (10)	157 (11)	164 (14)	201 (15)	158 (12)	190 (18)	1.2
Developing countries of which	389 (41)	433 (42)	432 (30)	353 (26)	314 (26)	390 (30)	394 (31)	375 (35)	-
Africa	114 (12)	125 (12)	180 (12)	148 (11)	105 (9)	127 (10)	138 (11)	145 (14)	-5.3
Asia	124 (13)	135 (13)	112 (8)	93 (7)	114 (9)	149 (11)	146 (11)	130 (12)	5.6
Latin America	151 (16)	173 (17)	140 (10)	112 (8)	95 (8)	114 (9)	110 (9)	100 (9)	-0.5
World Total	954	1039	1437	1387	1212	1317	1286	1074	-2.1

Note: a Figures in parentheses indicate percentage of total.

b Preliminary

Source: FAO, Commodity Review & Outlook, 1975-76 & previous issues.
FAO, "World Trade & Consumption of Jute Goods, 1968-72" in Monthly Bulletin of Agricultural Economics, and Statistics, 1972.

(b) Exports of jute to centrally planned economies also have a declining trend -- accounting for less than 20 percent of world trade.

(c) Exports of jute to developing countries -- excluding India -- follow a rather stable upward trend which now accounts for about 30 percent of world trade.

(d) Although the total volume of world trade in jute during the post-war years has been declining, the rate is not very spectacular, except for in recent years.

(e) With respect to jute manufactures, the total volume of world trade has remained more or less stable. The share of developed countries has been declining. However, still as a group they have the largest share, accounting for more than 50 percent of world trade. The share of centrally planned and developing countries, after stagnating, in some cases actually declining, for a long time, has started rising in recent years.

2.7 Trends in World Consumption of Jute and Allied Fibres Manufactures

The outstanding features in the development of world jute consumption since the Second World War have been the reduced level of consumption in most of the economically advanced countries in North American and Western Europe and the expansion in consumption in the rest of the world. During the early post-war period, world consumption of jute goods -- including consumption in centrally planned countries -- expanded at the high rate of almost 5 percent per year. Between 1950-51 and 1965-66 estimated world consumption of raw jute increased from 1.8 million tons to 3.57 million tons.[24] Similarly, the apparent consumption of jute goods rose to 3.4 million tons in 1964-66 from 2.2 million tons in 1953-55 (Table 2.8). However, the post-war trends in the demand for jute goods varied widely from region to region, and even from country to country.

In the United States, jute consumption expanded at about the same rate as the gross national product, although it tended to fluctuate more widely, until the mid-sixties after which a downward trend is marked. Nevertheless, the United States is still the world's third largest single market for jute, following only China and India. The EEC (including the UK and other countries that joined the Community) is currently the world's fourth largest market for jute goods. Its jute textile industry, which dates back to the period before the first world war, also ranks fourth, after those of India, China and Bangladesh, and provides the principal outlet for raw fibre from Bangladesh and Thailand. In Japan demand rose steeply between 1955

TABLE 2.8

APPARENT CONSUMPTION OF JUTE MANUFACTURES

(Thousand metric tons)

Countries	1953-55 average	1961-63 average	1964-66 average	1967	1968	1969	1970	1971	1972	1973	1974	1975[b]	Average rate of growth 1965-1975 (percent per annum)
U.S.A.	303	430	464	452	507	499	414	417	416	412	372	250	-3.7
EEC[a]	243	264	279	278	353	336	446	377	317	294	257	205	-8.1
Other developed countries	468	631	618	674	609	552	415	367	340	336	443	250	3.7
Centrally planned countries	361	558	775	792	778	744	858	881	1169	1483	1637	1800	9.1
Developing countries:	800	1132	1298	1310	1369	1272	1333	1297	1358	1405	1421	1663	-
of which													
India	182	350	458	521	553	492	543	590	640	559	460	690	1.8
Other Asia	293	373	361	368	390	389	357	310	331	371	444	448	1.3
Africa	90	134	244	240	228	212	220	220	204	251	274	285	0.8
Latin America	235	275	235	181	198	179	213	177	183	224	243	240	1.3
World Total	2175	3015	3434	3506	3616	3404	3466	3339	3600	3930	4130	4168	1.8

Note: a Includes Belgium, France, West Germany, Italy & Netherlands till 1969. From 1970, also includes Denmark, Ireland and United Kingdom.

b Preliminary

Source: 1. FAO Commodity Review and Outlook 1975-76 and previous issues.

and 1966, mainly owing to the growing volume of agricultural produce marketed rather than consumed on the farm and to the re-use value of jute sacks to Japanese farmers. However, after that period, jute consumption fell rapidly due to greater use of synthetics. Similar trends are observed in most of other developed countries notably in Australia and South Africa where jute woolpacks, which were a notable feature of those countries consumption pattern, have come under heavy competition from substitutes.

Jute consumption in centrally planned countries was very low during the early fifties but more than doubled between 1953-55 and 1966 as packaging requirements rose steeply with the growing volume of goods produced and marketed over long distances. Similarly in China, the consumption of jute goods for jute packaging materials has been growing rapidly with increased output, and has made China the largest consumer of jute goods.

Demand for jute goods rose more rapidly in developing that in developed regions. Between 1953-55 and 1961-63, internal consumption increased by 50 percent in Asia and the Far East and in Africa, by still more in the Near East, and by nearly 20 percent in Latin America. Post-war trends in Asia's demand for jute goods have been largely set by India, the 1964-66 level was almost two and a half times as great as that of 1953-55. In Pakistan (including Bangladesh), demand was stationary until 1953 when self-sufficiency was first achieved in jute manufactures, and has since increased relatively modestly. Elsewhere in Asia the most noticeable increases occurred in Thailand and Burma. It would appear that a domestic jute textile industry is a significant stimulant to demand for jute goods in developing countries with rising national incomes.

In Latin America, in contrast to other developing regions, demand for jute goods rose relatively slowly due to the diminishing volume of packageable commodities produced, e.g. grains, increased installation of bulk handling plants, and an increased proportion of total agricultural production being processed locally. Moreover, jute packaging materials had to compete with fabrics made from other fibres, e.g. flax in Argentina and Uruguay, sisal in Brazil, figue in Columbia, and henequen in Mexico and Cuba. Finally, plastic and paper bags, and synthetic fiber woolpacks began to make serious inroads into markets for jute and hard fiber packaging in this region.

Demand for jute goods in Africa increased very rapidly until 1966 after which it slowed down considerably, possibly due to competition from hard fibre bags, notably in East Africa and Angola.

Now it appears that since 1970 the developing countries have been the major consumers of jute along with the centrally planned countries which have also expanded their markets rapidly. Between 1970 and 1974 jute consumption in the developed countries fell by a startling 45 percent and they now account for around one-quarter of total world consumption. There seems little prospect of a reversal in this trend and the main hope for jute must be in the expansion of markets in the developing and centrally planned economies. The fall in the consumption of jute goods in the developed countries was caused mainly by the following factors:

(1) The structural inability of the jute manufacturing industries in the developed countries to produce and supply standard jute goods at a reasonable price, coupled with the maintenance in some of these countries (particularly in Western Europe and Japan) of high protective tariff and non-tariff barriers against the import of lower-priced jute products from developing exporting countries.

(2) The increasing availability of synthetic substitutes at progressively reduced prices, as against fluctuating, and often high prices of jute products.

(3) The continuous improvement of synthetic products through research, market development, and promotion undertaken by the synthetic manufacturers.

(4) Ready and assured availability of synthetic products at stable prices, mostly from producers in home countries, compared with the uncertainty of prices and supplies of jute products which are quite often associated with such problems as crop failures due to floods, droughts, transport difficulties, wars and strikes. Moreover, the long supply pipeline that exists in the case of jute not only implies that the storage and inventory charges are higher in the case of jute, but also that synthetic material producers have an additional advantage in the form of a protection equal to the difference between the cost of transporting jute from overseas and that of transporting synthetic substitutes from domestic or nearby sources of supply.[25]

(5) The most competitive materials have been developed and produced as by-products of the petrochemical industry. As a consequence, they have a specific price advantage in that within an integrated plant the general overheads of the undertaking can be distributed over different products depending upon the price competition each faces in the market. Moreover, adjustments for changes in the supply-demand relationships can be made more quickly in the case of man-made fibres than in the case of jute.

(6) Finally, we can enumerate the failure of the jute producing countries to fully appreciate the danger from polyolefin substitutes, and their failure to take adequate

counter measures in the way of research, development and market promotion and the adoption of an appropriate pricing policy to maintain the market share of jute.

Thus the overall future of jute in developed countries cannot be viewed with much optimism based on the events of the past, but on the other hand, the consumption of jute manufactures has not declined as rapidly as might have been expected. The main issue seems to be how long jute can maintain its existing role in these areas and what policy measures would improve the competitive position of jute through price stabilization and greater availability of quality jute goods.

2.8 Competition from Synthetic Substitutes in the Jute Market

Jute has increasingly come under competition from other materials and alternative techniques in virtually all its end uses during the past three of four decades. Synthetic competition is not a new experience for agricultural commodities -- it exists in the markets for such important commodities as natural rubber, wool, cotton, hard fibres, hides and skins, and oils and fats. It is also not entirely new for jute. Various types of substitutes have been in the market for jute for quite a long time. Cotton and hard fibres compete with jute in the bag and sack markets, in packaging and other industrial applications. Moreover, jute had to compete with plastic film bags in the heavy duty bag market and with a variety of synthetics in some minor end uses such as rope and twines. But, in general, synthetic competition was previously limited by the high price of the substitutes.

It was during the sixties, however, that competition in the real sense began when the new polyolefin plastics (mainly high density polyethylene and polypropylene) were developed as a by-product of the petro-chemical industry. In its various forms -- yarn, woven cloth and spun-bonded fabrics -- the polyolefin plastics, especially polypropylene (hereafter referred to as PP), represents the greatest threat to jute in the seventies. By 1975, PP had captured about 80 percent of the primary carpet-backing market in the U.S.A. and between 85 to 100 percent in Denmark, 48 percent in France, 20 to 35 percent in Italy and other EEC countries and 12 percent in the U.K.[26] The decline in jute usage in developed countries was accompanied by a corresponding increase in the market share taken by PP. The situation for two of the most important end uses -- carpet backing and cloth for bags -- are given below which shows consumption of synthetics in traditional jute markets in the U.S.A. and Western Europe:

	Carpet Backing		Cloth for Bags	
	1967	1974	1967	1974
U.S.A.	3.5	83.0	6.5	65.0
Western Europe	1.0	64.5	2.5	61.0

(Figures are shown in thousand tons)

Thus the impact of synthetics is likely to be one of the major factors determining the future development of world jute markets.

In order to trace the development of competition, it might be useful to divide the post-World War II period into two -- one until the mid-sixties and the other afterwards when the major substitutes moved into the jute market.

Until the mid-sixties, the degree of competition which jute experienced differed in each of its major markets. In the market for carpet backing, jute had a near-monopoly in most developed countries. For broadloom carpets, jute had been almost the sole backing material, in prewoven form for tufted carpets and in yarn form for woven and other broadloom carpets. In its other major market -- bags and sacks -- jute experienced considerable competition from cotton bags, paper sacks and low density polyethylene sacks, as well as from a variety of substitute techniques such as bulk-handling and consumer packaging. However, the competition was limited due to the low tear strength of paper bags, high cost of cotton bags and their inability to transport commodities which had to "breathe" during overseas shipments. The same disadvantages of the polyethylene film bags kept the competition with jute limited to the shipment of fertilizers and chemicals in the domestic market.

The second phase of the development of the competition began with the commercial production of the woven polyolefin tape around 1964, which represents a new competitor for jute in both the sack and the carpet-backing markets.

Woven polyolefin fabric is manufactured by extruding the basic raw material (which is usually called a polymer) in the form of a thin sheet, which is then slit into tapes and woven into fabric in much the same way as jute. There are three major raw materials in the "polyolefin" group: low density polyethylene (LDPE), high density polyethylene (HDPE) and polypropylene (PP).[27] Of these three, PP competes with jute in both the carpet-backing and bag markets and HDPE is used only to manufacture cloth for bags due to its physical properties.[28]

A product of the petrochemical industry, as mentioned earlier, PP is obtained from propylene. Propylene, the basic raw material, is manufactured by steam cracking and refinery processes. Since 1960, the production of PP increased at the high rate of over 50 percent per year (see Table 2.9) and the resulting economies of scale, technological improvements and competition among producers have brought PP prices down at a rapid rate.[29] PP is available to textile producers in a variety of forms: multifilament or monofilament fibres, tapes and non-wovens. Jute has suffered most from the development and marketing of PP tapes: slit film and extruded ribbons are used in the manufacture of bags and primary carpet backing. Mono and multifilament fibres are used in cordage -- particularly ropes and twines. Tapes are utilized in woven cloths and twine. Non-wovens are used as primary and secondary backings for carpets. Consumption of PP in carpet backing -- both in woven and non-woven -- increased from 3.5 to 116.5 thousand metric tons in the United States and from 1.5 to 47.8 thousand tons in Western Europe between 1967 and 1973 (see Table 2.10). The corresponding decline in the use of jute in its traditional markets are given in Table 2.11. It shows that although PP film has partly replaced jute in most of its major end-uses, the overriding concern of the countries producing jute is the risk of further loss, especially in the fields where the use of synthetics has started only recently, e.g., secondary carpet-backing and carpet yarn.

TABLE 2.9

POLYPROPYLENE RESIN CAPACITY AND PRODUCTION IN MAJOR DEVELOPED COUNTRIES -- 1960, 1965, 1970, 1976.

(Thousand Metric Tons)

	1960			1965			1970			1976		
	Capacity	Actual	PC	Capacity	Actual	PC	Capacity	Actual	PC	Capacity	Actual	PC
United States	75	19	25	238	170	71	650	471	73	1500	1200	80
Western Europe	30	5.4	18	105	73	70	400	300	75	1172	820	70
Japan	-	-	-	75	58	77	610	579	95	1010	685	68
TOTAL (rounded)	105	25	24	418	301	72	1660	1350	81	3682	2705	74

PC: Percentage Utilization

Source: 1. FAO, Impact of Synthetics on Jute and Allied fibres, op. cit.

2. UNCTAD; Report, TD/B/IPC/JUTE/L.14, June 30, 1977.

TABLE 2.10

ESTIMATED UTILIZATION OF POLYPROPYLENE RESIN IN TRADITIONAL JUTE

END-USES IN MAJOR DEVELOPED COUNTRIES
(Thousand Metric tons)

	1967	1970	1973	Percentage Increase 1967-70	Percentage Increase 1970-73
United States					
Carpet backing[a]	3.5	22.7	116.5	548.6	413.2
Bags & Industrial Cloth	6.3	4.5	20.5	-28.6[b]	355.5
Cordage	15.0	20.0	27.2	33.3	36.0
TOTAL	24.8	47.2	164.2	90.3	247.8
U.K.					
Carpet backing	1.0	8.6	23.3	760.0	170.9
Bags & Industrial Cloth	0.7	3.0	7.5	328.6	150.0
Cordage	9.0	12.0	15.5	33.3	29.2
TOTAL	10.7	23.6	46.3	120.6	96.2
Other Western Europe[c]					
Carpet backing	0.5	5.0	24.5	900.0	390.0
Bags & Industrial Cloth	1.5[d]	14.0	34.5	833.3	146.4
Cordage	5.0[d]	17.5	56.5	250.0	222.9
TOTAL	7.0	36.5	115.5	421.4	216.4

Note:

a. Woven and non-woven (non-woven PP backing estimated at 9000 MT in 1970 and 45000 MT in 1973)

b. The decline reflects the shift from PP to acrylics for sand-bags.

c. Excluding Greece and Yugoslavia.

d. Excluding Spain and Portugal.

Source: IBRD, The Impact of the Oil Crisis on the Competitive Position of Jute and Hard Fibres. Commodity Paper No. 11 (9/74).

TABLE 2.11

THE MAJOR END-USES OF JUTE IN THE DEVELOPED COUNTRIES, 1968 and 1971
(Thousand Metric Tons)

	1968	1971
All Developed Countries		
Bags and sacks	566	360
Other packaging, industrial and household uses	297	221
Carpet backing cloth	246	275
Carpet yarn	118	104
Cordage, cable, and other end uses	84	78
Felt and padding	109	70
TOTAL	1420	1108

Source: UNCTAD, Report TD/B/KPC/JUTE/L.14, June 30, 1977

PP production is also increasing in the centrally-planned economies and developing countries. Jute demand is negatively affected by this development. Small plants producing polyolefin fabrics for bags and sacks were established in almost every Central and South American country and many African countries. The estimated production capacity in these countries was 368 thousand metric tons (including centrally planned countries) in 1976.[30]

Several factors have accounted for this phenomenal market development of PP in direct competition with jute: relative prices, market structure, product performance and development and marketing techniques. Within a given market structure relative prices are one of the most important factors, at least in the short run. The basic advantage of PP over jute had been its low price and ready availability. The downward trend in the price of PP polymer continued until the beginning of 1974 when it reached 17 cents per pound in the United States. Prices in other countries also followed this downward trend and increased trade in the polymer tended to eliminate the inter-country price differentials. Thus between 1968 and 1973 while raw jute prices tended to fluctuate around a rising trend, PP polymer prices declined steadily in all major consuming areas. At the finished product stage, relative prices also turned against jute fabrics (see Table 2.12).

However, the second half of 1973 and the beginning of 1974 witnessed a number of fundamental changes in the pricing of crude oil. The increase in price of crude oil and embargoes and production cuts during this period by the OPEC countries resulted in steep rises in PP prices throughout the world (see Table 2.13). Despite the recent increases in the price of PP, the future outlook of the polymer

TABLE 2.12

COMPARATIVE PRICE TRENDS OF JUTE AND POLYPROPYLENE

UNITED STATES AND UNITED KINGDOM, 1968 - 1974

United States (current $ term)	Base Year	1968	1969	1970	1971	1972	1973	1974[a]
Polypropylene Resin	1968=100	100.0	95.2	90.5	81.0	76.2	78.6	107.1
Jute Carpet backing	1968=100	100.0	111.3	93.8	97.5	116.3	103.5	118.5
PP Carpet backing	1968=100	100.0	100.0	94.4	91.7	100.0	100.0	100.0
Jute Hessian	1968=100	100.0	110.5	112.9	131.5	160.5	140.3	193.5
PP Cloth	1968=100	100.0	87.5	68.8	68.8	75.0	78.1	82.2
United Kingdom (current £ term)								
Jute Fibre	1968=100	100.0	110.3	104.8	107.3	108.3	109.2	129.4
Polypropylene Resin	1968=100	100.0	91.8	83.6	75.0	72.7	72.7	122.7
Jute Carpet backing	1968=100	-	100.0	107.6	111.4	123.8	130.0	174.3
PP Carpet backing	1969=100	-	100.0	94.3	85.2	80.7	84.5	101.1

Note: a Estimated by source

Source: IBRD, Commodity Paper No. 11 (9/74), op. cit., derived from Table 3, p. 10.

is considered very bright. Projections for future production by industry sources in resins in the United States are given in Table 2.14.

TABLE 2.13

PRICES OF POLYPROPYLENE

(U.S. $ Per Ton, Current Values)

	1972	Early 1974	Early 1975	March 1976	December 1976
United States	352	480	420	617	672
Western Europe	385	680	630	-	-
Japan	430	640	580	-	-

Source: 1. Modern Plastics, January 1977
2. FAO, Competitive Price Levels for Jute, CCP:JU 75/5, April 1975

TABLE 2.14

ESTIMATED PRODUCTION IN THE UNITED STATES
(Thousand Metric Tons)

Product	1974	1980	1990	2000
LDPE	2700	4000	7500	13000
HDPE	1300	2000	3700	6500
PP	1000	2300	5800	14000

Source: Modern Plastics, September 1975.

In most countries the trend is quite similar. The estimates for the United Kingdom PP production capacity which was 270 thousand tons in December 1975 is projected to increase to 470 thousand tons in 1980. And by 1978 the rest of Europe is estimated to cater for two million tons of PP.[31] According to World Bank projections, in the United States, Western Europe and Japan which between them account for the bulk of world production, production capacity is expected to increase to 5.85 million metric tons and production to 4.5 million metric tons by 1980.[32]

PP fibre consumption in Western Europe, it is estimated, will increase at the rate of 12.5 percent per year to 405 thousand metric tons in 1980 which is about 32.7 percent of total PP consumption in those countries.[33] It is also estimated that in 1980, about 100 thousand tons would be used as carpet backing and carpet yarn and 109 thousand metric tons in packaging and industrial uses. If for the United States, consumption of PP fibre is assumed to increase by 15 percent per year during 1976-80 (as compared to 19.5 percent during 1970-75), total PP fibre consumption will be 540 thousand metric tons in 1980 (32 percent of total PP consumption) -- about 147 thousand tons in carpet backing and yarn and 128 thousand metric tons in industrial and packaging.

If these estimates are correct, the increase of PP fibre in traditional jute outlets between 1974 and 1980 in the United States and Western Europe will be 210.5 metric tons (127 thousand tons in the United States and 83.5 thousand tons in Western Europė). This is equivalent to approximately 550 thousand metric tons of jute manufactures. If the loss of market for the same reason in other developed countries and additional loss due to increasing use of high and low density polyethylene in the packaging field is taken into account, the total potential loss of jute to synthetics by 1980 could be quite high.

Moreover, the changes in the relative market structures which occurred during the past decade and also contributed to the success of PP as compared to jute. The world PP industry is basically an oligopoly which is characterized by substantial vertical intergration with petroleum complexes. During most of the period, it appears, the producers apparently have adjusted stocks, the rates of capacity utilization, and the degree of non-price incentives, but have kept their price relatively stable and constant. On the contrary, the raw jute market remained essentially responsive to the production situation in one single country -- Bangladesh. The PP film market also became more competitive during the period as more and new producers entered the market. The jute manufacturing market, on the other hand, continued to be a duolistic one: India provided the price leadership while Bangladesh followed suit (sometimes offering discounts on the prevailing prices).

Given the industrial structure of the synthetic industry and the above described behavior, a supply function cannot be defined. As long as capacity constraints are not pushed, demand apparently determines what is sold. In this study, therefore, PP production is assumed to be sufficient to meet the demands for the synthetic, at least in those uses that compete with jute. Although such an assumption should be qualified, substantial surplus production capacity for PP production is generally assumed to continue at least until 1980.[34]

The above discussion suggests that the consumption of the synthetics in the traditional jute markets will increase in the future. It appears that such an increase would not only practically eliminate any possible scope for growth of the jute market in these countries, but threatens as well to reduce further the existing market. The most important factor that contributed to the failure of jute to retain its market, as mentioned above, had been the relative price of jute compared to the synthetics. One important factor that contributed much for this state of affairs has been the tariff and non-tariff restrictions on imports of jute products in these countries.

2.9 The Economic and Tariff Policies on Jute by Major Importing Countries, and Their Effects

After expanding rapidly until the mid-sixties, the volume of international trade in jute and jute goods began to decline due to shrinking demand in the developed countries. In many of these importing countries, however, the decline was aggravated by the incidence of tariffs, quotas and licensing measures on imports of jute manufactures, by raising prices and/or restricting supplies, thus facilitating inroads from synthetics.

The tariff structures of the principal importing countries vary considerably, reflecting the importance of the domestic jute manufacturing industries or domestic crops of jute and, in certain cases, hard fibres. Thus in North America and Australia, where there is little spinning of weaving of jute, tariffs on jute goods are generally low, although imports of finished bags (which competed with those produced by domestic converters) into the United States were subject to high duty until the end of 1971. In Western Europe and Japan, on the other hand, where there are large although rapidly declining jute manufacturing industries, barriers against imports from developing countries have been eased only slightly in recent years. However, most classes of jute goods still carry high rates of import duty, and are subject to quota restrictions and import licensing. In the U.S.S.R. and other centrally planned economies, imports of jute and jute goods are regulated by the central authorities, in accordance with the requirements of national industries and availabilities of other packaging materials from domestic sources. In many developing countries, especially in Africa and Latin America, imports of jute and jute goods continue to be restricted by tariffs, quotas and even embargoes, in order to stimulate the output of the fibres or the manufactures, or both, with the multiple objectives of diversifying agriculture, creating employment, stimulating industrial development, and saving foreign exchange.

Some degree of import liberalization which took place in most developed countries during the early seventies could produce only limited benefits for the major jute-producing countries. In cases where the quota restrictions were abolished by levies such as the Jute Control mark-up applying in the U.K. prior to 1969, or the common external tariff of the EEC countries, were retained, the price-reducing effect of the liberalization measures were probably too small to allow the demand for jute goods to expand appreciably.

The relaxation of import restrictions on jute may prove to be a mixed blessing for the major exporting countries, depending upon the particular situation of the importing country. In most Asian and African developing importing countries, where substitution of jute by alternative products is not firmly grounded and where imports of jute and jute manufactures are frequently restricted on balance of payments grounds, rather than as a protection for domestic industry, the abolition of import barriers could be expected to reduce the domestic prices of jute and jute goods, and this might prevent further inroads from substitutes and reverse the downward trends of jute consumption in most of these countries. On the other hand, in Western Europe, Japan, and most other developed countries where the alternative techniques (such as bulk-handling, consumer pre-packaging, etc.) and petroleum-based synthetics industry are well-established, the liberalization of jute imports is likely to have little effect on those sectors of the market in which jute is losing chiefly on technical grounds. In those outlets, on the other hand, in which jute goods compete with synthetics chiefly on price grounds, import liberalization will bring benefits to exporting countries depending on the speed of removal, extents of the price reductions made possible by such action, and on the quality, quantity, and regularity of supplies from the exporting countries.

Thus the effects of liberalization of jute trade on the level of producing countries' export earnings could vary widely under differnt circumstances and needs careful assessment. However, it is clear that, on the supply side, the exporting countries should attempt to create the most favorable conditions for the wider entry of jute goods into the domestic markets of the importing countries. The most important of these are continuity of supply, competitive price levels and large-scale research and maketing efforts. The achievement of a regular and expanding flow of exports from the jute-producing countries would require the rapid solution of a number of problems which currently prevent the jute mills in India and Bangladesh from operating at full capacity: chronic shortage of power, recurrent labor disputes leading to stoppages and rising processing costs, and frequent disruptions in raw material supplies due to the inadequacy of the existing transport facilities and unavoidable variations in weather. In order to survive, the jute goods must be produced at prices competitive with those of the substitutes. The extent of any benefits which the jute producing countries can reap from liberalization measures in the principal importing countries, notably in Western Europe and Japan, will thus depend not only on the incidence of existing trade barriers on the supply and prices of different types of jute goods and on the kind, degree, and timing of various liberalization measures, but also on the ability of the producing countries to maintain or regain competitive price levels once such barriers have been removed.

Some scope for price reduction exists in the abolition of export duties, reduction in internal taxes and currency devaluation as well as through lowered processing costs by modernizing plants. It would seem, however, as is well-known, that the greatest reductions would have to be made in prices of raw jute, chiefly by means of increases in average yields brought about by improved cultivation practices, better seeds and research on high-yielding varieties and improvements in methods of retting and baling and developing efficient transport and marketing facilities.

The successful achievement of all these efforts, coupled with liberalization in trade, would ensure, it can be hoped, at least the present market share of jute in the developed countries. On the other hand, a lack of success could lead to further significant losses.

FOOTNOTES - CHAPTER TWO

[1] For detailed information on the volume of production and exports and imports of different industrial fibres, see Commonwealth Economic Committee; Industrial Fibres, various years, and Food and Agricultural Organization, Rome; Trade and Production Yearbooks, various years.

[2] See Government of Bangladesh, Jute Division; The Jute Season, 1970-71 and 1971-72, Table 6, pp. 56-57.

[3] See Industrial Fibres, op. cit.

[4] Government of Thailand, Agricultural Statistics of Thailand, 1962 and Thailand Statistical Yearbook, 1966.

[5] In Bangladesh and India, the "jute season" extends from July 1 of each year to June 30 of the next year. In Thailand, it refers to the period from September 1 to August 31.

[6] For a detailed discussion, see Watt, G.; The Commercial Products of India, London, John Murray, 1908 and Carter, H.R.; Jute and Its Manufactures, New York MacMillan and Co., 1921.

[7] See in this connection, Government of Pakistan, Ministry of Commerce; Report of the Jute Enquiry Commission, 1960, p. 37.

[8] In the data published by the producing countries, no distinction is made between kenaf and other allied fibres, and hence the term 'kenaf' should be taken to include all other fibres.

[9] In Bangladesh, these are: farias and beparis at the growers' and primary market level; aratdars, brokers, delals and kutcha balers at the secondary market level; pucca balers at the important secondary markets, and finally the shippers. See Socio-Economic Research Board, University of Dacca; Marketing of Jute in East Pakistan, 1956 and Report of the Jute Enquiry Commission, op. cit. For information on India, see Indian Exports of Jute Manufactures, Problems and Prospects, a Report prepared by Bension Varon for the IBRD-IDA, January 1969, p. 6.

[10] Report of the Jute Enquiry Commission, op. cit. p. 89. At the end of 1968 there were about 58,000 licensed farias/beparis, 572 aratdars, 2,000 kutcha balers, 364 pucca balers and 189 exporters. During 1970-71, 76,884 licenses of various categories were issued. See Jute Season, op. cit., p. 19.

[11] See, Report of the Jute Enquiry Commission, op. cit., pp. 90-93 and FAO, Commodity Review and Outlook, 1968, p. 153.

[12] According to one estimate during the period 1947-48 to 1965-66 prices of raw jute fluctuated around the average trend by 42 percent at growers' level, by 38.8 percent at the baling centres, and by 32 percent at the exporters' level. See A.K.M.G. Rabbani, "A Proposal for Fiscal Incentives for Raw Jute Exports", The Pakistan Development Review, 1969, Table V.

[13] The price support operations in Bangladesh involve the setting of internal minimum prices for raw jute each year and large-scale purchase of jute by the government-sponsored Jute Trading Corporation and the Jute Marketing Corporation from the growers and small dealers as well as the purchase by the Bangladesh Jute Board in a large number of their purchase centres in the interior markets. In India, also, the government sets a floor price and the State Trading Corporation, along with the Jute Buffer Stock Association, makes, whenever necessary, large scale purchases to support the minimum price fixed by the government. In addition, the government fixed a minimum monthly quota of compulsory purchase for the mills since 1969. See The Jute Season, op. cit. pp. 1-2, 9, 34. Also Industrial Fibres, 1969, pp. 186-187.

[14] In India, it is estimated that the difference between farm prices and the purchasing price paid by jute mills for raw jute is sometimes as high as 30 percent of the Calcutta price. See Indian Exports of Jute Manufactures, op. cit., p. 8. In Bangladesh, one estimate by the Jute Board indicated that "normal processes and costs" involved amounted to between 12.75 and 16.22 percent of the f.o.b. price of PWD grade of long jute in December, 1967 and 1968. It is to be noted, however, that these percentages do not include charges from growers' level to secondary markets. Earlier estimations had shown even wider price differentials between growers' and exporters' levels. See Food and Agricultural Organization of the United Nations, Rome, Italy; Internal Marketing and Distribution of Jute in ECAFE Countries, CCP/Jute, Ad Hoc 62/10-E/CN/11 Trade/JJPL, 10, December 3, 1962. In the case of Thailand, it is estimated that inland charges comprise about 50 percent of the estimated costs of kenaf. See UNCTAD, The Maritime Transportation of Jute, Report by the UNCTAD Secretariat, TD/B/C.4/85. January 21, 1971, p. 25.

[15] There is a widespread opinion that, in particular, the large shippers, with finance and superior marketing techniques, can afford to sell their stocks at below the EPC level and manipulate the market in such a way so as to revise even the EPC prices downwards.

[16] UNCTAD, The Maritime Transportation of Jute, op. cit. p. 28.

[17] See, The Jute Season, op. cit., Table 10, pp. 70-78.

[18] For some of the empirical estimations, see Clark, R. ; "The Economic Determinants of Jute Production" FAO Monthly Bulletin of Agricultural Economics and Statistics, Vol. VI., No. 9, September 1957, Hussain, S.M., "A Note on Farmers' Response to Price in East Pakistan", The Pakistan Development Review, Vol. IV, No. 1 (Spring 1964) 93-106, Rabbani, A.K.M.G.; "Economic Determinants of Jute Production in India and Pakistan", Pakistan Development Review, Vol. V (Summer 1965) No. 2, 190-228.

[19] Industrial Fibres, op. cit., 1970, Table 108.

[20] Industrial Fibres, 1970, p. 201. See also FAO; Prospects for Jute, Kenaf and Allied Fibres in African Countries, CCP: JU 68 Working Paper 1, Rome, August 1968 and Prospects for Jute, Kenaf and Allied Fibres in South America, CCP: JU/CC 70/12.

[21] See Statistical Yearbook of the European Jute Industry - Supplement 1969 - Association of European Jute Industries, Paris, Table 34.

[22] This is especially true in the case of Bangladesh where the government followed a deliberate policy of expanding jute manufacturing industry. As a result, the premium of jute manufactures over raw jute exported varied between 25 and 35 percent. See FAO; Trade in Agricultural Commodities in the U.N. Development Decade, Vol. 1: Parts I, II and III, PAO Commodity Review 1964, Special Supplement, pp. III-39 to 48.

[23] The Jute Season, op. cit., Table 8, pp. 62-67.

[24] Industrial Fibres, op. cit., 1969.

[25] The protection given to an industry by the saving of transport costs should not be confused with the protection which might be given by import quotas, tariffs, currency restrictions and the like.

[26] FAO, Competitive Price Levels for Jute, CCP: JU 75/5, April, 1975.

[27] Polyethylene is a thermoplastic composed by polymers of ethylene. PP is made by the polymerization of high-purity propylene gas in the presence of an organo-metallic catalyst. Polymerization is the

process of chemical reaction in which the structure of the molecules of the original substance, called a 'monomer', are linked together to form large chain-like molecules. The new substance thus formed, is called a 'polymer'.

[28] Since all the polymers have roughly similar production characteristics and follow same price trends, we shall focus our attention on PP alone since this is of more general interest due to its wide competition with jute.

[29] The impact of economies of scale on the costs of production of PP has been well-discussed. See G.C. Hufbauer; Synthetic Materials and the Theory of International Trade, London, 1966, pp. 56-151, FAO; Impact of Synthetics on Jute and Allied Fibres, Commodity Bulletin Series No. 46, Rome, 1969, pp. 14-21, IBRD; Jute and the Synthetics, Bank Staff Working Paper No. 171, January 1974, pp. 9-11.

[30] IBRD, Commodity Paper No. 11, p. 8.

[31] British Plastics and Rubber, March, 1976 and January, 1977.

[32] UNCTAD, Report, op. cit. p. 8.

[33] Reported in the European Chemical News, November 1976.

[34] According to World Bank projections, the outlook for 1980 would be as follows:

	Capacity	Production	Capacity Utilization
United States	2400	2000	83
Western Europe	2200	1500	68
Japan	1250	1000	80
TOTAL	5850	4500	77

(figures in thousand metric tons)

Source: UNCTAD, Report, op. cit.

CHAPTER THREE

AN OVERVIEW OF THE MODEL

3.1 Introduction

In this and the following two chapters we shall consider the construction of an annual model of the world market for jute for the post-Second World War years. It is hoped that the formulation, estimation and use (e.g., generation of forecasts, simulations, etc.) of the model will help in the understanding of the long-run structural aspects of the jute market. Moreover, this model will permit us to analyze not only the immediate impact of an exogenous shock in the country in which it originates but also the secondary impacts of this shock throughout the world market. The model will include functions analyzing the stock-adjustment behavior of the producers. It will also include lagged exogenous and endogenous variables in many of the relationships. Hence, the model will be a dynamic one. Some of the relationships are hypothesized to be recursive to the model. However, since it will not be fully recursive, simultaneous estimation techniques will be used to estimate parts of the model.

Since the model will be estimated in terms of annual observations, it will provide no information on such short-run movements, as seasonal variations in production and consumption and speculation. Adequate analysis of such short-run aspects needs the construction of a model in terms of monthly or quarterly data. The annual model, however, does permit us to examine important relationships which are of an essentially long-run nature, for example, the supply and demand functions for jute and jute manufactures and the intensive competition between jute and the synthetic substitutes. Moreover, the production of jute is an annual process. Thus for all jute producing countries, there exist only annual data on the production of raw jute. Finally, by looking at an annual model, we can consider consumption data for many countries for which no monthly or quarterly data exist; and hence we can include the jute markets of these countries as endogenous sectors in the world model. Of course, even in an annual model, there are a large number of countries which have to be lumped together in a "Rest-of-the-World" sector due to data limitations and unmanageability of an unduly large model.

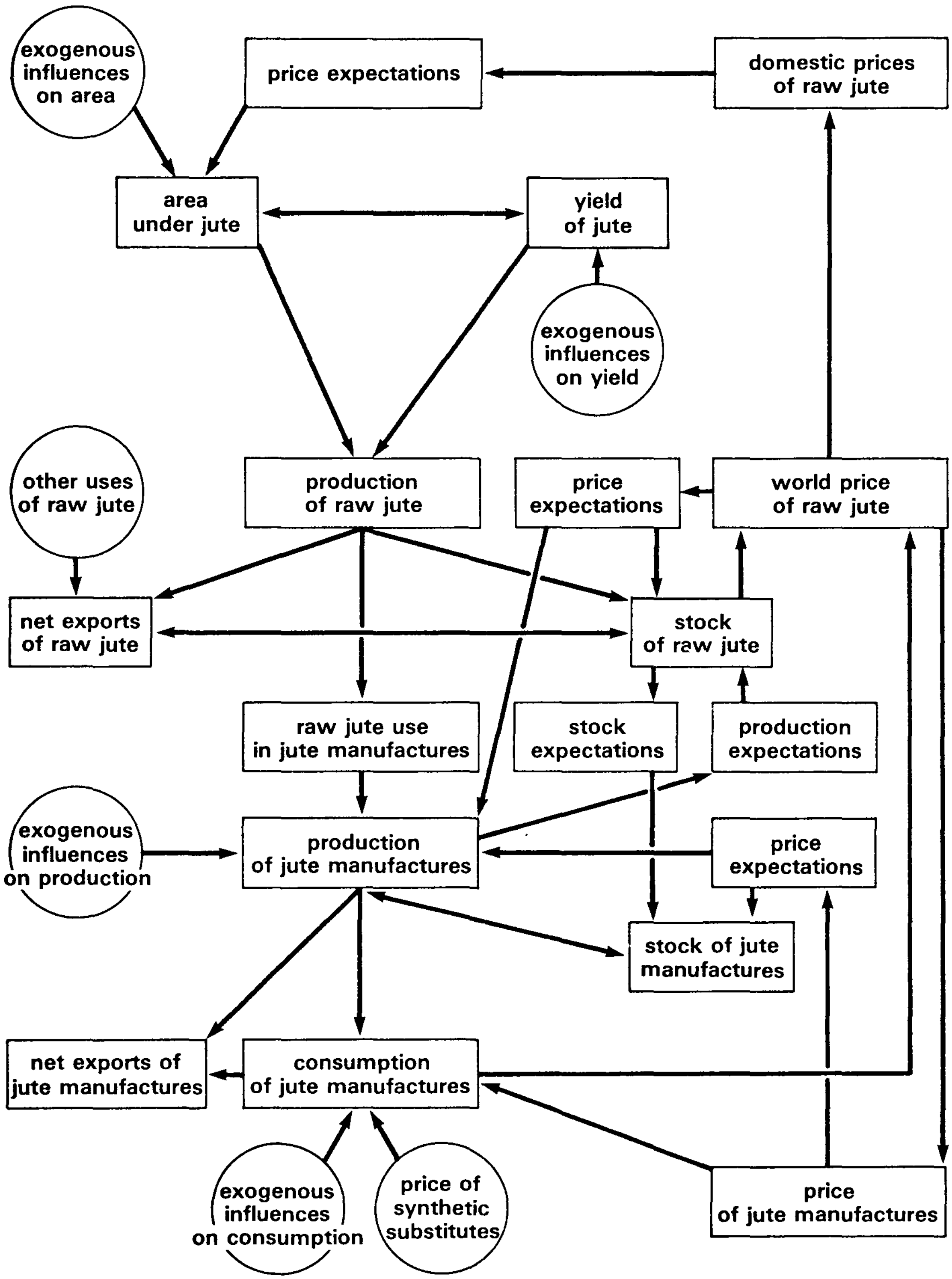
The annual model will encompass the main aggregative flows in the jute market. The market will be analyzed in terms of production and consumption of both raw jute and jute manufactures. Equations explaining level of stocks of both raw jute and jute manufactures by the major producing countries will also be included. However, due to lack of data the effects of stocks, consumption and trade-flows of jute and jute manufactures at the retail and wholesale levels in the consuming countries have been neglected. This is expected not to affect the conclusions of the study seriously, since such stocks are negligible both in quantity and in their effects on the world market.

Table 3.1 shows a schematic diagram of the world jute model indicating the way in which the major industry variables are related to one another. One interesting feature of the model is the explicit analysis of both raw jute and jute manufactures as separate products. Moreover, in analyzing the markets, the interactions between the two products have been considered. In the following paragraphs the important relationships of the model are summarized.

In explaining the production of raw jute, the area under jute cultivation has been used as a proxy for planned production since the yield of raw jute is influenced mainly by random factors (e.g., weather) due to the subsistence nature of cultivation. It is hypothesized that the actual area under jute, rather than actual production, is a much better index of planned production. The area under jute is influenced, among other factors, by the expectations of jute prices in relation to the price of alternative crops by the growers. Based on such hypotheses, acreage equations

TABLE 3.1

SCHEMATIC DIAGRAM OF THE WORLD JUTE MODEL



for jute are estimated for Bangladesh, India and Thailand. Yield of jute equations, along with the acreage equations, provide the production of raw jute.

