MACROECONOMETRIC MODELS FOR DEVELOPING COUNTRIES: A CASE STUDY OF BANGLADESH

by

Baker Ahmed Siddiquee

A thesis
presented to the University of Manitoba
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Economics

Winnipeg, Manitoba

ISBN 0-315-47900-0

MACROECONOMETRIC MODELS FOR DEVELOPING COUNTRIES:

A CASE STUDY OF BANGLADESH

BY

BAKER AHMED SIDDIQUEE

A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

I hereby declare that I am the sole author of this thesis.

I authorize the University of Manitoba to lend this thesis to other institutions or individuals for the purpose of scholarly research.

Baker Ahmed Siddiquee

I further authorize the University of Manitoba to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

Baker Ahmed Siddiquee

The University of Manitoba requires the signatures of all persons using or photocopying this thesis. Please sign below, and give address and date.

ABSTRACT

The major objectives of this thesis are to develop a macroeconomic model for the Bangladesh economy which captures all the major linkages among various sectors of the economy, to collect, measure, and estimate all the necessary data required for the estimation of the structural model from both published and unpublished sources, to present the estimated structural model, and finally to conduct multiplier analysis based on macroeconomic policy and exogenous shock simulations. The time period for the study is 1959/60 to 1982/83. Three major elements of the model are: its emphasis on supply side; the endogenous fiscal operations affecting both monetary and real sectors; and the endogenous linkages of the monetary sector with the domestic and international factors. The complete estimated model used for macroeconomic simulations contains 93 endogenous variables of which 43 are stochastic and 70 exogenous variables. A large number of simulations were conducted with the model to investigate model-response to macroeconomic policy changes and exogenous shocks.

The multiplier analyses demonstrate substantial endogenous responses in fiscal and monetary sector agents' behavior. In general, the time pattern of the responses vary

considerably across variables. Generally, the size of the multipliers are relatively small. Supply inelasticities, institutional rigidities, structural bottlenecks, etc. are quite powerful in cutting off or dwarfing the various channels of operation of multipliers in the country.

The simulation exercises also demonstrate the importance of building consistent macroeconomic models and question the value of various highly aggregative macroeconomic models. Endogenous fiscal, monetary, and private sector agents' responses, and various feedback effects and disequilibrium adjustment lags and induced changes in sectoral compositions, all produce results in many cases quite different from the predictions of the conventional IS-LM textbook macroeconomic models.

ACKNOWLEDGEMENTS

My thanks are particularly due to my adviser Professor Norman E. Cameron for his constant encouragement, assistance, and unfailing friendship. I also wish to acknowledge my indebtedness to Professors Henry Rempel, Wayne Simpson, and Louise Arthur--members of my dissertation committee who have read through and commented upon the first draft, either in whole or in part. I am also deeply indebted to Professor James Dean for his continuous support and encouragement during my long journey of completion of this project.

My personal debt to my elder brother Ferdous A. Quarishi for it was he who encouraged me to study economics during my uncertain first year at college. Special thanks and appreciation are due to M. Sayeduz-Zaman who provided me with much of the data I needed from both the World Bank and the Bangladesh Government sources. Also, I owe a great deal to my younger brother Iqbal A. Siddiquee for his time and efforts in collecting data for this study from various sources in Bangladesh.

I wish to acknowledge the financial support and almost unlimited computer facilities from the University of Manitoba which enabled me to undertake such a large computational project. My deep appreciations are also due to all the secretarial staffs in Economics at the University of Manitoba for their continuous support. Finally, a personal note of indebtedness to my friends and relatives in Winnipeg and elsewhere who have helped me financially and emotionally during my difficult times in Winnipeg.

Over the years I have benefited in sharpening my ideas concerning the Bangladesh economy from discussions and debates with my friends and colleagues at the University of Manitoba. I am indebted to all of them. I also, express my great appreciation to the local Bangladeshi community for their hospitality.