The producing nations utilize raw jute for three main purposes -- exports, production of jute manufactures, and carry-over stocks. In the model, production of jute manufactures and carry-over stocks are estimated while net exports have been determined residually after allowing for other exogenous uses of raw jute. The production of jute manufactures by the seven countries/regions in the model -- Bangladesh, India, U.K., U.S.A., Japan, EEC countries, and the "Rest-of-the-World" sector -- are hypothesized mainly to be influenced by the expectations of prices of raw jute and jute manufactures and, in some cases, by a time trend variable. The carry-over stocks of raw jute -- estimated for the three major producing countries of Bangladesh, India, and Thailand -- are assumed to be determined by future price and production expectations, along with other variables. As in the case of raw jute, net exports of jute manufactures are determined residually after allowing for domestic consumption and stocks. Except in the cases of Bangladesh and India where the consumption of jute manufactures has been estimated directly, total consumption of jute manufactures and synthetic substitutes have been estimated together first and then the ratio between the two has been determined for the five other countries/regions. The stocks of jute manufactures equations for India and Bangladesh, the two major producing nations, are estimated.

Finally, the world price of raw jute equation is estimated; the price is hypothesized to be influenced by world stocks of raw jute and world consumption of raw jute. The world price of jute manufactures is depended upon the world price of raw jute. Finally, the domestic prices of raw jute and jute manufactures are linked with the world prices of raw jute and jute manufactures respectively, for the major producing countries.

In total tne model consists of 39 stochastic equations and 25 identities. Since jute prices are thought to be relevant to the determination of jute acreage only in a lagged form, there is no simultaneity problem in estimating these equations. Hence these equations are estimated separately by the method of ordinary least squares and, in some cases, by the Cochrane-Orcutt iterative procedure. The same procedure is followed in a few other cases where the equations do not contain any simultaneous variables. The rest of the model is estimated simultaneously by the method of two-stage least squares.[1] However, the application of the method involves a number of problems. Since the model is dynamic and large, it includes lagged endogenous variables as essential parts of the system with relatively few truly exogenous variables. Thus given the limited number of observations, the possible application of the method of two-stage least squares is brought into question since the number of lagged endogenous and exogenous variables in the entire model which has to be used in the first stage in the estimation of a particular equation exceeds the number of observations, thereby creating the problem of insufficient degrees of freedom. Moreover, as Fisher[2] has shown, in the presence of serial correlation in the residuals, such estimation will not be consistent given the presence of the lagged endogenous variables.

The use of some form of instrumental variables for the first stage is thus necessitated by the dimensions of the model. Ordinarily in the first stage of two-stage least squares, an estimate of the variance-covariance matrix of the reduced-form disturbances is obtained by regressing the vector of the current endogenous variables which enter as explanatory variables in the equation being estimated on all the predetermined variables in the system, this regression requiring the inverse of the matrix of sums of squares and products of the predetermined variables. However, for the forms of the world jute market model considered here, the number of predetermined variables varies from 39 to 48 while the number of observations is only 25. Thus, for these models, the matrix of the sums of squares and products of the predetermined variables is singular.

In order to avoid this problem of singularity, a method suggested by Fisher (see footnote above) involves systematically choosing a subset of the predetermined variables as instruments by taking account of the recursive structure of the system. In this study we have used a method, due to Fair[3], which describes the estimation of consistent parameters in the presence of lagged endogenous variables and first-order serially correlated errors. In this method a small number of instrumental variables are chosen which are uncorrelated with the error term in the particular equation to be estimated and which include at least the lagged dependent variable, the lagged endogenous variables included in the equation and the predetermined variables included in the equation and their lagged values. Other variables have been chosen by the method suggested by Fisher. Regression on this set produces the estimated values in the first stage. Then an iterative procedure is used to yield the smallest sum of squared residuals of the second stage regression.

For all equations of the model, parameter estimates and their estimated t-scores, the multiple correlation coefficients (corrected for degrees of freedom), and Durbin-Watson statistics are reported. However, the standard t- and Durbin-Watson tests are not valid for structural estimates of simultaneous equation models, especially when many of the equations reported contain the lagged values of the dependent variables.

However, these statistics are included so that we may have a systematic basis for comparing the equations estimated. The inapplicability of the standard tests means that a greater reliance has to be placed on a priori specification of the model.

In determining the final forms of the equations for the complete world model, there was a certain amount of experimentation with different forms of each equation. Because of the size of the model, the whole model was not re-estimated for each form of each equation. However, when the final specification of the model was determined, all equations in the model were re-estimated and it is these estimates that are finally reported.

3.2 General Considerations Relating to Data

The relationships of our model will be expressed, insofar as is possible, in terms of comparable real economic variables. Clearly many of the variables, such as acreage and production, are already in real terms. However, the official jute statistics of Bangladesh and India have long been the target of criticism for their unreliability. As Myrdal[4] has put it, in general for the less developed countries of South-East Asia,

> "The attempts to sketch economic reality, to find out what the present situation is and discern dominant trends, is severely restricted by the lack of precise and reliable statistics and other information. Even more fundamentally, we are restricted by inconsistent, unrealistic, and even misleading concepts in attempting to grasp and interpret the facts."

The data problems are indeed severe, and special care has been taken in this study to ensure that the data used are the best available. Thus the data on the variables were checked, whenever possible, by constructing appropriate flow matrices in order to examine their reliability and, in this respect, they were found to satisfy the appropriate identities. For example, in the case of data relating to trade flows, partnership-trade data checks were made. That is, available export figures from A to B was checked against available import figures from B to A. In the case of production, checks were imposed to ensure that the amount produced each year in each country was equal to the sum of all possible uses. Similar checks were applied in connection with other major variables. Thus, it is believed that the data base on which the model reported here has been constructed is much more reliable than is typically the case in econometric studies involving the use of data from less developed countries.

The price and income variables were deflated by appropriate indexes, in each case to get them into real terms. For the annual world price of jute, we have used the price of the most commonly quoted jute (Export Hearts) in the London market, which has been taken as the representative price. Alternatively, we could have used the price of a composite quality jute, constructed by the weighted average of different grades of jute. However, the use of the representative price would not be misleading since the prices of different grades move with almost a fixed margin. The use of a single price rather than separate prices for different grades is dictated by the lack of a jute-quality breakdown of much of the data necessary for the world model. Most of the necessary data have been collected from the annual publication of the Commonwealth Economic Committee, Industrial Fibres, and the Production and Trade Yearbooks of the Food and Agricultural Organization of the United Nations.

Definitions and data sources for each of the variables used in the study are provided in Appendix A.

FOOTNOTES - CHAPTER THREE

[1] For a general discussion of the method of two-stage least squares, see any standard econometrics textbook. For example, Kmenta, J., Elements of Econometrics, Macmillan Publishing Co., Inc., New York, 1971, pp. 559-565.

[2] Fisher, F.M., "The Choice of Instrumental Variables in the Estimation of Economy-Wide Econometric Models", International Economic Review, Vol. 6, No. 3, September 1965, pp. 245-274. See also his "Dynamic Structure and Estimation in Economy-Wide Econometric Models" in The Brookings Quarterly Econometric Model of the United States, eds. J.S. Dusenberry, et. al., Chicago Rand McNally and Co., 1965, pp. 589-650.

[3] Fair, R.C., "The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First-Order Serially Correlated Errors", Econometrica, Vol. 38, No. 3, May, 1970, pp. 507-515.

[4] Myrdal, G., Asian Drama, An Inquiry into the Poverty of Nations, Vol. I, Penguin Books, p. 411.

CHAPTER FOUR

A MODEL OF WORLD JUTE SUPPLY

4.1 Introduction

Supply functions are a necessary input for the proposed model. The annual model will contain equations explaining the production of raw jute in the three major producing countries -- Bangladesh, India, and Thailand -- as well as in the "Rest of the World" sector. The accuracy and the predictive capacity of the model will depend, to a large extent, on these supply estimates. Section 4.2 presents the theoretical background for the annual production of jute in terms of the area planted under jute as the dependent variable. The equation for the dynamic supply response model is derived in section 4.3, while some of the statistical problems faced in fitting this model to time-series data are discussed in section 4.4. The results of fitting the model to data for the countries are presented in section 4.5 and 4.6. In section 4.7, comparisons between the results for the different countries and with earlier studies are made and some general conclusions about the nature of seasonal jute production are given. Finally, section 4.8 develops models of production of jute manufactures. Before going into the supply equations for raw jute, it might be worthwhile to discuss briefly the general theory of supply of agricultural commodities.

Basically, the supply of an agricultural commodity, like any other commodity, rests on the micro-relationships within agriculture. The foundation of the supply of a product and the demand for factors of production is the production functions. However, given the knowledge or expectations of the production function, the commodities a farmer will produce and the inputs he will employ during any specified period of time are tempered by the nature of the farmer's economic goals, capital position, investment in fixed inputs, expectations of prices, risk aversion and related conditions. On the other hand, the crucial supply information leading to the formulation of viable agricultural policies must come in macro-form, by important regional or national aggregates. The study of individual relationships and decisions are needed, however, to understand fully the supply phenomenon. Eventually, the individual quantities so derived must be aggregated or lead to improved procedures for estimating the supply function from aggregate data.

At the theoretical level, the supply function for a commodity can be obtained by three methods: (a) Derived from the underlying production function, (b) Estimated by budgeting and programming techniques, and (c) Estimated by regression analysis of the time series data on supply. Under conditions of perfect knowledge in respect to all variables, the static supply function can be derived directly from the production function and the set of commodity prices, given a goal of profit maximization for competitive farms which can provide a conceptual starting point in analysis of farmer's output responses.[1] However, the assumptions involved in deriving the supply functions by this technique hardly square with the decision-making processes in the real world. The presence of uncertainty, lack of knowledge, nonmonetary goals and other measurement difficulties make such derivation still more impossible. The second approach also requires the pure goal of profit maximization and perfect knowledge of production and price parameters.[2] Estimation based on the third approach, however, does not require the assumption of profit maximization or the knowledge of the production function. The important problem is to specify the variables that are supposed to influence the farmer's decision to produce a particular output. If one wishes to predict the future time path of some variables, estimates based on past responses can be thought of as adequate, provided of course the independent variables and their relations to the variables of interest follow the same patterns in the future as they have in the past. However the choice of these appropriate explanatory variables is a difficult job, and, at the same time, it might not always be desirable to extrapolate past trends into the future. Regression models based on time series observations cannot predict in light of new variables and structures, previously nonexistent but expected in the future. They are necessarily tied to the past and are reflections of historic relationships.

Moreover, estimation of supply functions from aggregate data leads to one of the most complex of econometric problems which influences not only the choice of explanatory variables but also the reliability of estimated parameters. Since production decisions are made at the micro-level, the estimation of aggregate supply function itself involves the translation from micro to approximately equivalent macro relationships which are of direct interest for policy purposes. Furthermore, the necessity of confining to a few relevant explanatory variables in time series analysis is itself a form of the aggregation problem.

Keeping these qualifications in mind, time series data are used in this study to estimate the supply functions since this procedure seems to imply fewer normative assumptions than the alternative techniques of programming-budgeting and derivation from production functions.

4.2 Theoretical Model of Annual Production of Jute

The extent of price responsiveness of producers of primary commodities has been a subject of wide debate.[3] However, the degree of supply responsiveness is basically an empirical question. In the past few decades a number of significant contributions have been made on the application of econometric techniques to the estimation of such responses.[4] Although there have been various a priori hypotheses about the supply responsiveness of underdeveloped agriculture to price changes ranging from quick and efficient to insignificant response due to institutional constraints, the price responsiveness of jute farmers has been recognized for a long time.[5]

In our analysis of supply responsiveness the important variables that is of interest is the response of planned production of jute to the various observed variables. However, there are no estimates of planned production that can be observed and hence some proxy for this variable has to be employed. Actual production often performs very badly for this purpose since actual production may sometimes differ very widely from planned production due to environmental factors which affect the production greatly and remain largely beyond the farmers' control. Another alternative which has been widely used by many economists is the area under crop.[6] The area actually planted under a particular crop can be expected, to a much greater degree than actual production, to be under the farmers' control and, presumably, is a much better index of planned production. This is particularly true in the case of jute, since the collective price response of jute growers manifests itself primarily in the form of acreage response, since variations in jute acreage alone usually explains 85-95 percent of the annual variations in the production of jute in Bangladesh and India.[7]

The relationship between planned production of jute and area under its cultivation can be further illustrated by considering the following relationships. Let us represent

J^* = the planned production of jute

ACR^* = the planned area under jute cultivation

ACR = the actual area under jute cultivation

YPA^* = the planned yield per acre of jute

X = some independent variable on which J^* depends

η_{mn} = the elasticity of m with respect to n

If we assume that the farmers have control over area then

$$ACR^* = ACR$$

and in terms of elasticities we can write

$$\eta_{J^*,X} \simeq \eta_{ACR,X} + \eta_{YPA^*,X} \qquad [4.1]$$

Hence, the use of area instead of planned production will result in estimated elasticities of $\eta_{ACR,X}$ instead of $\eta_{J^*,X}$. And the smaller is the absolute value of $\eta_{YPA^*,X}$, ceteris paribus, the better will $\eta_{ACR,X}$ approximate $\eta_{J^*,X}$. Thus the estimated values of the elasticities will be more realistic depending upon which variables are included in X. For the subsistence farmers of jute, however, the yield rate is random, being primarily influenced by the weather, and by traditional practices which do not involve the application of any yield-raising inputs such as fertilizers and better seeds. Moreover, the increased irrigation facilities and other agricultural improvements over the period were mostly beyond the farmers' control and the benefits generally substantially exceeded the costs, given any reasonable price expectations. Thus the elasticity of planned yield with respect to price and similar other variables is expected to be very low. It is expected, then, that the estimates of elasticities calculated from the model using area under jute cultivation as the dependent variable will approximate very closely the desired elasticities of planned production.

In order to obtain accurate estimates of area under jute it is necessary to determine the variables that may be considered important in explaining the actual acreage under jute. Most of the world's jute is produced within the predominantly rice-growing areas of Bangladesh and India.[8] Rice is grown as the staple food crop, while jute is the principal cash crop of the farmers of the jute belt. The economic cost of growing any crop, including jute, is the cost of foregoing the crop which might have been grown in its place. If, with given resources of land, labor, capital and knowledge, nothing could be grown in its place, then the opportunity cost would be zero. In the jute-belt, rice, which is planted on over 70 percent of the cultivated area, is the main competitive crop (See Table 4.1). Although there are areas where rice will not readily grow, over large areas jute can be grown only at the expense of rice.[9] In the area, three main varieties of rice crops are grown, designated by the time of harvest -- <u>Aus</u> (summer), <u>Aman</u> (winter) and <u>Boro</u> (spring). In the past, competition has come principally, but not entirely, from <u>aus</u> rice, which has virtually the same growing season as jute: both are planted around March and harvested in July and August. If jute is planted, the <u>aus</u> crop is necessarily sacrificed. In some areas, jute may also conflict with the planting of <u>boro</u> -- which is planted in December and harvested in April -- or with broadcast <u>aman</u> but, at least until recently, the amounts involved were relatively small. Although opportunities exist for double-cropping jute with transplanted _aman_, these are limited and is only effective if a late _aman_ crop can be transplanted on the same land after an early jute harvest. This, however, involves a reduction in yields of both crops and may be made impossible if the weather is not suitable. According to one survey, in Bangladesh, only 3 percent of jute growers' cultivated land was used for double cropping _aman_ rice and jute during 1958-59.[10] Similarly in India, double-cropping _aman_ rice is limited to less than 1 percent of the jute growers' land.[11] Competition can thus be considered to have come larged from _aus_ crop.

However, in recent years, with the growing importance of high-yielding varieties of rice in this region, jute is increasingly coming under competition from high-yielding varieties of both _boro_ and _aman_. For example, their area increased from less than half a million acres in 1968-69 to about 5 million acres in 1974-75 (See Table 4.1) in Bangladesh. IRRI _boro_ -- which is transplanted in late January and harvested in May and June -- is displacing jute in those areas where water is available in sufficient quantities and, since its yield is exceptionally high, it is extremely attractive to growers.[12] The area under IRRI _aman_ has increased even more rapidly, and since it must be transplanted by July, it tends to encroach on jute acreage more

TABLE 4.1

AREA UNDER JUTE AND RICE IN BANGLADESH
(In million acres)

Year[a]	Jute	Rice				
		Aus	Boro	Aman	Total	Of which high yielding varieties
1955-56 to 1959-60 (average)	1.5	-	-	-	20.1	-
1966-67 to 1968-69 (average)	2.32	7.61	1.65	14.38	23.64	-
1969-70	2.5	8.4	2.2	14.8	25.5	0.6
1970-71	2.3	7.9	2.4	14.2	24.5	1.2
1971-72	1.7	7.4	2.2	13.4	23.0	1.5
1972-73	2.2	7.3	2.4	14.1	23.8	2.7
1973-74	2.2	7.7	2.6	14.1	24.4	3.8
1974-75	1.4	7.9	2.6	14.4	24.9	5.0

a. July-June season

Source: Government of Bangladesh, Statistical Yearbooks and other sources.

than traditional _aman_, which is not transplanted until late August.

Although the extension of the area under high yielding varieties of rice has been considerable in recent years, its encroachment on the area under jute is limited by the need for controlled water supply. Jute's ability to survive in areas with severe flooding gives it a distinct advantage over IRRI _aus_, which has tended to be sown in areas with the best hydrological conditions. Similarly, IRRI _boro_ which requires abundant water in the winter season, is often planted in depressions remaining under water during the jute growing season. Thus it appears that the high-yielding varieties of rice do not pose a threat to all areas currently under jute.

It is now clear that over most of the jute-belt in Bangladesh and India, rice is practically the only alternative to jute cultivation.[13] Moveover, the cultural practices of the two crops are such that land, labor, and other inputs necessary for their cultivation are readily interchangeable. In fact, for most farmers the cultivation of jute is primarily a choice between a cash crop and the staple food crop. Thus, in the jute-belt of Bangladesh and India, rice prices to a large extent represent the opportunity cost for jute production, since rice production usually has to be foregone to grow jute. Where the grower has a choice between rice and jute, the assumption is that his decision will turn upon the prices which he expects to receive for rice and jute. The individual grower will have a wide range of production possibilities and his choice of combination of the area devoted to rice and to jute will depend on his assessment of the probabilities of different price situation, a choice which will depend mainly on the prices of the two crops at the time of sowing. Each season's area under jute is thus expected to be related to the prices of jute and rice which existed at sowing time in the previous season.

The jute/rice price ratio has long been recognized as a key determinant of the area under jute vis-a-vis rice.[14] The hypothesis has been advanced that the proportion (or amount) of land devoted to jute will rise as the ratio of expected jute prices to expected rice prices increases, and will fall as the ratio decreases. While the exact size of the ratio required in any given year to maintain the area under jute in equilibrium with that under rice will depend on costs of production and yields of the two crops, a close historical relationship may be observed between changes in the acreage under jute. This can be seen from Table 4.2, which relates the price of jute and rice with area under jute indicating a close link between them, in the case of

TABLE 4.2

JUTE/RICE PRICE RATIO AND AREA UNDER JUTE
BANGLADESH

Year[a]	Price of Jute[b]	Price of Rice[c]	Price Ratio Jute/Rice	Area under Jute[d] (million acres)
	Taka per maund[e]			
1947-48	21.50	16.08	1.33	1.9
1948-49	30.25	20.04	1.50	1.6
1949-50	20.00	16.33	1.22	1.7
1950-51	19.00	12.92	1.47	1.8
1951-52	25.75	14.75	1.74	1.9
1952-53	10.25	14.00	0.73	1.0
1953-54	15.50	10.25	1.51	1.2
1954-55	15.64	7.33	2.13	1.6
1955-56	18.87	13.79	1.36	1.2
1956-57	24.09	21.04	1.17	1.6
1957-58	10.06	17.63	1.13	1.5
1958-59	16.00	16.96	0.94	1.4
1959-60	20.90	17.75	1.17	1.6
1960-61	47.94	16.07	2.98	2.1
1961-62	24.88	17.02	1.46	1.9
1962-63	21.95	17.57	1.24	1.8
1963-64	22.52	15.76	1.42	1.7
1964-65	31.47	16.67	1.88	2.2
1965-66	27.39	21.38	1.28	2.3
1966-67	36.03	28.59	1.26	2.4
1967-78	27.58	28.29	0.97	2.2
1968-69	34.01	30.82	1.10	2.5
1969-70	29.78	30.17	0.98	2.3
1970-71	35.15	29.50	1.20	1.7
1971-72	38.80	35.00	1.10	2.3
1972-73	52.58	39.88	1.31	2.2
1973-74	52.81	51.36	1.02	1.4
1974-75[f]	93.61	118.61	0.78	-

a. July-June season
b. Price of jute at growers' level
c. Wholesale price of aus paddy
d. In the season following the one shown
e. Taka refers to units of Bangladesh currency (1 US$ = 14.83 Taka)
1 maund = 82.286 lbs.
f. Seven months average

Source: Government of Bangaldesh, Statistics Yearbooks.

Bangladesh. Similar relationships can also be traced in the case of India.[15] However, the true nature of the relationship between area under jute and jute and rice prices is a matter for conjecture and assumption.

Among the major long-term determinants of the parameters of this relationship are the rate of population growth in Bangladesh and India, the relative rates of improvement in jute and rice productivity per acre, government policies with regard to jute and rice prices and governments' financial availabilities and outlays for food grain imports and stocks. Exogenous trends in prices of substitute materials and the development of substitute techniques are also critical, given their influence on the international jute prices, and thus, indirectly, on the jute price at growers' level.

While the historical relationship between area under jute and jute-rice prices are no doubt important, any precise estimation of the jute acreage function should also consider the relative costs of production and yields in order to get some measure of net returns, and some measure of changes in technology, if any, which occurred during the period. Small growers, do not, of course, make precise calculations of net returns when the yields from one unit of land under jute and rice are very different (especially with improved varieties of rice), the choice of the crop may not be based on a straight comparison of expected prices, but on a comparison, however unsophisticated, of net returns.

The cost of producing jute varies considerably according to the areas in which it is grown and to the conditions of cultivation. According to one estimate, the average cost per maund (36 kg.) over the various areas of Bangladesh and India varied from 15 to 26 rupees in 1956, of which four-fifths are human labor.[16] Another FAO study[17] has examined the costs of production of both jute and rice under both traditional and improved methods of cultivation in Bangladesh during 1974-75. The data presented in Table 4.3 compare the costs of production of jute and rice under traditional methods of cultivation which predominate in most of Bangladesh and under the improved methods which, though still applied in a limited way, offer considerable potential. Given the traditional method, the net (refers to net of by-product return) production cost of jute is approximately 10 percent higher than the net production cost of aus rice, which is entirely due to higher labor costs. To the extend that family labor is utilized instead of hired labor, the production cost of jute would be slightly lower.[18] Thus it would appear that under the traditional method, which is still widely prevalent,[19] the costs of production of jute and aus rice are quite

TABLE 4.3

COMPARISON OF YIELDS AND VARIABLE COSTS OF PRODUCTION OF JUTE AND RICE IN BANGLADESH, 1974-75

	Traditional Method of Cultivation		Improved Jute Cultivation			IRRI Rice	
	Jute	Aus Rice	Improved Seed Only	Intensive Cultivation[a] Package	BJA[b] Package	Boro	Aus
Average yield (maunds/acre)	15	15	17	22	30	60	50
Production costs (Taka/acre)	1140	910	1185	1400	1824	1240	1240
By-product return (Taka/acre)	360	200	408	528	720	180	150
Net[c] production costs (Taka/acre)	780	710	777	872	1104	1060	1090
Net[c] production costs (Taka/maunds)	52	47	45	40	37	18	22

a. Improved seed, line-sowing, fertilization, weeding and thinning, pesticides and insecticides, and timely sowing and harvesting.
b. According to the experience of Bangladesh Jute Association's intensive cultivation scheme with larger inputs and supervision.
c. Net of by-product return.

Source: FAO, Domestic Prices of Jute in Bangladesh, op.cit., Table 3, p. 5.

comparable and hence expected prices of the crops can be considered as depicting fairly the net returns of both the crops.

The problem of how to include prices of inputs and competing products in the regression analysis of supply forces one to consider many interesting alternatives. In general, the alternatives include such things as whether to include individual prices or indexes involving several commodities and whether to include prices in a linear fashion or nonlinearly, the most common of which is as a deflator. The problem of multicollinearity among price series is such that one seldom attempts to include prices of more than one or two major competing products of inputs. It is assumed that the prices thus included adequately account for other less important commodities which might logically enter into a more complete model.

As regards the question of whether total areas should be included or only year to year differences, which is often used where adaptation in the pattern of agricultural production is rather limited or slow, the total area under jute has been preferred in this study due to the traditional role of rice and jute in the society -- the widespread familiarity with cultivation of both the crops and their complementary nature and vast area under rice as compared to jute.[20] There are also questions regarding the

the use of the price-ratio. For example, we may use the jute-rice price ratio as a single independent variable rather than the prices of jute and rice separately. The use of the relative price is based on the hypothesis that the effect on jute acreage of a percentage change in the price of rice is the same as that of an equal change in the price of jute so that independent price variables can be expressed in the form of a ratio. Further, it assumes that the absolute levels of jute and rice prices are unimportant. This may be true within some range of prices, but it probably may not be true over the observable range of prices for a given period of time. In any case, it is probably worthwhile to let the data determine the separate effects of the individual prices rather than force conclusions such as indicated above.

It seems impossible to employ all variables in estimating acreage equations for jute because of limited observations and, in some cases, some of the variables are difficult to quantify because of the lack of continuous and reliable information for the countries concerned. Input prices and technology will be ignored mainly due to the lack of adequate information. This can be justified by the fact that the production of jute in these countries is still predominantly a product of subsistence nature of cultivation.

To account for changes in technology and institutional changes (e.g., better irrigation facilities, availability of rural credits, etc.) a time variable may be used, which presumably accounts for shifting effects not adequatly accounted for by other variables in the equation that have shown a relatively constant pattern of change over time. Similarly, the existence of a "once and for all" structural change can often be accounted for by including a dummy variable.

4.3 Formulation of Jute Acreage Function

An agricultural supply response model, in terms of area under the crop of concern, typically has the form

$$ACR_t^* = \alpha_o + \alpha_1 P_t^* + \alpha_2 Z_t \qquad [4.2]$$

where ACR_t^* = desired acreage at time t

P_t^* = expected price level at time t [21]

Z_t = a surrogate for non-price variables, and

α_0, α_1 and α_2 = the regression coefficients to be estimated

The traditional short run supply response model assumes that $ACR_t^* = ACR_t$ and $P_t^* = P_{t-1}$, that is, farmers fully adjust to their desired acreage each year according to the price level in the preceding year. However, the traditional model often fails to explain the farmers' supply response due to two reasons. First, farm product prices fluctuate considerably from year to year around a long term trend. Farmers' expectations of future prices are therefore likely to depend not just on immediate past prices but on a number of years' prices,[22] from which the farmers would arrive at an expected price level. Secondly, farming is characterized by near-perfect competition on the output side and "asset fixity" on the input side. Thus while farmers are price-takers, they cannot always readily adjust to price changes in the short run.[23]

It may be argued, however, that the problem of "asset fixity" is not substantial in the case of jute production in Bangladesh and India. Almost all the jute growers are primarily rice growers and their land and other inputs are readily interchangeable between their cultivation. It may thus be a reasonable approximation to assume $ACR_t{}^* = ACR_t$, that is, the farmers fully adjust their jute area each year to their desired level. The validity of this assumption is considered later on in this section.

Assuming then that $ACR_t{}^* = ACR_t$ and ignoring the non-price variables for the moment, the model [4.2] can be expressed as the general distributed lag model

$$ACR_t = \sum_{s=0}^{k} \phi_s P_{t-s-1} \qquad [4.3]$$

where k is the number of the past years' prices which affect acreage. However, due to estimation problems involved it might be desirable to restrict the form of distribution the lag might take.[24] In his work on investment, Koyck assumed that ϕ has the special form

$$\phi = \beta(1-\beta)^s,\ 0 \leq \beta \leq 1,\ \beta \text{ constant and } k \to \infty$$

which was later used by Cagan, Nerlove and Friedman, among others.[25] Of relevance to the present study, is the notion of adaptive expectations first used by Nerlove, which introduces the influence of previous forecast error implying that current expected price differs from the past expected price by an amount proportional to the previous forecast error. Thus the difference between the price of jute expected in season t and the price of jute expected in season t-1, that is, the revision of last year's expected price, is proportional to the error made in forecasting last season's price:

$$P_t^* - P_{t-1}^* = \beta[P_{t-1} - P_{t-1}^*] \qquad [4.4]$$

which is equivalent to

$$P_t^* = \sum_{s=0}^{\infty} \beta(1-\beta)^s P_{t-s-1} \qquad [4.5]$$

where β is called the "coefficient to expectations".[26] Note that if β=0, then actual values of past prices have no effect on expected prices; while if β=1, then the actual value of price in year t-1 is projected as the forecast price in year t, that is, expectations are "naive".

Assuming $ACR_t^* = ACR_t$, equation [4.4] can be substituted in equation [4.2] to obtain

$$ACR_t = \alpha_0\beta + \alpha_1\beta\ P_{t-1} + (1-\beta)\ ACR_{t-1} + \alpha_2 Z_t + (\beta-1)\ \alpha_2 Z_{t-1} \qquad [4.6]$$

In other words,

$$ACR_t = \pi_0 + \pi_1 P_{t-1} + \pi_2\ ACR_{t-1} + \pi_3 Z_t + \pi_4 Z_{t-1} \qquad [4.7]$$

which provides simultaneous estimates for both the short-run and the long run price elasticities of supply.[27]

However, the equation [4.7] has been derived on the assumption that $ACR_t^* = ACR_t$, that is, the farmers fully adjust their jute acreages each year to their desired level. This assumption might not be completely realistic. It might be necessary to build into the jute acreage equations for each country the essential dynamic aspect that the level of a country's area under jute cannot be changed rapidly in the short run in response to changing economic conditions.

In building this dynamic aspect into our acreage equations, following Nerlove,[28] the adjustment lag may be specified as:

$$ACR_t - ACR_{t-1} = \lambda[ACR_t{}^* - ACR_{t-1}],\ 0 \le \lambda \le 1,$$

$$\lambda \text{ constant} \qquad [4.8]$$

In equation [4.8], the actual change in acreage in year t is specified to be equal to a fraction, λ, the "coefficient of adjustment", of the desired or equilibrium change in acreage. The jute farmers are able to increase the acreage under jute in any year only to the extent of a fraction λ of the difference between the acreage they would like to plant and the acreage they actually planted in the preceding year. The size of the fraction λ is a measure of the speed with which actual acreage adjusts in response to factors determining desired acreage. Such factors will vary for different countries and the adjustment speed is determined by the institutional, technological and behavioral rigidities. Equation [4.8] indicates that adjustment takes time and

> "Between one period and the next you will travel only a fraction of the distance which separates you from where you are and where you would like to be if you could adjust instantaneously, where you would want to be if adjustments were painless and costless, and if you really believe that the current data (prices) would persist ..." 29

If [4.8] is substituted into model [4.2] and it is assumed that the previous year's price level is the expected price for this year ($P_t^* = P_{t-1}$) then a model similar to the adaptive expectations model [4.7] is obtained, with Z_{t-1} excluded. This has come to be known as the "partial adjustment model". Thus the autoregressive model [4.7] with Z_t and Z_{t-1} omitted is open to a dual interpretation, depending on whether it is assumed that $0 \leq \beta \leq 1$ and $ACR_t^* = ACR_t$, so that $\lambda=1$ (adaptive expectations), or $0 \leq \lambda \leq 1$ and $P_t^* = P_{t-1}$, so that $\beta=1$ (partial adjustment).

In the case of the partial adjustment model, it might be interesting to consider other specifications of the formation of price expectations besides the "naive" expectations specification used above. However, it is particularly important to note that the limited length of time series and the degree of aggregation used in this study limits the choice of alternative specifications to a few simple formulations. At the same time, the high degree of variation over time of annual jute acreage is most countries may be an indication of the relative importance of price expectations in the formation of jute acreage decisions.

One specification of expectations formation, used in this study, is the one due to Goodwin[30]:

$$P_t^* = P_{t-1} + \mu[P_{t-1}-P_{t-2}], \quad -1\leq\mu\leq 1 \qquad [4.9]$$

Here we have used the case of a one-year lag between expectation formation and the realization of actual prices, so that expected price is a function of previous actual price plus or minus a fraction of the previous price change. Muth[31] calls such expectation formulation "extrapolative expectations", for the specification states that the decision-maker estimates future prices by extrapolating the current prices, adjusting by a factor μ, for the most recent observed change in price. Letting

$$\Delta P_{t-1} = P_{t-1} - P_{t-2}$$

and substituting [4.9] and [4.8] into [4.2] yields the following equation:

$$ACR_t = \lambda\alpha_0 + (1-\lambda)\ ACR_{t-1} + \lambda\alpha_1\ P_{t-1} +$$

$$\lambda\alpha_1\mu\ \Delta P_{t-1} + \lambda\alpha_2 Z_t \qquad [4.10]$$

Note that $\mu=0$ yields the case of "naive expectations" and $\mu=1$ yields the case where the price change in year t-1 is extrapolated, unadjusted, to the present.

Moreover, the specification given in [4.2] and [4.8] illustrates the Marshallian distinction between the short and long-runs, where long-run corresponds to what Marshall defined as "normal".[32] In the short-run, the supply of factors to the economic unit, for example, a jute cultivator, is relatively fixed; while as longer and longer runs are considered, the supply of factors becomes more and more variable as more alternative courses of action become available.

However, despite the mathematical similarities of the final acreage equations, whereas the adaptive expectations model reflects the values of the variables such as prices which in turn determine the acreage; the partial adjustment model, on the other hand, reflects the technological and institutional constraints which permit only a fraction of the intended acreage to be realized during a given short period. In reality, both types of lags are important and neither can be supposed, a priori, to be non-existent. When both are incorporated in model [4.2] and Z is omitted for simplicity, the following "expectations and adjustment" model results:

$$ACR_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 ACR_{t-1} + \gamma_3 ACR_{t-2} \qquad [4.11]$$

from which it can be shown that

$$\beta, \gamma = (2 - \gamma_2 \pm \sqrt{\gamma_2^2 - 4\gamma_3})/2$$

Since β and λ enter the equation symmetrically, it is only possible to distinguish between them on a priori grounds. In this study, λ is chosen as the smaller one because, as explained above, lags in the formation of jute price expectations are considered to be larger than lags in acreage adjustment.

It is necessary to test that the expanded expectations and adjustment model [4.11] is not more appropriate when using either the adaptive expectations or partial adjustment model since failure to do so might create serious implications. Waud[33] has shown that, for the large sample case, the use of the adaptive expectations (or the partial adjustment) model when in fact the expanded model is the correct formulation leads to: (a) serious bias in the least squares estimates of the regression coefficients, (b) a noticeable increase in the size of the estimated standard errors relative to the estimated regression coefficients as the coefficient of adjustment, λ (or the coefficient of expectation, β) gets further away from its erroneously assumed value of 1, and (c) a very serious downward bias in the estimate for β (or λ) and hence an upward bias in the estimate of the mean lag, which becomes extremely serious as λ (or β) gets smaller. The situation would be even less satisfactory for small sample cases such as in the present study.

Thus equations [4.7], [4.10] and [4.11] would form the basis of the estimated acreage equations of jute for the major producing countries. We have not introduced explicitly the changes in input prices in the models mainly due to lack of adequate data. However, the price of rice in Bangladesh and India and other alternative crops in Thailand takes account, to a large extent, of the major elements in the costs of production of jute. Moreover, the evidence on the relative costs of cultivation of jute and rice in the region suggests that the deflated cost of cultivation of jute has not changed significantly over time.[34] Also, no demand relations have been specified in deriving the acreage equations which is based on the implicit assumption that shifts in demand and supply of jute are independent. This kind of assumption does not seem unrealistic for an agricultural commodity like jute produced under subsistence agriculture.

4.4 A Note on Estimation

The various forms of equations considered above, describing the acreage of jute in the producing countries, all exclude current variables endogenous to the rest of the world market model of jute. Hence we propose to use the method of ordinary least squares. One of the basic pre-requisites of the method of ordinary least square is that

$$E(u_t, u_{t+s}) = 0 \text{ for all } t \text{ and all } s \neq 0$$

where u_t is the disturbance term in period t and u_{t+s} is that of period t+s. The assumption of zero correlation between all disturbance terms of different periods is often violated in the analysis of economic time series and estimation by ordinary least squares in such cases lead to inefficient estimations.[35] Moreover, Griliches[36] has shown that if the true equation is of the simple form

$$ACR_t = \alpha_1 P_{t-1} + u_t \qquad [4.12]$$

and if the disturbance term u_t follows a first order autoregressive scheme such that

$$u_t = \rho \cdot u_{t-1} + \varepsilon_t$$

and, in place of [4.12], the distributed lag model

$$ACR_t = \alpha_1 P_{t-1} + \alpha_2 ACR_{t-1} + \nu_t \qquad [4.13]$$

is estimated, introducing the irrelevant variable ACR_{t-1}, then significant coefficients usually result with reduced serial correlation in the estimated residuals of [4.13]. But this may be due to ACR_{t-1} in [4.13] acting as a surrogate for u_{t-1} in what may be the true model [4.12]. And in cases with highly positive autocorrelation, ρ will be significant and so the estimated coefficient of ACR_{t-1} may appear to be positive and significant even though the basic model [4.13] is wrongly specified. Furthermore, it is for this reason that the usual Durbin-Watson test for serial correlation is inappropriate for models including a lagged dependent variable as an explanatory variable.[37] There is always a greater likelihood of autocorrelation in autoregressive models than the d-statistic test would suggest.[38] Hence while we may compute the value of this statistic for all our estimated equations, in most cases we are unable to perform any statistical tests of the absence of serial correlation. However, in cases where this statistic appears to be "unusually" high or low, the equation is reestimated by the Cochrane-Orcutt iterative procedure.[39]

At the same time, it is also necessary to test against the possibility of price lag misspecification, even though there are strong a priori reasons for expecting lags. If model [4.12] does have a first order positively autocorrelated error structure, then by substituting this structure and

$$u_{t-1} = ACR_{t-1} - \alpha_1 P_{t-2}$$

into [4.12], the following can be obtained:

$$ACR_t = \alpha_1 P_{t-1} + \rho\, ACR_{t-1} - \alpha_1 \rho\, P_{t-2} + \varepsilon_t \qquad [4.14]$$

To indicate whether [4.12] or [4.13] is the true model, [4.14] can be estimated to see if the estimated coefficient of P_{t-2} is negative and significant and approximately equal to $-\alpha_1\rho$. This would provide a rough criteria for choosing between the traditional static model and the distributed lag specification implicit in the adaptive expectations model.

4.5 Estimation of Acreage Equations

Based on the various equations derived in Section 4.4, we now turn to the estimation of the acreage functions for India, Bangladesh and Thailand. The most important variable to specify before actual estimation is done is the surrogate for the non-price variable, Z_t.

I. Acreage Equation for Bangladesh

Jute, as emphasized earlier, plays a major role in the economy of Bangladesh. Most of the policies of the government of Bangladesh affecting jute are either direct or indirect efforts towards stabilization of jute prices.

Jute is the only crop for which restrictions were imposed on acreage in order to regulate the price through the size of the crop. A jute board was set up in 1949 to reorganize the jute trade and regulate the volume of production by controlling the area planted each year; however, this proved largely ineffective because the jute growers planted beyond their licensed areas in nine out of thirteen years during which the measure was in operation.[40] In addition, the government also attempted periodically to fix the minimum jute prices for growers and for exporters, but its efforts proved largely ineffective due to a lack of stabilization funds available to finance the operation. Consequently, prices in Bangladesh follow inevitably the world market trends. Thus in specifying the acreage equations, no specific variables have been included for these government policy measures.

In addition to prices of jute and rice, the choice of other non-price explanatory variables is a difficult task. It seems impossible to use all variables in estimating acreage function of jute, due to data limitations and multicollinearity and other associated problems. Nevertheless, based on a priori information, the desired acreage equation [4.2] is respecified in the following form:[41]

$$ACR_t^* = \alpha_0 + \alpha_1 P_t^* + \alpha_2 RYPA_t^* +$$

$$\alpha_3 SDRAV_t + \alpha_4 T + u_t \quad [4.15]$$

and the estimating equations are obtained by the same way as described above. The expected price variable, P_t^*, has been used both in the form of a ratio between the prices of jute and rice and separately. The expected per acre yield of jute relative to yield of rice, $RYPA_t^*$, is expected to have significant influence in forming the desired acreage. One would expect α_2 to be positive under normal circumstances since increases in the expected yield, certeris paribus, presumably would make production of the crop under consideration more desirable.[42] For simplicity, and given the subsistence nature of cultivation, the relative yield rate of the previous season has been taken as the expected yield rate ($RYPA_t^* = RYPA_{t-1}$).

In the economic literature it has often been emphasized that for subsistence farmers the possible rewards for returns above the expected value may not offset the severe consequences for returns below the expected value.[43] A crop, with small expected values and higher central moments in the subjective price and yield probability distributions may therefore be preferable to a crop for which the probability distributions have substantially higher expected values, but also larger higher central moments. Thus for subsistence farmers, characteristics of the probability distributions other than the expected values are very important in determining the desired area. In the absence of any precise and satisfactory approach, a crude representation of such variances is included in this study. The actual standard deviation of the relative acre value of jute compared to rice, $SDRAV_t$, in the three preceding years is included as a proxy for the variance of the subjective probability distribution.[44] The selection of a three year period is, however, arbitrary. It is expected that α_3 would be negative since increased standard deviation, ceteris paribus, would make jute production less desirable. Finally, a time trend variable, T, has been included to account for other technological and institutional changes not adequately accounted for by other included explanatory variables. A dummy variable, DUM, is introduced for the year 1971 when production was disrupted due to the independence war of Bangladesh.

The results of the regression analysis are presented in Table 4.4 for the period 1948-49 to 1975-76, for total jute acreage in Bangladesh. Models I and II refer to the adaptive expectations model (or alternatively the partial adjustment model) as derived in [4.7] without the surrogate variable Z_t. Similarly, models VIII and IX are the esti-

TABLE 4.4

ESTIMATED ACREAGE EQUATION FOR BANGLADESH (ACRBD)[a]

1948-49 to 1975-76

Models	Intercept	ACR_{-1}	ACR_{-2}	RPR_{-1}	RPR_{-2}	PRJ_{-1}	PRJ_{-2}	PRR_{-1}	ΔPRJ_{-1}	ΔRPR_{-1}	SDRAV	$RYPA_{-1}$	T	DUM	$\bar{R}^2$	DW	ρ^b	β	γ
	Regression Coefficients (with t-values in parentheses)																		
I	558.6	0.46		509.2											0.51	1.48		0.55	
	(1.46)	(3.23)		(2.28)															
II	814.4	0.39				0.57		-0.20							0.55	1.55		0.61	
	(2.31)	(2.67)				(2.28)		(-1.83)											
III	1348.5					0.50									0.35	0.72			
	(5.19)					(1.83)													
IV	369.6	0.36	0.16	596.4											0.48	1.22			
	(1.89)	(2.25)	(0.43)	(2.53)															
V	532.2	0.24	0.23			0.71		-0.21							0.53	1.37			
	(1.57)	(1.34)	(0.59)			(2.79)		(-1.88)											
VI	530.4	0.63		463.3	-480.7										0.46	1.73			
	(1.83)	(4.39)		(3.16)	(-0.60)														
VII	1015.8	0.59				0.26	-0.46	-0.29							0.43	1.91			
	(2.75)	(3.31)				(2.19)	(-0.76)	(-1.06)											
VIII	530.4	0.63		182.6						480.7					0.50	1.73			
	(1.53)	(4.39)		(0.77)						(1.60)									
IX	1005.0	0.59				0.10		-0.30	0.47						0.52	1.90			
	(2.87)	(3.39)				(1.30)		(-1.48)	(1.90)										
X	501.1	0.57		665.2							-580.4	-144.7	9.22	-489.6	0.73	1.92	-0.29		0.43
	(1.81)	(3.33)		(3.77)							(-1.90)	(-0.89)	(1.74)	(-1.84)					
XI	918.3	0.55				0.69		-0.55			-480.4	-119.3	16.3	-554.5	0.75	1.84	-0.12		0.45
	(1.92)	(3.41)				(3.57)		(-3.25)			(-1.84)	(-0.75)	(1.88)	(-2.19)					

a Variable definitions and data sources are given in Appendix A.

b Estimated by Cochrane-Orcutt interative procedure.

mations of [4.10] depicting the "extrapolative expectations" behavior (again without Z_t) which do not show any better results than the simple "naive" expectations behavior. The much less significant results obtained in estimating the static model III (which is a gernal formulation of [4.12] with a constant term) lends further support that lags in the acreage equation are important. To indicate which of [4.12] and [4.13] is the true model, model VI and VII (corresponding to [4.14]) is estimated. From model VI, $\hat{\alpha}_1\hat{\rho}$ = 291.879 which does not approximate $\hat{\alpha}_1\rho$ = 480.734. Similarly from model VII, $\hat{\alpha}_1\hat{\rho}$ = .154 which does not approximate $\hat{\alpha}_1\rho$ = .461. Therefore the traditional static model is rejected in preference to the distributed lag specification implicit in model [4.7]. Before the ultimate choice is made, it is again necessary to test whether the expanded expectations and adjustment model [4.11] is more appropriate than the other models. Model IV and V gives the results for the expanded model, from which it appears that the acreage variable lagged two years is quite insignificant at the 5 percent level of significance, and the fit of the regression has not improved much. Thus we reject the expanded model in favor of the simple partial adjustment model.

Finally, models X and XI were estimated including the other variables, in addition to the price variables.

Our interpretation of the model will run in terms of the partial adjustment model with "naive" expectations of prices, since the adaptive expectations model involves lagged values for each of the additional explanatory variables other than prices, which were found insignificant. In model X, the relative price of jute and rice is utilized, whereas in model XI, they enter separately. Both of the equations have performed quite well, although preference can be given to model XI in terms of statistical fit. Both yield quite similar results, the signs of all coefficients confirming a priori assumptions, except for the lagged relative yield variable. However, as pointed out earlier, this points out to the importance of rice yield for the farmers of Bangladesh. As rice is the staple food, the farmers always plan to grow enough rice for their on-farm consumption, independent of the unpredictable prices of rice in the market. Moreover, the variable is not significant. The estimated coefficient of adjustment values of 0.431 and 0.454 demonstrate the rigidities in the relationship. Comparison of the lag with India and Thailand (in Tables 4.5 and 4.7) reveals that while significant lags are found in those countries due to the nature of the product, the lag is relatively longer in Bangladesh, perhaps because the cultivation of jute in Bangladesh has become a traditional "way of life" for so many people for so many years.

The estimated jute acreage elasticities that result from model XI are 0.3453 for the short-run (one year) elasticity and 0.7605 for the long-run or equilibrium elasticity, with respect to jute prices. (All elasticities computed from this model are evaluated at the mean values of the respective time series.) The estimated long run elasticities are somewhat greater than the short-run elasticities, the difference being determined by the size of the adjustment coefficients.

We were unable to isolate a significant price expectations effect (other than of naive expectations) in the Bangladesh jute acreage equation. However, the importance of expectations about future prices is actually already included implicitly in the partial adjustment model, for one of the behavioral factors determining the size of λ is the degree to which jute growers assume that currently observed price changes are permanent, as opposed to transitory.

Looking at the other coefficients in model XI, we find that the price of rice, as expected, has a negative impact on jute acreage. The estimated short-run and long-run cross-elasticities of jute supply to the price of rice are -0.3320 and -0.7312 respectively. The risk aversion behavior of the farmers is quite evident, and in accordance with the theory. The elasticity of jute acreage with respect to the relative yield rate of jute and rice is calculated to be -.1101 in the short run and -.2426 for the long run, although they have to be interpreted with caution due to poor statistical significance. The time trend variable, which is used as a proxy for technological and other developments, has been found to be quite significant.

Again we must emphasize that there seems to be little basis for a choice between models X and XI on statistical grounds. But since an equation has to be picked up for the world model, the choice must be based on a priori notions and the purpose of the model, and, therefore, the choice must be fairly arbitrary. Since we are most interested in the effects of jute prices on jute acreage, model XI is chosen.

However, all the Bangladesh equations yield quite similar qualitative results. The adjustment of actual to desired jute acreage is quite slow. The elasticities of supply with respect to jute and rice prices are very small. Thus, jute acreage in Bangladesh does not appear to be very sensitive, especially in the short-run, to economic factors.

One weakness of this part of the study is that the effects of changing costs on jute acreage have not been explicitly considered, partly because of lack of sufficient data. Apparently the costs of all major inputs to jute production have been rising while jute prices presumably are not rising as fast. Clearly the relevance of these cost changes to past and future jute production is an important area for future research. An adequate treatment of this relationship would have to take into account the importance of jute production in determining agricultural costs, especially wages, in a country in which jute is such an important component of the agricultural sector.

II. Acreage Equation for India

The acreage equation used for India closely resembles the one in the case of Bangladesh. However, in the case of India another variable -- the farm population in the area of concern -- has been added to the desired area relationship. The logic behind the inclusion of this variable is that in India, where jute acreage increased enormously after 1947 due to the government's policy of attaining self-sufficiency in jute, jute cultivation was introduced into completely new areas under government initiatives. Given the high prices of jute and the associated cash income, as the population in the area of concern increases, jute acreage is expected to increase as new land is brought under cultivation. Thus we would expect the estimated coefficient to be positive. Except for this addition, the same equations, as for Bangladesh, are estimated in the case of India.

As in the case of Bangladesh, jute is one of India's most important cash crops. After the partition of the Indian subcontinent in 1947, the government of India embarked on a policy of making the country self-sufficient in raw jute and in 1948 a production drive was launched by the Indian Central Jute Committee, mainly to increase the acreage and yield per acre of jute through more scientific cultivation. Price control measures were also initiated and, with the cooperation of the Indian Jute Mills' Association, it was possible to maintain floor and ceiling prices for periods long enough to achieve some degree of stability. Allocation of maximum and minimum purchase quotas and periodic adjustments of operating capacity of the jute mills, combined with alternative tightening and relaxation of import restrictions, were generally sufficient to influence the market; in time of acute shortage or glut, however, they proved inadequate. The financial resources of the jute mills were inadequate for carrying stocks over long periods and the internal marketing system was inflexible. Moreover, the policy failed to eliminate year to year fluctuations in the size of the crop, although price control may have mitigated them somewhat. The Jute Buffer Stock Association was established in 1962 with the aim of stabilizing jute production and prices by open market operations. Although this met with some success, the level of production varies with free market forces and weather conditions rather than the national stabilization measures. Hence the acreage equations have been specified independent of these government measures, and presumably effects, if any, of these measures are reflected in the market prices.

The results for India are presented in Table 4.5 for the period 1950-51 to 1975-76. As in the case of Bangladesh, the specification of extrapolative expectations in models VIII and IX does not seem as satisfactory as that of naive expectations, for the coefficient of change in price variable is not statistically significant. Also the specification of extrapolative expectations tends to decrease the significance of the estimates of other coefficients in the acreage equation. So the extrapolative expectations behavior is rejected in favor of simple naive expectations. Moreover, the less significant results obtained from the simple static model III point to the importance of lags in the behavior of the farmers. The test in terms of models VI and VII (corresponding to equation [4.14]) gives $\hat{\alpha}_1\hat{\rho} =$ 294.32 whereas $\hat{\alpha_1\rho} = 531.650$ for model VI and $\hat{\alpha}_1\hat{\rho} = .142$ compared to $\hat{\alpha_1\rho} = .375$ for model VII. Thus we may reject

TABLE 4.5

ESTIMATED ACREAGE EQUATION FOR INDIA (ACRIN)[a]

1950-51 to 1975-76

	Regression Coefficients (with t-values in parentheses)																	
Models	Intercept	ACR_{-1}	ACR_{-2}	RPR_{-1}	RPR_{-2}	PRJ_{-1}	PRJ_{-2}	PRR_{-1}	ΔPRJ_{-1}	ΔRPR_{-1}	SDRAV	$RYPA_{-1}$	FAPOP	T	$\bar{R}^2$	DW	β	γ
I	616.1	0.55		494.5											0.49	1.76	0.45	
	(1.73)	(2.43)		(2.03)														
II	91.9	0.45				1.14		-0.07							0.47	2.00	0.55	
	(1.79)	(2.14)				(3.48)		(-1.66)										
III	1357.8					1.09									0.42	1.52		
	(2.66)					(3.03)												
IV	436.6	0.51	0.10	520.7											0.32	1.71		
	(1.49)	(2.14)	(0.79)	(2.09)														
V	86.8	0.41	0.01			1.14									0.44	2.01		
	(1.12)	(2.17)	(0.08)			(3.42)												
VI	311.8	0.80		367.9	-531.7										0.45	1.97		
	(1.38)	(3.06)		(2.71)	(-1.06)													
VII	14.14	0.29				0.49	0.38								0.47	1.91		
	(1.42)	(1.88)				(3.33)	(0.85)											
VIII	311.8	0.80		236.3						531.7					0.41	1.97		
	(1.38)	(3.06)		(1.85)						(1.06)								
IX	10.10	0.32				1.49		-0.11	-0.40						0.43	1.88		
	(1.02)	(1.84)				(2.88)		(-1.39)	(-0.87)									
X	-36425.7	0.29		1483.1							-846.9	2617.6	3.93	-462.5	0.87	1.85		0.71
	(-5.62)	(2.58)		(8.82)							(-2.01)	(4.47)	(5.57)	(-4.64)				
XI	-33571.9	0.39				1.19		-1.41			-51.56	1963.7	3.88	-479.5	0.71	2.51		0.60
	(-2.98)	(2.27)				(3.75)		(-3.37)			(-1.08)	(2.34)	(2.92)	(-2.56)				

a Variable definitions and data sources are given in Appendix A.

the traditional model on the basis of this test. With respect to the expanded expectations and adjustment model [4.11], the estimated models IV and V show that the acre-age variable lagged two years is insignificant in both cases and its inclusion in no way improves the fit of the equation. Thus we can reject the expanded model in favor of the simple partial adjustment model.

As argued in case of Bangladesh, our interpretation will run in terms of the partial adjustment model, which is estimated in equations X and XI along with other explanatory variables. Both the equations have performed relatively well, although preference can be given to model X in terms of accepted measures of statistical fitness. Hence model X has been chosen as the representative acreage equation for jute in India in the world model. The results are quite significant with the signs of all coefficients in accordance with a priori assumptions. The estimated coefficient of adjustment value of .713, which is larger than Bangladesh, demonstrates the importance of rigidities. However, as expected, these are less severe than in the case of Bangladesh. The estimated jute acreage elasticities, as computed from model X, are 0.7120 for the short run (one year) and 0.9986 for the long run, with respect to relative prices of jute and rice.

Looking at other coefficients, the relative yield of jute compared to rice has been found quite significant. The elasticities of acreage to the relative yield variable is found to be 0.9611 in the short run and 1.3480 in the long run. Thus the farmers are found to be quite sensitive to the yield rate variable in making their decisions. Moreover, their behavior of risk aversion is prominent and significant, so that any increase in the relative variability of returns from jute cultivation makes the production of jute less desirable. Farm population in the area has a significant positive impact on the extent of area cultivated under jute. However, the time trend variable has a negative impact on acreage.

Thus it is found that jute acreage in India is more sensitive to economic factors than in the case of Bangladesh. Moreover, the rate of adjustment of actual to desired jute acreage is relatively high.

III. Acreage Equation for Thailand

In Thailand, jute (including kenaf) has become one of the most important commodities over the past two decades. By 1966, it ranked third after rice and rubber as an export earner for Thailand. Although jute has been grown in Thailand for a long time, production was relatively insignificant until at least the mid-1950's. Traditionally the agricultural economy of Thailand has been dominated by a single crop -- rice. For almost a century after King Mongkut opened the country to external trade in 1855, the trend was toward greater specialization in rice.[45] However, large increases in other cash crops, notably kenaf, to about a third of total area planted in crops by 1965-67, has been an important development in Thailand since 1950[46]. A considerable degree of regional specialization has developed in the case of jute and kenaf. Jute is grown along river banks in the Center whose production is limited due to competition with rice for land. Kenaf is mainly concentrated in the Northeast where the land is dry and unsuitable for rice cultivation (see Table 4.6).

In the Northeast, where most of the kenaf cultivation is concentrated, the farmer cultivates both the bottom land, which is his permanent holding where he grows the wet-rice, and some upland on which he grows a cash crop on a shifting cultivation pattern. The cultivation of rice offers a high probability of achieving a continued subsistence living. However, on the upland, the farmer is then confronted with a separate set of choices -- a compartmentalized non-rice agricultural economy. As Behrman has put it, "the hypothesis

TABLE 4.6

AVERAGE ANNUAL AREA PLANTED IN JUTE AND KENAF, THAILAND

(Thousand Rai)

	Whole Kingdom			Center			North			Northeast			South		
	1950-52	1958-60	1965-67	1950-52	1958-60	1965-67	1950-52	1958-60	1965-67	1950-52	1958-60	1965-67	1950-52	1958-60	1965-67
Kenaf	62	427	2631	2	9	44	-	2	4	59	416	2583	-	-	-
Jute	30	23	57	15	15	43	-	-	-	14	7	14	-	-	-

Note: Thailand is normally divided into four areas: the Central Plain, North, Northeast and South. These are again divided into seventy-one provinces, called changwads.

Source: Government of Thailand, Ministry of Agriculture, Agricultural Statistics of Thailand 1967, Bangkok, 1970.

has been proposed that subsistence farmers always attempt to produce enough grain for on-farm consumption in order to lessen the risk by assuring a basic food supply, independent of fluctuations in relative market prices. The estimates (made in this study) for rice provide support for this hypothesis".[47] Once subsistence is assured, the farmer can afford to attempt to maximize his income based on relative price expectations. With subsistence reasonably assured and the alternative cost of his own labor practically nil, the farmer faces little risk in the non-rice agricultural economy. This is perhaps a critical difference between the two agricultural regimes that helps explain the growing of rice regardless of price, in contrast with sensitivity to price differentials when selecting upland crops.[48]

Among the upland crops, while in the late fifties and early sixties when kenaf production rapidly expanded, maize was the main crop competing with kenaf for virgin land in the Northeast, the picture has recently changed as less virgin land has become available, and maize cultivation has tended to move out of the Northeast into the Central plain where kenaf is not grown. Kenaf now competes mainly with castor beans and cassava and, to some extent, rice, not only for land, but also for labor. This is in marked contrast with the pattern of jute growing in Bangladesh and India, where labor is plentiful. However, as in those cases, the decision to grow more or less kenaf in any one year is also determined by kenaf prices at the previous harvest and at the time of sowing, relative to the competing crops. Availability of sufficient retting water also constitutes an additional constraint on the supply of kenaf in some years, although the fibre quality tends to be more affected by this factor than the quantity.

The main measures taken by the Thai Government to promote jute and kenaf cultivation lie in the field of scientific research, agricultural education and the introduction of a price support scheme. The Government's price support scheme for jute and kenaf is operated by the Thai Jute Company Limited, a semi-governmental body. The Company maintains storage facilities at several market centres in the Northeast and purchases fibre directly from the growers.

Based on a hypothesis similar to that adopted in the case of Bangladesh and India, the acreage equations for Thailand are estimated and the results are presented in Table 4.7. However, in this case in the absence of a single alternative crop, the weighted prices of maize and rice were used. In the case of yield per acre, in the absence of reliable data, the lagged yield per acre of jute was used. Regres-

TABLE 4.7

ESTIMATED ACREAGE EQUATION FOR THAILAND (ACRTH)[a] 1960 TO 1975

Models	Intercept	Regression Coefficients (with t-values in parentheses)											
		ACR_{-1}	ACR_{-2}	RPR_{-1}	RPR_{-2}	ΔRPR_{-1}	$YPAJ_{-1}$	T	$\bar{R}^2$	DW	ρ[b]	β	γ
I	-205.4 (-1.82)	0.50 (4.42)		232.2 (4.73)					0.83	2.22		0.50	
II	-211.9 (-1.81)	0.44 (2.46)	0.07 (0.39)	233.1 (4.62)					0.83	2.15			
III	-272.1 (-2.09)	0.35 (1.86)		100.2 (4.69)	70.5 (1.02)				0.84	1.95			
IV	-272.1 (-2.09)	0.35 (1.86)		170.5 (3.61)		-70.5 (1.02)			0.84	1.95			
V	-718.8 (-3.34)	0.30 (2.23)		231.4 (5.76)			900.7 (2.47)	20.6 (1.87)	0.90	2.21	-0.36		0.70

a Variable definitions and data sources are given in Appendix A.

b Estimated by Cochrane-Orcutt iterative procedure.

sions were run in terms of relative prices only. Model I represents the adaptive expectations (or alternatively the partial adjustment model) while model IV represents the equation with "extrapolative" expectations behavior, which does not turn out any better. To test the superiority of models [4.12] and [4.13], equation III was estimated from which $\hat{\alpha}_1\hat{\rho} = 35.020$ which does not approximate $\alpha_1\hat{\rho} = 70.491$. Furthermore, the results obtained from the expanded model II where the acreage lagged two years turned out very insignificant justifies the use of the partial adjustment model V which is the equation chosen for the world model . All the coefficients are quite significant with signs corresponding to a priori assumptions. The estimated coefficient of adjustment value of 0.702 demonstrates a high degree of adjustment of actual to desired acreage. The estimated jute acreage elasticities are 0.8205 for the short run and 1.1688 for the long run with respect to lagged relative prices and 0.6475 for the short run and 0.9223 for the long run with respect to lagged yield rate of jute. The time trend variable, used as surrogate for other changes, is significant.

4.6 Estimation of Yield Per Acre of Jute Equations

In order to arrive at the production of jute figures for the three countries involved in our model, it is necessary

TABLE 4.8

CALCULATED ELASTICITIES OF ESTIMATED ACREAGE EQUATIONS[a]

Country and Years	Elasticity with respect to lagged price of jute		Elasticity with respect to lagged relative price of jute and rice/other commodities of interest		Elasticity with respect to lagged price of rice		Elasticity with respect to lagged yield rate of jute and rice/other commodities of interest	
	Short run	Long run	Short run	Long run	Short run	Long run	Short run	Long run
Bangladesh 1948-49 to 1975-76	0.3453	0.7605	-	-	-0.3320	-0.7312	-0.1101	-0.2426
India 1950-51 to 1975-76	-	-	0.7120	0.9986	-	-	0.9611	1.3480
Thailand 1960-61 to 1975-76	-	-	0.8205	1.1688	-	-	0.6475	0.9223

[a]All elasticities are calculated at the mean levels of the respective time series.

to estimate the yield per acre of jute equations which, along with the estimated jute acreage equations, will provide the production of jute in the respective countries. It was seen earlier that the expected yield per acre of jute as compared to the yield of alternative crops was an important variable in deciding the desired acreage under jute. However, the yield rate of a particular crop, especially in the case of jute which is predominantly cultivated under subsistence agriculture in these countries, is difficult to estimate. The yield rate is mostly determined by random factors such as weather, rainfall and the like. These environmental factors, although very relevant in yield equations, are difficult to quantify due to their very nature and non-availability of reliable data for most of these under-developed countries. In addition to these environmental factors, other variables that can be thought as affecting the yield rate include the price of the commodity in relation to alternative commodities, crop variety program, rate of fertilizer application, use of insecticies, cultural practices and the like.

The actual yield per acre of jute is defined to be a linear function of the following form:

$$YPAJ_t = a_0 + a_1\, ACR_t + a_2\, T + a_3\, T^2 + u_t \qquad [4.16]$$

where

$YPAJ_t$ = Yield per acre of jute at time t

ACR_t = Acreage under jute in period t

T = A time trend variable.

The price of jute compared to alternative crops was also used but did not produce any significant coefficient. This can be explained by the fact that variation in average yields appear to be more or less random and usually have insignificant effects on changes in jute production and hence, prices. The acreage variable is introduced to test the hypothesis that average yields tend to rise when the area under jute is reduced, because only the most productive lands remain under cultivation; when plantings are extended to less suitable holdings, the " law of diminishing returns" operates and average yields tend to fall.

Time trends do not "explain", and their inclusion in any econometric relationship just "to improve the fit" is often questionable. In the present study, however, the objective is not to explain the yield rate, but to approximate the aggregate expectations of the jute farmers regarding the future yields of jute. Although jute is still produced by traditional methods using little or no capital and modern inputs so that the farmers have very little control over the average yield, still some secular trends in yields might occur due to soil depletion, gradual extension of irrigation facilities and dissemination of improved cultivation techniques with better seeds and fertilizers over the period of study. If the farmers have observed such secular trends in yields, it is reasonable to assume that they might expect them to continue in the future. The time trend variables, thus, are included in equation [4.16] as proxies for such secular trends, the causes of which are clear to the farmers but, unfortunately, for which no quantitative data are available.

Weather is an important variable for which no suitable proxy has been used. Rainfall in the area of concern could be utilized for this. However, although the amount of rainfall is an important aspect of the weather conditions affecting jute production in these countries, many other factors, such as the timing of the rainfall, and the amount of sunshine, are also important. Adequate representation of all these factors would require the construction of a comprehensive weather index, which, at present, is not possible due to unavailability of the necessary data. Hence, for our purpose, the weather variable has been treated as completely random and relegated to the error term.

The estimates for equation [4.16] are presented in Table 4.9. A dummy variable was added for Bangladesh and India for 1960 when much of the crop was damaged by extensive

TABLE 4.9

ESTIMATES OF YIELD OF JUTE PER UNIT PLANTED AREA (YPA)[a]

Country and Years	Regression Coefficients (with t-values in parentheses)						
	Intercept	ACR_{it}	T	T^2	Dummy	$\bar{R}^2$	DW
Bangladesh 1948-49 to 1975-76	0.735244 (12.62)	-0.00010412 (-3.22)	0.0171435 (3.16)	-0.0007263 (-3.88)	-0.133756 (-3.31)	0.736	1.313
India 1950-51 to 1975-76	0.450265 (10.97)	-0.0000073 (-0.50)	0.0051567 (1.31)	-0.000436 (-2.62)	-0.054090 (-2.24)	0.672	2.141
Thailand 1960-61 to 1975-76	0.528253 (13.23)	0.00003156 (.70)	-0.0072388 (-.62)	-0.0002771 (-.44)	-	0.628	1.703

[a]Variable definitions and data sources are given in Appendix A.

flood and disease. These estimates suggest that fairly strong secular trends occurred in Bangladesh and India. In Thailand there is no marked trend, probably due to the fact that cultivation of jute on a significant level dates only from the mid-fifties. The estimates also suggest the operation of the law of diminishing returns, especially in the case of Bangladesh.

Jute production is, of course, the product of the total estimated area and the average yield per unit area. In general,

$$J_{it} = ACR_{it} \times YPAJ_{it} \qquad [4.17]$$

where J_{it} is the production of jute in country i during the period t.

Thus the estimated acreage equations and the average yields per unit area of jute will provide a measure of the estimated production of jute in these countries.

"Rest-of-the-World" Production of Jute

In order to complete the production side of the model of jute, a study of production of jute in the "rest-of-the-world" sector was undertaken. The area covers such diverse countries as Nepal, Burma, China, Brazil, Congo, and many others. If the aggregation involved in the previous equations could be termed, at the best, bold, the amount of aggregation involved here will probably cause many to question why the attempt was made at all. Yet to the extent that the production of jute in the countries in this sector are linked to the world jute market, some aggregate response of the production of jute to appropriate explanatory variables may be estimable.

A Nerlovian lagged adjustment model is used with the dependent variable, JRW_t, the production of jute in the "rest-of-the-world" in thousands of metric tons in year t. This is derived by subtracting the total production of Bangladesh, India and Thailand from the world total production for each year as estimated by the Commonwealth Economic Committee (now defunct) and the Food and Agricultural Organization of the United Nations. The explanatory variables are JRW_{t-1} and T, a time trend variable. The time trend variable was chosen as a proxy for the institutional and technological changes that might have influenced the production of jute in these countries. A price variable was also included; however, it did not perform well and so was not included in the final equation. The equation, which was estimated by the Cochrane-Orcutt iterative procedure due to presence of autocorrelation, is presented below for the years 1948-49 to 1975-76:

$$JRW_t = -109.879 + 0.753\ JRW_{t-1} + 21.307T \quad [4.18]$$
$$(-1.95) \quad (5.00) \quad (1.96)$$
$$\bar{R}^2 = 0.984,\ DW = 2.041,\ \rho = 0.684$$

(figures in the parentheses represent t-ratios)

Equation [4.18] indicates that the adjustment lag for the ROW sector is 0.247. The adjustment lag appears to be very long and is probably due to the fact that production in these countries has expanded very rapidly in recent years and the farmers' reaction is very fast in increasing production. Most countries in the ROW sector produce jute for their own domestic consumption and very little, if any, enters the world market. Thus price of jute in the world market does not play a prominent role in their production decisions. Rather the overrriding need of import substitution and independence from external sources of supply, which is more often characterized by wide fluctuations in supply and hence prices, are the rationales behind the production increases at such a phenomenal rate.

The "Rest-of-the-World" sector's production of jute is thus contemplated to be dependent on lagged production and time only. Equation [4.18] is included in the world model.

4.7 Comparison with other Results, and Conclusions

This study of jute production of the three major jute producing countries of the world and of the "Rest-of-the-World" sector has resulted in some interesting equations which explain the production side of the world market for jute. Since these equations yield quite similar results for the countries studied, it is possible to make some general observations about world jute production.

First, by using a model incorporating an adjustment lag, this study shows that jute production is indeed quite responsive to changing economic factors. The estimates of elasticities of jute acreage with respect to lagged jute (or relative) prices vary from 0.3453 to 0.8205 for the short run and from 0.7605 to 1.1688 for the long run. The elastic nature of jute acreage to prices is, therefore, an important aspect of the world jute market. The effects of substitute products (e.g., rice) on jute production also are estimated to be quite high. Thus we would expect to find in jute production the strong cycles that have been observed in the production of other agricultural products.

Statistically, the estimated equations for all the countries are quite good where serial correlation of the residuals did prove to be a problem the equations were estimated by the Cochrane-Orcutt iterative procedure. From the point of view of economic theory, the main deficiency in all the equations is the absence of cost variables. A considerable amount of future research is needed on the production of jute of each country if these cost factors are to be analyzed adequately, but those who undertake such research will certainly have problems in obtaining the necessary data. Another deficiency of all these equations is the lack of proper variable for technological changes which had to be approximated by the time trend variable. However, in spite of these deficiences, these equations do seem to give the approximate structure of the production side of the world jute market and should be useful for the world market model.

The elasticity of acreage under jute with respect to price has been estimated by several authors, and a comparison of the results is summarized in Table 4.10. Although the other studies cover different time periods and employ different methods of analysis, the results are roughly similiar. In general, the elasticities are higher in India than in Bangladesh. However, acreage under jute is found to be most responsive in Thailand. In making inter-country comparisons, it is difficult to reconcile why estimated price elasticities in India are higher than in Bangladesh, given the quite similar and comparable production conditions. It

TABLE 4.10

SUMMARY OF ESTIMATES OF PRICE ELASTICITIES OF PRODUCTION OF JUTE

Geographic Region	Time Period	Short-run Elasticity	Long-run Elasticity	Dependent Variable
Bangladesh[a]	1948-1975	0.3453	0.7605	Area under jute.
East Pakistan[b]	1948-1961	0.29 to 0.42	-	Area in jute or area in jute relative to alternative crop.
Pakistan[c]	1949-1962	0.40	0.65	Area in jute.
East Bengal[d]	1931-1953	0.60	-	Quantity.
Bengal[e]	1911-1938	0.68	1.03	Area in jute relative to alternative crop.
Bengal, Bihar, Orissa[e]	1911-1938	0.75	-	Area in jute relative to alternative crop.
India[a]	1950-1975	0.7120	0.9986	Area in jute.
India[d]	1931-1954	0.60	-	Quantity.
India[c]	1951-1962	0.76	0.99	Area in jute.
India (undivided)[f]	1911-1938	0.46	0.73	Area.
Thailand[a]	1960-1975	0.8205	1.1688	Area in jute.
Thailand[g]	1954-1963	0.88 to 5.50 Mean 2.70	1.19 to 22.45 mean 5.75	Area in jute.

a. Our estimates.

b. Hussain, S.M., "A Note on Farmer Response to Price in East Pakistan", The Pakistan Development Review, IV (Spring 1964), 93-106.

c. Rabbani, AKMG., "Economic Determinants of Jute Production in India and Pakistan", The Pakistan Development Review, V, 1965, 191-228.

d. Clark, R., "The Economic Determinants of Jute Production", United Nations, Food and Agricultural Organization, Monthly Bulletin of Agricultural Economics and Statistics, VI (September 1957), 1-10.

e. Stern, R.M., "The Price Responsiveness of Primary Producers", The Review of Economics and Statistics, XLIV (May 1962), 202-207.

f. Venkataraman, L.S., A Statistical Study of Indian Jute Production and Marketing, Unpublished Ph.D. Dissertation, Department of Economics, University of Chicago, 1958.

g. Behrman, J.R., Supply Response in Underdeveloped Agriculture, A Case Study of Four Major Annual Crops in Thailand, 1937-1963, North-Holland, 1968.

may be that prices have fluctuated considerably more in India, which will result in different coefficients than if prices had changed by equal amounts. In addition, inter-country comparisons are difficult to make because the coefficients may be biased due to inaccuracy of data.

The above analysis of jute production suggests that the principal determinant of area under jute in these countries is the jute farmer's expectation of the relative price of jute compared to the alternative crops, which is largely based on the preceding year's prices. Thus it should come as no surprise that the most remote subsistence-oriented farmers of these traditional developing countries are as much economic men as their counterparts in developed countries, and are driven by motives akin to profit maximization.

To quote from Behrman,

> "..., in the short run, farmers in under-developed countries respond rationally and substantially to economic incentives. No significant evidence, in contrast, has been found for the hypothesis that institutional constraints preclude significant responses to economic incentives in underdeveloped agriculture. The burden of proof, thus now lies with those who maintain that the supply behavior of farmers in under-developed agriculture cannot be understood predominantly within the framework of traditional economic analysis". 49

The models of farm supply response, which was primarily developed for the developed countries by Nerlove and others, when used for the developing countries, as in our study, not only do not break down, but yield plausible, interesting and internationally comparable supply response estimates.

4.8 Models of Production of Jute Manufactures

In this section, a model is developed to explain the production of jute manufactures in the major producing countries. As discussed in Chapter 2, India and Bangladesh are the two major producers of jute manufactures, and much of their production is destined for exports. Outside the subcontinent, the major production of jute manufactures takes place in the United Kingdom, EEC countries, and other Western European countries. The United States and Japan also import raw jute in some quantities for domestic consumption. Aside from the above six countries/regions, we shall also consider the production of jute manufactures in a "Rest-of-the-World" sector.

While the production of jute manufactures in India and Bangladesh is mainly for exports, production in most other countries is geared to domestic consumption. Especially in the Western European countries, where jute is not produced locally, raw jute is imported and processed into jute manufactures. In view of the stronger competitive position of the Indian and Bangladesh industries, due to ready availability of the raw material and low production costs (cheap labor and government measures to encourage production), the Western European industries have increasingly concentrated on specialized products for domestic consumption, mainly jute yarn and hessian cloth for carpet-backing. Thus we propose to use different models for the production of jute manufactures in these two groups of countries.

Model I

This model explains the production of jute manufactures in India, Bangladesh and in the "Rest-of-the-World" sector. The decision to produce jute manufactures is closely related to the volume of sales by the jute mills. The model used to explain the desired or equilibrium level of production of jute manufactures at period t, $PRODJM_t{}^*$, is

$$PRODJM_t{}^* = \alpha_0 + \alpha_1 \left[\frac{PJM}{PRJ}\right]_t + \alpha_2 \left[\frac{PJM}{PRJ}\right]^e_{t+1} + \alpha_3 T + \alpha_4 SJM_{t-1} \qquad [4.19]$$

The explanatory variables are the current and future expected price ratio between the domestic prices of jute manufactures and raw jute, $\left[\frac{PJM}{PRJ}\right]_t$ and $\left[\frac{PJM}{PRJ}\right]^e_{t+1}$, a time trend variable, T, and the last period's stocks of jute manufactures, SJM_{t-1}. The ratio of the two prices of the final output and the raw material has been added as a proxy for the profitability of the production decision. In a strict sense, the profit would consist of the difference between the value of output and the total costs of production including labor, capital, and all other costs. However, due to lack of relevant time series on all the variables, the above proxy has been used. It has been observed that price of the raw material usually accounts for nearly 50 to 60 percent of the selling price of jute manufactures. Moreover, all other costs, for example, wages and interest costs and the like, are expected to be stable with a well-defined trend. Thus the inclusion of the time trend variable hopefully will catch the effects of these excluded variables. The lagged stocks of jute manufactures are also hypothesized to affect the present decision to produce. If the carry-over stocks are large, the mills would be expected to produce less in order to avoid accumulating unduly large amounts of inventories.

As for the expected relative price, as in the stock equations in Chapter 5, we use the model of "extrapolative" expectations in which the estimates of future prices are made by extrapolating the current price adjusted for the most recent change in the prices; or more specifically,

$$\left[\frac{PJM}{PRJ}\right]^{e}_{t+1} = \left[\frac{PJM}{PRJ}\right]_t + \beta\ \Delta \left[\frac{PJM}{PRJ}\right]_t , \quad -1<\beta<1 \qquad [4.20]$$

Substitution of [4.20] into [4.19] yields

$$PRODJM_t{}^* = \alpha_0 + (\alpha_1+\alpha_2) \left[\frac{PJM}{PRJ}\right]_t + \alpha_2\beta\ \Delta \left[\frac{PJM}{PRJ}\right]_t$$

$$+ \alpha_3\ T + \alpha_4\ SJM_{t-1} \qquad [4.21]$$

In addition, in order to build into the production equations for each country the essential dynamic aspect that the level of the country's production of jute manufactures cannot be changed rapidly in the short run in response to changes in the explanatory variables, the distributed lag model of supply adjustment, as used above, has been used. In particular, it is assumed that the change in actual production in year t over year t-1 is a fraction, γ, of the desired or equilibrium increase. That is,

$$PRODJM_t - PRODJM_{t-1} = \gamma(PRODJM_t{}^* - PRODJM_{t-1}) \quad [4.22]$$

The producers are able to increase their production of jute manufactures in any year only to the extent of a fraction γ of the difference between the amount they would like to produce and the actual production in the preceding year. The size of the fraction, γ, called the "coefficient of adjustment", is a measure of the speed with which actual production adjusts in response to factors determining desired production. The adjustment is incomplete due to the presence of the institutional, technological and other rigidities such as lags in ordering and in delivery of raw materials etc. Such lags are expected to be quite important in these countries due to general political and economic instability and other uncertainties.

Finally, the estimating equation can be obtained by solving equations [4.21] and [4.22] to yield:

$$PRODJM_t = \gamma\alpha_0 + (1-\gamma)\ PRODJM_{t-1} + \gamma(\alpha_1+\alpha_2)\left[\frac{PJM}{PRJ}\right]_t + \gamma\alpha_2\beta\ \Delta\left[\frac{PJM}{PRJ}\right]_t + \gamma\alpha_3\ T + \gamma\alpha_4\ SJM_{t-1} \qquad [4.23]$$

Equation [4.23] was applied to the data for the production of jute manufactures in India, Bangladesh and the "Rest-of-the-World" sector. In the case of Bangladesh, a dummy variable was added for the year 1971 when the war disrupted production. The results are presented in Table 4.11. For Bangladesh and the "Rest-of-the-World", the stocks and time trend variables were dropped since their

TABLE 4.11

ESTIMATES OF PRODUCTION OF JUTE MANUFACTURES EQUATIONS FOR BANGLADESH, INDIA AND "REST-OF-THE-WORLD" SECTOR (PRODJM)[a]

Country and Years	Regression coefficients (with t-values in parentheses)										
	Intercept	$PRODJM_{-1}$	$\frac{PJM}{PRJ}$	$\Delta\frac{PJM}{PRJ}$	T	SJM_{-1}	DUM	$\bar{R}^2$	DW	ρ^b	γ
Bangladesh 1954-1974	165.7 (1.83)	0.85 (4.94)	-43.0 (-1.57)	72.1 (1.88)			-266.3 (-4.03)	0.86	2.09	-0.35	0.15
India 1950-1974	72.88 (2.27)	0.86 (4.86)	94.8 (1.94)	83.7 (1.96)	-3.62 (-2.02)	-0.30 (-2.34)		0.63	2.17		0.14
Rest-of-the-World 1950-1974	-440.4 (-1.65)	0.84 (7.86)	343.6 (2.02)	-242.6 (-1.63)				0.95	1.85		0.16

a. Variable definitions and data sources are given in Appendix A.

b. Estimated by Cochrane-Orcutt iterative procedure.

coefficients were found to be insignificant. The results are quite interesting. For all the countries, the adjustment coefficients are quite similar and low, which indicates a slow adjustment to equilibrium. In Bangladesh, the current price ratio variable enters with a negative sign while the change-in-ratio of prices has a positive sign. This may mean that the producer extrapolates the current price as the future price and feel that the most recent change in the ratio will be continued. As we mentioned elsewhere, forward contracts to sell jute manufactures form a large part of the total sales of the jute mills in Bangladesh. The extent of forward contracts made depends on expectations of the future prices as compared to the current price. Thus whenever expectations of future prices are high, the jute mills produce less, and hence sell less of jute manufactures during the current period, since the decisions to produce is closely linked with the decisions to sell. This is in sharp contrast to the behavior of jute mills in India. In India, both the current price ratio and the change in price ratio variables enter with positive signs, which imply the same kind of expectations formation as in Bangladesh. However, in this case, producers increase their production and hence sales with higher current prices. A comparison of the expectations behavior of these two countries would suggest that in Bangladesh the future expectations play a more important role than in India. The lagged stocks of jute manufactures, as expected, have a negative coefficient, implying that producers would reduce production in response to higher carry-over stocks. The secular trend, as represented by the time trend variable, has a negative impact on production, probably due to rising costs and to other factors.

The equation for the "Rest-of-the-World" sector implies a different kind of expectations behavior. Here the producers extrapolate the current price-ratio as the future price-ratio, however, they feel that the most recent change in the ratio will be reversed. The reasons for such expectations are difficult to explain since this is a highly aggregated sector encompassing many different countries. However, the basis for such expectations might lie in their anticipations that higher current prices would lead to rapid expansion in the production of jute manufactures resulting in lower prices in the future.

The above equations, however, should be interpreted with caution. The costs of production, other than the raw material costs, have been ignored mainly due to lack of reliable data. Nevertheless, these equations reflect the decisions of the producers to produce jute manufactures in a significant way and have been included in the world model. Moreover, in these countries, other costs especially labor, which represent nearly 60 percent of the values added in India and Bangladesh, is somewhat organized and hence their wages are expected to have a trend upwards. Thus the profitability of production will be dependent on the costs of raw materials which has been included in our equations and are expected to represent a close picture of reality.

Model II

This model has been developed to explain the production of jute manufactures in the United Kingdom, the United States, Japan and the EEC countries (excluding U.K.). The production of jute manufactures in these countries are geared mainly for domestic consumption. The consumption of jute manufactures in these countries have been falling steadily, due to growing competition from synthetic substitutes, and so production also has the same trend. For example, from an average level of production of 472 thousand metric tons of jute manufactures during 1950-1953, the production declined sharply to an average of 370 thousand metric tons during 1971-1974 in the above four countries/regions.

In order to explain the production of jute manufactures in these countries, different variables, e.g., prices and other related variables, were tried but the results were found to be unsatisfactory. Production of jute manufactures, nevertheless, followed closely the trend of consumption. In the absence of any suitable explanatory variables it was decided to regress production against time, which is hypothesized to act as a proxy for all the relevant explanatory variables. Thus, the production of jute manufactures in these countries is explained by lagged production and a time trend variable. Specifically,

$$PRODJM_t = \alpha_0 + \alpha_1 \; PRODJM_{t-1} + \alpha_2 \; TIME \qquad [4.24]$$

A dummy variable was added for 1960 when extensive floods damaged the jute crops in Bangladesh and India, causing a world-wide shortage of the fibre which affected the levels of production in these countries. In terms of our distributed lag analysis the above equation can be derived in the following way. It is assumed that the desired or equilibrium production of jute manufactures, $PRODJM_t{}^*$, at period t is a function of the time trend variable, TIME:

$$PRODJM_t{}^* = \alpha_0 + \alpha_2 \; TIME \qquad [4.25]$$

As before, assumption of distributed lag model of supply adjustment would yield:

$$PRODJM_t - PRODJM_{t-1} = (PRODJM_t{}^* - PRODJM_{t-1}) \qquad [4.26]$$

Now from [4.25] and [4.26] the above estimating equation can be derived. The results are presented in Table 4.12.

TABLE 4.12

ESTIMATES OF PRODUCTION OF JUTE MANUFACTURES

EQUATIONS FOR U.K., U.S.A., JAPAN AND EEC COUNTRIES (PRODJM)[a]

Country and Years	Regression Coefficients (with t-values in parentheses)							
	Intercept	$PRODJM_{-1}$	TIME	DUM	$\bar{R}^2$	DW	ρ[b]	γ
United Kingdom 1950-1974	119.1 (7.54)	0.24 (2.04)	-3.01 (-4.65)	-28.6 (-1.56)	0.64	1.89		0.76
United States 1950-1974	57.4 (5.24)	0.24 (1.82)	-2.13 (-3.83)	-31.4 (-2.13)	0.61	1.73		0.76
Japan 1950-1974	14.2 (2.70)	0.98 (7.37)	-0.95 (-2.47)		0.87	2.14		0.02
EEC countries 1950-1974	300.4 (4.36)	0.06 (1.74)	-4.71 (-1.87)	-66.2 (-3.02)	0.61	1.57	0.66	0.94

a. Variable definitions and data sources are given in Appendix A.

b. Estimated by Cochrane-Orcutt iterative procedure.

The dummy variable was omitted in the case of Japan since it was found insignificant. The results are satisfactory. In all the countries, there is found a secular decline in the production of jute manufactures. Moreover, the estimated speed of adjustment varies significantly from country to country with a low of .022 for Japan to a high of .944 for the EEC countries.

The unsatisfactory specification of these equations is not expected to affect our world model much since the production of jute manufactures in these four countries constitutes a small percentage of total world production (for example, during 1974 the total production in these four countries constituted only about 7 percent of total world production). These equations are included in the world model.

FOOTNOTES - CHAPTER FOUR

[1] For a theoretical discussion on actual derivation of such supply function, see Heady, Earl O., ed.; Agricultural Supply Functions: Estimating Techniques and Interpretations, Ames, Iowa: Iowa State University Press, 1961.

[2] See Day, Richard H.; "Recursive Programming and Supply Predictions", Heady, E.O., ed., Agricultural Supply Functions, ibid., pp. 108-125.

[3] For an extensive summary of this literature, see Falcon, W.P.; Farmer Response to Price in an Underdeveloped Area: A Case Study of West Pakistan, Unpublished Ph.D. Dissertation, Harvard University, 1963.

[4] For a detailed bibliography of such empirical studies see Stern, R.M.; "The Price Responsiveness of Primary Producers", Review of Economics and Statistics, vol. XLIV, No. 2, May 1962, Behrman, J.R.; Supply Response in Underdeveloped Agriculture, A Case Study of Four Major Annual Crops in Thailand, 1937-1963, North-Holland, 1968.

[5] For example, see Sinha, A.R. and J. Guhathak rurta; "Indian Cultivators' Response to Price," Sankhya, Vol. I, 1934.

[6] See Nerlove, M.; The Dynamics of Supply: Estimation of Farmers' Response to Price, The John Hopkins University Press, Baltimore, 1958, pp. 66-86.

[7] Rabbani, A.K.M.G.; "Economic Determinants of Jute Production in India and Pakistan", The Pakistan Development Review, Vol. V Summer 1965, p. 198.

[8] The case of Thailand is dealt separately later since the conditions there are different from those in this region.

[9] While it would be desirable to quantify the area under jute which is subject to competition from rice, that is, the area which could be considered suitable "exclusively" for jute, the present inadequacy of land use data in the region makes it impossible to do so with any degree of precision. A large proportion of the area under jute is either subject to severe flooding so that cultivation of rice is impossible without flood control during rainy season or lacks sufficient moisture for its cultivation without irrigation during dry season. Despite this imprecision, it is believed in Bangladesh, for example, that almost one million acres constitute the floor for jute cultivation given the present state of irrigation and flood control.

[10] Pakistan Central Jute Committee; Report on Survey of Cost of Production of Jute in East Pakistan, Dacca, 1962.

[11] Mahalanobis, P.C.; "Some Aspects of Costs of Cultivation of Barley, Maize, Rabi, Grain, Small Millets, Groundnut, Cotton and Jute", National Sample Survey Report No. 32, New Delhi, Govt. of India, 1958.

[12] 60 maunds per acre, as compared with 50 maunds for IRRI aus and 15 maunds for traditional boro. (1 mound = 36 kilograms).

[13] Only in some peripheral areas of the jute-belt, such as in parts of the states of Uttar Pradesh and Bihar in India and some districts of Bangladesh (e.g. Dinajpur, Rajshahi, Kushtia) cultivation of sugarcane offers an alternative for jute. However, since land once cultivated with sugarcane stays for a long time under the crop, competition between jute and sugarcane is of little significance.

[14] See, for example, FAO; "Jute: A Survey of Markets, Manufacturing and Production", Commodity Series - Bulletin No. 28, Rome, 1957, Clark, R.; "The Economic Determinants of Jute Production", FAO Monthly Bulletin of Agricultural Economics and Statistics, Vol. VI, No. 9, September 1957, Stern, R.M.; "The

Price Responsiveness of Primary Producers", op. cit. pp. 202-207, Hussain, S.M.; "A Note on Farmer Response to Price in East Pakistan", Pakistan Development Review, Vol. IV, No. 1, 1964, pp. 93-103; Rabbani, A.K.M.G.; "Economic Determinants of Jute Production in India and Pakistan", op. cit. pp. 191-228.

[15] This relationship, which has been the subject of much study as stated above, has however become increasingly weak in recent years. Despite government encouragement of rice growing and a marginal comparative advantage for jute, the farmers do not appear to have switched to rice to the extent that former statistical relationships would have suggested. In part this may be explained by the increased appreciation of jute as a source of cash income whereas, at least for subsistence farmers, greater rice production may only lead to greater on-farm consumption. However, apart from the unpredictable climatic conditions which in fact dominate the total supply situation in any given season, the jute-rice price relationship still remains the main single identifiable long-term factor influencing the supply of jute in Bangladesh and India.

[16] Kirby, R.H., *Vegetable Fibers*, Leonard Hill Ltd., 1963, p. 71.

[17] FAO; *Domestic Prices of Jute in Bangladesh*, CCP: JU 75/3, May 1975, pp. 2-4.

[18] In 1958-59 it was estimated that, in the case of jute, 75 percent of the seed, manure and bullock labor was provided by the grower, and 49 percent of the labor by members of his family. See Pakistan Jute Committee, *Report on Survey of Cost of Production in East Pakistan*, 1958 and 1959.

[19] For example, in Bangladesh during 1974-75, out of 1.4 million acres cultivated under jute, intensive cultivation is reported to have covered only 270,000 acres.

[20] Rice occupies over 90 percent of the total arable area in Bangladesh compared to under 10 percent for jute. In the jute-belt of India, rice acreage is normally 15 to 20 times as extensive as the total jute acreage.

[21] Conceptually the price level refers to the price of the crop of concern relative to the price of all other products that compete for the same resources and relative to the price of all the inputs used to produce the crop.

[22] Farmers' price expectations are also likely to depend on the available market informations, but this factor has not been explicitly included in the model.

[23] For a detailed discussion, see Johnson, G.L.: "The State of Agricultural Supply Analysis", Journal of Farm Economics, 42(2), May 1960, pp. 435-452.

[24] For the problems involved in estimation see, Johnston, J., Econometric Methods, McGraw-Hills, Tokyo, 1963, pp. 201-207.

[25] Koyck, L.; Distributed Lags and Investment Analysis, North-Holland, Amsterdam 1954; Cagan, P.; "The Monetary Dynamics of Hyper Inflation", in Friedman, M., ed., Studies in the Quantity Theory of Money, Vol. I, University of Chicago Press, Chicago, 1956, Nerlove, M.; "Estimates of Supply of Selected Agricultural Commodities", Journal of Farm Economics, 38(2): May 1956, pp. 496-509, Friedman, M., A Theory of Consumption Function, Princeton University Press, Princeton, 1957.

[26] Adaptive expectations are optimal if the time series comprises of a "transitory" random component lasting in a single time period and a "permanent" random component prevailing in all subsequent time periods.

The forecasts are optimal in the sense that they either give the means of the distribution of the actual values of the series or are a least-squares approximation to them. See Muth, J.; "Rational Expectations and the Theory of Price Movements", Econometrica, July 1961, pp. 315-35. Moreover, Nerlove has shown that if logarithms are used, β corresponds to Hicks' "elasticity of expectations". Nerlove, M.; "Adaptive Expectations and Cobwel Phenomena", Quarterly Journal of Economics, Vol. 73, May 1958, pp. 52-53.

[27] From the estimate of π_1 in model [4.7] it is possible to estimate the short run elasticity, and from the estimate of π_2 it is possible to estimate β, the 'coefficient of expectations'. Hence it is possible to obtain an estimate of α_1 of model [4.2] from which a long run elasticity estimate can be obtained. Also, Griliches has shown that the mean lag is given by $(1-\beta)/\beta$. See Griliches, Z.; "Distributed Lags: A Survey", Econometrica, 35(1), January 1967, p. 19.

[28] Nerlove, M.; The Dynamics of Supply: Estimation of Farmers' Response to Price, The John Hopkins Press, Baltimore, 1958.

[29] Griliches, Z.; "The Demand for Fertilizer: An Economic Interpretation of a Technological Change", Journal of Farm Economics, Vol. XL (August, 1958), pp. 591-606.

[30] Goodwin, Richard M.; "Secular and Cyclical Aspects of the Multiplier and Accelerator", in Income, Employment, and Public Policy: Essays in Honor of Alvin M. Hansen, Lloyd A. Metzler, et. al., New York: W.W. Norton and Company, Inc., 1948, pp. 108-132.

[31] Muth, J.F.; op. cit.

[32] Marshall, A.; Principles of Economics, 8th ed., London: MacMillan and Company Limited, 1938, pp. 378-379.

[33] Waud, R.N.; "Small Sample Bias Due to Mis specification in the Partial Adjustment and Adaptive Expectations Models", Journal of the American Statistical Association, 61, 1966, pp. 1130-1152. See also his "Misspecification in the Partial Adjustment and Adaptive Expectations Models", International Economic Review, 9: 1968, pp. 204-217.

[34] Rabbani, A.K.M.G.; "Economic Determinants of Jute Production in India and Pakistan", op. cit. p. 203.

[35] Johnston, J., Econometric Methods, op. cit., p. 179. Another very important statistical problem associated with the geometric lag model is that its estimation by ordinary least squares may lead to biased and inconsistent estimates unless the disturbance term u_t is positively serially correlated, with the correlation between u_t and u_{t-1} being $1-\beta$. See Nerlove, M.; The Dynamics of Supply: Estimation of Farmers' Response to Price, op. cit., p. 193. Liviatan and Dhrymes, however, have suggested some alternative estimation methods. See Liviatan, N.; "Consistent Estimation of Distributed Lags", International Economic Review, 4(1): January 1963, pp. 44-52 and Dhrymes, P.J., Distributed Lags: Problems of Estimation and Formulation, Holden Day, San Francisco, 1971.

[36] Griliches, Z.; "A Note on the Serial Correlation Bias in Estimates of Distributed Lags", Econometrica, 29, January 1961, pp. 65-73.

[37] Durbin, J., and Watson, G.S., "Testing for Serial Correlation in Least Squares Regression II", Biometrika, June 1951, pp. 159-178.

[38] Nerlove, M., and Wallis, K.F.; "Use of the Durbin-Watson Statistic in Inappropriate Situation", Econometrica, 34(1) January 1966, pp. 235-238.

[39] For an outline of this procedure, see Cochrane, D., and Orcutt, G.H.; "Application of Least Squares Regressions to Relationships Containing Autocorrelated Error Terms", Journal of the American Statistical Association, Vol. 44, March 1949, pp. 32-61.

[40] Area licensing was introduced under the Bengal Jute Regulation Act of 1940, which was continued until the end of 1959-60 season in Bangladesh. Under this Act, 4725 thousand acres in Bangladesh were declared suitable for jute cultivation, and a proportion of this 'basic acreage' was licensed for sowing jute at the beginning of each season, in accordance with the expected level of demand. Licensed and actual acreage under jute during the period in Bangladesh are shown below:

Year	Area Licensed	Actual Area	Actual Area as a percentage of area licensed.
	(.........thousand	acres.....)	
1947-48	2207	2059	93.4
1948-49	2133	1877	88.0
1949-50	1861	1561	83.7
1950-51	1310	1711	130.6
1951-52	1869	1779	95.2
1952-53	1717	1907	111.1

Year	Area Licensed	Actual Area	Actual area as a percentage of area licensed
	(.....thousand acres.......)		
1953-54	811	965	118.5
1954-55	1231	1243	101.1
1955-56	1546	1635	105.5
1956-57	1204	1230	102.1
1957-58	1402	1563	111.5
1958-59	1101	1528	138.8
1959-60	992	1375	139.0

Source: Report of the Jute Inquiry Commission, 1960, *op. cit*.

[41] Linear functions have been used except in cases where some compelling reasons for using some specific nonlinear forms are present. However, if some nonlinear forms are better specifications of reality where linear functions are used, then they can be thought as approximations (the first term of a Taylor expansion of the perticular nonlinear forms).

[42] However, a negative value for expected yield is also plausible. If the farmers' goal is to maximize cash income from jute subject to the constraint that sufficient rice for his subsistence consumption has to be grown, then an increase in the expected relative yield as defined (implying a decrease in the

yield rate of rice), ceteris paribus, might result in a decrease in the desired area under jute.

[43] See Behrman, J.R., Supply Response in Underdeveloped Agriculture, *op. cit.*, pp. 96-97, and the references cited therein. For further discussion see Roumasset, J.A.; Rice and Risks: Decision Making Among Low Income Farmers, North-Holland, 1976.

[44] The relative acre value has been defined as:

$$RAV_t = \frac{PRJ_t \times YPAJ_t}{PRR_t \times YPAR_t}$$

where

PRJ = Price of jute

YPAJ = Yield per acre of jute

PRR = Price of rice

YPAR = Yield per acre of rice.

[45] For details of the developments during this period, see Ingram, James C.; Economic Change in Thailand, Stanford University Press, 1971, Chapters 2 and 3. Brown, L.R., "Agricultural Diversification and Economic Development in Thailand: A Case Study", Foreign Agricultural Economic Report No. 8, Regional Analysis Division, Economic Research Service, U.S. Department of Agriculture, Washington D.C. 1963.

[46] Whereas the total area under rice increased from 35.1 million *rai* during 1950-52 to 42.2 million *rai*

during 1965-67, the area under all other crops increased from 5.0 to 20.5 million rai during the same period (2.5 rai equal one acre). See, Agricultural Statistics of Thailand, 1967, Ministry of Agriculture, Bangkok, 1970.

[47] Behrman, J.R.; Supply Response in Underdeveloped Agriculture, op. cit., p. 335.

[48] For an excellent account of the traditional role of rice in Thai rural community see Hanks, Lucien M.; Rice and Man, Agricultural Ecology in Southeast Asia, Aldine, New York 1972; Muscat, Robert J.; Development Strategy in Thailand, A Study of Economic Growth, Praeger Special Studies in International Economics and Development, Frederick A. Praeger Publishers, New York, 1966.

[49] Behrman, J.R.; Supply Response in Underdeveloped Agriculture, op. cit., p. 337.

CHAPTER FIVE

MODEL OF WORLD JUTE DEMAND

5.1 Introduction

Jute manufactures are produced in many developed and developing countries of the world and are consumed in just about all of them. The universal use of jute[1] is primarily due to its cheapness compared with other fibres. Thus the concentration found in the supply side is not a feature of the demand side. Yet in this study we shall focus our attention to the following six principal consuming countries/regions: Bangladesh, India, the United States, the United Kingdom, Japan, the EEC countries (excluding the U.K. and other countries that joined later) and a "Rest-of-the-World" sector. In 1972, the six principal consuming countries listed above accounted for about 46 percent of the world's consumption of jute manufactures.[2]

In this chapter the consumption demand functions and the stock demand functions are estimated; they are an essential part of the world model. In Section 5.2 the consumption demand equations are discussed in the context of empirical estimation. Section 5.3 discusses the specification of the consumption demand equations for Bangladesh and India, where consumption of other synthetic substitutes that closely compete with jute is not so prominent. Section

5.4 presents the empirical results of the estimation of these equations. In Section 5.5., the total demand for current consumption of jute manufactures and the synthetic substitutes (that compete with jute manufactures) is estimated in one relationship for each of the other four leading consuming countries (i.e., the U.K., the U.S.A., Japan and EEC countries) and in the "Rest-of-the-World" sector while in Section 5.6 a model is developed to estimate the relative current consumption demand of jute manufactures to synthetic substitutes in a separate relationship. Finally, in Section 5.7 and 5.8, the stock demand for raw jute and jute manufactures, respectively, are estimated while Section 5.9 contains the specification and estimation of the equations for prices of raw jute and jute manufactures. Section 5.10 concludes the chapter.

5.2 Empirical Estimation of Consumption Demand Equations

It is well known that the demand for a product is a function of its own price, prices of other related commodities, income, tastes, population, socio-economic factors and so on. The concept of a demand function was prevalent in economics long before any attempt was made to estimate its parameters empirically. Empirical estimation of demand functions developed with the pioneering works of Moore, Schultz, Stone and others.[3] A consistent feature of this development is its concern with the demand for consumer goods, chiefly non-durables. The basic model that has been used can be summarized in the following form:

$$\frac{D_i}{N} = f(\frac{Y}{N}, P_i, P_r, t) \qquad [5.1]$$

where D_i is the demand for the ith commodity, N is the number of consumers, Y is real income, P_i is the deflated price of the commodity in question, P_r is the real price of related commodities and t is a proxy variable to account for other structural changes. This basic model has been widely used in its various specifications and aggregations over different forms of data (for example, time-series and/or cross-section). At the same time theories have been founded on utility maximization by consumers. However, one basic problem in econmetric estimation of the demand functions is the familiar one of simultaneous equation bias due to the existence of the supply function.[4] The most fundamental decision here is whether to use a single or simultaneous equation system, depending upon the interdependence between the variables hypothesized to influence the demand for and the supply of the product. Fortunately, in the case of an agricultural commodity like jute where there is a lagged response of supply to price, we can postulate the supply to be exogenously given and overcome this problem.

The net consumption of jute manufactures for each country, $CONJM_{it}$, can be measured from the annual production ($PRODJM_{it}$), exports ($EXPJM_{it}$), imports ($IMPJM_{it}$) and the variation in stocks of jute manufactures ($STKJM_{it}$ - $STKJM_{it-1}$), satisfying the following relationship:

$$CONJM_{it} = PRODJM_{it} - EXPJM_{it} + IMPJM_{it} - (STKJM_{it} - STKJM_{it-1}) \quad [5.2]$$

This variable measures the country's demand for jute manufactures and not for raw jute, which is a derived demand. However, except in the cases of Bangladesh and India, for which separate demand equations for stocks of jute manufactures have been estimated, this variable also measures the country's demand for additions to stocks of jute manufactures since, due to lack of data, no stock figures are considered for these countries and hence it is impossible to separate these two aspects of demand. Since annual data are considered, the importance of movements in stocks of jute products in the different levels of the jute industry and by final consumers is less than would be the case if monthly or even quarterly data were considered; however, the omission of these factors will still affect the estimated demand equations to some degree. Another simplification dictated by data limitations is that there is no breakdown of jute manufactures demand into demands for different types of jute manufactures. In particular, jute products used for bags, hessian, carpet-backing and the like are all aggregated together, although these different components of the total demand probably are determined by somewhat different processes. When better data become available, the study of a more disaggregated model should be undertaken.

5.3 Specification of the Consumption Demand Equation of Jute Manufactures for Bangladesh and India

As was the case for the supply equations, the distinction between "short-run" and "long-run" or "equilibrium" relationships is important in studying the demand for a commodity. This distinction has been emphasized by many economists,[5] and successfully applied to the estimation of demand equations by Nerlove.[6] The models considered here are of the same type as those estimated by Nerlove and are similar to the lagged adjustment acreage equations considered in Chapter 4.

In many cases, it becomes necessary to distinguish between demand equations that involve different adjustment periods since the effects of a change in an explanatory variable, say the price of the product or income, on demand are manifested not only during the time period it is observed but is likely to be distributed over a number of future time periods also. In this connection, Nerlove notes that in most demand relationships there are a number of institutional and technological rigidities which prevent the instantaneous adjustment of actual consumption to desired or equilibrium consumption. However, the longer the adjustment period becomes, the less important these constraints become also. Thus the country demand curves can be considered to be the results of the aggregations of the solutions of individual consumer utility maximization problems subject to the appropriate constraints in each of the cases. The characteristic feature of these constraints is that they become less restrictive and fewer in number as the adjustment period becomes longer. An example of the effect of such rigidities is the impact of synthetic substitutes on the consumption of jute manufactures in the last couple of years. This impact was not felt all at once at a single point of time. On the contrary, their cumulative effects are spread over the entire period to adjust to new methods of production, to encourage acceptance of the new products developed, and to adjust to new levels of income. The existence of contractual agreements at many levels of the jute market is another source of such rigidities. A related cause of lagged response to changing explantory variables is the existence of uncertainty. It is probable that consumers do not react immediately to a change in income or price, but instead it is more reasonable to assume that they distribute their response over a number of future periods as, and to the degree that, the observed income or price proves to be "permanent" rather than "transitory". Such rigidities caused by uncertainty are included implicitly in the model below since their explicit inclusion makes the model far too complicated.

In order to introduce the distinction between the short-run and the long-run or equilibrium demand curves, a dynamic-flow-adjustment model is utilized in which the demand for jute manufactures depends on underlying economic factors (such as income), but that the effects of these factors is spread out over time. Such a model has been successfully used in demand for energy studies and demand for copper.[7] To begin with, we define a long-run or equilibrium demand for jute manufactures in country i for year t, $CONJM_{it}*$, which is the amount that would be consumed if there were no rigidities constraining demand response or is the equilibrium amount that would be consumed at some future date if the present values of the explanatory variables continued indefinitely into the future. However, the quantity, $CONJM_{it}*$, in fact, is never actually observed since the values of the explanatory variables do change and rigidities in the adjustment process do exist. In the short run, say in any one year, consumers adjust actual consumption, $CONJM_{it}$, by a fraction, δ_i, of the distance towards equilibrium consumption, $CONJM_{it}{}^*$. The actual level of consumption in any one year is not necessarily equal to the desired level. In particular, actual consumption adjusts toward desired consumption with a lag, so that this year's consumption is a function of this year's economic variables and last year's consumption. The adjustment process is represented as:

$$CONJM_{it} - CONJM_{it-1} = \delta_i [CONJM_{it}{}^* - CONJM_{it-1}] \quad [5.3]$$

and this fraction will be larger, the longer the time period considered. Note that [5.3] implies that actual consumption in period t is a distributed-lag function of past desired or equilibrium consumption; that is, solving [5.3] for $CONJM_{it}$ yields

$$CONJM_{it} = \sum_{j=0}^{t} \delta_i (1-\delta_i)^j \; CONJM_{it-j}{}^* \quad [5.4]$$

Thus there is no unique short-run demand curve and hence, correspondingly no unique short-run price or income elasticity of demand. These elasticities will vary with the position from which we start and the length of time allowed for adjustment. However, by specifying an equation for equilibrium or long-run demand curve and incorporating this equation with the adjustment equation in [5.3], we can obtain estimates of the particular short-run elasticities corresponding to the adjustment period assumed in [5.3]. Moreover, it is possible to derive the estimates of the long-run or equilibrium elasticities from these estimates.

The equilibrium net annual consumption of jute in these two countries, $CONJM_{it}*$, is based on the hypothesis that it depends on national income, NI_{it}, the ratio of current national income over what it was in the previous year, $\frac{N_{it}}{N_{it-1}}$ the price of jute manufactures, PJM_t, and the price of any competitive material for jute. As an alternative to income variables, some measure of activity in the production sector of the economy, for example, an index of annual production of selected agricultural and industrial marketed commodities, was tried. However, it did not perform any better and so income variables have been used. The absence of any suitable substitute commodity posed a problem. In many earlier studies,[8] cotton was utilized as the substitute commodity. But since in Bangladesh, cotton is mainly imported from abroad for apparel purposes, it does not really compete with jute in its traditional end-uses, the major use being jute sacks for packing industrial and agricultural commodities, which accounts for more than 70 percent of total -- for which no effective and cheap material is present to compete with jute. Thus no price of substitute materials is considered for these two countries in this study.

Thus the equilibrium net consumption demand is specified as:

$$CONJM_{it}* = \alpha_0 + \alpha_1 \; PJM_t + \alpha_2 \; Ni_{it} + \alpha_3 \frac{NI_{it}}{NI_{it-1}} \qquad [5.5]$$

All price and income variables are deflated to get the equation in "real" terms. The NI_{it}/NI_{it-1} variable is included to test the ralationship to consumption, of the growth of income from recent levels;for some of the jute products which are semi-durable goods, (e.g., carpets), the purchase can be postponed if "transitory" income deviates downward from "permanent" income or can be accelerated if the deviation is upward.

If equation [5.5] is substituted into [5.3] and the result is solved for $CONJM_{it}$, the following equation results which is suitable for estimation:

$$CONJM_{it} = \delta_i\alpha_0 + (1-\delta_i)\ CONJM_{it-1} + \delta_i\alpha_1\ PJM_t$$

$$+ \delta_i\alpha_2\ NI_{it} + \delta_i\alpha_3 \frac{NI_{it}}{NI_{it-1}} \qquad [5.6]$$

From equation [5.6] we can obtain estimates of the "short-run" (equal to one year) elasticity of demand with respect to price and income at the mean values of these variables in the observation period by multiplying the corresponding coefficients by the ratios of the mean values of respective variables. An estimate of the long-run or equilibrium elasticities, that is the elasticity corresponding to equation [5.3], can be derived from the estimated value of δ_i, $\hat{\delta}_i$. However, Brandow[9] notes that specification error may bias the estimate of δ_i and hence affect the estimate of the long-run elasticity. The estimates of the long-run elasticity obtained in this study, therefore, should be considered with this reservation in mind.

5.4 The Estimated Net Consumption Demand Equations for Bangladesh and India

Since there are no theoretical considerations dictating a specific functional form, equation [5.6] was estimated in both linear and log-linear forms. In both the cases, the log-linear form gave decidedly better results and hence this particular form was chosen to represent the consumption demand equations for Bangladesh and India. The estimated equations are presented in Table 5.1. The results are quite interesting. The price elasticities of demand (short-run) are -0.878 and -0.441 for Bangladesh and India respectively. In the case of Bangladesh, all the coefficients have expected signs. In India, the NI_t/NI_{t-1} has a negative sign, contrary to expectations. However, as the t-ratio indicates the variable is insignificant. Low coefficients of the lagged consumption variable, especially in the case of India, suggest that adjustment of consumption to changing factors in both the countries is fairly rapid. The most important factor in explaining demand in these two countries appears to be income. Since both these countries are undergoing development plans which are expected to lead to considerable growth in their incomes in the next few decades, the above results suggest that these countries will provide significant new markets for jute manufactures.

The elasticities of demand obtained in this study are comparable to other studies. For example, Imam's study,[10] although it covers a different time period and employs a different method of analysis, computed the price elasticity of demand for Pakistan at -0.84 as compared to -0.878 found in this study. The price elasticity for India

TABLE 5.1

ESTIMATED CONSUMPTION DEMAND EQUATIONS FOR JUTE MANUFACTURES FOR BANGLADESH AND INDIA (CONJM)[a]

(t-scores in parentheses)

Country and Years	Intercept	ln $CONJM_{-1}$	ln NI_t	ln NI_t/NI_{t-1}	ln PJM_t	$\bar{R}^2$	DW	ρ[b]
Bangladesh 1954-1974	7.05 (1.67)	0.30 (3.01)	0.31 (1.82)	1.43 (5.19)	-0.88 (-1.92)	.79	1.812	-0.173
India 1948-1974	4.85 (2.47)	0.08 (1.79)	0.84 (5.91)	-0.29 (-2.57)	-0.44 (-2.14)	.82	1.868	-

[a]Variable definitions and data sources are given in Appendix A.

[b]Estimated by Cochrane-Orcutt iterative procedure.

is relatively low as compared to Bangladesh. This is difficult to reconcile in view of the similarity in the use of jute in both the countries. It may be that prices have fluctuated considerably more in one country than in the other (which in fact is the case between Bangladesh and India) resulting in different coefficients. Moreover, inter-country comparisons are sometimes misleading since the coefficients may be biased due to inaccuracy in data or misspecification of the model.

Nevertheless, our estimated consumption demand equations are quite satisfactory and hence included in the world model.

5.5 Total Demand for Current Consumption of Jute Manufactures and Synthetic Substitutes in Other Regions

In this section as discussed in Chapter Two, we propose to estimate a single equation representing the total current consumption demand for jute manufactures and synthetic substitutes that compete with jute manufactures for each of the following countries -- the United States, the United Kingdom, Japan, the EEC countries (excluding the U.K.) and in the "Rest-of-the-World" sector. Subsequently, the current consumption demand for jute manufactures relative to synthetic substitutes is estimated in a separate relationship, and the results reported in the following section.

As was the case of consumption demand for jute manufactures in Bangladesh and India, the proposed model for the areas stresses the distinction between short-run and long-run or equilibrium relationships in demand. Based on a dynamic-flow-adjustment model, the adjustment process is represented as:

$$CONJS_{it} - CONJS_{it-1} = \delta_i [CONJS_{it}^* - CONJS_{it-1}] \quad [5.7]$$

where $CONJS_i$ represents the total consumption of jute manufactures and synthetic substitutes together, with an asterisk used to denote the desired level.

The equilibrium level of consumption, $CONJS_{it}^*$, is hypothesized to depend on national income (or an index of selected commodities) and a time trend variable:

$$CONJS_{it}^* = \alpha_0 + \alpha_1 NI_{it} + \alpha_2 T \quad [5.8]$$

Income is expected to help explain the final demand for the products in question, and is expected to have a positive effect on consumption. The trend variable is used to represent technological factors such as the development of bulk-handling as well as other methods. Moreover, changes in consumer tastes necessitate different types of packaging, which have tended to reinforce the need for bulk handling over the demand for jute manufactures. Since no data are available to quantify the effects of these changes and it is difficult to determine a priori the extent to which excluded variables are randomly and independently distributed, the demand equations are estimated with a trend variable.

Since fibres other than the synthetics considered here (poly-propylene and high density polyethylene) do compete with jute, it would be preferable to analyze the demand for jute in the context of the whole range of products competing with jute. However, it is the synthetics which are the primary substitutes for jute. Moreover, since the other substitutes for jute (e.g., cotton, paper, and the like) have existed for a long time, it is likely that the relative market shares of these traditional commodities are in long-run equilibrium, and hence that jute's share of this sector of the market is essentially stationary. Thus, in order to avoid an unmanageably large model, synthetic substitutes are the only substitutes considered in the model.

The income variable is deflated to get the equation in real terms. We also try the "real" weighted price of jute manufactures and synthetic substitutes in the estimation in an attempt to represent the effects of this price on marginal costs and thus on movements along the final demand curves. From equations [5.7] and [5.8], the following estimating equation can be obtained:

$$CONJS_{it} = \delta_i\alpha_0 + (1-\delta_i)\ CONJS_{it-1} + \delta_i\alpha_1 NI_{it}$$

$$+ \delta_i\alpha_2\ T \qquad [5.9]$$

The estimates for total demand for jute manufactures and synthetic substitutes are presented in Table 5.2. The coefficient of lagged consumption for the U.K. equation was very insignificant and was dropped. Similarly, the NI variable for the consumption equations for the U.K., the U.S.A. and the "Rest-of-the-World" sector had coefficients with large standard errors and sign contrary to our a priori expectations. These equations were re-estimated with the change in income variable rather than income. The weighted price variables did not turn out to be significant for the U.K. or for the "Rest-of-the-World" sector. The estimated adjustment coefficients indicate that adjustment of consumption to changing economic factors is very slow, especially in the United States and the "Rest-of-the-World" sector. Also, the estimated values of the income coefficients suggest that income is the most important fac-

TABLE 5.2

ESTIMATES OF TOTAL ANNUAL CONSUMPTION DEMAND
FOR JUTE MANUFACTURES AND SYNTHETIC SUBSTITUTES (CONJS)[a]

Country and Years	Intercept	$CONJS_{-1}$	NI	ΔNI	T	PJS	$\bar{R}^2$	DW	ρ[b]	δ
United Kingdom 1960-1974	208.6 (14.23)			0.63 (3.56)	-1.98 (-1.72)		0.64	1.82	0.56	1.00
United States 1960-1974	582.2 (2.92)	0.63 (4.23)		2.07 (2.64)	-5.83 (-2.29)	-0.67 (-2.11)	0.91	2.38		0.37
Japan 1960-1974	-138.4 (-1.99)	0.43 (2.13)	3.54 (2.41)		-23.05 (-1.61)	-0.27 (-2.17)	0.99	1.46		0.57
EEC Countries 1960-1974	408.1 (2.31)	0.15 (1.62)	0.56 (2.53)		13.31 (1.65)	-0.49 (-1.62)	0.99	2.46	0.21	0.85
Rest-of-the-World 1960-1974	18.18 (2.03)	0.57 (2.23)		3.96 (2.10)	99.30 (2.03)		0.93	2.16	0.73	0.43

[a] Variable definitions and data sources are given in Appendix A.

[b] Estimated by Cochrane-Orcutt iterative procedure.

tor in explaining demand in these countries, especially in the aggregate "Rest-of-the-World" sector. Since many of the countries included in this sector are going through a rapid development process, income is expected to grow at very high rates in this secotr, and thus provide significant new markets for these products.

We have thus found that the determination of the net consumption of jute manufactures and synthetic substitutes varies significantly in the four major consuming countries/regions and a "Rest-of-the-World" sector with respect to the importance and direction of the effects of composite price of the two products, income or change-in-income, time trend and to the speed of adjustment of actual consumption to desired consumption. Whereas the levels of income is found important in the case of Japan and the EEC countries (excluding U.K.), the change-in-income variable is much more significant in the case of the U.K., U.S.A. and the "Rest-of-the-World" sector. In all cases, income is found to affect consumption much more strongly than price. The estimated one-year adjustment coefficients vary from a low of .3692 for the United States to a high of 1.0000 for the United Kingdom.

5.6 The Demand for Jute Manufactures Relative to the Demand for Synthetic Substitutes

Changes in the relative shares of total consumption of jute manufactures are summarized in Chapter 2. In this section we investigate the relationships, if any, in the above five countries/regions, of the relative prices of jute manufactures and synthetic substitutes and the market shares of the two products. These relationships are of interest to producers of both jute manufactures and synthetic substitutes. This is also of general interest, as a case study of marginal productivity analysis and of substitution between factors of production.

There is no doubt, as discussed in Chapter 2, that technological factors rather than economic factors dominated the process of the jute market's adjustment to synthetic substitutes. The technological aspects of this process have been accompanied by vigorous promotional activity by the synthetic substitute producers. Thus it may be true that during the initial years of introduction of the synthetic substitutes the relative price of jute to synthetics might have played virtually no significant role in the technological adjustment to synthetic fibres. Thus, to be meaningful, it is clear that the impacts of the major technological changes should be included in the study. Technological change,

in the broad sense, may be divided conveniently into two (not necessarily exclusive) categories:
(1) technological changes which lower the cost of producing a given product, and (2) technological changes which change the characteristics of the product. However, in the case of the synthetic polymers in which we are interested it is the first category which is the most important since this has enabled the industry not only to keep the current prices constant, but actually declining (and, thus, declining more in real terms) for more than a decade until 1974. Unfortunately, due to the lack of data, we are unable to construct any index of the technical change associated with the industry. However, it is hoped that the price of the substitutes would reflect the effects of the technological change within the industry. Furthermore, it is assumed that the progress of the substitutes within a particular end-use in the jute market once it has made the quantum jump of penetrating the end-use, depends primarily and directly on the relative price movements of the two products.

The industry, using jute manufactures and/or the synthetic substitutes as their inputs to produce the final consuming goods, is assumed to be competitive.[11] All firms in the industry are assumed to have CES production functions,[12] with differing multiplicative "efficiency parameters". The production function has two parts -- a labor-capital part and a part of jute manufactures and synthetic substitutes. There may be substitution between the parts (probably with a very low degree) and together they may be subject to non-constant returns to scale over certain ranges of production. Within the labor-capital part, substitutability between the two factors exists. Similarly in the other part, jute manufactures can be substituted for the synthetics. The production function for the ith firm can be represented as

$$O_i = S^i \left[\{(\alpha_0 J_1^{-k} + J_2^{-k})^{-1/k}\}^{-\lambda} + \{(\alpha_1 K^{-s} + L^{-s})^{-1/s}\}^{-\lambda} \right]^{\frac{-f(O_i)}{\lambda}} \tag{5.10}$$

where J_1 refers to jute manufactures, J_2 is synthetics, and K and L stand for capital and labor respectively, and α_0, α_1, k, s, and λ are parameters.

The potential number of firms in the industry is assumed to be fixed. But the number of firms actually producing will vary since those firms would produce zero output if by producing they would make losses. Each firm maximizes profits and is in long run equilibrium, subject to "commercial" error terms in the marginal productivity conditions. Since the production function satisfies the conditions of homothetic separability,[13] this implies that each of the two groups of inputs has a price and quantity index such that the marginal productivity conditions can be expressed in terms of these indices. This has the important implication that the ratio of capital to labor is fixed independent of other input ratios. In each case, the ratio is solely dependent on the ratio of the corresponding price indices. The output level of the firm, all these ratios being given and fixed, is determined by the ratio of an index of factor prices to the price of final output. Thus factor ratios are independent of both the output level of the firm, and by similar reasonings, that of the industry. In particular, we can write the ratio of inputs of jute manufactures to synthetics as functions solely of their price ratios. In general, the marginal productivity conditions are recursive.

In order to complete the analysis, it is necessary to assume that the jute manufactures and synthetics price ratio is exogenous, that is, independent of changes in demand by the industry. This can be taken as a reasonable assumption in our analysis. As discussed in Chapter 2, the proportion of total output of synthetics competing with jute manufactures constitutes a small percentage of the total output of synthetics. Moreover, the synthetics are produced in the countries examined in this study under conditions of oligopoly. The producers mainly tend to aim for price stability, this being probably the result of the need to maintain pricing discipline.[14] Also, during most of the data period, overcapacity was the problem of the industry. Hence current changes in demand for the substitutes are unlikely to affect their price; rather capacity utilization and stocks are likely to be varied. Prices will be changed in lagged response to a sustained change in demand. Jute manufactures, on the other hand, are mostly imported in the countries concerned. Changes in domestic prices of jute manufactures in these countries will, therefore, be closely related to changes in world prices. Changes in demand in any particular country could have at most an insignificant effect on the world price and hence also on the domestic price of jute manufactures in that country.

In its reduced form, the model can be written as a set of marginal productivity conditions with price ratios as the independent variable:

$$\frac{J_1}{J_2} = \alpha_0^{\sigma} \left[\frac{PJM}{PSS}\right]^{-\sigma} u_0 \qquad [5.11]$$

where $\sigma = 1/k+1$ and PJM and PSS refer to prices of jute manufactures and synthetic substitutes respectively. u_0 is the error term representing commercial misjudgements and any omitted variables.

The availability of data on price of synthetic substitutes in the countries studied created a problem. As a proxy for the price of all synthetic substitutes, the list price of polypropylene in the United States is used for all data cells because of the availability of that price and the dominance of polypropylene in synthetics production. This can be justified by the fact that in all these countries the general price trend of polypropylene has been very similar to the United States. Although there were wide differences in the price level during initial periods due to low level of international trade, intercountry price differentials tended to be eliminated with increased trade in the polymer. Thus the use of the U.S. price series alone should not be too misleading because of the dominance of the United States in total world production of polypropylene and the fact that a large proportion of the production outside the United States is controlled by the U.S. companies so that prices in other countries more or less always followed the United States trend.

Another problem arises because the price data are affected by the existence of quantity, and other discounts, given by the producers over the list prices which have been used in the study. If the discounts are a constant percentage of the list price, the percentage can be treated as a logarithmic constant and knowing its value, say 10 percent, we can allow for the bias in the constant term of the regression. However, the discount is not generally constant (depending instead on excess capacity and business conditions) and this would lead the error term to follow the cycle of the synthetics industry activity. In general, the error term would be autocorrelated.

Equation [5.11] was estimated in the loglinear form, made familiar by Arrow et. al. and others:

$$\ln \frac{J_1}{J_2} = \sigma \text{ in } \alpha_0 - \sigma \ln \frac{PJM}{PSS} + \ln u_0 \qquad [5.12]$$

The estimated results are presented in Table 5.3. The results need careful interpretation. The likelihood of autocorrelated residuals was suggested earlier, and in almost all the cases there was in fact evidence of autocorrelation. However, since no lagged endogenous variables appear as explanatory variables, parameter estimates will be unbiased in spite of autocorrelation. This will, nevertheless, result in the loss of the minimum variance property and lead to underestimates of their standard errors.

Attempts were made to remove the serial correlation by the Cochrane-Orcutt iterative procedure, but it became apparent that such transformation would destroy the basic relationship between quantity demanded and price ratios. Given the expected very high value of ρ, the first-order

TABLE 5.3

ESTIMATES OF NATURAL LOGARITHM OF RATIO OF ANNUAL DEMAND OF JUTE MANUFACTURES TO ANNUAL DEMAND OF SYNTHETIC SUBSTITUTES (In CONJM/CONSS)[a]

Regression Coefficients (with t-values in parentheses)

Country and Years	Constant	Natural logarithm of price ratio (i.e., elasticity of substitution)	$\bar{R}^2$	DW
United Kingdom 1960-1974	3.60 (12.17)	-2.35 (-8.43)	.85	.88
United States 1960-1974	3.79 (14.66)	-2.09 (-8.60)	.85	1.11
Japan 1960-1974	4.00 (11.48)	-4.07 (-12.39)	.92	1.47
European Economic Community (Excluding U.K.) 1960-1974	3.51 (9.61)	-2.80 (-8.14)	.84	.85
Rest-of-the-World 1960-1974	5.16 (15.97)	-2.44 (-8.02)	.83	1.002

[a]Variable definitions and data sources are given in Appendix A.

autocorrelation coefficient, the transformation is nearly equivalent to taking first-differences. The disappearance of the relationship under first-differences could imply the existence of some lag in the relationship. However, some fixed lags were proved unsuccessful. We have assumed no lag in the relationship, but this should not create any serious misspecification for our model which is in terms of absolute levels not in terms of changes. Nevertheless, this effectively prevents the statistical removal of autocorrelation.

As we have discussed earlier, the residuals might be correlated with cycles in the synthetics industry. However, due to lack of data on the cycle, nothing could be done at present and this requires further study.

Under the circumstances, we can adjust the estimated standard errors for the inefficiency due to the presence of autocorrelation.[15] The correction factor depends on ρ (the first-order autocorrelation coefficient, an estimate of which is provided by the Durbin-Watson statistic) and the degree of autocorrelation in the independent variable (i.e., the price-ratios). This factor can be used as a basis for reappraising the significance of the results in an approximate fashion.

Economic theory suggests that products which are "competitive" with one another should display elasticities of substitution greater than unity, and the algebraic value depending on the degree of "competitiveness". For jute manufactures and synthetics, the range is from 2.09 for the United States to 4.07 for Japan. Thus these estimates may be considered as reasonably plausible.

However, one weakness of the analysis is the absence of an explicit role for non-price variables, especially technological changes. In further research, technological changes should usefully be captured in additional variables, since they played a very significant role in the acceptance of synthetics in the traditional end-uses of jute manufactures. Nevertheless, the extent of substitutability uncovered here carries conviction, at least as a minimum.

5.7 Demand for Stocks of Raw Jute

In this section, the relationship between raw jute stocks and prices are studied and equations explaining the central dynamic role of these variables are estimated.

A difficult problem, both conceptual and statistical, that one faces in studying raw jute stocks is that stocks are held by many different people and organizations for many different purposes. For example, significant amounts of stocks of raw jute are held by dealers, exporters, government organizations, jute boards, importers, and manufacturers of jute products -- these stocks being held in both producing and consuming countries. A further complication is that stocks of semi-finished and finished jute products also have a significant effect in the market of raw jute.

For the purpose of our analysis, the many types of holdings of raw jute stocks are aggregated together into one class, "producer stocks", held in the three main producing countries of Bangladesh, India, and Thailand. The non-availability of reliable data is the deciding factor for assuming that the consuming countries do not hold any stocks.

A large proportion of raw jute, from about 15 to 25 percent of the total world production, is carried over at the end of the year in the producing countries (see Table 5.4). These stocks are withheld from sale mainly for transactions, and presumably also for speculative reasons. Since jute is cultivated on relatively small holdings by peasant farmers under subsistence agriculture, they sell the season's crop as soon as the fibre is ready for baling and transport. They cannot afford to carry their jute over to the next year because they need returns to pay for the current expenses. Thus, in most cases, it is the exporters and the manufacturers of the jute products who hold the stocks in the producing countries. Since the size of the producers' stocks are relatively large, changes in these

TABLE 5.4

TOTAL WORLD PRODUCTION AND STOCKS[a] OF
RAW JUTE IN THE MAJOR PRODUCING COUNTRIES
(In Thousand Metric Tons)

	Average 1948-1951	Average 1960-1964	Average 1968-1971	Average 1973-1975
Total world production of raw jute and allied fibres	1714	3162	3239	4058
Total production of Bangladesh, India, Thailand	1531	2563	2494	2639
Total world stocks (i.e., stocks held by the major three producing countries)	294	615	520	1003
Total stocks as percentage of total world production	17	19	16	25
Total stocks as percentage of total production of Bangladesh, India, Thailand	19	24	21	38

[a] At the end of the period

Source: 1. Commonwealth Economic Committee, Industrial Fibres (different issues)
2. FAO Commodity Review and Outlook 1976-77 and earlier issues.

stocks are thought to have a significant effect on the level of world jute prices, and hence a study of the factors determining these stocks is central to the world market model being constructed.

The stock data used is the series of unsold jute at the end of the year for each of the three producing countries. No producer stocks data are available for countries other than the three producing and exporting countries studies here. Since other such stocks, if they exist, are negligible both in quantity and in their effects on the world market, they are specified to be equal to zero in this model.[16]

As mentioned earlier, two main groups of people hold these stocks in Bangladesh and India -- exporters and dealers of raw jute and the manufacturers of jute goods (Jute Mills). In Thailand, where the manufacturing activity is not very significant and most of the jute is exported, it is assumed that the exporters are the only group that withhold the stocks. In the following pages we build up a model to analyze the holding of the stocks of raw jute on the basis of the assumed motivation of these groups of people.

Model of Stock Demand

The principal reasons for the exporters to carry stocks over to the next year are apparently those of transactions and speculations. Moreover, it is reasonable to assume that the producer stocks of raw jute held by the manufacturers of jute goods (Jute Mills) are mainly for present and expected future mill consumption, but some may also be used for speculation or price-hedging. The simple model used in this study to explain the desired or equilibrium level of carry-over stocks by the exporters and the manufacturers at the end of the year t, $SRJ_t{}^*$, is

$$SRJ_t{}^* = \alpha_0 + \alpha_1 \, PRJW_t + \alpha_2 \, PRJW^e_{t+1} + \alpha_3 \, RJUJM_t + \alpha_4 \, RJUJM^e_{t+1} + \alpha_5 \, DEVNP_t \qquad [5.13]$$

The explanatory variables are the current and expected future price of raw jute, $PRJW_t$ and $PRJW^e_{t+1}$, and the current and expected future raw jute use in jute manufactures, $RJUJM_t$ and $RJUJM^e_{t+1}$ -- these expectations and anticipations being made at the beginning of the period. $DEVNP_t$ is the deviation of the actual production of raw jute from the normal expected production -- normal production being determined by the three-year moving average of the preceding three years' production. A dummy variable was added to equation [5.13] for Bangladesh during the period of the Korean War of 1950-1953.

While "naive" expectations were found to be useful in the equations explaining jute acreage in Chapter 4, a more complex form of expectation formation is assumed for the stock equations. This specification of a more complex form of expectations formation is consistent with the specification of the jute acreage equations because it is assumed that carry-over stocks are held only by the exporters and the Jute Mills who have the capital to permit carrying these stocks and not by the subsistence jute farmers. It is for these groups that the more complex form of expectations formation is assumed to hold.

The expectations of future prices of raw jute are based on information available in period t. While a great many economic and non-economic variables are observed, it is assumed, for simplicity, that the market has reacted in such a way that the effects of all these variables on the jute market are contained in current and past jute prices. The basic assumption, following the specification of expectations formation used by Goodwin and many others,[17] is the following:

$$PRJW^{e}_{t+1} = PRJW_{t} + \beta[PRJW_{t} - PRJW_{t-1}] \quad -1<\beta<1 \qquad [5.14]$$

Here we have used the case of a one-year lag between expectations formation and the realization of actual prices, so that expected price is a function of previous actual price plus or minus a fraction of the previous price change. Muth[18] has called such expectation formation "extrapolative expectations", for the specification states that the decision-maker estimates future prices by extrapolating the current prices, adjusting by a factor, β, for the most recent observed change in price. Letting

$$\Delta PRJW_t = PRJW_t - PRJW_{t-1}$$

and substituting [5.14] into [5.13] yields the following equation:

$$SRJ_t{}^* = \alpha_0 + (\alpha_1+\alpha_2)\ PRJW_t + \alpha_2\beta\ \Delta PRJW_t + \alpha_3\ RJUJM_t + \alpha_4\ RJUJM^e_{t+1} + \alpha_5\ DEVNP_t \qquad [5.15]$$

Note that $\beta=0$ yields the case of "naive expectations" and $\beta=1$ yields the case where the price change in year t is extrapolated, unadjusted, to the future. Similarly, for the expected future use of raw jute in manufactures, we hypothesize that

$$RJUJM^e_{t+1} = RJUJM_t + \gamma\ \Delta RJUJM_t, \qquad -1<\gamma<1 \qquad [5.16]$$

and substitute [5.16] into [5.15] to get:

$$SRJ_t{}^* = \alpha_0 + (\alpha_1+\alpha_2)\ PRJW_t + \alpha_2\ \beta\ \Delta PRJW_t + (\alpha_3+\alpha_4)\ RJUJM_t$$

$$+ \alpha_4\ \gamma\ \Delta RJUJM_t + \alpha_5\ DEVNP_t \qquad [5.17]$$

The relationship between the stocks of raw materials and the level of activity or production of the final good can be stated in its simplest form as the assumption that "manufacturers and merchants are both desirous and able to maintain inventories in constant ratio to their output or sales",[19] that is, as the assumption of a simple accelerator relationship. However, it seems clear that the accelerator in this form is too simple.

One modification which is used in this study is the flexible accelerator concept suggested by Goodwin, which states that the manufacturers of jute products adjust the actual stock in period t, SRJ_t, only a fraction, δ, of the distance to equilibrium or desired stock, $SRJ_t{}^*$, in any one time period.[20] That is,

$$SRJ_t - SRJ_{t-1} = \beta\,[SRJ_t{}^* - SRJ_{t-1}] \qquad [5.18]$$

and it is the equilibrium or the desired stocks which are assumed to be linearly related to the desired raw jute use in jute manufactures as in equation [5.13]. Assuming the flexible accelerator, [5.18], yields the following expression:

$$SRJ_t = \delta \sum_{i=0}^{\infty} (1-\delta)^i \ SRJ^*_{t-1} \qquad [5.19]$$

which states that the current inventory stocks are a weighted average of all past equilibrium inventory stocks. Lovell,[21] in his analysis of econometric studies of the determinants of inventory behavior, asserts that the producers may adjust only partially to equilibrium inventories in any one time period because of lags in ordering and in delivery of raw materials, significant savings that can be realized by large bulk purchases, limited means of running down inventories in times of declining demand or limited warehouse facilities in times of expansion. In particular, the adjustment lag in the jute industry might be expected to be relatively large, because the supply of the raw material is highly seasonal.

As we mentioned earlier, some of the raw jute stocks held by the manufacturers may be used for the purposes of hedging or speculating on jute prices. A true test of whether such speculative stock holding is significant would require the knowledge of expected prices. However, we are limited to using some proxy for expected prices. In our study, since price of raw jute is already included in the equations, this can be assumed as the proxy variable.

From equations [5.17] and [5.19], the following equation can be obtained:

$$SRJ_t = \delta\alpha_0 + (1-\delta)\ SRJ_{t-1} + \delta(\alpha_1+\alpha_2)\ PRJW_t + \delta\alpha_2\beta\ \Delta PRJW_t$$

$$+ \delta(\alpha_3+\alpha_4)\ RJUJM_t + \delta\alpha_4\gamma\ \Delta RJUJM_t + \delta\alpha_5\ DEVNP_t \quad [5.20]$$

Specification [5.20] is in terms of observed variables and can be estimated.

One important criticism of the above analysis is that the data and the model are on an annual basis while inventory stock decisions generally are made on the basis of a shorter time period. However, in defence of such criticisms, we can argue that the seasonality of jute supply probably does lengthen the horizon over which such decisions are made, relative to those in other industries. The main consequences of using annual data will be that estimated adjustment coefficients will be higher and short-run variations of stocks will be eliminated. Also, to the extent that price speculations are based on a time period of less than one year, the effects of speculation on stocks will not show up in these annual equations.

Equations [5.20] was applied to the stock data for raw jute in Bangladesh, India and Thailand. In the case of Thailand, the raw jute used in jute manufactures variable is dropped, as the activity is insignificant and no data are available. The resulting estimates are presented in Table 5.5, equations I for each of the three countries.

TABLE 5.5

ESTIMATED EQUATIONS FOR PRODUCERS' STOCKS OF RAW JUTE (SRJ)[a]

Country and Years		Regression Coefficients (with t-values in parentheses) Intercept	SRJ_{-1}	PRJW	ΔPRJW	RJUJM	ΔRJUJM	DEVNP	DUM	$\bar{R}^2$	DW	ρ	δ
Bangladesh	I	132.6	0.19	-0.70	-2.33	0.33	-0.85	0.16	214.9	0.74	2.41		0.81
1950-1974		(1.89)	(1.90)	(-0.69)	(-2.66)	(3.22)	(-3.79)	(1.99)	(3.41)				
	II	- 5.65	0.73		-0.56	0.21	-0.94	0.41	278.2	0.87	2.56	-0.23	0.27
		(-1.87)	(3.52)		(-2.20)	(2.61)	(-3.99)	(1.82)	(1.97)				
India	I	-70.66	0.49	-1.06	0.72	0.05	-0.46	0.80		0.62	1.62	0.51	0.51
1950-1974		(-2.15)	(2.01)	(-1.91)	(2.03)	(0.85)	(-2.07)	(4.63)					
	II	213.3	0.52	-0.24	0.50		-0.34	0.75		0.74	1.65	0.63	0.48
		(1.76)	(2.89)	(-2.27)	(2.09)		(-2.47)	(5.64)					
Thailand	I	28.32	0.62	0.12	-0.72			0.59		0.83	1.86		0.38
1956-1974		(2.43)	(5.99)	(0.21)	(-1.95)			(6.64)					
	II	41.91	0.62		-0.64			0.60		0.84	1.86		0.38
		(3.42)	(6.12)		(-2.03)			(7.00)					

a Variable definitions and data sources are given in Appendix A.

b Estimated by Cochrane-Orcutt iterative procedure.

Although the estimated standard errors of many of the coefficients in these three equations are rather high, the results are fairly intersting. The estimates of the reaction lag coefficient, δ, are given in the last column for the countries. The results for Bangladesh imply that the annual adjustment of actual stocks to desired stocks is fairly complete, about 81 percent. Also, expectations about annual use of raw jute in jute manufactures are interesting. Here the current use enters with a positive sign, as expected, and the change in use with a negative sign. This may mean that the producers extrapolate current use as future use and feel that the most recent change in use will be reversed. Although the jute price coefficient does have the right sign, it is statistically insignificant and lends little support to the hypothesis that a significant amount of jute stocks held in Bangladesh are held for the purpose of speculating or hedging on year-to-year price changes. Clearly, however, the test used is quite crude. Probably there is more speculation and hedging on shorter-run price changes and on relative price changes between different grades of jute. Also, while the holder of the stocks may feel capable of forecasting short-run, e.g. seasonal, price fluctations, they may not attempt to forecast year-to-year price changes. The lack of activity in the jute future markets in Bangladesh lends further support to these results. The price change variable, $\Delta PRJW_t$, was included to indicate the effects of price expectations, the rationale being that short-run price movements appear to be very important for holders of stocks in countries like Bangladesh, due to the instability of the political and market systems. In the equation for Bangladesh, both the current jute price and the change in prices enter with a negative sign. This may mean that the holders of stocks extrapolate current price as future price and feel that the most recent change in price will be reversed.

The results for India indicate that the annual adjustment process of desired to actual stocks in this country is less complete than that for Bangladesh, at about 52 percent. Again, manufacturers of jute goods appear to extrapolate current use as future use with reversed expectation about the most recent change. Again the coefficient of the current price variable is not significant. One interesting result is that in this case the current jute price variable enters with a negative sign and the change in prices enters with a positive sign, indicating that the holder of stocks feel that the most recent change in price will be continued. This differs sharply from the expectations formations in the case of Bangladesh.

A very important factor affecting producer stocks in these two countries has been the frequently changing relationship of government economic policy towards jute exports. Changing taxes, differential exchange rates, export license policies and general political instability have resulted in great variations in the carry-over stocks held in these countries. Preferably the construction of an index which systematically accounted for changes in the official and the effective exchange rates for raw jute exports and export taxes and restrictions would have been ideal in estimating equations explaining raw jute stocks. A study of the economic policies of the period in these countries, however, showed that this approach was futile, especially since for many periods it is difficult to determine what the effective exchange rate on raw jute exports was.[22]

The Thailand estimates differ markedly from those of the other two countries. The estimated reaction coefficient, .381, is significantly lower than those for the other two countries. The jute price variables are not significant having very large estimated standard errors. The current jute price enters with a positive sign and the change in prices enters with a negative sign. This may mean that the holders extrapolate current price as future price and feel that the most recent change in price will be reversed. Perhaps because of the rapid expansion in jute production in recent years, the exporters in Thailand have not as yet developed a strong idea of the ideal or equilibrium relations of stocks which is supported by the small estimated value of δ, .381, which indicates a slow adjustment to equilibrium. Moreover, the deviations from normal production seems to be very important in determining the level of stocks.

Because the current jute price variable performed so badly for Bangladesh and Thailand, the equations were re-estimated using change in jute price variables only. The results are equations II under both the countries in Table 5.5. In the case of India, since the coefficient of raw jute use in jute manufactures variable is essentially zero and insignificant in equation I, this variable was omitted in equation II. The Indian equation can be interpreted best by assuming that equilibrium stocks are linearly related to the current price, the expected future price, the change in raw jute use in jute manufactures, and the deviation from normal production, that is, $\Delta RJUJM_t$ is substituted for $RJUJM^e_{t+1}$ in [5.13]. The resulting model is

$$SRJ_t = \delta\alpha_0 + (1-\delta)\ SRJ_{t-1} + \delta(\alpha_1+\alpha_2)\ PRJW_t$$

$$+ \delta\alpha_2\beta\ \Delta PRJW_t + \delta\alpha_3\ \Delta RJUJM_t + \delta\alpha_4\ DEVNP_t \qquad [5.21]$$

Using this model, the estimate of raw jute stocks for India is given in equation II under India in Table 5.5.

Equations II for each of the countries of Bangladesh, India, and Thailand are chosen for the world model. Annual levels of raw jute stocks appear to be determined mainly by an accelerator relationship between stocks and raw jute use in jute manufactures and deviations from normal production in Bangladesh while jute prices are more significant determinants of stocks in India along with the above factors. In Thailand, the deviation from normal production is quite significant. The short-run(one year) and long-run or equilibrium elasticities[23] estimated from equation I in Table 5.5 of Bangladesh raw jute stocks with respect to price are -1.003 and -1.243 respectively. These estimates are considerably different from those for India, -.973 and -1.889, and those for Thailand, .259 and .679, respectively. An adequate study of speculation in all three countries would require monthly or at least quarterly stock data, preferably disaggregated into jute stocks of different qualities and also into stocks held by exporters and stocks held by manufacturers of jute products.

These relationships should be estimated simultaneously with disaggregated equations of semi-finished and finished jute products. Unfortunately, data limitations did not permit such an analysis in this study. The equations estimated here, however, do appear to give a good measure of the relative importance of the long-run accelerator and price speculation in determining jute stocks in the three countries considered.

5.8 Demand for Stocks of Jute Manufactures

This section examines the determinants of stocks of jute manufactures by different countries. Stocks of jute manufactures are held usually in both the producing and consuming nations, presumably to facilitate transactions and meet unexpected emergencies. Moreover, the stocks are maintained in different types of jute goods. For simplicity, we have lumped all those into a single homogenous commodity -- jute manufactures -- along with appropriately weighted price for the commodity. Another simplification dictated by data limitations is the assumption that the stocks are held in only the two most important producing countries -- India and Bangladesh. Although other major consuming countries -- especially the United States -- holds stocks of jute manufactures, these have been omitted since the quantity involved is not very significant and initial estimates with the data did not result in significant coefficients.[24] Stocks in the other countries are believed to be negligible in quantity, and not to exert any significant influence in the world market. Thus the stocks of jute manufactures are assumed to be held only in India and Bangladesh.

The stocks of jute manufactures are usually held by the manufacturers of jute products (Jute Mills). The stocks of jute manufactures that the mills have held at any period have always been a small fraction of either total production or total sales. Stocks seldom exceed one month's production.[25] The production of jute manufactures by the mills are usually very closely related to their decision regarding sales.[26] Forward sales have always constituted a large proportion of their total sales, and existence of the forward sales mechanism allows the mills to pursue a policy of regulating production over the entire year in such a fashion that they can afford not to hold large stocks of jute manufactures. The main reason behind such production decisions and the preference for holding small amounts of stocks is the absence of hedge available against fall in prices of jute manufactures for the excess of stocks over future sales commitments. This kind of feeling is inherent in the very nature of the way of conducting their purchase and sales decisions. The jute mills usually engage themselves in what is commonly known as "simultaneous business" -- usually during a given period, when the mills purchase raw jute in forward purchase, they also usually sell an equivalent amount of jute manufactures in forward sale. In this manner, the holding of stocks of jute manufactures are kept to a minimum to facilitate transactions.

The above mentioned behavior of the jute mills suggest that the principal reason of carrying stocks is that of transactions. The simple model used to explain the desired or equilibrium stocks at the end of year t, $SJM_t{}^*$ is:

$$SJM_t{}^* = \alpha_0 + \alpha_1 \text{ PRODJM}_t + \alpha_2 \text{ PRODJM}^e_{t+1} + \alpha_3 \text{ SRJ}^e_{t+1} \qquad [5.22]$$

The explanatory variables are the current and expected future production of jute manufactures, $PRODJM_t$ and $PRODJM^e_{t+1}$ and expected future stock of raw jute, SRJ^e_{t+1}. We would also try the current price of jute manufactures to see if the stocks are used for the purposes of hedging or speculating on jute manufactures prices. A true test of such holdings, however, requires the knowledge of expected prices. However, for a crude analysis of the proposition the current price can be thought as a proxy variable.

As in the case of raw jute stocks, based on the extrapolative expectations behavior, the expected variables can be written as:

$$PRODJM^e_{t+1} = PRODJM_t + \beta\ \Delta PRODJM_t, \quad -1<\beta<1 \qquad [5.23]$$

$$SRJ^e_{t+1} = SRJ_t + \gamma\ \Delta SRJ_t, \qquad -1<\gamma<1 \qquad [5.24]$$

Substitution of [5.23] and [5.24] into [5.22] yields the equation

$$SJM_t{}^* = \alpha_0 + (\alpha_1+\alpha_2)\ PRODJM_t + \alpha_2\beta\ \Delta PRODJM_t$$

$$+\ \alpha_3\ SRJ_t + \alpha_3\ \gamma\ \Delta SRJ_t \qquad [5.25]$$

The producers of jute goods, in order to facilitate transactions, probably aim at keeping sufficient inventories. However, due to errors in calculations and other rigidities, they can adjust actual stock to desired stock by only a fraction, δ, in any year:

$$SJM_t - SJM_{t-1} = \delta\,[SJM_t{}^* - SJM_{t-1}] \qquad [5.26]$$

This implies that current stocks are a weighted average of all past desired stocks. Solution of equations [5.25] and [5.26] result in the following equation suitable for estimation:

$$SJM_t = \delta\alpha_0 + (1-\delta)\ SJM_{t-1} + \delta(\alpha_1+\alpha_2)\ PRODJM_t$$

$$+ \delta\alpha_2\ \beta\ \Delta PRODJM_t + \delta\alpha_3\ SRJ_t + \delta\alpha_3\ \gamma\ \Delta SRJ_t \qquad [5.27]$$

Equation [5.27] was applied to the stocks of jute manufactures in India and Bangladesh and the results are summarized in equation I in Table 5.6 for each of the two countries. Unfortunately, the results are not very significant, as indicated by the estimate t-ratios. Many of the coefficients are insignificantly different from zero. The estimated reaction lag coefficients, δ, are quite high for both Bangladesh and India, .832 and .950 respectively, indicating fairly complete adjustment of actual to desired stocks. In the case of Bangladesh, current production of jute manufactures enters with a positive sign, as expected, and the change in production variable with a negative sign, implying the producers might extrapolate current production as future production and feel that the most recent change in production will be reversed. The same kind of expectations is prevalent in the stocks of raw jute variables. Price of jute manufactures does not appear to have much effect in the decision regarding holding stocks, as revealed by its coefficient. The equation for Bangladesh was re-

TABLE 5.6

ESTIMATED EQUATIONS FOR STOCKS OF JUTE MANUFACTURES (SJM)[a]

Country and Years		Regression Coefficients (with t-values in parentheses)									
		Intercept	SJM_{-1}	PRODJM	ΔPRODJM	SRJ	ΔSRJ	PJM	$\bar{R}^2$	DW	δ
Bangladesh 1956-1974	I	-20.50	0.17	0.09	-0.009	0.07	-0.05	0.002	0.89	2.02	0.83
		(-1.85)	(0.42)	(1.88)	(-0.18)	(1.66)	(-1.78)	(0.78)			
	II	-6.97		0.12		0.07	-0.04		0.90	1.99	1.00
		(-2.14)		(5.33)		(1.78)	(-2.10)				
India	I	120.2	0.05	0.07	0.04	0.02	-0.08	-0.17	0.46	2.07	0.95
		(1.70)	(0.19)	(1.65)	(1.71)	(0.25)	(-1.48)	(-1.65)			
	II	113.7		0.08	0.03		-0.07	-0.17	0.56	1.97	1.00
		(1.78)		(1.94)	(1.80)		(-1.93)	(-1.77)			

[a] Variable definitions and data sources are given in Appendix A.

estimated without the lagged stock variable, the change in production and the price of jute manufactures variable since these coefficients were insignificant and close to zero. The resulting equation II has been chosen for the world model.

In the case of India, both the production and change in production variables enter with a positive sign. This may imply that the producers extrapolate current production as future production and feel that the most recent change in production will be continued. However, the expectations are reversed in the case of raw jute stocks. The price of jute manufactures has considerably greater influence on stocks in India, with stocks decreasing with increase in current price. Since the coefficients of lagged stocks of jute manufactures and current stocks of raw jute are insignificant, the stock equation for India was re-estimated without these two variables and the resulting equation II has been included in the world model.

The stocks of jute manufactures are thus found to be determined mainly by the production of jute manufactures and stocks of raw jute. The price of jute manufactures also has a significant effect in the case of India. Although the equations, especially in the case of India, are not very satisfactory in terms of statistical yardsticks, it is hoped that the equations will serve our purpose in the world model. Any further study should consider the stocks in terms of different types of the products separately along with their production and demand since the production decisions might vary along with the types of product produced and so with the stocks of the products.

5.9 Prices of Raw Jute and Jute Manufactures

In this section equations are specified for the estimation of the world prices of raw jute and jute manufactures and attempts are made to relate the world prices to the domestic prices in the producing countries. Because of the importance of the London market in the world jute economy, and the relatively high correlation between the various prices of jute in different countries, the London prices of jute and jute manufactures have been treated as world prices and all other prices of jute and jute manufactures used in the study are related to the London prices.

A. Price of Raw Jute

There are two ways in which the formation of jute prices could be included in the model. First, we could specify an equation which explicitly states the way in which changes in the supply, demand, and stocks of raw jute interact to generate the world jute prices. Alternatively, we could normalize one of the equations for stocks on the jute price variable and then find the equation for jute prices by solving the reduced form of the model. The former approach has been preferred due to the importance of the price variable in the model and its computational simplicity.

It has already been demonstrated in our study that production of raw jute and consumption of jute manufactures are not very sensitive to prices. Producers' carry-over stocks of raw jute are somewhat more affected by jute prices. This relative unresponsiveness of final demand and supply to price implies that small imbalances between these two factors would lead to large variations in the jute prices. Under the circumstances, the world price of jute is hypothesized to be a linear function of (a) the current world stock of raw jute relative to the current world consumption of raw jute, (b) a time trend variable to account for the long term secular trend in jute prices, and (c) a dummy variable to represent large speculative price increases in the world jute market during the outbreak of the Korean War in 1950:

$$PRJW_t = \alpha_0 + \alpha_1 \frac{WSRJ_t}{WCRJ_t} + \alpha_2\ TIME + \alpha_3\ KOREA + u_0 \qquad [5.28]$$

Equation [5.28] was estimated, with price measured in United States dollars per ton as before, by the method of two-stage least squares. This yielded the following equation for the period 1950-1974:

$$PRJW_t = \underset{(15.62)}{421.072} - \underset{(-2.08)}{161.101} \frac{WSRJ_t}{WCRJ_t} - \underset{(-6.76)}{7.319}\ TIME + \underset{(5.62)}{204.847}\ KOREA \qquad [5.29]$$

$\bar{R}^2 = 0.87$, $DW = 1.54$

(figures in parentheses represent t score. Variable definitions and data sources are given in Appendix A).

Equation [5.29] seems to do reasonably well in explaining annual jute prices. Ten percent changes in the ratio of current world raw jute stocks to current world raw jute consumption result in changes in the opposite direction of about U.S. $16 in the world price of raw jute per ton. Also there seems to operate a long-run secular decline in prices of raw jute, as reflected by the time trend variable. During the outbreak of the Korean War, the world price of raw jute increased by about U.S. $205 per ton due to the speculative boom during which the market appears to have been distorted. Equation [5.29] has been used in the following chapter for simulation purposes.

The domestic prices, or more specifically, the prices received by farmers of raw jute were used in the acreage equations in Chapter 4 for Bangladesh, India, and Thailand. An attempt is made here to establish relationships between the domestic prices in each of these countries and the world price of raw jute. The domestic prices are hypothesized to be log-linear functions of the world price of raw jute and the exchange rates of the respective countries:

$$\ln PRJ_{it} = \ln \alpha_0 + \alpha_1 \ln(PRJW_t - EXDT_{it} - FR_{it}) + \alpha_2 \ln ER_{it} \qquad [5.30]$$

Since the London price of raw jute, $PRJW_t$, which is used as the world price in the model, includes any export duties on raw jute as well as freight charges, these amounts have been subtracted from the world price to focus on the net price of raw jute. Thus, for each country, the export duty, $EXDT_{it}$, and the freight charges, FR_{it}, from the main exporting centre to the port of entry in the United Kingdom, both expressed in United States dollars per ton, have been subtracted. The exchange rate, ER_{it}, defined for each country as the units of domestic currency per United States dollar has been included to measure the effects of changes in the exchange rates on domestic prices, PRJ_{it}, which is expressed in units of domestic currencies per ton. In the equation for Bangladesh, two dummy variables were added -- (1) to represent the unusual circumstances which existed during the Korean War periods of 1950-1953 when speculation and other abnormalities in the world market increased prices in the international market for jute, but which had less effect on the prices received by farmers in the domestic markets, and (2) to represent the unusual price increases in the domestic market during the period of war in 1971. In the equation for India, the dummy variable represents the effects of war in 1971. The dummy variable for Thailand represents the higher prices that prevailed in the domestic market during 1971 in anticipations of higher world prices due to the war in Bangladesh and India. The results of the estimations are presented in Table 5.7. For the Thailand prices, the coefficient of determination is substantially lower than one might hope to obtain. The results suggest that the domestic prices in Bangladesh move in close relation with the world price with almost one-to-one

TABLE 5.7

ESTIMATES OF DEFLATED PRICE OF RAW JUTE
DETERMINATION RELATIONSHIPS (ln PRJ)[a]

Country and Years	Regression Coefficients (with t-values in parentheses)							
	Intercept	ln(PRJW-EXDT-FR)	ln ER	KOREA	DUM	$\bar{R}^2$	DW	ρ[b]
Bangladesh 1950-1974	-1.08 (-1.73)	1.06 (9.37)	1.06 (6.04)	-0.68 (-2.10)	1.15 (4.58)	0.95	1.80	0.64
India 1954-1974	2.65 (2.48)	0.57 (3.27)	0.64 (2.51)		1.15 (4.25)	0.93	2.73	0.84
Thailand 1960-1974	-18.77 (-1.96)	0.96 (2.44)	7.03 (2.16)		0.69 (2.93)	0.72	2.41	0.49

[a] Variable definitions and data sources are given in Appendix A.

[b] Estimated by Cochrane-Orcutt iterative procedure.

relationship. In India, any given increase in world price have almost half the impact on domestic price. This is expected since Indian production does not enter world market in any significant amount and hence the domestic price is not very sensitive to the world price. The case of Thailand is somewhat unsatisfactory. Nevertheless, the world price does seem to have substantial impact on domestic price in Thailand.

B. Price of Jute Manufactures

The price of jute manufactures is closely related to the price of raw jute. As mentioned earlier, it is usually observed that the price of raw jute accounts for nearly 50-60 percent of the selling price of jute manufactures while the remaining part consists of other manufacturing costs, including labor. Since these other costs are somewhat stable, the price of jute manufactures is hypothesized to be a linear function of the price of raw jute. Both the prices are measured in United States dollars per ton in the London market. The relationship also includes two dummy variables -- (a) a dummy for the Korean War period of 1950-1953 and (b) one dummy variable for the India-Pakistan wars of 1965 and 1971, when disruption in production of jute manufactures in these two countries resulted in unexpected increases in the price of jute manufactures in the world market. The resulting estimating equation is

$$PJMW_t = \alpha_0 + \alpha_1 \, PRJW_t + \alpha_2 \, KOREA + \alpha_3 \, DUM + u_0 \qquad [5.31]$$

Equation [5.31] was estimated for the period 1950-1974:

$$PJMW_t = \underset{(4.12)}{234.179} + \underset{(6.83)}{1.267} PRJW_t + \underset{(3.64)}{192.390} KOREA + \underset{(1.98)}{67.294} DUM \qquad [5.32]$$

$\bar{R}^2 = 0.86$, $DW = 1.23$

(Figures in parentheses represent t-ratios. Variable definitions and data sources are given in Appendix A)

The result suggest that a ten percent increase in the price of raw jute results in about thirteen percent increase in the world price of jute manufactures.

Finally, the domestic prices of jute manufactures which were used in the production of jute manufactures equations for Bangladesh and India, are related to the world price of jute manufactures in terms of the following equation:

$$\ln PJM_{it} = \ln \alpha_0 + \alpha_1 \ln (PJMW_t - EXDT_{it} - FR_{it}) + \alpha_2 \ln ER_{it} \qquad [5.33]$$

where PJM_{it} = domestic price of jute manufactures in country i (expressed in units of domestic currency) per ton.

$PJMW_t$ = world price of jute manufactures (in United States dollars per ton).

$EXDT_{it}$ = export duty (in United States dollars per ton) on jute manufactures levied by country i.

FR_{it} = freight rate (in United States dollars per ton) of jute manufactures from the country of concern to the U.K.

ER_{it} = exchange rate (units of domestic currency per United States dollar) for country i.

A dummy variable was added for both equations for the India-Pakistan wars of 1965 and 1971. The results which are presented in Table 5.8, are fairly interesting. For example, the equation for Bangladesh suggests the very significant role of the exchange rate for the domestic price, since changes in exchange rates was one of the major instruments for stimulating the jute manufacturing industry in the country during most of the period.[27]

TABLE 5.8

ESTIMATES OF DEFLATED PRICE OF JUTE MANUFACTURES
DETERMINATION RELATIONSHIPS (ln PJM)[a]

Country and Years	Regression Coefficients (with t-values in parentheses)						
	Intercept	ln(PJMW-EXDT-FR)	ln ER	DUM	$\bar{R}^2$	DW	ρ[b]
Bangladesh 1954-1974	1.67 (1.71)	0.59 (1.94)	1.31 (8.76)	0.22 (2.46)	0.83	1.71	
India 1954-1974	3.98 (2.34)	0.62 (2.79)	0.55 (2.00)	0.16 (2.50)	0.93	1.51	0.96

[a] Variable definitions and data sources are given in Appendix A

[b] Estimated by Cochrane-Orcutt interative procedure.

The results in this section suggest that the prices in the world market and in the producing countries are very closely related. This is important since it indicates that stabilization of world prices will also stabilize the domestic prices so that large fluctations in year-to-year supply of raw jute could be avoided. These estimated price equations have been included in the world model in the following chapter.

5.10 Conclusions

The analysis in this chapter reveals that the determination of the consumption of jute manufactures varies significantly in the six major consuming countries and a "Rest-of-the-World" sector with respect to the direction and importance of the effects of price of jute manufactures, income, change-in-income, time trend and to the speed of adjustment of actual consumption towards desired consumption. The effects of synthetic substitutes have been quite disastrous on the consumption of jute manufactures, as measured by the high elasticity of substitution between them in most of the countries.

The heterogeneous nature of the demand side of the world jute market, as revealed in this study, indicates the difficulties facing the attainment of any international agreement on jute and the differential impacts such an agreement would have on jute consumption in the different countries considered. This heterogeneity is in direct contrast to the homogeneous and concentrated nature of the supply side of the market. Another implication of these results is that the aggregation of demand into a single world demand for jute would tend not to express the full implications of different interesting aspects of world demand. Thus disaggregation, at least by countries, is desirable in any study of demand for jute, whenever possible.

FOOTNOTES - CHAPTER FIVE

[1] According to one study in 1960, jute was consumed in more than 70 countries in the world in some form or another. See Food and Agricultural Organization, United Nations, "Trends in World Demand for Jute Manufactures", Monthly Bulletin of Agricultural Economics and Statistics. December 1960 and January 1961.

[2] The lack of adequate data prohibited the analysis of jute consumption in the U.S.S.R., Peoples' China and other centrally planned countries in which the consumption of jute in 1972 was 26 percent of the total world consumption.

[3] Moore, H.L., "Empirical Laws of Demand and Supply and the Flexibility of Prices", Political Science Quarterly, Vol. 34, 1919, pp. 546-567; Schultz, H., The Theory and Measurement of Demand, Chicago, 1938; Stone, R., The Measurement of Consumers' Expenditure and Behavior in the United Kingdom 1920-1938, Cambridge, 1954.

[4] For first exposition of the basic problem see Working, E.J., "What do Statistical Demand Curves Show?", Quarterly Journal of Economics, Vol. XLI, Also in Readings in Price Theory, Homewood, Illinois; Richard D. Irwin, Inc., 1952.

[5] See, for example, Marshall, A., Principles of Economics (8th ed.), London: MacMillan and Company Limited, 1938, pp. 378-379.

[6] Nerlove, M., Distributed Lags and Demand Analysis for Agricultural and Other Commodites, Agricultural Handbook No. 141, U.S. Department of Agriculture, Washington, D.C.: U.S. Government Printing Office, 1958: Nerlove, M. and Addison, W., "Statistical Estimation of Long-Run Elasticities of Supply and Demand", Journal of Farm Economics, Vol. XL, November 1958, pp. 861-880.

[7] Balestra, P. and Nerlove, M., "Pooling Cross-Section and Time-Series Data in the Estimation of a Dynamic Model: The Demand for Natural Gas", Econometrica, Vol. 34, No. 3, July 1966, pp. 585-612; Fisher, F.M., Cootner, P.H., Bailey, M.N., "An Econometric Model of the World Copper Industry", Bell Journal of Economics and Management Science, 1972, pp. 568-609. A description of this model and its statistical properties in the context of the general distributed lag problem is found in Griliches, Z., "Distributed Lags: A Survey" Econometrica, Vol. 35, No. 1, January 1967.

[8] See, for example, Imam, K.A.T.M.H., "Statistical Estimation of the Demand for Jute Goods in Pakistan", The Pakistan Development Review, Vol. IV, Number 4, Winter 1964, pp. 707-733.

[9] Brandow, G.E., "A Note on the Nerlove Estimate of Supply Elasticity", Journal of Farm Economics, Vol. XL, August 1958, pp. 719-722. However, Nerlove notes that bias in the estimate of δ need not imply bias in the estimate of the long-run elasticities. For his comments, see, "On the Nerlove Estimate of Supply Elasticity: A Reply", Journal of Farm Economics, Vol. XL, August 1958, pp. 723-728.

[10] Imam, K.A.T.M.H., op. cit.

[11] This industry includes, among other, the carpet manufacturing industry, packaging industry, etc. In the absence of any detailed information regarding the structure of these heterogeneous industries in these countries, the simplifying assumption of perfect competition does not seem unrealistic.

[12] The well-known constant-elasticity-of-substitution production function. See Arrow, K.J., H.B. Chenery, B.S. Minhas and R.M. Solow, "Capital-Labor Substitution and Economic Efficiency", Review of Economics and Statistics, Vol. 62, August 1961.

[13] Blackorby, C., G. Lady, B. Nissen and R.R. Russell, "Homothetic Separability and Consumer Budgeting", Econometrica, Vol. 38, No. 3, May 1970. For more discussion of the CES production function, see Armington, P.S., "A Theory of Demand for Products Distinguished by Place of Production", IMF Staff Papers, Vol. XVI, 1969, pp. 159-178. The kind of "nested" CES production function we used was first developed by Sato. See Sato, K., "A Two-Level Constant-Elasticity-of-Substitution Production Function", Review of Economic Studies, April 1967.

[14] For a discussion of the controversy over pricing policies, see Stigler, G. and J. Kindahl, The Behavior of Industrial Prices, New York, 1970.

[15] This is discussed in Johnston, J., Econometric Methods, Second Edition, McGraw-Hill, 1972, pp. 246-249.

[16] Of the other countries, excluding China and other centrally planned countries which are not considered in the model for lack of reliable data, Brazil, Nepal, Burma are the main producing countries. Their individual production of jute and consumption of jute manufactures (as estimated by FAO) for some years are given below:

	Production 1968	Production 1969	Production 1970	Consumption 1968	Consumption 1969	Consumption 1970
Brazil	67	49	56	47	46	56
Nepal	29	35	35	2	3	4
Burma	42	44	46	25	22	26

(All figures are in thousand metric tons)

From the above table, it is clear that stocks, if any, of these countries are relatively small and can be expected to have no significant effect on the world market.

[17] Goodwin, R.M., op. cit., pp. 108-132.

[18] Muth, op. cit., p. 6.

[19] Abramovitz, M., Inventories and Business Cycles with Special Reference to Manufactures' Inventories, National Bureau of Economic Research, 1950, p. 20.

[20] Goodwin, R.M., op. cit.

[21] Lovell, M., Determinants of Inventory Investments, National Bureau of Economic Research, 1964, p. 180.

[22] For a study of economic policy in India for the period 1950-1970, see, Bhagwati, J.N., and T.N. Srinivasan, Foreign Trade Regimes and Economic Development, India; A Special Conference Series on Foreign Trade Regimes and Economic Development, Vol. VI, National Bureau of Economic Research, New York, 1975.

[23] Which is equal to $1/\delta$ times the short-run elasticity. These elasticities are measured at the mean levels of the variables for the time period studied.

[24] The data on the end of year stock figures for hessian cloth in the United States are available through the publications of the Indian Jute Mills Association. For example, at the end of 1974, total stock of hessian cloth in the United States was 78 million metres of which 64 million metres were spot and 15 million metres were afloat, as against the total consumption of 362 million metres. One justification for this neglect of the United States stocks figures is the fact that since the production of jute manufactures is almost negligible in the United States, stocks held in this country do not have much influence in the world market, which is mainly influenced by the conditions in India and Bangladesh.

[25] See U.S. Tariff Commission: Burlap-War Changes in Industry Series, Report No. 26, Washington, D.C., Government Printing Office, 1947, p. 56. Also Indian Jute Mills Association, Department of Statistics, Annual Summary of Jute and Gunny Statistics (different issues).

[26] For a detailed account of the behavior of the Indian and Bangladeshi jute mills, see Government of India, Report of the Jute Enquiry Commission, 1954 and Government of Pakistan, Report of the Pakistan Jute Enquiry Committee, 1961.

[27] See, for example, Ahmad, Q.K., "The Operation of the Export Bonus Scheme in Pakistan's Jute and Cotton Industries", The Pakistan Development Review, Vol. VI, No. 1, Spring 1966, pp. 1-37 and Mallon, R., "Export Policy in Pakistan", The Pakistan Development Review, Vol. VI, No. 1, Spring 1966, pp. 57-79.

CHAPTER SIX

THE COMPLETE WORLD JUTE MARKET MODEL AND SOME POLICY SIMULATIONS

6.1 Introduction

A model of the components of the world jute economy is discussed in some detail in the previous three chapters. In this chapter we draw together from the previous chapters a complete model of the world jute market. Simulations with the model over part of the period of estimation are also presented and discussed in order to obtain some measure of the success of the model, to understand better how the model works, and to explore some interesting hypothetical situations. Moreover, simulations over future periods are also investigated in order to obtain conditional forecasts and to explore further some of the hypothetical situation. In section 6.2 the final estimates of the model are summarized for convenient reference and some of the model's statistical properties are reviewed. In section 6.3 the basic simulation for the 1961-1973 period is examined, while section 6.4 examines four hypothetical situations during the simulation period. The first three explore hypothetical forms of international jute agreements: (a) the maintenance of a floor for the world raw jute price at U.S. $350.00 per metric ton, made possible by the absorption of sufficient quantities of raw jute by an international agency; (b) the maintenance of a price floor at the same level and of a price ceiling at a five percent higher level, made possible by absorptions and releases of sufficient quantities of raw jute; and (c) the institution of disincentives for the production of raw jute, by reducing by ten percent the price received by all raw jute producers. The fourth involves a hypothetical situation in which the ratio of the price of jute and rice is maintained at 1.04, the level thought to be required to maintain the area under jute in equilibrium in Bangladesh. In section 6.5 simulations over the 17-year period from 1974 through 1990 are investigated to obtain conditional forecasts. Finally, section 6.6 explores further the hypothetical situations discussed in section 6.4 while section 6.7 concludes the chapter.

6.2 Final Equation Summary

Equations (6.1) through (6.50) are the final forms of the jute production, stocks, price and consumption equations in the world jute market model. The variable definitions and data sources are given in Appendix A. Equations (6.1), (6.2), and (6.3) are the jute acreage equations for Bangladesh, India and Thailand, respectively; the acreage equations along with the jute yield per acre equations, (6.4), (6.5) and (6.6), determine the total production of raw jute in those countries as defined in the identities (6.7), (6.8) and (6.9). Equation (6.10) defines the production of raw jute in the "Rest-of-the-World" sector.

(6.11) defines the total world production of raw jute. Equations (6.12) through (6.14) are the stocks of raw jute equations for Bangladesh, India and Thailand, respectively while (6.15) defines the world stocks of raw jute. (6.16) and (6.17) give the estimated equations for the stocks of jute manufactures in Bangladesh and India. Equations (6.18) and (6.19) are the domestic consumption of jute manufactures for Bangladesh and India. Equations (6.20) through (6.29) are the estimated equations for total jute manufactures and synthetic substitutes and their relative consumptions in the five other areas of this study -- U.K., U.S.A., Japan, E.E.C. Countries, and "Rest-of-the-World". Equations (6.30) to (6.36) estimate the production of jute manufactures in the seven areas used in the study. Equations (6.37) and (6.38) define the estimated world price of raw jute and jute manufactures, respectively, while equations (6.39) through (6.43) establish the relationships between the world prices and the domestic prices of raw jute and jute manufactures in Bangladesh, India and Thailand (for raw jute only). Finally, (6.44) and (6.47) are the identities defining net exports of raw jute and jute manufactures, respectively, while (6.45) and (6.46) are the identities defining total domestic uses of raw jute and the technological relationship between raw jute and jute manufactures, respectively. (6.48) and (6.49) are the identities defining the total world consumption of jute manufactures and raw jute respectively while (6.50) defines total world production of jute manufactures.

A. <u>Production of Raw Jute</u>

(6.1)

$$
\begin{aligned}
ACRBD_t = {} & \underset{(1.92)}{918.27} + \underset{(3.44)}{0.55}\ ACRBD_{t-1} + \underset{(3.57)}{0.69}\ PRJBD_{t-1} \\
& - \underset{(-3.25)}{0.55}\ PRRBD_{t-1} - \underset{(-1.84)}{480.40}\ SDRAVBD_t \\
& - \underset{(-0.75)}{119.32}\ RYPABD_{t-1} + \underset{(1.88)}{16.30}\ T \\
& - \underset{(-2.19)}{554.53}\ DUMBD
\end{aligned}
$$

$\bar{R}^2 = 0.75,\ DW = 1.84,\ \rho = -0.12$

(6.2)

$$
\begin{aligned}
ACRIN_t = {} & \underset{(-5.62)}{-36425.73} + \underset{(2.58)}{0.29}\ ACRIN_{t-1} \\
& + \underset{(8.82)}{1483.13}\ RPRIN_{t-1} - \underset{(-2.01)}{846.99}\ SDRAVIN_t \\
& + \underset{(4.47)}{2617.56}\ RYPAIN_{t-1} + \underset{(5.57)}{3.93}\ FAPOPIN_t \\
& - \underset{(-4.64)}{462.57}\ T
\end{aligned}
$$

$\bar{R}^2 = 0.87,\ DW = 1.85$

(6.3)

$$
\begin{aligned}
ACRTH_t = {} & \underset{(-3.34)}{-718.79} + \underset{(2.23)}{0.30}\ ACRTH_{t-1} + \underset{(5.76)}{231.44}\ RPRTH_{t-1} \\
& + \underset{(2.47)}{900.65}\ RYPATH_{t-1} + \underset{(1.87)}{20.60}\ T
\end{aligned}
$$

$\bar{R}^2 = 0.90,\ DW = 2.21,\ \rho = -0.36$

$$(6.4)\quad YPAJBD_t = \underset{(12.62)}{0.74} - \underset{(-3.22)}{0.0001}\ ACRBD_t + \underset{(3.16)}{0.017}\ T - \underset{(-3.88)}{0.0007}\ T^2 - \underset{(-3.31)}{0.134}\ DUMBD$$

$$\bar{R}^2 = 0.74,\ DW = 1.32$$

$$(6.5)\quad YPAJIN_t = \underset{(10.97)}{0.45} - \underset{(-0.50)}{0.000007}\ ACRIN_t + \underset{(1.31)}{0.005}\ T - \underset{(-2.62)}{0.0004}\ T^2 - \underset{(-2.24)}{0.054}\ DUMIN$$

$$\bar{R}^2 = 0.67,\ DW = 2.14$$

$$(6.6)\quad YPAJTH_t = \underset{(13.23)}{0.53} + \underset{(0.70)}{0.00003}\ ACRTH_t - \underset{(-0.62)}{0.007}\ T - \underset{(-0.44)}{0.0003}\ T^2$$

$$\bar{R}^2 = 0.63,\ DW = 1.70$$

$$(6.7)\quad JBD_t = ACRBD_t \times YPAJBD_t$$

$$(6.8)\quad JIN_t = ACRIN_t \times YPAJIN_t$$

$$(6.9)\quad JTH_t = ACRTH_t \times YPAJTH_t$$

$$(6.10)\quad JRW_t = \underset{(1.95)}{-109.88} + \underset{(5.00)}{0.75}\ JRW_{t-1} + \underset{(1.96)}{21.31}\ T$$

$$\bar{R}^2 = 0.98,\ DW = 2.04,\ \rho = 0.68$$

$$(6.11)\quad RJW_t = JBD_t + JIN_t + JTH_t + JRW_t$$

B. Stocks of Raw Jute

$$(6.12)\quad SRJBD_t = \underset{(-1.87)}{-5.65} + \underset{(3.52)}{0.73}\ SRJBD_{t-1} - \underset{(-2.20)}{0.56}\ \Delta PRJW_t$$

$$+ \underset{(2.61)}{0.21}\ RJUJMBD_t - \underset{(-3.99)}{0.94}\ \Delta RJUJMBD_t$$

$$+ \underset{(1.82)}{0.41}\ DEVNPBD_t + \underset{(1.97)}{278.16}\ DUMBD$$

$$\bar{R}^2 = 0.87,\ DW = 2.56,\ \rho = -0.23.$$

(6.13) $$SRJIN_t = \underset{(1.76)}{213.27} + \underset{(2.89)}{0.52}\ SRJIN_{t-1} - \underset{(-2.27)}{0.24}\ PRJW_t$$

$$+ \underset{(2.09)}{0.50}\ \Delta PRJW_t - \underset{(-2.47)}{0.34}\ \Delta RJUJMIN_t$$

$$+ \underset{(5.64)}{0.75}\ DEVNPIN_t$$

$$\bar{R}^2 = 0.74,\ DW = 1.65,\ \rho = 0.63$$

(6.14) $$SRJTH_t = \underset{(3.42)}{41.91} + \underset{(6.12)}{0.62}\ SRJTH_{t-1} - \underset{(-2.03)}{0.64}\ \Delta PRJW_t$$

$$+ \underset{(7.00)}{0.60}\ DEVNPTH_t$$

$$\bar{R}^2 = 0.84,\ DW = 1.86$$

(6.15) $$WSRJ_t = SRJBD_t + SRJIN_t + SRJTH_t$$

C. Stocks of Jute Manufactures

(6.16) $$SJMBD_t = \underset{(-2.14)}{-6.97} + \underset{(5.33)}{0.12}\ PRODJMBD_t + \underset{(1.78)}{0.07}\ SRJBD_t$$

$$- \underset{(-2.10)}{0.04}\ \Delta SRJBD_t$$

$$\bar{R}^2 = 0.90,\ DW = 1.99$$

(6.17) $$SJMIN_t = \underset{(1.78)}{113.70} + \underset{(1.94)}{0.08}\ PRODJMIN_t + \underset{(1.80)}{0.03}\ \Delta PRODJMIN_t$$

$$- \underset{(-1.93)}{0.07}\ \Delta SRJIN_t - \underset{(-1.77)}{0.17}\ PJMIN_t$$

$$\bar{R}^2 = 0.56,\ DW = 1.97$$

D. Consumption of Jute Manufactures and Synthetic Substitutes

$$\text{(6.18)}\quad \ln CONJMBD_t = \underset{(1.67)}{7.05} + \underset{(3.01)}{0.30} \ln CONJMBD_{t-1} + 0.31 \ln NIBD_t + \underset{(5.19)}{1.43} \ln \frac{NIBD_t}{NIBD_{t-1}} - \underset{(-1.92)}{0.88} \ln PJMBD_t$$

$$\bar{R}^2 = 0.79,\ DW = 1.81,\ \rho = -0.17$$

$$\text{(6.19)}\quad \ln CONJMIN_t = \underset{(2.47)}{4.85} + \underset{(1.79)}{0.08} \ln CONJMIN_{t-1} + \underset{(5.91)}{0.84} \ln NIIN_t - \underset{(-2.57)}{0.29} \ln \frac{NIIN_t}{NIIN_{t-1}} - \underset{(-2.14)}{0.44} \ln PJMIN_t$$

$$\bar{R}^2 = 0.82 \quad DW = 1.87$$

$$\text{(6.20)}\quad CONJSUK_t = \underset{(14.23)}{208.63} + \underset{(3.56)}{0.63}\, \Delta NIUK_t - \underset{(-1.72)}{1.99}\, T$$

$$\bar{R}^2 = 0.64,\ DW = 1.82,\ \rho = 0.56$$

$$\text{(6.21)}\quad CONJSUS_t = \underset{(2.92)}{582.16} + \underset{(4.23)}{0.63}\, CONJSUS_{t-1} + \underset{(2.64)}{2.07}\, \Delta NIUS_t - \underset{(-2.29)}{5.83}\, T - \underset{(-2.11)}{0.67}\, PJSUS_t$$

$$\bar{R}^2 = 0.91,\ DW = 2.38$$

$$\text{(6.22)}\quad CONJSJN_t = \underset{(-1.99)}{-138.44} + \underset{(2.13)}{0.43}\, CONJSJN_{t-1} + \underset{(2.41)}{3.54}\, NIJN_t - \underset{(-1.61)}{23.05}\, T - \underset{(-2.17)}{0.27}\, PJSJN_t$$

$$\bar{R}^2 = 0.99,\ DW = 1.46$$

$$\text{(6.23)}\quad CONJSEC_t = \underset{(2.31)}{408.11} + \underset{(1.62)}{0.15}\, CONJSEC_{t-1} + \underset{(2.53)}{0.56}\, NIEC_t + \underset{(1.65)}{13.31}\, T - \underset{(-1.62)}{0.49}\, PJSEC_t$$

$$\bar{R}^2 = 0.99,\ DW = 2.46,\ \rho = 0.21$$

$$(6.24)\quad CONJSRW_t = \underset{(2.03)}{18.18} + \underset{(2.23)}{0.57}\ CONJSRW_t + \underset{(2.10)}{3.96}\ \Delta NIRW_t + \underset{(2.03)}{99.30}\ T$$

$$\bar{R}^2 = 0.93,\ DW = 2.16,\ \rho = 0.73$$

$$(6.25)\quad \ln \frac{CONJMUK_t}{CONSSUK_t} = \underset{(12.17)}{3.60} - \underset{(-8.43)}{2.35} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.85,\ DW = 0.88$$

$$(6.26)\quad \ln \frac{CONJMUS_t}{CONSSUS_t} = \underset{(14.66)}{3.79} - \underset{(-8.60)}{2.09} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.85,\ DW = 1.11$$

$$(6.27)\quad \ln \frac{CONJMJN_t}{CONSSJN_t} = \underset{(11.48)}{4.00} - \underset{(-12.39)}{4.07} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.92,\ DW = 1.47$$

$$(6.28)\quad \ln \frac{CONJMEC_t}{CONSSEC_t} = \underset{(9.61)}{3.51} - \underset{(-8.14)}{2.80} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.84,\ DW = 0.85$$

$$(6.29)\quad \ln \frac{CONJMRW_t}{CONSSRW_t} = \underset{(15.97)}{5.16} - \underset{(-8.02)}{2.44} \ln \frac{PJMW_t}{PSSW_t}$$

$$\bar{R}^2 = 0.83,\ DW = 1.00$$

E. <u>Production of Jute Manufactures</u>

$$(6.30)\quad PRODJMBD_t = \underset{(1.83)}{165.72} + \underset{(4.94)}{0.85}\ PRODJMBD_{t-1} - \underset{(-1.57)}{43.04} \frac{PJMBD_t}{PRJBD_t} + \underset{(1.88)}{72.05}\ \Delta \frac{PJMBD_t}{PRJBD_t} - \underset{(-4.03)}{266.27}\ DUMBD$$

$$\bar{R}^2 = 0.86,\ DW = 2.09,\ \rho = -0.35$$

(6.31) $$\text{PRODJMIN}_t = \underset{(2.27)}{72.88} + \underset{(4.86)}{0.86}\ \text{PRODJMIN}_{t-1} + \underset{(1.94)}{94.80}\ \frac{\text{PJMIN}_t}{\text{PRJIN}_t} + \underset{(1.96)}{83.70}\ \Delta \frac{\text{PJMIN}_t}{\text{PRJIN}_t} - \underset{(-2.34)}{0.30}\ \text{SJMIN}_{t-1} - \underset{(-2.02)}{3.62}\ \text{T}$$

$$\bar{R}^2 = 0.63,\ DW = 2.17$$

(6.32) $$\text{PRODJMRW}_t = \underset{(-1.65)}{-440.44} + \underset{(7.86)}{0.84}\ \text{PRODJMRW}_{t-1} + \underset{(2.02)}{343.55}\ \frac{\text{PJMW}_t}{\text{PRJW}_t} - \underset{(-1.63)}{242.58}\ \Delta \frac{\text{PJMW}_t}{\text{PRJW}_t}$$

$$\bar{R}^2 = 0.95,\ DW = 1.85$$

(6.33) $$\text{PRODJMUK}_t = \underset{(7.54)}{119.06} + \underset{(2.04)}{0.24}\ \text{PRODJMUK}_{t-1} - \underset{(-4.65)}{3.01}\ \text{TIME} - \underset{(-1.56)}{28.63}\ \text{DUMUK}$$

$$\bar{R}^2 = 0.64,\ DW = 1.89$$

(6.34) $$\text{PRODJMUS}_t = \underset{(5.24)}{57.41} + \underset{(1.82)}{0.24}\ \text{PRODJMUS}_{t-1} - \underset{(-3.83)}{2.13}\ \text{TIME} - \underset{(-2.13)}{31.43}\ \text{DUMUS}$$

$$\bar{R}^2 = 0.61,\ DW = 1.73$$

(6.35) $$\text{PRODJMJN}_t = \underset{(2.70)}{14.20} + \underset{(7.37)}{0.98}\ \text{PRODJMJN}_{t-1} - \underset{(-2.47)}{0.95}\ \text{TIME}$$

$$\bar{R}^2 = 0.87,\ DW = 2.14$$

(6.36) $$\text{PRODJMEC}_t = \underset{(4.36)}{300.40} + \underset{(1.74)}{0.06}\ \text{PRODJMEC}_{t-1} - \underset{(-1.87)}{4.71}\ \text{TIME} - \underset{(-3.02)}{66.16}\ \text{DUMEC}$$

$$\bar{R}^2 = 0.61,\ DW = 1.57,\ \rho = 0.66$$

F. Prices of Raw Jute and Jute Manufactures

$$(6.37)\quad PRJW_t = \underset{(15.62)}{421.072} - \underset{(-2.08)}{161.10}\,\frac{WSRJ_t}{WCRJ_t} - \underset{(-6.76)}{7.32}\,TIME + \underset{(5.62)}{204.85}\,KOREA$$

$$\bar{R}^2 = 0.87,\ DW = 1.54$$

$$(6.38)\quad PJMW_t = \underset{(4.12)}{234.18} + \underset{(6.83)}{1.27}\,PRJW_t + \underset{(3.64)}{192.39}\,KOREA + \underset{(1.98)}{67.29}\,DUM$$

$$\bar{R}^2 = 0.86,\ DW = 1.23$$

$$(6.39)\quad \ln PRJBD_t = \underset{(-1.73)}{-1.08} + \underset{(9.37)}{1.06}\,\ln\,(PRJW_t - EXDTBD_t - FRBD_t) + \underset{(6.04)}{1.06}\,\ln ERBD_t - \underset{(-2.10)}{0.68}\,KOREA + \underset{(4.58)}{1.15}\,DUMBD$$

$$\bar{R}^2 = 0.95,\ DW = 1.80,\ \rho = 0.64$$

$$(6.40)\quad \ln PRJIN_t = \underset{(2.48)}{2.65} + \underset{(3.27)}{0.57}\,\ln\,(PRJW_t - EXDTIN_t - FRIN_t) + \underset{(2.51)}{0.64}\,\ln ERIN_t + \underset{(4.25)}{1.15}\,DUMIN$$

$$\bar{R}^2 = 0.93,\ DW = 2.73,\ \rho = 0.84$$

$$(6.41)\quad \ln PRJTH_t = \underset{(-1.96)}{-18.77} + \underset{(2.44)}{0.96}\,\ln\,(PRJW_t - EXDTTH_t - FRTH_t) + \underset{(2.16)}{7.03}\,\ln ERTH_t + \underset{(2.93)}{0.69}\,DUMTH$$

$$\bar{R}^2 = 0.72,\ DW = 2.41,\ \rho = 0.49$$

$$(6.42)\quad \ln PJMBD_t = \underset{(1.71)}{1.67} + \underset{(1.94)}{0.59} \ln (PJMW_t - EXDTBD_t - FRBD_t)$$

$$+ \underset{(8.76)}{1.31} \ln ERBD_t + \underset{(2.46)}{0.22} DUMBD$$

$$\bar{R}^2 = 0.83,\ DW = 1.71$$

$$(6.43)\quad \ln PJMIN_t = \underset{(2.34)}{3.98} + \underset{(2.79)}{0.62} \ln (PJMW_t - EXDTIN_t - FRIN_t)$$

$$+ \underset{(2.00)}{0.55} \ln ERIN_t + \underset{(2.50)}{0.16} DUMIN$$

$$\bar{R}^2 = 0.93,\ DW = 1.51,\ \rho = 0.96$$

$$(6.44)\quad NEXRJ_{it} = J_{it} - TDURJ_{it} + SRJ_{it-1} - SRJ_{it}$$

$$(6.45)\quad TDURJ_{it} = RJUJM_{it} + OTHURJ_{it}$$

$$(6.46)\quad RJUJM_{it} = 1.07\ PRODJM_{it}$$

$$(6.47)\quad NEXJM_{it} = PRODJM_{it} - CONJM_{it} + SJM_{it-1} - SJM_{it}$$

$$(6.48)\quad WCJM_t = CONJMBD_t + CONJMIN_t + CONJMUK_t + CONJMUS_t + CONJMJN_t + CONJMEC_t + CONJMRW_t$$

$$(6.49)\quad WCRJ_t = 1.07\ WCJM_t$$

$$(6.50)\quad PRODJMW_t = PRODJMBD_t + PRODJMIN_t + PRODJMUK_t + PRODJMUS_t + PRODJMJN_t + PRODJMEC_t + PRODJMRW_t$$

The inclusion of explicit price equations for raw jute and jute manufactures in the model necessitated the ommission of the market clearing constraints of $\sum_{i=1}^{8} NEXRJ_{it} = \sum_{i=1}^{7} NEXJM_{it} = 0$ for each t. Consequently, the only interaction of supply and demand occurs in the equation for price of raw jute through the world stock and consumption of raw jute variables. The excluded constraints, however, preclude any cumulative effects of growing excess stocks. Moreover, the extent to which the constraints are violated might be a useful gauge of the performance of the model. In order to test this, the sum of net exports over all countries was calculated for each year for both the 1961-1973 and 1974-1990 simulation periods. During the 1961-1973 period, the range of discrepancy was found to be +3.2 to -3.6 and +4.2 to -2.8 thousand metric tons for raw jute and jute manufactures respectively. For the 1974-1990 period, the corresponding figures are +5.9 to -5.0 and +5.5 to -1.7 thousand metric tons for raw jute and jute manufactures respectively; in no case did the discrepancy amount to more than 0.01 percent of total exports. Thus the calculated residuals of the total net exports over the simulation periods indicate to the degree of consistency achieved in the model.

Most of the equations were estimated by the method of two-stage least squares, as was described in Chapter Three; the acreage equations were estimated by ordinary least squares since they contain no explanatory endogenous variables. The estimated t-ratios of all coefficients are given beneath the coefficients and the estimated values of the multiple correlation coefficients (corrected for degrees of freedom), $\bar{R}^2$, the Durbin-Watson statistic, DW, and the first-order autoregression coefficient, ρ, estimated by the Cochrane-Orcutt iterative procedure whenever found necessary, are also reported for each estimated equation.

The statistical properties of the thirty-eight estimated equations vary quite widely, with $\bar{R}^2$ values ranging from a low of 0.56 to a high of 0.99 and DW statistic ranging from 0.85 to 2.73. However, as was pointed out in Chapter Three, the standard t and DW tests are not valid for structural estimates of simultaneous equation models, especially in cases where lagged values of the dependent variable are used in explanatory variables. Yet these statistics were included as a systematic means of evaluating the estimated equations. Because of this failure of the standard tests, greater emphasis had to be placed on the a priori specifications of the model, and the model is quite reasonable in this respect.

The resulting system of equations analyzes the world jute market as a highly damped system with the world raw jute price serving as the main simultaneous link. While this highly simplified model can be thought as only a rough approximation of the extreme complications of the actual market, the analysis of this model in the remaining sections of this chapter is expected to yield some interesting insights into the functioning of the market over time.

6.3 The Basic Simulation of the World Jute Economy, 1961-1973

In this and the following sections the model defined in the above section has been termed as the basic model and is used as a point of reference. All simulations in this study are nonstochastic. An iterative Gauss-Seidel procedure was used to solve the simultaneous model[1].

The basic simulation over a part of the sample period (1961-1973) includes the relations outlined in Section 6.2. In order to limit the variables to a manageable number, in discussing this and subsequent simulations, attention is focused on a few key aggregate variables. Interesting patterns among variables on a more disaggregate level, however, are noted.

In Table 6.1 are presented the annual percentage differences and mean absolute percentage differences between the actual values and the basic simulated values for key aggregate variables over the 1961-1973 period. This table provides a framework for discussing the basic simulation for 1961-1973 with respect to the world production of raw jute and jute manufactures, and prices of raw jute and jute manufactures. Similar information for each of the countries and regions is provided in Tables 6.1A through 6.1E.

The first column of Table 6.1 refers to the world production of raw jute. The mean absolute percentage difference

TABLE 6.1

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961 - 1973[a]

	RAW JUTE			JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	PRODJMW	WCJM	PJMW
1961	3.29	-6.31	-10.09	-1.69	-3.21	-1.78
1962	4.85	-5.27	-2.63	-2.14	1.18	3.84
1963	-2.53	3.98	4.38	-4.03	1.56	3.57
1964	1.83	-2.21	-9.62	-1.21	-4.03	-3.60
1965	2.69	2.07	-0.58	-0.72	0.89	2.03
1966	1.98	-2.78	-4.98	3.80	-2.80	-3.51
1967	0.38	0.83	6.96	0.80	0.15	-0.47
1968	15.40	3.47	0.15	2.77	-0.11	1.88
1969	-2.99	5.23	8.86	-3.65	3.12	4.92
1970	3.12	3.85	9.04	3.05	4.85	6.70
1971	-2.87	11.57	4.66	2.39	-0.04	-1.57
1972	-7.98	-3.56	13.60	-4.15	3.03	-10.18
1973	-5.92	-5.30	1.82	-0.39	-1.04	1.64
Mean Absolute Percentage Difference 1961-1973	4.29	4.34	5.95	2.37	2.00	3.51

a. All percentage differences are the simulated values minus the actual value relative to the actual value, in percentage terms. Variable definitions and data sources are given in Appendix A.

TABLE 6.1A

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF BANGLADESH, 1961 - 1973[a]

	RAW JUTE					JUTE MANUFACTURES				
	ACRBD	JBD	SRJBD	NEXRJBD	PRJBD	PRODJMBD	CONJMBD	SJMBD	NEXTJMBD	PJMBD
1961	7.89	9.29	-6.59	-2.82	8.76	5.15	-0.99	10.33	-6.39	2.43
1962	7.36	10.05	0.46	-3.60	4.92	15.41	3.05	-0.78	-7.38	-6.20
1963	4.83	10.11	4.66	-1.37	5.76	7.33	3.05	9.73	5.86	5.34
1964	5.95	21.55	1.59	-6.55	1.31	7.44	-1.98	-0.85	-0.21	-1.98
1965	-6.47	-1.26	0.90	0.44	2.53	19.65	-1.98	1.13	-0.83	3.15
1966	-5.96	3.60	-3.38	0.03	-2.27	0.86	6.18	1.58	-7.71	-5.07
1967	-8.04	7.51	-0.63	9.13	-1.39	-8.75	4.08	-4.72	-0.72	-1.49
1968	-0.64	21.49	6.85	2.88	-1.98	-7.21	3.05	-11.11	-1.10	-1.09
1969	-10.09	-4.76	7.81	3.45	-6.29	-8.47	2.96	8.55	-0.84	-7.78
1970	-2.56	2.78	3.89	-5.52	5.44	5.91	5.13	-2.36	2.14	-1.59
1971	-1.11	3.52	6.96	5.69	2.22	1.20	6.18	4.80	6.08	-3.15
1972	-10.15	-5.56	-3.91	1.32	1.51	-10.30	5.13	3.19	-8.89	4.81
1973	-8.18	0.40	-6.30	5.99	-5.54	-15.37	10.52	-1.33	-2.81	7.04
Mean absolute % Difference 1961-1973	6.09	7.84	4.15	3.75	3.84	8.69	4.10	4.65	3.92	3.93

a. All percentage differences are the simulated value minus the actual value relative to the actual value, in percentage terms. Variable definitions and data sources are given in Appendix A.

TABLE 6.1B

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES
BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES
FOR KEY VARIABLES IN THE JUTE ECONOMY OF INDIA, 1961 - 1973[a]

	RAW JUTE				JUTE MANUFACTURES				
	ACRIN	JIN	SRJIN	PRJIN	PRODJMIN	CONJMIN	SJMIN	NEXJMIN	PJMIN
1961	0.36	-0.25	-9.39	12.41	-1.08	-3.92	1.81	2.35	-7.69
1962	5.73	2.91	-6.68	9.20	-3.32	2.02	-1.19	2.66	-7.69
1963	-2.87	-3.10	4.21	5.97	-3.16	0.00	2.16	-0.82	8.33
1964	1.22	-2.35	-4.17	9.97	-4.58	-1.98	7.65	5.65	6.18
1965	7.48	16.37	2.25	6.40	2.83	4.08	-1.98	-3.12	-0.99
1966	0.82	8.52	-3.37	4.92	0.52	3.05	-2.48	6.38	-1.98
1967	-5.37	-4.08	4.78	10.41	0.29	0.00	-0.98	-6.62	5.13
1968	7.60	11.92	5.72	-3.15	12.89	-3.92	9.24	-2.89	-0.99
1969	1.58	-3.07	2.62	-0.80	0.29	8.33	-1.83	-3.65	-2.96
1970	-4.10	8.19	3.19	-9.34	4.40	4.08	7.04	-7.96	-4.88
1971	-6.47	4.97	5.89	1.31	-2.56	3.05	6.94	-3.64	-8.61
1972	-3.29	6.80	-3.62	-9.52	0.68	0.00	-9.11	2.01	4.08
1973	3.50	-0.07	-7.01	-3.34	9.46	2.02	-2.11	-5.51	5.13
Mean absolute % difference 1961-1973	3.87	5.60	4.84	5.90	3.54	2.80	4.19	4.09	4.97

a. All percentage differences are the simulated values minus the actual value relative to the actual value, in percentage terms. Variable definitions and data sources are given in Appendix A.

TABLE 6.1C

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF THAILAND, 1961 - 1973[a]

	RAW JUTE				
	ACRTH	JTH	SRJTH	NEXRJTH	PRJTH
1961	-5.49	-5.95	1.31	-1.27	0.00
1962	10.97	6.30	-7.22	7.66	0.00
1963	07.84	-21.40	-30.90	0.48	8.65
1964	-1.65	-8.86	4.31	-0.38	5.55
1965	-9.86	-5.17	2.98	-1.42	3.15
1966	-7.13	-15.39	-1.54	0.79	-4.21
1967	-7.09	-7.12	-3.19	1.56	4.50
1968	5.14	9.32	-10.61	1.55	-4.21
1969	-0.88	-7.25	5.61	-1.02	1.01
1970	3.39	9.67	12.76	-0.73	4.08
1971	-8.51	-9.52	0.00	-7.42	-3.25
1972	2.74	-12.76	-0.48	0.06	-2.86
1973	-8.58	-15.95	0.77	-0.49	-5.45
Mean absolute % difference 1961-1973	5.33	10.36	6.20	1.91	3.68

a. All percentage differences are the simulated value minus the actual value relative to the actual value, in percentage terms. Variable definitions are given in Appendix A.

TABLE 6.1D

ANNAUL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR PRODUCTION AND CONSUMPTION OF JUTE MANUFACTURES IN THE UNITED KINGDOM, THE UNITED STATES, JAPAN, AND THE EEC COUNTRIES, 1961 - 1973[a]

	U.K.		U.S.A.		JAPAN		E.E.C.	
	PRODJMUK	CONJMUK	PRODJMUS	CONJMUS	PRODJMJN	CONJMJN	PRODJMEC	CONJMEC
1961	-3.11	8.12	-0.70	7.68	1.15	17.64	5.94	1.35
1962	-8.95	5.86	-5.63	-2.51	-2.46	5.82	-3.20	0.06
1963	-4.03	6.17	-9.92	-0.88	-6.89	8.65	5.19	-2.60
1964	-6.36	3.16	-9.53	0.81	-16.97	7.10	5.33	5.03
1965	-8.32	2.81	0.14	8.99	-2.26	7.22	1.61	0.43
1966	-2.84	3.30	-6.84	-3.04	-3.38	-5.30	4.04	-0.69
1967	-9.51	-4.16	-8.18	0.79	-4.46	-4.31	-3.78	21.02
1968	-11.82	-3.23	-10.32	-4.92	-7.58	-3.72	-10.34	-9.29
1969	2.16	1.30	-1.07	2.64	-15.55	-7.02	-6.58	-3.69
1970	-0.35	5.74	-3.25	9.62	-0.07	-7.69	-6.18	-2.06
1971	4.42	0.35	10.85	-2.04	0.10	-5.95	-4.36	-5.02
1972	-0.54	7.23	3.81	1.75	12.37	-6.84	-8.55	-0.43
1973	3.23	0.60	14.11	-2.61	12.79	5.75	6.47	2.12
Mean absolute % difference 1961-1973	4.97	4.00	6.49	3.64	6.62	7.51	5.50	4.14

a. All percentage differences are the simulated value minus the actual value relative to the actual value, in percentage terms. Variable definitions are given in Appendix A.

TABLE 6.1E

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND BASIC SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF THE "REST-OF-THE-WORLD" SECTOR, 1961 - 1973[a]

	RAW JUTE		JUTE MANUFACTURES	
	JRW	NEXRJRW	PRODJMRW	CONJMRW
1961	5.18	-7.08	-5.96	-10.61
1962	-2.23	-8.30	-4.59	1.40
1963	-13.62	-4.51	-9.65	2.78
1964	-8.53	0.28	0.15	-8.43
1965	9.56	-7.06	-8.65	-2.41
1966	5.03	6.59	9.65	-5.22
1967	8.13	-1.13	7.05	-2.14
1968	12.12	7.25	3.86	4.44
1969	13.32	-6.20	-3.46	4.73
1970	-5.41	6.78	3.18	5.92
1971	-13.16	2.53	6.48	0.09
1972	-16.33	-2.39	4.28	4.59
1973	-7.84	4.92	-2.29	-2.31
Mean absolute % difference 1961-1973	9.26	5.00	5.33	4.23

a. All percentage differences are the simulated value minus the actual value relative to the actual value, in percentage terms. Variable definitions are given in Appendix A.

between simulated and actual values over the period is 4.29 percent. On a more disaggregate level, the mean absolute percentage difference are 7.84 percent for Bangladesh, 5.60 percent for India, 10.36 percent for Thailand, and 9.26 percent for the "Rest-of-the-World" sector. Given the limitations of the supply model which underlies these values (see Chapter Four), such results are quite satisfactory. An examination of the variables referring to the area under raw jute in Bangladesh, India and Thailand indicates that the large percentage deviations in the production are mainly the result of higher deviations in the yield per acre of jute, especially in the case of Thailand. Thus the equation relating to the yield per acre of jute appears to be the weakest link in the simulation of raw jute production. Further examination of column one of Table 6.1 indicates that the percentage differences between simulated and actual aggregate raw jute production tend to increase in the latter part of the period under consideration. The largest percentage differences are the overestimates for 1968 and underestimates for 1972 and 1973. Underlying these percentage differences are somewhat larger percentage overestimates for 1968 for Bangladesh, India and Thailand (which is again the result of overestimates in the yield equations) and larger underestimates for Thai production during 1972 and 1973. At the country level, the variable referring to the area under jute performed much better, as expected, than did the production variable, due to the poor explanatory power of the yield variable.

Columns two and three in Table 6.1 refer to the total world stocks and price of raw jute; respectively. The mean absolute percentage difference in total world stocks of raw jute over the period is 4.34 percent, with a relatively large overestimate in 1971. This is the result of relative overestimations for both Bangladesh and India during 1971, when unusual circumstances created by war prevailed. With respect to the price of raw jute, the mean absolute percentage difference over the period is 5.95 percent, or larger than that for any other variables at the aggregate level. The link between the world price of raw jute and the supply and demand variables, of course, is the level of world raw jute stocks relative to the world current consumption demand for raw jute. Evidiently relatively small percentage differences in the supply and demand variables are transmitted and amplified through this link into much larger percentage differences in raw jute prices. The transmission of such effects, of course, is complicated by the lags in both supply and demand responses and by the existence of autocorrelation in some of the relationships.

Finally, columns four, five, and six of Table 6.1 refer to the world production, consumption, and price respectively, of jute manufactures. The mean absolute percentage differences are 2.37 percent for production, 2.00 percent for consumption and 3.51 percent for price of jute manufactures. Although there are a few large discrepancies (e.g., price of jute manufactures in 1972), the magnitude of the percentage differences suggests that these simulated values also are quite satisfactory.

The simulation discussed above will be referred to as "the basic simulation for the 1961-1973 period", and all other simulations will be compared to it in Section 6.4.

In tables 6.1A through 6.1E, the basic simulation results at the area level are presented for some of the key variables for each country or region. The results, in general, are quite satisfactory with the mean absolute percentage deviations ranging from a high of 10.36 percent for the production of raw jute in Thailand to a low of 1.91 percent for the exports of raw jute from Thailand.

6.4 Simulations Under Four Hypothetical Situations

In this section simulations are conducted under four hypothetical situations and are compared with the basic simulation.

Simulation 6.4A: The maintenance of a world floor price for raw jute at US $350 per metric ton, accomplished by the absorption of raw jute by an international agency.

In this simulation an international agency is assumed to absorb sufficient quantities of raw jute to maintain the raw jute price at a level no lower than US $350 per metric ton. Raw jute so accumulated in the buffer stock is assumed not to be released later into the international market, but to be accumulated, destroyed, or sold into completely isolated markets in a manner so that only their initial absorption (and not their subsequent existence nor disposal) affects prices or price expectations in the world market. The effects of such assumptions on key variables in the world jute economy are compared with the basic simulation values in Table 6.2. The simulation was carried out by modifying the price equation (6.37) to take care of the floor. Aggregate raw jute production is greater from 1962 on because of the distributed lag response to the higher prices in the seven years in which buffer stock accumulations were made. On the more disaggregate level, of course, the patterns of production reflect relative responsiveness and the patterns of lags. Increase in Indian production is found to be greater, especially during the initial years of the period. The mean absolute increase in the production of raw jute over the period is 5.10 percent.

Aggregate jute demand reflects directly the effects on the price of jute manufactures which, in turn, is affected by the price of raw jute. Consumption of jute manufactures is lower in every year except 1969, 1970 and 1972 when the

TABLE 6.2

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.4A FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961 - 1973[a]

	RAW JUTE			RJW x	Buffer Stock	JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	PRJW	changes (in thousands of metric tons)	PRODJMW	WCJM	PJMW
1961	0.00	-8.96	13.16	13.16	75.48	25.74	-3.91	8.15
1962	12.97	28.92	15.05	29.97	0.00	6.49	-1.61	9.08
1963	16.98	-4.53	9.54	28.14	30.68	3.34	-0.33	5.83
1964	10.07	0.58	10.64	21.78	0.00	-1.08	-3.81	6.59
1965	5.37	-10.23	2.44	7.94	58.04	7.54	-0.52	1.33
1966	3.87	4.49	5.24	9.32	0.00	10.06	-3.69	2.80
1967	2.64	19.48	7.50	10.34	0.00	7.07	-1.62	4.36
1968	5.25	-41.40	-0.15	5.09	145.21	11.94	-0.41	-0.09
1969	2.70	22.73	-4.14	-1.56	0.00	5.43	0.34	-2.43
1970	2.39	-19.69	-4.38	-2.09	151.14	4.28	1.33	-2.23
1971	0.28	73.34	-4.45	-4.72	0.00	-1.69	-5.15	-2.20
1972	2.81	-18.98	-11.97	-14.44	123.76	-9.71	1.95	-6.65
1973	8.93	-9.06	-1.79	-10.56	112.02	-1.42	-1.81	-0.93
Mean absolute % difference, 1961-1973	5.10	20.16	6.96	12.24	53.56	7.37	2.04	4.05

a. Variable definitions and data sources are given in Appendix A. All percentage differences are the simulation 6.4A value minus the basic simulation value, relative to the basic simulation value. In simulation 6.4A a floor of U.S. $350 per metric ton for the world raw jute price is maintained by the absorption of stocks of raw jute from the market by an international agency, whenever necessary.

price of jute manufactures is well below the basic simulation values. Such a price pattern is perhaps the most interesting aspect of this simulation. Evidently in lagged response to the higher 1961-1967 prices of raw jute and jute manufactures, raw jute production is sufficiently greater during 1969, 1970 and 1972 to result in a lower raw jute price (but still above the floor price) in those years.

World raw jute stocks are less than in the basic simulation for 7 years due to the buffer stock purchases during those years. Necessary buffer stock purchases over the period total 696.33 thousand metric tons of raw jute. To operate a buffer stock of such a magnitude without having effects on prices and price expectations beyond those of the initial purchases (as assumed in this simulation) would not be an easy task. Despite the costs involved, the raw jute producing nations probably would benefit from such a scheme, even if they had to bear the entire cost of the buffer stock purchases and disposals. To expand raw jute production by a mean of 5.71 percent and to destroy the 696.33 thousand metric tons of raw jute purchased by the buffer stock probably would have a marginal cost less than the gain in total revenue (see Table 6.2) over the period from raw jute production. If alternatives to destroying the raw jute could be found, or consuming nations could be induced to help support the buffer stock purchases, of course, the benefits would be greater to the raw jute producing nations. One alternative to destroying buffer stock purchases of raw jute would be to limit production, with the resulting savings of the marginal costs of production. A variant of such a policy is explored below in simulation 6.4C.

Simulation 6.4B: The use of an international buffer stock to maintain the world floor price for raw jute at US $350 per ton, and of a world ceiling prive five percent higher, at US $367.50.

One price of the cooperation from the jute consuming countries in any attempt to impose an effective floor on raw jute prices by buffer stock purchases might be the imposition of an effective ceiling on such prices by buffer stock sales, whenever necessary. In this simulation such a policy is examined. Simulation 6.4B is exactly the same as simulation 6.4A, except such a ceiling is imposed at a level five percent above the level of the price floor (thus, the ceiling is at US $367.50 per metric ton). Table 6.3 provides a basis for comparison of simulation 6.4B with the basic simulation. In this case also the price equation (6.37) was modified to consider price floor and ceiling. Aggregate raw jute production is generally larger than in the basic simulation, although smaller than in simulation 6.4A, because the price ceilings are

TABLE 6.3

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.4B FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961 - 1973[a]

	RAW JUTE					JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stocks (in thousands of metric tons)	PRODJMW	WCJM	PJMW
1961	0.00	-8.48	13.16	13.16	71.46	27.94	-3.93	8.15
1962	11.49	28.62	15.04	28.26	-251.34	8.85	-1.54	9.08
1963	11.06	-4.53	9.53	21.65	30.67	7.67	-0.34	5.83
1964	6.40	2.49	7.09	13.95	-12.99	0.19	-3.33	4.39
1965	2.84	-11.53	2.44	5.35	65.43	8.26	-0.61	1.33
1966	1.84	4.58	4.91	6.84	-39.18	5.99	-3.58	2.62
1967	1.62	19.41	7.50	9.24	-164.79	6.15	-1.49	4.35
1968	5.41	-41.20	-0.42	4.96	144.53	8.92	-0.31	-0.25
1969	-1.47	22.62	-4.15	-5.56	-98.52	9.38	0.49	-2.43
1970	0.26	-19.61	-4.38	-4.13	150.64	1.49	1.20	-2.23
1971	-1.07	73.40	-4.61	-5.63	430.75	-4.10	3.50	-2.27
1972	0.53	-19.08	-11.81	-11.35	124.38	-5.77	12.48	-6.56
1973	-2.36	-8.84	-3.08	-5.37	109.37	-0.81	8.54	-1.60
Mean absolute % difference 1961-1973	3.57	20.34	6.98	10.42	130.30	7.35	3.18	3.93

a. Variable definitions and data sources are given in Appendix A. All percentage differences are the simulation 6.4B value minus the basic simulation value, relative to the basic simulation value. In simulation 6.4B, a floor of U.S. $350 per metric ton and a ceiling at a 5 percent higher for the price of raw jute is maintained by purchases and sales of raw jute by an international buffer stock agency.

effective during 1962, 1964, 1966, 1967, 1969 and 1971. During the years 1969, 1971 and 1973, however, aggregate raw jute production is less than in the basic simulation (although on a more disaggregate level, the production in Bangladesh is less in 1969 and the production in India is less during all three years than the basic simulation). Because of the lower supplies and prices, as compared to simulation 6.4A, the gain in the command over external resources through raw jute exports are considerably less. For the 1969-1973 period, in fact, the price ceiling results in a loss in the command over such resources, despite slightly increased production in some years, compared to the basic simulation.

Consumption, both aggregate and disaggregate, reflects the effects of the hypothetical policy on raw jute prices. When the prices are lower, consumption is greater than the basic simulation. Thus until 1967 prices are consistently higher than the basic simulation and hence consumption is lower, after which the trends have been reversed.

The mean absolute percentage deviation for raw jute prices between the basic simulation and simulation 6.4B values is greater than between the basic and simulation 6.4A values because of the effective price ceiling. Both normal raw jute stock activity and buffer stock activity, likewise, are greater although the net accumulation of buffer stocks (560.28 thousand metric tons) is less because of the buffer stock releases necessary to maintain the price ceiling.

Simulation 6.4C: Reduction by ten percent in the price received by all raw jute producers.

One alternative to the destruction of raw jute stocks assumed in simulation 6.4A would be the limitation of raw jute production. In simulation 6.4C are explored the effects of a limitation scheme which operates through the price response of raw jute producers, the unit prices actually received by the producers of raw jute (i.e., the growers' price of raw jute in each year of the period) are reduced by ten percent in all relevant countries (e.g., through the imposition of export taxes of the proper magnitude). The effects of such a scheme on key variables in the jute economy in comparison with the basic simulation are presented in Table 6.4. In this case the price received by farmers in major producing countries was reduced by ten percent from the actual level and the effects on world market was traced.

Aggregate raw jute production is decreased over the period due to lagged price responses to changed price expectations. The total value of such production also decreases, except for 1967 and 1968 when the smaller production is more than offset by higher prices, since the marginal increase in prices proves inadequate to compensate for the decrease in

TABLE 6.4

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.4C FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1961 - 1973[a]

	RAW JUTE				JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	RJW x PRJW	PRODJMW	WCJM	PJMW
1961	-6.68	-4.74	1.84	-4.97	2.61	-0.34	0.31
1962	-4.62	-4.22	2.67	-2.07	1.13	-0.09	1.43
1963	-4.64	-3.88	3.35	-1.44	1.01	-0.18	2.01
1964	-4.35	3.97	2.87	-1.61	0.12	-2.18	1.08
1965	-4.20	-3.52	3.62	-0.54	0.97	1.27	1.98
1966	-3.93	1.56	2.23	-1.78	0.69	-2.07	1.02
1967	-3.48	-0.38	3.68	0.08	0.83	2.52	1.85
1968	-2.54	5.57	3.70	1.06	1.94	1.67	1.91
1969	-4.92	4.75	-0.76	-5.64	-0.11	-3.03	-0.46
1970	-2.86	1.56	-0.80	-3.64	-1.13	4.26	-0.42
1971	-4.23	4.03	-0.43	-4.65	-3.16	6.03	-0.21
1972	-0.34	7.66	-0.36	-0.70	-4.84	1.53	-0.28
1973	-6.34	0.37	-1.50	-7.75	-0.08	1.08	-0.98
Mean absolute % difference 1961 - 1973	4.07	3.56	2.14	2.76	1.43	2.02	1.07

a. Variable definitions and data sources are given in Appendix A. All percentage differences are the simulation 6.4C value minus the basic simulation value relative to the basic simulation value. In simulation 6.4 C a disincentive to raw jute production is provided by a ten percent reduction in the actual price received by all the raw jute producers throughout the simulation period.

production. Government revenues in the raw jute producing countries presumably would increase by somewhat larger percentages (and, correspondingly, the total revenue received by the farmers would decrease) due to the export tax. Whether or not such a scheme is preferable from the point of view of the raw jute producing nations depends upon the desirability of such transfers from the raw jute producers to governments, the marginal cost of resources saved by reduced production (in contrast to the marginal cost of extra resources required in the buffer stock scheme), and the relative cost of operating the buffer stock purchase scheme in comparison with the cost of increasing export tax collections.

The other effects of this hypothetical scheme are quite straightforward. Production of jute manufactures are higher during the initial years due to higher prices and lower during the last five years of the period in comparison with the basic simulation. Likewise consumption of jute manufactures are lower during initial years. However, the decrease in consumption is smaller in quantitative terms than is the reduction in production, so stocks are drawn down and raw jute as well as the jute manufactures prices are higher.

Simulation 6.4D: Maintenance of the ratio of prices of jute and rice at the level of 1.04 in Bangladesh.

The relative share of Bangladesh in the international raw jute market fell substantially over the sample period. In reality, however, not only the relative share, but also her absolute production tended to decline over the period, especially during the later years. As discussed in Chapter Four, the jute/rice price ratio has long been recognized as a key determinant of the area sown to jute vis-a-vis rice. The exact size of the ratio required in any given year to maintain the area under jute in equilibrium with that under rice will depend upon the relative costs of production and yields in order to determine at what point the net return from the two crops will be equalized. One study by FAO[2] has recently calculated that under the traditional methods of cultivation, which are widely prevalent, the required jute-rice price ratios that would equalize the net return from the cultivation of jute and rice and, as a result, would ensure that the area under the two crops would remain in equilibrium, is 1.04. In simulation 6.4D a hypothetical situation is examined in which some government policy is adopted that ensures the required price ratio is maintained throughout the simulation period in Bangladesh. In this case, the price of jute was fixed in each year at the given ratio of the price of rice and the fixed price of jute was treated as the actual price for each year. The results of such a policy in Bangladesh is given in Table 6.5, which gives the actual area and the simulated area under jute in Bangladesh and their percentage deviations. It can be seen

TABLE 6.5

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN ACTUAL VALUES AND SIMULATION 6.4D VALUES FOR THE AREA UNDER RAW JUTE VARIABLE IN BANGLADESH, 1961 - 1973[a]

	Actual area under jute (in thousand acres)	Simulated area under jute (in thousand acres)	Percentage Deviation
1961	2100.00	1606.36	-23.51
1962	1823.00	1945.02	6.69
1963	1784.00	1950.40	9.33
1964	1732.00	1836.98	6.06
1965	2192.00	1941.44	-11.43
1966	2261.00	2203.77	-2.53
1967	2460.00	2366.41	-3.80
1968	2220.00	2479.67	11.70
1969	2491.00	2442.83	-1.93
1970	2318.00	2518.57	8.65
1971	1755.00	1877.98	7.01
1972	2262.00	2167.56	-4.17
1973	2243.00	2431.88	8.42
Mean absolute % Difference 1961 - 1973	-	-	8.09

a. Variable definitions and data sources are given in Appendix A. All percentage differences are the simulation 6.4D value minus the actual value relative to the actual value. In simulation 6.4D, a price policy has been followed by the government to maintain the ratio of domestic prices of jute and rice at the level of 1.o4 in Bangladesh.

that the simulated area has declined sharply during 1961 and 1965. Moreover, the area under jute is lower during 1966, 1967, 1969 and 1972. In all other years, the area has increased. Over the simulation period, the area under jute has fluctuated from a low of 1606 thousand acres in 1961 to a high of about 2519 thousand acres during 1970. The mean absolute percentage difference during the period is 8.09 percent.

6.5 Forecast of Key Variables in the World Jute Economy, 1974-1990

In Section 6.4 simulations over a part of the sample period were examined in order to obtain some measure of the success of the model in explaining the structure of the world jute market and analyzing some interesting hypothetical situations. In this section simulations over the 17-year period from 1974 through 1990 are investigated in order to obtain conditional forecasts and to explore further some of the hypothetical situations discussed in Section 6.4. All projections are, of course, based on the analysis of past trends and contain the implicit assumption that the nature of the relationships between the variables observed during the sample period will continue to hold during the future. More precisely, the procedure used in the projections entail: (a) the quantification of the "contribution" of each of the explanatory variables, as measured by the estimated parameters, to the changes in the dependent variable during the sample period, (b) the determination of the probable values of the explanatory variables for the projection years, and (c) the combination of the magnitudes of the estimated coefficients from the model with the determined values of the explanatory variables for the projection years. Before discussing the actual simulations, the assumptions which are made about the exogenous variables in these simulations are outlined:

Assumptions about the Exogenous Variables

The assumptions about the exogenous variables which are made throughout this and the following sections (unless otherwise noted) are as follows:

(1) PRRBD - domestic deflated price of rice in Bangladesh - actual values are used for the period 1974-1976. After 1976 the price is assumed constant in real terms at the 1974-1976 average level (Taka 1053.96 per metric ton). The cost of living index in Bangladesh increases from 1976 actual level at the average annual rate of 15 percent. During 1974-1976 actual annual figures are used.

(2) $SDRAV_i$ - standard deviation of relative acre value - actual figures are used during 1974-1976; after 1976 the value is held constant at the average of the 1974-1976 level for both Bangladesh and

India (0.25 and 0.23 respectively).

(3) $RYPA_i$ - relative yield rates of jute compared to rice - actual figures are used during 1974-1976; after 1976, held constant at the average of the levels during 1974-1976, for all the three producing countries of Bangladesh, India, and Thailand (the average levels are 1.35, 0.85, and 0.40 respectively).

(4) PRR_i - domestic prices of rice or other alternative crops for India and Thailand - actual figures are used for 1974-1976; after 1976 the variable is assumed constant at the real average level during 1974-1976.

(5) TIME - time trend variable - increasing monotonically with equal increments for production of jute manufactures equations. In all other cases the value is frozen at the actual 1977 level.

(6) $FAPOP_i$ - farm population in India - actual values are used during 1974-1976 after which increases at the average annual rate of 2 percent.

(7) DUM - dummy variable - set equal to zero.

(8) $YPAJ_i$ - yield per acre of jute - actual values are used during 1974-1976 for all three producing countries; after 1976 the level for each is held constant at the average of the 1974-1976 levels - (0.49,

0.40 and 0.42 for Bangladesh, India and Thailand respectively).

(9) $DEVNP_i$ - deviation from normal production of raw jute - assumed zero for all the three countries of Bangladesh, India and Thailand.

(10) $OTHURJ_i$ - other miscellaneous uses of raw jute in Bangladesh and India - held constant at the average level of 30 and 54 thousand metric tons respectively.

(11) NI_i - real national incomes - for Bangladesh and India increasing annually by the average annual rate during 1965-1973 (1.5 percent and 2 percent respectively). For U.K., and E.E.C. countries, U.S.A., Japan and "Rest-of-the-World" sector, increasing at the annual rates of 3.5, 3.5, 4.0, 5.0, and 2.5 percent respectively.

(12) PJS_i - composite real prices of jute manufactures and synthetic substitutes - actual figures are used during 1974-1976; after 1976 the variable is assumed constant at the average of its 1974-1976 levels for U.S.A., Japan, and E.E.C. countries.

(13) PSSW - price of synthetic substitutes - actual values are used during 1974-1976. From 1977 onwards, assumed constant in real terms at the 1977 level.

The index of raw material prices used to deflate the PRJW variable increases by 3 percent per year over the 1976 level. During 1974-1976, actual figures are used.

(14) ER_i - exchange rates - actual values are used during 1974-1976. From 1977 onwards, the prevailing exchange rates during 1977 are used.

(15) $EXDT_i$ - export duties on raw jute and jute manufactures - actual figures are used during 1974-1976. After 1976, the actual figures for 1977 are used.

(16) FR_i - freight charges - prevailing rates during 1975 are used.

(17) KOREA - dummy for Korean War - set equal to zero.

The assumption (1) results in an increasing nominal price of rice in Bangladesh. The future price of rice is extremely difficult to predict since it depends on the level of production which, in turn, is difficult to forecast, given the subsistence nature of production and the unforeseen weather conditions. Any meaningful assessment of the future course of the price of rice would require the specifications of the demand and supply equations for rice in order to arrive at the most likely price level at which the market will be cleared. The vast efforts required for such an estimate seem hardly to be justified in view of the doubtfulness of the possibility of computing reliable functions, especially in the case of supply. These considerations led us to rely on general approximations made on the basis of a priori knowledge.[3] Given the chronic shortage of rice and growth of population in the area, the above assumption of modest increase in the nominal price of rice does not seem unrealistic. The above observations also apply to assumption (4). Assumptions (2) and (3) imply that no disproportionate increases in the yield rates are expected in either jute or rice in the three producing countries of Bangladesh, India, and Thailand. Asssumption (5) regarding the TIME variable represents that the secular movements in the sample period will continue in the post-1973 period, for production of jute manufactures. The farm population in the regions of concern in India is expected to increase by 2 percent per year, assumption (6). which appears realistic, given the high rate of population growth in the country. Assumption (7) implies that non-normal occurrences such as the war which caused sharp decline in the area under jute in Bangaldesh during 1971 will not be important during the post-1973 simulation period. The difficulties of predicting such events, of course, make this assumption almost a necessity.

Assumption (8) needs some elaboration. Simulations of production on the basis of the estimated equations relating to the yield of jute per acre proved very unsatisfactory. (For example, yields of jute in India became negative during the end of the simulation period; moreover, the yield equations were also found unsatisfactory in Section 6.3). One alternative would have been to suppress the quadratic terms in the yield equations. However, rather than using such an ad hoc equation, the present assumption is chosen.

Assumption (9) is made due to the impossibility of predicting uncertain events in the present context. The remaining assumptions regarding the exogenous variables are self-explanatory. The assumptions regarding the price of synthetic substitutes, assumptions (12) and (13), result in an increasing nominal price. Information regarding the future trends in synthetic substitutes prices or costs is extremely difficult to obtain. One projection by the FAO for the year 1980, which has taken into account the probable impact of the energy crisis, foresees an increase in the polymer prices amounting to 16-22 percent between the end of 1974 and 1980.[4] Thus the modest increasing price for synthetics is not inconsistent with this observation. Our assumptions regarding the national income variables are not inconsistent with the available forecasts.[5]

The assumption regarding the KOREA variable, assumption (17), is necessitated by the extreme difficulty of predicting such events. Moreover, all other dummy variables are also set equal to zero in the price equations. That such events historically have been related to disruptions in the supply of raw jute and jute manufactures, and that jute will account for a much smaller share of total jute and synthetic substitutes production in the post-1973 period than historically was the case, however, suggest that the probability of such events causing sudden increases in the real price of raw jute in the future are quite limited. Perhaps the decreases in the real raw jute prices during the late sixties and early seventies despite the expansion of the Vietnam War in those years provide partial empirical verification of such a limited probability.

The Basic Simulation for the 1974-1990 Period

Except where noted explicitly, the basic model for all of the post-1974 simulations is identical to the model outlined above in Section 6.2 with the following exceptions: the yield per acre of jute equations are dropped and substituted with constant values, the productions of jute manufactures in the U.K., U.S.A., and Japan are assumed not to fall below 40, 10, and 30 thousand metric tons respectively during the simulation period,[6] and the assumptions about the exogenous variables outlined above are maintained. Also as in Section 6.3, all simulations are nonstochastic.

This model has limitations in respect to forecasts for as many as 17 years outside of the sample period, as should be clear from discussions in the above sections. In respect to the supply of raw jute, the "Rest-of-the-World" relationship with its lack of response to price or any other endogenous variables in the model clearly is the weakest link, given the increasing importance of this sector in the total world supply. The other raw jute supply relationships also have their limitations, especially in respect to the specification of the yield equations which do not allow for changes in productivity over the period. In respect to the supply of synthetic substitutes, the assumption of underutilization of capacity is weaker the more distant the forecast. The assumptions of constant growth rates in the national incomes, of course, does not allow for cyclic fluctuations such as the recessions.

The long list of possible weaknesses in the model, however, does not exclude the possibility of deriving useful information from forecasts. The model incorporates most of the essential and most interesting features of the international jute market, the interacting effects of which could not be examined easily within the framework of most other forecasting procedures. The above paragraph is only meant to make explicit that in forecasting with an econometric model such as the one used in this study, as with other forecasting procedures, any weakness in the specification of the original model will necessarily be carried into the forecast period. Moreover, as is generally the case with any forecasting procedure, weaknesses in the original specification and hence error in forecasts tend to be greater the more distant is any individual forecast period from the sample period.

Given the above background and qualifications, the basic simulation for the 1974-1990 period is now examined. Following the pattern of Section 6.3, attention is focused on a manageable number of key variables in the model, but interesting patterns on a more disaggregate level are noted when they occur. The simulated annual values for such variables are presented in Table 6.6 and the annual percentage values with respect to the simulated 1974 values for the same variables are presented in Table 6.6A. In the last two rows of the latter table are the annual constant exponential percentage growth rates between the 1974 and 1990 simulated values.[7] Of course, there is no reason to expect that these two sets of growth rates should be the same. (If there were good reasons for such expectations, one probably would forego an analysis of the jute market any more extensive than the calculation of historical growth rates.) Nevertheless, the comparison is suggestive of appropriate orders of magnitudes. Finally, simulated annual values for some of the key variables in the disaggregate level for each of the countries/regions

TABLE 6.6 ..

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN

THE WORLD JUTE MARKET, 1974-1990[a]

	RAW JUTE			JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	PRODJMW	WCJM	PJMW
1974	3965.3	1147.4	299.9	3543.0	3691.9	485.7
1975	3979.1	1009.6	302.7	3653.7	3660.4	483.1
1976	4192.7	914.2	338.8	3722.4	3727.6	507.5
1977	4323.4	863.9	326.1	3800.6	3794.1	492.3
1978	4211.3	824.1	358.1	3749.0	3751.5	512.4
1979	4360.1	803.2	360.4	3792.5	3783.3	509.2
1980	4401.4	797.3	361.8	3833.2	3827.8	505.3
1981	4427.6	802.9	355.4	3846.4	3839.7	495.9
1982	4453.7	814.7	348.1	3854.4	3851.3	486.1
1983	4507.6	829.1	339.9	3846.8	3841.7	476.0
1984	4511.1	843.7	331.9	3881.1	3874.0	466.4
1985	4522.8	840.7	364.4	3863.5	3865.6	484.9
1986	4522.0	824.1	398.9	3868.6	3871.0	504.4
1987	4494.5	847.3	334.3	3895.3	3880.5	457.0
1988	4509.4	870.2	323.8	3879.3	3885.7	446.7
1989	4457.3	852.7	401.9	3878.9	3889.3	493.9
1990	4509.3	824.9	439.4	3892.5	3889.8	513.8

a. Variable definitions and data sources are given in Appendix A. PRJW and PJMW are in units of current U.S. dollars per metric ton. All other variables are in units of thousands of metric tons.

TABLE 6.6A

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE WORLD JUTE MARKET AS PERCENTS OF 1974 SIMULATED VALUES, 1974 - 1990[a]

	RAW JUTE			JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	PRODJMW	WCJM	PJMW
1974	100.00	100.00	100.00	100.00	100.00	100.00
1975	100.35	87.99	100.93	103.12	99.15	99.47
1976	105.74	79.68	112.97	105.06	100.97	104.49
1977	109.03	75.29	108.72	107.27	102.77	101.36
1978	106.20	71.82	119.40	105.81	101.61	105.50
1979	109.96	70.00	120.17	107.04	102.48	104.84
1980	110.99	69.49	120.61	108.19	103.68	104.04
1981	111.66	69.98	118.49	108.56	104.00	102.10
1982	112.32	71.00	116.07	108.78	104.32	100.08
1983	113.68	72.26	113.34	108.57	104.06	98.00
1984	113.76	73.53	110.65	109.54	104.93	96.03
1985	114.06	73.27	121.49	109.04	104.71	99.84
1986	114.04	71.82	133.03	109.18	104.85	103.85
1987	113.35	73.85	111.46	109.94	105.11	94.09
1988	113.72	75.84	107.97	109.49	105.25	91.97
1989	112.41	74.32	134.02	109.48	105.35	101.69
1990	113.72	71.89	146.50	109.86	105.36	105.79
Annual constant exponential growth rate between simulated 1974 & 1990 values	0.80	-2.06	2.39	0.59	0.33	0.35
Annual Constant Exponential growth rate between actual 1958 and 1974 values	2.13	3.31	3.14	2.62	2.80	0.63

a. Variable definitions and data sources are given in Appendix A. Percentages are calculated from Table 6.6.

are presented in Tables 6.6B through 6.6F.

Basic simulation values of aggregate raw jute production increase at an average annual exponential rate of 0.80 percent to about 4509 thousand metric tons in 1990. The simulated rate of growth is substantially lower than the actual rate of over 2 percent per year which prevailed during the 1958-1974 period. The total world production increased during the sixties at the very high rate in response to increasing demand for jute which, however, slowed down in the seventies due to competition with the synthetic substitutes. Nonetheless, the basic simulated aggregate raw jute production for 1980 are in the lower part of the range of other forecasts which are presented in Table 6.7.

On a more disaggregate level, the sources of the simulated expanded production are primarily in the "Rest-of-the-World" sector. In this basic simulation, the "Rest-of-the-World" sector increases this share of raw jute production from about 42 percent in 1974 to about 50 percent in 1990, primarily at the expense of India. The shares of Bangladesh and Thailand remain somewhat constant over the simulation period. Over the 17-year forecast period simulated, Indian production declined by approximately one-fourth and India's share of the world's raw jute production drops from 30 percent to about 26 percent. The shares of Bangladesh and Thailand remain somewhat constant at around 18 and 7 percent

TABLE 6.6B

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF BANGLADESH, 1974 - 1990[a]

	RAW JUTE					JUTE MANUFACTURES				
	ACRBD	JBD	SRJBD	NEXRJBD	PRJBD	PRODJMBD	CONJMBD	SJMBD	NEXJMBD	PJMBD
1974	1531.8	750.6	514.7	224.9	1793.2	443.1	60.3	79.1	447.3	3402.2
1975	1535.1	798.2	465.7	338.1	2016.6	447.8	63.2	81.8	381.8	3859.9
1976	1763.9	899.6	425.5	434.5	2356.2	444.2	63.9	78.3	383.8	4030.7
1977	1937.1	871.7	399.8	378.3	2154.8	457.1	64.1	77.5	393.7	3760.8
1978	1995.2	837.9	376.4	339.4	2430.4	459.9	64.9	76.1	396.3	3862.1
1979	2019.8	848.3	362.2	326.8	2450.7	472.6	65.7	76.3	406.7	3845.9
1980	2035.1	814.0	356.7	272.6	2462.4	483.1	66.6	76.8	416.0	3826.5
1981	2110.1	844.0	358.2	285.4	2407.2	492.6	67.4	77.8	424.2	3778.9
1982	2128.6	851.4	363.8	281.7	2344.6	499.3	68.3	78.8	429.9	3729.3
1983	2117.3	846.9	371.3	270.7	2273.9	503.5	69.2	79.8	433.3	3677.5
1984	2090.6	836.3	379.3	257.3	2204.5	505.6	70.1	80.6	434.7	3627.3
1985	2057.8	823.1	378.5	258.0	2485.2	500.9	71.0	80.3	430.1	3723.5
1986	2048.2	819.3	370.2	258.0	2785.9	504.2	72.0	80.5	432.1	3822.1
1987	2084.6	792.2	382.3	190.7	2225.5	522.7	72.9	82.7	447.6	3578.2
1988	2012.7	805.1	394.9	205.2	2135.4	520.9	73.9	83.3	446.4	3523.4
1989	1957.4	782.9	387.6	217.4	2811.8	507.4	75.0	82.0	433.7	3769.1
1990	2022.5	809.0	373.6	240.3	2839.3	516.5	76.3	82.4	439.8	3869.3

a. Variable definitions and data sources are given in Appendix A. ACR is in thousands of acres. PRJ and PJM are in units of Bangladesh Taka per metric ton. All other variables are in units of thousands of metric tons.

TABLE 6.6C

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF INDIA, 1974 - 1990[a]

	RAW JUTE					JUTE MANUFACTURES				
	ACRIN	JIN	SRJIN	NEXRJIN	PRJIN	PRODJMIN	CONJMIN	SJMIN	NEXJMIN	PJMIN
1974	3016.9	1206.7	439.3	-24.1	1687.5	1035.8	478.7	138.4	539.9	3985.9
1975	2794.5	1117.8	381.2	-48.0	1811.6	1066.9	489.3	128.6	587.3	4194.7
1976	3073.7	1229.5	358.5	-50.0	1942.7	1093.9	506.2	124.3	591.9	4349.4
1977	3348.5	1339.3	334.2	46.0	1801.8	1120.6	529.5	129.2	586.2	4065.1
1978	3386.7	1344.7	335.6	-5.0	1915.1	1136.6	547.3	125.1	593.3	4198.5
1979	3386.7	1344.7	328.2	21.0	1923.2	1151.3	558.4	127.5	590.6	4177.2
1980	3331.2	1324.5	327.1	65.2	1927.9	1159.9	581.7	128.2	577.5	4151.6
1981	3408.0	1363.2	327.9	41.8	1905.8	1163.6	593.5	129.8	568.6	4088.9
1982	3344.9	1338.0	331.9	7.2	1880.4	1162.3	604.9	130.9	556.3	4023.5
1983	3360.3	1344.1	337.3	-17.6	1851.5	1157.1	615.9	131.9	540.3	3955.0
1984	3264.7	1305.9	343.2	-46.3	1822.6	1148.6	627.0	132.6	520.8	3888.8
1985	3196.5	1278.6	354.8	-108.6	1936.9	1137.7	639.1	128.2	503.1	4015.8
1986	3180.7	1272.3	355.4	-138.6	2053.1	1132.3	650.7	125.5	484.4	4145.8
1987	3180.0	1272.0	338.3	-69.8	1831.4	1127.2	673.9	134.1	444.7	3823.8
1988	3064.9	1226.0	349.9	-149.7	1793.6	1101.5	699.2	132.1	414.2	3751.3
1989	2931.9	1172.8	369.6	-126.0	2062.8	1095.8	722.7	122.5	382.8	4075.9
1990	2882.6	1153.0	360.3	-224.8	2182.7	1093.5	743.2	121.4	351.3	4207.9

a. Variable definitions and data sources are given in Appendix A. ACR is in units of thousands of acres. PRJ and PJM are in units of Indian Rupees per metric ton. All other variables are in units of thousands of metric tons.

TABLE 6.6D

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF THAILAND, 1974-1990[a]

			RAW JUTE		
	ACRTH	JTH	SRJTH	NEXRJTH	PRJTH
1974	953.0	352.6	193.4	407.2	2324.8
1975	777.9	373.4	162.7	404.1	2364.3
1976	759.7	326.7	130.2	359.2	2648.4
1977	783.9	329.3	130.0	329.4	2560.3
1978	715.0	300.3	112.1	318.2	2827.2
1979	700.7	293.9	112.8	293.2	2846.8
1988	655.7	275.3	113.6	274.6	2858.0
1981	617.6	258.8	116.8	255.6	2804.9
1982	617.8	258.9	119.0	256.7	2744.4
1983	636.9	267.6	120.5	266.1	2675.9
1984	657.5	276.4	121.2	275.7	2608.6
1985	678.7	285.2	107.5	298.9	2879.9
1986	700.2	293.9	98.5	302.9	3167.4
1987	671.3	282.6	126.6	254.5	2628.9
1988	740.8	311.6	125.4	312.8	2541.4
1989	738.7	309.9	95.6	339.7	3192.1
1990	776.8	326.1	91.0	300.7	3501.5

a. Variable definitions and data sources are given in Appendix A. ACR is in units of thousands of acres. PRJ is in units of Thai Baht per metric ton. All other variables are in units of thousands of metric tons.

TABLE 6.6E

BASIC ANNUAL SIMULATED VALUES FOR THE PRODUCTION AND CONSUMPTION OF JUTE MANUFACTURES IN THE U.K., U.S.A., JAPAN, AND THE E.E.C. COUNTRIES, 1974-1990[a]

	PRODJM				CONJM			
	U.K.	U.S.	J.N.	E.C.	U.K.	U.S.	J.N.	E.C.
1974	67.0	14.0	52.0	208.2	93.8	348.4	58.1	171.3
1975	69.9	11.7	43.3	203.9	91.2	327.5	54.7	166.4
1976	66.4	10.0	33.8	198.9	94.5	333.2	59.1	174.8
1977	62.5	10.0	23.6	193.9	96.2	336.6	63.5	182.9
1978	58.6	10.0	20.0	188.9	93.9	327.9	56.4	172.0
1979	54.6	10.0	20.0	183.9	95.0	329.0	57.6	176.3
1980	50.7	10.0	20.0	178.9	96.1	330.6	58.8	180.6
1981	46.7	10.0	20.0	173.9	96.1	330.1	57.8	181.1
1982	42.4	10.0	20.0	169.0	96.1	329.8	56.8	181.6
1983	40.0	10.0	20.0	164.0	95.0	327.2	53.8	178.2
1984	40.0	10.0	20.0	159.0	96.1	329.5	54.7	182.5
1985	40.0	10.0	20.0	154.0	95.0	327.0	51.8	179.2
1986	40.0	10.0	20.0	149.0	93.9	324.6	49.0	189.6
1987	40.0	10.0	20.0	144.0	93.9	324.5	48.0	175.9
1988	40.0	10.0	20.0	139.0	92.8	322.1	45.4	172.4
1989	40.0	10.0	20.0	134.0	91.7	319.8	42.9	169.3
1990	40.0	10.0	20.0	129.0	90.6	317.3	40.4	165.7

a. Variable definitions and data sources are given in Appendix A. All figures are in units of thousands of metric tons.

TABLE 6.6F

BASIC ANNUAL SIMULATED VALUES FOR KEY VARIABLES IN THE JUTE ECONOMY OF THE "REST-OF-THE-WORLD" SECTOR, 1974-1990[a]

	JRW	PRODJMRW	CONJMRW
1974	1655.4	1722.9	2481.5
1975	1689.7	1810.2	2468.0
1976	1736.9	1875.2	2495.7
1977	1783.1	1932.9	2521.1
1978	1828.4	1875.0	2489.2
1979	1873.2	1900.1	2501.4
1980	1917.6	1930.6	2513.4
1981	1961.6	1939.6	2513.7
1982	2005.4	1951.4	2513.9
1983	2049.0	1952.2	2502.5
1984	2092.5	1997.9	2514.1
1985	2135.9	2000.9	2502.6
1986	2136.5	2013.1	2491.4
1987	2147.7	2031.4	2491.4
1988	2166.7	2047.9	2479.9
1989	2191.7	2071.7	2467.9
1990	2221.2	2083.5	2456.2

a. Variable definitions and data sources are given in Appendix A. All variables are in units of thousands of metric tons.

TABLE 6.7

FORECASTS OF PRODUCTION OF RAW JUTE AND JUTE MANUFACTURES AND CONSUMPTION OF JUTE MANUFACTURES FOR 1980 AND 1990 FOR WORLD AND LEADING PRODUCING AND CONSUMING AREAS[a]

A. Area under Raw Jute:

	Year and Source	BD	IN	TH
1980	Mujeri, basic simulation	2035	3331	656
	FAO[b]	2220	2520	-
1990	Mujeri, basic simulation	2023	2883	777

B. Production of Raw Jute:

	Year and Source		W	BD	IN	TH	RW
1980	Mujeri, basic simulation		4401	814	1325	275	1918
	FAO[b]	Lower[c]	4100	1400	1400	330	970
		Higher[c]	5000	1800	1620	450	1130
	Khan[d]		3915	1505	1617	793	-
1990	Mujeri, basic simulation		4509	809	1153	326	2221

C. Production of Jute Manufactures:

	Year and Source	W	BD	IN	UK,US,JN,EC	RW
1980	Mujeri, basic simulation	3833	483	1160	260	1931
1990	Mujeri, basic simulation	3893	517	1094	199	2084

D. Consumption of Jute Manufactures:

	Year and Source		W	BD	IN	JN	US	UK	EC	RW
1980	Mujeri, basic simulation		3828	67	582	59	331	96	181	2482
	IBRD[e]	I[f]	3625	40	755	61	410	-280[g]-		2184
		II[f]	3850	45	755	71	445	-350[g]-		2184
	FAO[h]		3515	60	705	53	407	66	161	2063
	FAO[b]	Basic[i]	4250	-	740	-	530[j]	-475[k]-		2505
		Supplementary[i]	2750	-	580	-	200[j]	-185[k]-		1785
	Khan[d]		4031	48	680	158	451	192	271	2231
1990	Mujeri, basic simulation		3890	76	743	40	317	91	166	2456

a. Variable definitions and data sources are given in Appendix A. All figures are in thousands of metric tons.

b. FAO, Agricultural Commodity Projections, 1970-1980 vol. I, Rome, 1971.

c. The difference between the two production projection results reflects uncertainty as to the outcome of a single set of price and policy assumptions.

d. Khan, A.S., An Economic Analysis of 1980 International Trade in Jute With Special Reference to Pakistan, Unpublished Ph.d. dissertation, University of Wisconsin, Madison, 1972.

e. IBRD, Jute and Synthetics, Bank Staff Working Paper No. 171, January 1974.

f. The basic difference between simulations I and II being that II assumes elimination of import restrictions in Western Europe and large imports by China and Africa.

g. Figures are for Western Europe excluding Greece, Turkey and Yugoslavia.

h. FAO, Demand Prospects for Jute to 1980, ESCR: Mis. 72/4, September 1972.

i. Basic projection assumes both a continuing competitiveness of jute with polyolefin materials in developed countries and high rates of growth of marketed output of agricultural products elsewhere. The supplementary projection implies less favorable assumptions.

j. Figures are for North America.

k. Figures relate to Western Europe.

respectively. The increased world supply comes from increased production in the "Rest-of-the-World" sector which increases from 1655 to 2221 thousand metric tons over the period 1974 to 1990.

Basic simulation values of the production of jute manufactures increase at an average annual rate of 0.59 percent to around 3.9 million metric tons in 1990. However, this rate of growth is substantially lower than the actual average annual rate for 1958-1974. Again the share of the "Rest-of-the-World" sector increases from 49 percent in 1974 to 54 percent in 1990 while the share of India decreases from 29 percent to about 28 percent over the same period. The share of Bangladesh remains relatively constant at around 13 percent of total world production while the combined share of the U.K., U.S.A., Japan, and the E.E.C. countries declines from 8 percent to 5 percent over the 1974-1990 period. Thus, it appears, in the production of both raw jute and jute manufactures, the "Rest-of-the-World" category will emerge as the leading source in coming years accounting for more than half of total world supply in both cases.

Basic simulation values of total consumption demand for jute manufactures increase at an average annual rate of 0.33 percent to about 4.9 million metric tons in 1990. Again, the rate of growth is not substantial when compared to the actual average annual rate for 1958-1974. Nevertheless, the basic simulated aggregate values for consumption compare quite favorably with other projections for 1980 which are presented in Table 6.7.

On the more disaggregate level, the basic simulated values for quantities of jute manufactures demanded tend to reflect the factors that produce a shift towards the synthetic substitutes, especially in the developed countries. The share of the four developed countries (i.e., U.K., U.S.A., Japan, E.E.C.) declined from 18 percent of aggregate world consumption in 1974 to 16 percent in 1990. The decline, although not spectacular, represents the long-run secular trend in the consumption of jute manufactures in these countries that became prominent since the late sixties when the synthetic substitutes moved rapidly into the market of jute goods. The consumption of jute manufactures in the "Rest-of-the-World" category increases till the early 1980's after which the declining trend becomes apparent due to increasing consumption of the synthetic substitutes. Over the period, the share of the "Rest-of-the-World" sector decreases from 67 percent in 1974 to 63 percent in 1990. The basic simulation values for the consumption of jute manufactures in Bangladesh and India increase monotonically throughout the forecast period. In this respect the growth of demand in India is spectacular, increasing her share from 13 percent in 1974 to 19 percent during 1990.

Basic simulation values for raw jute prices throughout the forecast period fluctuate around a rising trend. However, the average annual exponential rate of 2.39 percent during 1974-1990 is lower than the actual rate of 3.14 percent observed during the 1958-1974 period. Moreover, since the price index for the world price of jute is assumed to increase at the annual rate of 3 percent per year, it appears that the real price of raw jute would decrease over the period. The price of jute manufactures also follow the same trend in the world market over the simulation period with much less increase in the level--the average annual exponential rate being 0.35 percent.

On a disaggregate level, the domestic prices of raw jute and jute manufactures in Bangladesh, India, and Thailand are generally increasing--although slowly. However, it should be noted that this upward rise in prices is the result of increases in the cost-of-living over the period rather than any increase in the real prices of jute and jute manufactures which actually declines over the simulation period.

The above analysis suggests that the future expansion of either production or consumption of jute will be very modest with no substantial increase in the price level. Moreover, the traditional role of Bangladesh and India as the major supplier of raw jute and jute manufactures, respectively, will be further diminished. With production more diversified, the major causes of wide fluctuations in the price level originating on the supply side will be few.

In the following section, the effects of variations in the specification of the model on simulations over the 1974-1990 period are examined. In such investigations, the basic simulation in this section is used as a reference, much as is done for the 1960-1973 period in Section 6.4.

6.6 Simulations Under Hypothetical International Raw Jute Agreements, 1974-1990

In this section the three variants of international raw jute market organization which are investigated in Section 6.4 for the estimation period are further explored for the 1974-1990 period.

Simulation 6.6A: Raw jute price floor of US $350 per metric ton maintained by raw jute purchases by an international organization.

Table 6.8 provides a framework for a comparison of simulation 6.6A with the basic simulation.

The raw jute price floor is effective for the periods

TABLE 6.8

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.6A FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974 - 1990[a]

	RAW JUTE					JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stock	PROD JMW	WCJM	PJMW
1974	0.00	1.65	16.70	16.70	18.94	-0.92	1.13	8.65
1975	0.88	-0.17	15.62	17.80	0.00	-1.57	-0.70	8.05
1976	2.69	0.23	3.30	6.08	2.14	-1.52	-0.52	1.78
1977	2.66	0.55	7.34	10.19	4.71	-1.77	-0.57	3.85
1978	2.32	1.61	0.00	2.31	13.24	-1.59	-0.02	0.00
1979	2.41	2.40	0.00	2.41	19.29	-1.48	0.00	0.00
1980	2.19	2.60	0.00	2.19	20.73	-1.37	0.00	0.00
1981	5.45	2.48	0.00	-5.45	19.93	-1.26	0.00	0.00
1982	-1.21	2.14	0.54	-0.68	17.41	-1.18	-0.20	0.28
1983	0.08	1.45	2.97	3.04	12.00	-1.21	-0.36	1.51
1984	0.38	0.62	5.47	5.86	5.22	-1.36	-0.48	2.72
1985	0.71	0.77	0.00	0.71	6.48	-1.23	-0.02	0.00
1986	0.31	1.10	0.00	0.31	9.03	-1.15	-0.36	0.00
1987	0.14	0.58	4.70	4.85	4.88	-1.28	-0.39	2.29
1988	0.54	-0.23	8.08	8.66	0.00	-1.55	-0.56	3.85
1989	0.81	0.11	0.00	0.81	0.91	-1.41	0.00	0.00
1990	0.35	0.77	0.00	0.35	6.35	-1.33	0.00	0.00
Mean absolute % difference 1974-1990	1.41	1.14	3.80	5.70	9.48	1.36	0.31	1.94

a. Variable definitions and data sources are given in Appendix A. All percentage differences are defined to be simulation 6.6A minus basic simulation values relative to basic simulation values. In simulation 6.6A a raw jute price floor of U.S. $350 metric ton is maintained by buffer stock purchases.

1974-1977, 1982-1984, and 1987-1988. The average buffer stock acquisitions of 9.48 thousand metric tons per year over the period result in an average increase in the raw jute price of 3.80 percent. The increased price during the forecast period induces decrease in the consumption of jute manufactures for most of the years except in 1974. This is due to a shift from jute to synthetic substitutes as a result of the higher price of jute. This same increase in the price of jute induces a mean increase of 1.41 percent in aggregate raw jute production over the period, which--together with the raw jute price changes--results in a mean increase of 5.70 percent in the value of raw jute production (although the value decreases during 1981 and 1982). Production of jute manufactures are low compared to the basic simulation, due to the lower consumption and reduced profitability caused by higher raw jute prices and lesser increase in the price of jute manufactures (average annual increase of 1.94 percent compared to 3.80 percent for raw jute). Thus, leaving aside the question of financing the costs of buffer stock operations, the price floor seems to work to the benefit of the producing nations. The mean value of the buffer stock needed to be held during the period is 9.48 thousand metric tons.

Simulation 6.6B: Identical to simulation 6.6A except that stock sales from the buffer stock occur whenever raw jute prices exceed a ceiling which is five percent above the price floor (i.e., at US $367.50).

The price ceiling is effective in only three years during the entire period--1986 and 1989-1990. During those three years, prices are lower and, in response to these lower prices, total world production actually declines between 1987 and 1990, relative to the basic simulation. The value of total world production during those years is lower. Total consumption increases slightly during 1989-1990 in response to lower prices. However, since the ceiling is not very effective, such simulations are not particularly interesting and thus are not discussed further. The results are presented in Table 6.9.

Simulation 6.6C: Prices received by all raw jute producers are reduced by ten percent through the imposition of an appropriate tax in order to limit the raw jute production.

In Table 6.10 are presented the percentage differences in key variable values between simulation 6.6C and the basic simulation. As a result of this hypothetical policy, raw jute production decreases over the forecast period due to the lagged response to the lower prices received by the producers. Aggregate consumption of jute manufactures also decreases over the forecast period (due to higher jute manufactures prices),

TABLE 6.9

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.6B FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974-1990[a]

	RAW JUTE					JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	RJW x PRJW	Buffer Stock	PRODJMW	WCJM	PJMW
1974	0.00	1.65	16.70	16.70	18.94	-0.92	1.13	8.65
1975	1.88	-0.17	15.62	17.80	0.00	-1.57	-0.70	8.05
1976	2.69	0.23	3.30	6.08	2.14	-1.52	-0.52	1.78
1977	2.66	0.55	7.34	10.19	4.71	-1.77	-0.57	3.85
1978	2.32	1.61	0.00	2.31	13.24	-1.59	-0.02	0.00
1979	2.41	2.40	0.00	2.41	19.29	-1.48	0.00	0.00
1980	2.19	2.60	0.00	2.19	20.73	-1.37	0.00	0.00
1981	-5.45	2.48	0.00	-5.45	19.93	-1.26	0.00	0.00
1982	-1.21	2.14	0.54	-0.68	17.41	-1.18	-0.29	0.28
1983	0.08	1.45	2.97	3.04	12.00	-1.21	-0.36	1.51
1984	0.38	0.62	5.47	5.86	5.22	-1.36	-0.48	2.72
1985	0.71	0.77	0.00	0.71	6.48	-1.23	-0.02	0.00
1986	0.31	2.42	-7.89	-7.60	-19.93	-0.79	-0.22	-4.23
1987	-0.49	1.25	4.70	4.18	10.61	-0.98	-0.25	2.29
1988	0.24	-0.13	8.08	8.35	1.09	-1.25	-0.57	3.85
1989	0.67	1.27	-8.57	-7.96	-10.82	-0.74	0.10	-4.51
1990	-0.39	4.14	-16.36	-16.69	-34.15	0.03	0.53	-8.91
Mean absolute % difference 1974-1990	1.41	1.52	5.73	5.73	12.74	1.19	0.33	2.97

a. Variable definitions and data sources are given in Appendix A. All percentage difference are defined to be simulation 6.6B minus basic simulation values relative to basic simulation values. In simulation 6.6B, both a price floor at U.S. $350 and a price ceiling at U.S. $367.50 are maintained by buffer stock activities.

TABLE 6.10

ANNUAL PERCENTAGE DIFFERENCES AND MEAN ABSOLUTE PERCENTAGE DIFFERENCES BETWEEN BASIC SIMULATION AND SIMULATION 6.6C FOR KEY VARIABLES IN THE WORLD JUTE ECONOMY, 1974 - 1990[a]

	RAW JUTE				JUTE MANUFACTURES		
	RJW	WSRJ	PRJW	RJW x PRJW	PRODJMW	WCJM	PJMW
1974	0.00	-0.04	0.40	0.40	-0.03	-0.68	0.21
1975	-1.69	-0.02	0.17	-1.86	-0.01	-0.81	0.09
1976	-1.86	-0.04	0.22	-2.07	0.00	-1.24	0.12
1977	-1.81	-0.07	0.23	-2.04	0.01	-1.29	0.12
1978	-1.84	-0.07	0.18	-2.04	0.02	-1.13	0.10
1979	-1.91	-0.06	0.17	-2.08	0.03	-1.09	0.09
1980	-1.87	-0.03	0.09	-1.95	0.03	-0.55	0.05
1981	-1.87	-0.01	0.09	-1.95	0.03	-0.54	0.04
1982	-1.85	0.00	0.10	-1.95	0.03	-0.62	0.05
1983	-1.81	-0.01	0.10	-1.91	0.03	-0.58	0.05
1984	-1.75	0.00	0.19	-1.94	0.04	-1.07	0.10
1985	-1.69	-0.01	0.18	-1.87	0.05	-1.08	0.09
1986	-1.71	-0.02	0.22	-1.92	0.05	-1.40	0.12
1987	-1.68	-0.01	0.22	-1.89	0.06	-1.13	0.10
1988	-1.56	0.00	0.24	-1.79	0.07	-1.15	0.11
1989	-1.38	-0.01	0.17	-1.54	0.07	-1.02	0.09
1990	-1.35	-0.02	0.08	-1.43	0.07	-0.59	0.05
Mean absolute % difference 1974 - 1990	1.62	0.02	0.17	1.80	0.03	0.93	0.09

a. Variable definitions and data sources are given in Appendix A. All percentage differences are defined to be simulation 6.6C minus basic simulation values relative to the basic simulation values. In simulation 6.6C, the prices received by the producers of raw jute are reduced by ten percent by an appropriate tax.

but not by absolute quantities as large as the production decreases. Raw jute stocks, therefore, are reduced in comparison with the basic simulation, thus causing increases in raw jute prices. The increases in this price, however, are not sufficient to offset the decreases in raw jute production so that the value of raw jute production decreases compared to the basic simulation. Thus it appears that the increasing aggregate elasticity of substitution between jute and synthetic substitutes makes policies which depend on limitations of raw jute production even more ineffective in the forecast period than in the sample period in respect to increasing the value of raw jute production.

6.7 Conclusions

In this chapter the estimated model of the world jute economy was tested in terms of simulation experiments both within the sample period and over future periods. During the 1960-1973 period, the basic simulation, on both the aggregate and the disaggregate level, traces quite satisfactorily the trajectories of the raw jute production and consumption and other variables. On the aggregate level, the highest mean absolute percentage discrepancy is for the price of raw jute variable (5.95 percent). This relative lack of success for the price variable apparently reflects largely the abstraction from short-run cyclical fluctuations in total demand for jute manufactures. Nevertheless, the model was found to perform reasonably well in explaining the basic structure of the world jute market.

The basic forecasts for the 1974-1990 period, although, they have to be qualified for the assumptions regarding the future paths of the exogenous variables, are quite interesting. In fact, the simulations over the period imply practically a stagnation of the position with relatively small increases in world production, consumption and prices. Moreover, the present trend of decreasing consumption of jute manufactures in the developed countries is expected to continue.

Finally, the possible institution of various international agreements to benefit (in part, at least) raw jute producers has been a subject of considerable interest in some quarters. A few variants of such agreements in comparisons with the basic simulations are also examined for both the 1960-1973 and 1974-1990 periods. However, it has been found that in most cases these programs will have very limited benefits (although both producers and consumers might benefit from increased price stability) due to high and increasing elasticity of substitution between jute and synthetic substitutes.

FOOTNOTE - CHAPTER SIX

[1] The computer program utilized is the Toronto Econometric Model Solution Program (TEMS) which is adapted to the CDC6400 computer at McMaster University.

[2] Food and Agricultural Organization, Committee on Commodity Problems, Domestic Prices of Jute in Bangladesh, CCP: JU 75/3, May 1975.

[3] An exception to this rule is the study of Balassa who, while recognizing the problem concerning the supply functions in this context, nevertheless projects the price changes of some 15 major commodities by using a method of successive approximations--an effort which has been criticized by Maizels as one that lend an air of spurious precision to the projection exercise. See Balassa, B., Trade Prospects of Developing Countries, Homewood, Ill., 1964, pp. 352-355 and Table A 15-I and Maizels, A., Exports and Economic Growth of Developing Countries, Cambridge, 1968, p. 118.

[4] Food and Agricultural Organization, Committee on Commodity Problems, Impact of the Energy Crisis on the Competitive Position of Agricultural Raw Materials, CCP: JU 74/8, Oct. 1974.

[5] For example, OECD forecasts for the annual rate of growth of real GNP for the above countries for 1978

are as follows: U.K. - 3 percent, U.S.A. - 4-1/4 percent, Japan - 5 percent, average of the major E.E.C. countries - 2-1/2 percent. See OECD, Economic Outlook, 22, December 1977, Table 1, p. 15.

[6] These are considered as the lower limits for each of these countries below which production of jute manufactures would not drop during the period. Given the existing jute manufacturing industries in these countries, such an assumption does not seem unrealistic.

[7] The 1958-1974 values are included because they span almost all of the sample period and a number of years equal to the forecast period. The problem of choosing a typical year for a base for comparison, of course, exists here, but the length of the span covered should eliminate much of the distortion due to the choice of particular base years.

CHAPTER SEVEN

CONCLUDING REMARKS

The study has provided, hopefully, an operational econometric model for one traditional primary commodity, jute. The relatively simple structural model which was developed has been described in full detail above. The research yields a number of general conclusions which are summarized in this chapter and comments are made for future research.

7.1 Summary of the Present Study

The aim of this study was to examine the dynamic structure of the world commodity market for jute, in order to understand better the operation of the market and the causes of high variability in the prices. The approach followed involved the construction and analysis of an annual econometric model, including the use of simulation procedures to explore the model. This kind of analysis, it is believed, has distinct advantages over the traditional trend extrapolation method of forecasting.

The study is motivated, in part, by the fact that primary commodities are of great importance for the developing countries, in view of their absolute dependence on the foreign exchange earnings from such sources to assist in their economic development. Thus, an improved understanding of the functioning of such markets is of particular importance.

Bangladesh, for example, derives more than 90 percent of its foreign exchange earnings from jute. The insights into the functioning of the international market for jute provided by the specification and estimation of the model and the subsequent utilization of the model in simulations over a part of the sample period (1961-1973) and over a 17-year forecast period (1974-1990) will, hopefully, help in the formulation of appropriate policy measures. The remainder of this section, therefore, is devoted to summarizing the main strengths and weaknesses and interesting characteristics of this specific study.

In developing the supply sector of the model, two sets of supply equations are estimated--one for the production of raw jute and the other for production of jute manufactures. Equations explaining the production of raw jute are presented for three major producing countries (Bangladesh, India, and Thailand) and for a "Rest-of-the-World" sector. The areas under jute cultivation in the major producing countries are found to be sensitive to the price of jute the farmers receive and to the prospective gains associated with alternative crops. The elasticity of acreage with respect to the price of jute varies from 0.35 to 0.82 in the short run and 0.76 to 1.17 in the long run. Thus the study offers further proof of the much-debated responsiveness of subsistence farmers to economic incentives. Another hypothesis that is tested in the course of the study is the behavior of risk-aversion for the subsistence farmers. The results for Bangladesh and India suggest support for this hypothesis. Other factors that are found important in the relationship are the expected relative yield rate of jute compared to the alternative crop, the farm population in the area of concern, and a time trend variable (used as a proxy for long-run technological changes).

In the case of the yield-per-acre-of-jute equations, in the absence of data relating to weather and other factors that are believed to affect the yield rate of jute, a time trend and the area under jute were the variables used. The rest of the world production of jute is found unresponsive to the world price of jute; rather, a secular increase in the production of jute in this sector is observed. This is mainly due to the efforts of the countries of this sector to become self sufficient in the production of jute; and almost the entire production of these countries never enters the international market, but is consumed instead by the producing units. The major weakness of the acreage equations is the absence of any cost variables due to lack of reliable data. Despite such weaknesses, however, the available data do not seem to permit alternative preferable specifications. The interesting features of the distributed-lag nature in the supply relationships are found useful in analyzing the relationships. Moreover, the results are suggestive, despite substantial qualifications, in respect to the general controversy over the supply responsiveness of agriculture in underdeveloped areas.

The production of jute manufactures in the world has been estimated also in terms of a distributed-lag model. In the absence of data on the costs of different inputs, the ratio of the prices of jute manufactures and raw jute is used as a proxy for the profitability of the production process. Such an assumption does not seem unrealistic since other inputs which include mainly labor, power, machinery and the like, are somewhat stable. The above variable has performed reasonably well in explaining the production of jute manufactures in the major producing countries of India, Bangladesh, and the "Rest-of-the-World" sector. However, for the cases of the U.K., the U.S.A., Japan, and the E.E.C, such a formulation proved unsatisfactory. Since production of jute manufactures in these countries is geared mainly to the volume of domestic consumption of the product and raw jute is not produced domestically, it proved difficult to find suitable explanatory variables. When experiments with several probable variables failed, it was decided to use the time trend variable as the suitable candidate in the distributed-lag framework. This somewhat simplified approach is unsatisfactory, no doubt, but given the very small percentage of total world production of jute manufactures accounted for by these countries, it is expected not to produce a large bias in the analysis.

The construction of the consumption demand sector of the model, that is, the equations explaining the net consumption of jute manufactures in the major consuming countries and a "Rest-of-the-World" sector, has been performed in two stages. First, for India and Bangladesh, where the competition with synthetic substitutes is unimportant, total consumption of jute manufactures are estimated alone. The analysis indicated that consumption in these two countries varies significantly with respect to the importance, timing and direction of the effects of the price of jute manufactures, national income and ratio of past year's and current year's income. In both cases, income was found to be an important positive determinant of consumption. For each of the four other consuming nations/regions (U.K., U.S.A., Japan, E.E.C. Countries) and the "Rest-of-the-World", the demand side of the market is represented by two equations, one to determine the total consumption of jute manufactures and synthetic substitutes and another to determine the allocation between jute manufactures and synthetic substitutes.

The total consumption of jute manufactures and synthetic substitutes for each of the five countries/regions is estimated as a function of indices of national income or change-in-income and of a time trend variable (price variables are also included but are omitted in the cases where they do not have significantly non-zero coefficients). For the simulations, the included indexes of income are represented by assumed constant exponential growth rates and thus does not reflect short-term cyclical fluctuations. In all the cases, the income or the change-in-income variables have strong positive influences on total demand. The distributed-lag relationship appears to hold in all cases except the U.K. with varying degrees of adjustment lag.

The current consumption demand for jute manufactures, relative to synthetic substitutes is estimated as a function of the price of jute manufactures relative to that of synthetic substitutes. The equations, in turn, are derived from a "nested" CES production function for the industries using the above products as inputs along with labor and capital. Although attempts were made to use technical change explicitly in such relationships, severe data limitations was the main hindrance for such an analysis. However, insofar as the effects of technical change in the synthetic substitutes industry are reflected in the prices of the products, the results of the analysis will be unbiased. In general, the estimated elasticities of substitution are quite high, especially in the case of Japan. These differences in elasticity of substitution are probably due to differences in the structure and geographical distribution of the jute manufacturing industries and in the preferences of the consumers in the different countries.

The stocks of raw jute and jute manufactures held in the major producing countries are highly variable. The model developed to explain the amounts of stocks of raw jute carried over to the next year in the major producing countries suggests that they are affected by the current and expected future raw jute prices and the deviation from normal production of raw jute. Moreover, in the case of Bangladesh and India, current and expected future use of raw jute in the production of jute manufactures are also important determinants. The specification of the stocks of jute manufactures equations by the major producing countries implies that the current and expected future volume of production of jute manufactures and stocks of raw jute are important in its determination. Stocks in India are also found to be affected by the price of jute manufactures.

The links between the supply and demand relations are the prices, and so a separate price equation was estimated. In the model, world raw jute prices are estimated as a function of the existing world stock of raw jute relative to current consumption demand for raw jute, a time trend variable to represent the secular trend in raw jute prices, and dummy variable to represent the special situation during the Korean War. There appears to be a strong downward secular trend in raw jute prices, probably because of the increased technical substitution possibilities.

The domestic prices of raw jute received by farmers are also linked with the world price. The results of this analysis are fairly interesting. The domestic prices in Bangladesh and Thailand are very sensitive to world prices. Any increase in world prices are reflected in domestic prices (net of export duties and transportation costs). However, in the case of India, such a relationship is less strong. This is probably explained by the fact that Indian production of raw jute satisfies mainly domestic requirements, and hardly enters the international market.

Finally, the world price of jute manufactures has been determined in the model by the world price of raw jute along with two dummy variables representing the Korean War and India-Pakistan Wars of 1965 and 1971. The analysis shows that a 10 percent increase in the price of raw jute results in about 13 percent increase in the price of jute manufactures. The relationship between the world price of jute manufactures and the domestic prices of jute manufactures in Bangladesh and India suggests that domestic prices are quite responsive to the world price.

The price of synthetic substitutes is assumed to be set exogenously by the producers; given the oligopolistic nature of the industry, this seems not unrealistic. Because of the lack of data, United States prices have been used for other countries as well. However, since the United States is the dominant producer and the price of synthetic substitutes in other countries more or less follows the U.S. trend, the use of such U.S. data for other countries should not be too misleading.

Next, simulations over a part of the sample period (1961-1973) and the simulations over the 17-year forecast period (1974-1990) are examined with the estimated model. Comparison of the simulated values with actual values during the sample period indicates that, on both the aggregate and the country levels, the basic simulation for this period traces quite satisfactorily the trajectories of supply, demand, stock and price variables. On the aggregate level, the mean absolute percentage differences for such variables over the 1961-1973 period are as follows: world production of raw jute (4.29 percent), world stocks of raw jute (4.34 percent), world price of raw jute (5.95 percent), world production of jute manufactures (2.37 percent), world consumption of jute manufactures (2.00 percent) and world price of jute manufactures (3.51 percent). On the country levels, in the production side the yield per acre of raw jute equations, as expected, has performed less satisfactorily. This apparent lack of success is mainly due to the lack of proper specification of the weather variable for which no suitable proxy could be found.

The basic forecasts for the 1974-1990 period have been discussed extensively in Section 6.5. Some of the highlights of that study are presented here. Under the assumptions made, world raw jute production would increase at an average annual exponential rate of 0.80 percent to about 4509 thousand metric tons in 1990. Although much lower than the rate of growth during the 1958-1974 period (which was over 2 percent), the result follows from the assumed adverse price relationship with the main competing crop, rice, which means that production in the major producing countries of Bangladesh and India is not expected to increase much. As a matter of fact, the share of India's production decreases from about 30 percent to about 26 percent during the simulation period. The "Rest-of-the-World" category emerges as the largest producer with about 50 percent of the share of the market in 1990. The shares of Bangladesh and Thailand remain constant at around 18 and 7 percent respecitvely.

The basic simulation values for the production of jute manufactures increases to more than 3.9 million metric tons in 1990. The rate of growth is 0.59 percent per annum compared to 2.62 percent during 1958-1974. The main increase occurs in the "Rest-of-the-World" category at the expense of India and other developed countries. Thus the importance of both India and Bangladesh, as the traditional supplier of both raw jute and jute manufactures, is expected to diminish in the coming years.

Total world consumption demand for jute manufactures is forecast to increase at the very modest annual rate of only 0.33 percent to about 3.9 million metric tons in 1990. Although the total consumption of jute manufactures and synthetic substitutes together increases in the four developed countries we considered here (U.K., U.S.A., Japan, E.E.C. countries), the share of jute manufactures in the total volume actually declines. The total share of these four countries in the world consumption of jute manufactures declines from 18 percent in 1974 to 16 percent in 1990. The rate of decline, however, is not as spectacular as was observed during the late sixties and early seventies. The total consumption in the "Rest-of-the-World" category increases at a modest rate till the early 1980's after which it actually declines in the simulation as a result of increase in the consumption of synthetic substitutes. Only in India and Bangladesh can we find a steady increase in consumption. A comparison with other studies indicates that the forecasts presented in this study are at least as reasonable as the forecasts presented by others.

The forecasts for the raw jute prices indicate fluctuations around a rising trend. However, the rate of increase of 2.39 percent per annum during 1974-1990 is lower than the actual observed during 1958-1974 which is 3.14 percent. The price of jute manufactures also increases marginally over the period.

The overall picture that emerges from the basic simulation of the 1974-1990 period is that the world market for jute during the period is not expected to change much. Levels of production and consumption during the period would increase only marginally with prices remaining more or less stable. Thus the prospects of any substantial increase in the foreign exchange earnings from the exports of jute by the major producing countries would appear unrealistic.

A number of simulations under hypothetical assumptions are discussed extensively in Sections 6.4 and 6.6. Interesting aspects of some of these simulations are summarized here.

The possible institution of various international agreements to benefit (in part, at least) the jute producing nations has been a subject of considerable interest in many quarters. Various international organizations, especially the Food and Agricultural Organization (FAO) and the United Nations Conference on Trade and Development (UNCTAD) provide a natural forum for the development of positive programs for international commodities. Under the initiation of FAO, a Consultative Committee on Jute, Kenaf, and Allied Fibres was formed which, after due consideration of the production and demand prospects, set an Indicative Price Range for jute each year. However, such price range has proven ineffective in regulating fluctuations in world prices of jute since it does not have any power to enforce it. In the recent past, mostly as a result of the UNCTAD Integrated Program for Commodities, there has been a revival of interest in international commodity trading arrangements--buffer stocks in particular--designed to reduce short-term fluctuations in the prices of primary commodities exported by developing countries. A few variants of such agreements in comparison with the basic simulations are examined in Sections 6.4 and 6.6 for both the 1961-1973 and 1974-1990 periods.

Some of the highlights of these simulations are now summarized. First, what would be the effects of the maintenance of a floor for the price of raw jute at U.S. $350 per metric ton through raw jute purchases by an international agency? For the sample and forecasts periods, the effects are quite similar. Raw jute acquisitions by the international agency average (respectively) about 54 and 10 thousand metric tons per year, the price of raw jute increased by an average of 6.96 and 3.80 percent which induces some increase in raw jute production and thus results in increase in the gross value of raw jute production. To calculate the net benefits to the raw jute producers, of course, one would have to subtract the marginal cost of the expanded production, the producer's share of the cost of raw jute purchases and disposals by the international agency, and any changes in transportation and shipping costs. Even so, the net benefits to raw jute producers of such a scheme probably would be positive over the years considered.

Second, what would be the effects of the addition of a price ceiling at a level 5 percent above the floor of the previous scheme? The simulation implies that the buffer stock manager operates with sufficient financial and commodity reserves to buy and sell raw jute, whenever necessary, to defend the price floor and the price ceiling to discourage destabilizing speculation. The price floor and ceiling are in nominal terms. Although economic behavior is generally posited and empirically tested in real terms, the above choice is made since the floors and ceilings in the case of commodity agreements are usually set in nominal terms. However, such a choice is not expected to change the qualitative results of our analysis. The choice of a ceiling at 5 percent above the floor, although arbitrary, is dictated by the fact that a credibly narrow range, despite increasing price stability, may destroy future markets and much of the motive for private inventories, as well as reduce profits from the buffer stock operations since they depend primarily on price differences between buying at the floor and selling at the ceiling. For the 1961-1973 period, such a ceiling is effective only in six years with resulting reduction in raw jute production. Average stock acquisitions, however, are increased to about 130 thousand metric tons per year. The gross benefits to raw jute producers are reduced compared to the above simulation, but the institution of a price ceiling might be one of the conditions for cooperation of the jute consuming nations. For the 1974-1990 period, the ceiling is only effective during three years 1986 and 1989-1990. Thus the qualitative results between this and earlier simulation do not change much during this time period except some decrease in world production and marginal increase in world consumption.

Third, what would be the effects of a reduction by ten percent of the price received by all raw jute producers through appropriate taxes in order to limit raw jute production? For the 1961-1973 period, however, the induced reduction in raw jute production fails to increase the value of raw jute production due to smaller percentage increases in raw jute prices. During the 1974-1990 period, such policy results in still less command over resources. This difference between the sample and forecasts periods again reflects the increasing aggregate elasticity of substitution between jute and synthetic substitutes over time. The high and increasing elasticity of substitution, moreover, not only implies that any limitation scheme will have very limited benefits (if any) to raw jute producers, but also that price maintenance programs of other varieties (such as the price floor schemes discussed above) will also be marginally beneficial (although both producers and consumers might benefit from increased price stability). This leaves the only potential for relative gains for jute producers in reducing prices through decrease in costs of production. The scope for such decreases are wide, since jute is still produced under subsistence agriculture with relatively few modern inputs. The increase in productivity in both the production of raw jute and jute manufactures, coupled with international measures for price stability, is thus expected to contribute positively towards the fulfillments of the desired increased flow of foreign exchange from the traditional commodity, jute.

7.2 Suggested Directions for Future Research

There are a number of lines along which the research done in this study could be refined by the introduction of non-linearities into the model where they are most needed and by the disaggregation of jute into a number of major quality grades. Also, the statistics of some of the large jute producing countries (especially Bangladesh, India and Thailand) should be disaggregated, if possible, into their major regions so that better estimates of the effects of weather and other crops can be obtained. Moreover, for all producing countries, research should be done on the effects of changing costs of production over the years on the production of jute.

When adequate data are available, the nature of the competition between jute and synthetics should be analyzed more closely and the competitive effects of the substitutes studied. The interaction of technical change should be explored explicitly in such a model. While such a model no doubt would require a very large amount of still unavailable data, the natural direction for the future model to evolve would be toward an integrated model encompassing both world jute and synthetic substitutes markets.

Another significant possibility for further consideration is the role of various interventions in the jute market. Significant interventions in the jute market occur in the producing and consuming countries and at the level of intergovernmental commodity organizations. These interventions include discrepancies between world market prices and prices paid by the consumers or received by the producers, production quotas, import restrictions and the like. Although some of these have been treated either explicitly or implicitly in the model discussed here, more explicit recognition of these factors is needed for evaluating their proper role. Moreover, the role of expectations and speculations in the determination of jute prices is another factor that needs careful examination. Price expectations in the model have been treated only by distributed lag representations and costs of holding inventories are not represented explicitly. In future work the incorporation of such factors might be valuable.

Another major direction for future research is the development of quarterly or monthly models of the jute manufacturing industries of the major producing and consuming countries, which would permit the study of the complicated structure of these industries and the generation of short-run movements in stocks of raw jute and jute manufactures might also shed important information regarding the market.

Finally, the short-run functioning of the jute market should be studied with particular emphasis on the efficiency and stability of the markets, the process by which prices are generated, the role of middlemen, and other effects in the market. Such studies of the short-run behavior of the jute market would not only be useful in themselves but would also shed light on how the long-run annual model could be improved, especially in respect to price and stock determination and the role played by speculation in the market.

Barring such developments, however, it is highly promising that the simple aggregate model constructed here is able to describe many aspects of the behavior of the world jute market over the period and observe several dynamic behavior properties which are substantially in accord with prior notions. While the model cannot be considered definitive in any sense, it reveals a surprising richness of response properties and is thus a step in the direction of comprehensive modeling of the world jute economy.

APPENDIX A

VARIABLE DEFINITIONS AND DATA SOURCES

All variables are defined for annual time periods.

All variables are for year t unless otherwise indicated by subscripts. Notation in respect to geographical regions are excluded in order to simplify the definitions except in those cases in which to do so would be confusing.

The definitions of such country notations are as follows:

BD = Bangladesh

IN = India

TH = Thailand

RW = Rest-of-the-World

UK = United Kingdom

US = United States

JN = Japan

EC = European Economic Community (excluding the U.K.)

An appendix containing all the data indicated below will be prepared by the author. It will be included in the McMaster University Department of Economics Working Paper series and will be available on request. Those interested should contact the Department of Economics.

The definitions of the variables are as follows:

ACR = Area under raw jute cultivation. For all countries in units of thousands of acres. Source: Till 1970-71, Commonwealth Economic Committee, London, Industrial Fibres, 1973 and previous issues. After the period, from FAO, Rome, Commodity Review and Outlook, 1976-1977 and earlier issues and Government of Bangladesh, Dacca, The Jute Season 1970-1971 and 1971-1972; Bangladesh Jute Industries Corporation, Dacca, Quarterly Summary of Jute Goods Statistics Vol. 9, 1975-1976.

PRJ = Domestic price of raw jute received by farmers (in units of domestic currencies per metric ton). For BD: FAO, Domestic Prices of Jute in Bangladesh, CCP JU/75 May, 1975 and Government of Bangladesh, The Jute Season, op. cit. and Statistical Yearbooks various years. For IN: Government of India, Ministry of Agriculture and Irrigation, Directorate of Economics and Statistics, New Delhi 1975; Farm (Harvest) Prices of Principal Crops in India, 1954-1955 to 1965-1966 and 1965-66 to 1970-71. For later years, FAO, Domestic Prices of Jute in Major Producing Countries. The prices for different regions in India were weighted by their respective shares in total production in each year to arrive at a single price figure for raw jute. For TH: FAO, op. cit. and Government of Thailand, Agricultural Statistics of Thai-

land, various issues, The prices were deflated by the consumer price indexes of the respective countries taken from IMF, *International Financial Statistics*, different issues.

PRR = Domestic price of rice/other alternative crops (in units of domestic currencies per metric ton). Sources are the same as in PRJ. Prices were deflated by the consumer price indexes for the respective countries.

SDRAV = Standard deviation of the relative acre value. The formula for computation of relative acre value utilized is PRJ × YPAJ/PRR × YPAR. The standard deviation for year t was calculated from the relative acre value for the preceding three years. Sources are the same as mentioned in PRJ, PRR, YPAJ and YPAR.

RYPA = Relative yield rate of jute compared to rice and/or alternative crops, YPAJ/YPAR. Source: For BD: *The Jute Season*, op. cit. and *Statistical Yearbooks*, op. cit. For IN: Government of India, New Delhi; *Estimates of Area and Production of Principal Crops in India* and *Abstracts of Agricultural Statistics*, various issues. For TH: *Agricultural*

Statistics of Thailand, different issues.

T, TIME = A time trend variable with T, TIME = 1 in first year of sample and is incremented by one for each subsequent year.

DUM = Dummy variables used for floods in 1960 and wars in 1965, 1971 in Bangladesh and India with DUM = 1 for these years.

RPR = Relative price of raw jute compared to prices of jute and/or alternative crops. Source same as in PRJ and PRR.

FAPOP = Farm population (in thousands) in the area of concern. Source: for IN: Government of India, New Delhi; Basic Statistics Relating to the Indian Economy - published by the Planning Commission.

YPAJ = Yield (in metric tons per acre) of jute. Source: as mentioned in RYPA.

YPAR = Yield (in metric tons per acre) of rice. Source: same as RYPA.

J = Total production (in thousands of metric tons) of raw jute (including allied fibres). Source: BD, IN, TH: Industrial Fibres, op. cit., and FAO Commodity Review and Outlook, op. cit. various issues.

JRW = Rest of the world production of raw jute. Calculated as residual from the subtraction of the total production of raw jute of the above three countries from the world total production. Source: Same as in J.

RJW = Total production (in thousands of metric tons) of raw jute in the world, defined as the sum of production in the above four countries/regions.

SRJ = Stocks (at the end of the year) of raw jute held in the producing countries in thousands of metric tons. Source: for BD, IN, TH: Industrial Fibres, op. cit., and FAO Commodity Review and Outlook, op. cit., different issues.

PRJW = World price of raw jute (in US dollars per metric ton). The price of raw jute in the London market for the most commonly quoted grade has been taken as the world price in the model. The prices were deflated by the index of wholesale prices of basic raw materials in England. Source: Industrial Fibres, op. cit., OECD, Main Economic Indicators, Historical Statistics 1960-1975 and

1955-1971, FAO, Production Yearbooks, various issues.

RJUJM = Total amount of raw jute used in the production of jute manufactures (in thousands of metric tons). Source: For BD and IN: Industrial Fibres, op. cit., different issues, FAO Commodity Review and Outlook 1976-1977 and previous years, Government of Bangladesh, BJIC, Quarterly Summary of Jute Goods Statistics 1975-1976, FAO, Commodity Review 1964 Special Supplement and Trade in Agricultural Commodity in UN Development Decade, Vol. I, 1964.

DEVNP = Deviation of actual production of raw jute from normal production (in units of thousands of metric tons). Normal production of raw jute has been measured by a moving average of the three preceding years' production of raw jute in the respective countries. Source: Same as in J.

CONJM = Consumption of jute manufactures in thousands of metric tons. The consumption figures has been derived, whenever possible, from individual country sources. Statistics of domestic consumption were used for India and Bangladesh. For all other countries, consumption was estimated on the basis of net imports of jute and jute goods, plus domestic production, if any. The figures were compared with the estimated figuresof consumption published by FAO. Source: BD and IN: Bangladesh Jute board, The Jute Season op. cit. and Bangladesh Jute Mills Association, miscellaneous publications, Indian Jute Mills Association, Annual Summary of Jute and Gunny Statistics (various issues), Commonwealth Secretariat, Industrial Fibers (various issues). For US: U.S. Department of Commerce, Bureau of the Census, Imports for Consumption (various issues) and U.S. Tariff Commission, TC Publications 267, 285, 311, 346 and 366. U.K. and EC: FAO, CCP: JU 73/7, Association of European Jute Industries, Statistical Yearbook, various years and Quarterly Statistics, different issues. JN: The Japan Jute Mills Association and FAO, Statistical Supplement of Jute Goods Available for Home Use. For other countries, FAO, Trends in World Demand For Jute Manufactures and World Trade and Consumption of Jute Goods, 1968-1972, Reprints from Monthly Bulletin of Agricultural Economics and Statistics, 1960, 1961 and 1972 and FAO Commodity Review and Outlook, various issues.

NI = Index of national income in 1959-60 prices (1960=100). Source: United Nations, Yearbook of National Accounts Statistics and Statistical Yearbooks different years, International Monetary Fund, International Financial Statistics, various issues.

PJM = Domestic price of jute manufactures per metric ton (in units of domestic currencies). The price of the single composite commodity 'jute manufactures' was calculated from the two main components -- hessian and sacking - with weights proportional to the consumption (production in case of production equations) of the two components in each year for the respective countries. Source: BD and IN: The Jute Season, op. cit. and Bangladesh Jute Mills Association, op. cit., Indian Jute Mills Association, op. cit. These were converted from price per yard to price per metric ton for hessian and from 100 bags to metric ton for sacking using standard conversion factors. For details see FAO, Commodity Bulletin 46, p. 53. The prices were deflated by the consumer price indexes of respective countries.

SJM = Stocks of jute manufactures (in thousand metric tons) carried over to the next period. Source: BD and IN; Bangladesh Jute Industries Corporation, op. cit., and Indian Jute Mills Association, op. cit., and Industrial Fibers, op. cit., various issues.

PRODJM = Production of jute manufactures in thousands of metric tons. The figures include all the different kinds of products manufactured by the jute mills, e.g., hessian, sacking, carpet-backing, etc. Source: Industrial Fibers, op. cit., FAO Commodity Review and Outlook, op. cit., and sources mentioned in CONJM.

CONJS = Total consumption of jute manufactures and synthetic substitutes in thousands of metric tons. Consumption figures for the synthetics were arrived from the total consumption of the PP resin in these countries that are included in the 'fibre' category. In cases where no definite breakdown was found, estimates by the sources were used. Next, in order to make jute manufactures and synthetics comparable in terms of weight, the synthetic figures were multiplied by a conversion factor of 2.0115 to transform them into units of 'jute equivalence'. For such other concepts e.g. 'cotton equivalence' see Industrial Fibres, op. cit. Source: European Chemical News (weekly, London, various issues; Chemical Age (weekly), London, various issues; FAO, Commodity Bulletin 46, 1968; UN, Yearbook of Industrial Statistics, various years, IBRD, Bank Staff Working Pap-per No. 171, 1974; McGraw-Hills, Modern Plastics (monthly), New York, various issues; British Plastics and Rubber, (monthly) London, various issues.

PJS = Composite price of jute manufactures and synthetic substitutes in US dollars per metric ton. The prices were arrived by a weighted average of the prices of jute manufactures and synthetic substitutes with the shares of jute manufactures and synthetic substitutes in consumption used as the respective weights for each country. In the absence of data on prices of each country, the 'world' prices of both the commodities were used. For data sources, see PJMW and PSSW.

CONSS = Total consumption of synthetic substitutes in jute end-uses. Data source: same as in CONJS.

PJMW = World price of jute manufactures (in US dollars per metric ton). The price in the London market has been taken as the world price and this was arrived at by taking a weighted average of the prices of hessian, and sacking with weights proportional to the share of these two products in the market for each year. The price was deflated accordingly as in PRJW. Source: Industrial Fibres, op. cit., different issues, Indian Jute Mills Association, Annual Summary of Jute and Gunny Statistics, various years.

PSSW = World price of synthetic substitutes in US dollars per metric ton. The list price of PP polymer in the United States has been taken as the world price. The price was adjusted by the factor, as defined in CONJS, for comparison with jute manufactures and deflated by the consumer price index in the US. Source: FAO, Commodity Bulletin No. 46, op. cit.; Modern Plastics, op. cit., different issues; IBRD, Bank Staff Working Paper No. 171, op. cit.; IMF, International Financial Statistics, various years.

WSRJ = Total stocks of raw jute in the world which is the sum of raw jute stocks held in Bangdesh, India and Thailand.

WCRJ = Total consumption of raw jute in the world. This is the sum of world consumption of jute manufactures multiplied by a conversion factor of 1.07.

KOREA = A dummy variable used in the price equations for Korean War with a value of one for 1950-1952 and with a value of zero in the other years.

EXDT = Export duty levied by the major producing countries on raw jute and jute manufactures (expressed in units of US dollars per metric ton). Source: Industrial Fibres, op. cit., various years; Government of Bangladesh, Quarterly Summary of Jute Goods Statistics, various issues, Indian Jute Mills Association, Annual Summary of Jute and Gunny Statistics, various years.

FR = Freight charges (in US dollars per metric ton) on the transportation of raw jute and jute manufactures from the major producing countries to port in England. Source: UNCTAD, The Maritime Transportation of Jute, 1971; Government of Bangladesh, The Jute Season, various issues; Industrial Fibres, various years.

ER = Exchange rate (expressed in units of domestic currency per US dollar). Source: IMF, International Financial Statistics, various years.

NEXRJ = Net exports of raw jute (in units of thousands of metric tons). Source: Industrial Fibres, op. cit., FAO Commodity Review and Outlook, op. cit.

TDURJ = Total domestic uses of raw jute in thousands of metric tons. Source: same as RJUJM.

OTHURJ = Other uses of raw jute in thousands of metric tons. This allows for village consumption in Bangladesh and India. Source: Industrial Fibres, op. cit., The Jute Season, op. cit., and Annual Summary of Jute and Gunny Statistics, op. cit., various issues.

NEXJM = Net exports of jute manufactures in thousand metric tons. Source: Same as NEXRJ.

WCJM = World consumption of jute manufactures in thousand metric tons. Source: as stated in CONJM.

PRODJMW = Total world production of jute manufactures in thousand metric tons. Source: as in PRODJM.

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