My final debt of gratitude is to my family. My parents have been very kind and patient over such a long time of separation from them. My four wonderful children, Nawshaba, Nabilah, Imran and Yusuf have been very tolerant of the absences and preoccupations that authorship seems to involve. My friend and wife, Nazmun, has been all these things as well as a willing partner in my research activities. She has been sympathetic and supportive throughout the endeavour, and without her I doubt that it would have been completed.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION

> Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. The object of a model is to segregate the semi- permanent or relatively constant factors from those which are transitory or fluctuating so as to develop a logical way of thinking about the latter, and of understanding the time sequences to which they give rise in particular case.
>
> --John Maynard Keynes(1938)

1.1 PERSPECTIVE ON ECONOMETRIC MODELING IN DEVELOPING COUNTRIES

It is now well recognized that the macroeconomic theories in the post-Keynesian developed world have reached the point at which they are thought to be fit for application in the form of macroeconometric modelling and for policy analysis.[1] For the developing countries the consensus on this is far from clear. However, in 1965 Lawrence R. Klein, in an important paper,[2] came to the conclusion that parts of the models of the developed countries could be carried over in

[1] Although Keynes initially expressed his disapproval of Tinbergen's econometric applications, later he changed his mind and wrote in 1944: "Theoretical economic analysis has now reached the point where it is fit to be applied. Its application only awaits the collection of the detailed facts..."(Keynes, vol.xxvii, p371-2). Furthermore, he foresaw a new era of 'Joy through statistics' as the policy came into operation. See Stone(1978) and Patinkin(1978) for more on the debate.

[2] Klein(1965). See also Behrman and Klein(1970).

modelling developing countries, but for the rest, a substantial modification and extensions may be necessary to make the model consistent and useful, in particular, according to Klein and others, the supply side must be given much greater emphasis in the models for developing countries. Recent trends in econometric model building, both in developed and developing countries, involve a substantial extension of the standard macroeconomic model; the models are more dynamic, incorporating both medium to long-run growth aspects and the short-run cyclical features, they will most certainly incorporate fiscal and monetary sectors and the country specific institutional features explicitly into account, and finally their level of disaggregation and details would be such as to permit an evaluation of the trade-offs which are of special relevance to respective countries.

For the developing countries, the major developmental objectives are medium to long-term ones. The main focus of economic policy, usually carried out by the Ministry of Planning, is on real variables such as the growth and structure of production, employment, and investment. The attainment of desired goals in these areas is expected to take time, and in order to move purposefully toward them, a long-run "development strategy" is formulated. As such the greater emphasis on long-run planning is understandable. To this end traditional planning models, in particular, Harrod-Domar growth models, 'two-gap' models, input- output models, and in recent years computable multi-sectoral general equilibrium models are built for consistency checks and growth projections.

Despite the overwhelming emphasis on planning models, it is a fact that development policy must also address the issues of short-term macroeconomic management. In fact, the day-to-day policy is dominated by short-run considerations and needs, which are usually placed under the broad heading of 'stabilization policy'. Concern is focused largely on various nominal flow-of-funds balances in the economy, in particular, the balance of payments, the government accounts, and the savings-investment balance. Usually, the Ministry of Finance is responsible to set out these policies. For developing countries the disturbances coming from, for example, fluctuations in crop yields and in world market conditions, are well known. Economic agents including governments, therefore, are continually confronted with the necessity to adjust to these short-run disturbances. Hence the need for a systematic and comprehensive study of the structure of the economy which will help improve the understanding of how the day-to-day economy works as well as provide useful guidance for sound macro policy. Recognizing the need for short-term macroeconometric modelling in 1965 Jan Tinbergen wrote, in the preface[3] to one of the early macroeconometric models for a developing country, "For such short-run planning purposes economic models are useful, dif-

[3] Islam(1965).

fering in nature from long-run growth models".[4] Similarly, in a recent paper, Stanley Fischer(1986) suggests that the analysis of macroeconomic adjustments in principle "requires a fully articulated model of the economy. Furthermore, "(E)conometric models provide useful consistency tests of policy packages". Therefore, Fischer writes, "It would be useful to work toward the creation of structural models...for developing countries".

Model building is not an easy task. It is more difficult for the developing countries, given the severe data limitations and also our poor understanding of the behavioral responses and the structure of these economies. However these difficulties should not deter one from model building, since, as Fischer observes "...models are useful precisely because they force the analyst to set out the structure of the economy and to focus on the relationship that determine the outcome of the policy changes". Furthermore, "(T)he alternative of forsaking models altogether and relying on general principles to guide advice giving and policy evaluation is not feasible: policy cannot be evaluated without

---

[4] On the 'uses' and possible 'abuses' of macroeconometric modelling in general, see Brunner, et al ed.(1972), Vernon(1966), Samualson(1975), Okun(1975), Taylor(1975, 1979a), and Tinbergen(1981). Taylor(1979) is an excellent survey of macroeconomic modelling methodology and estimation procedures for developing countries. The pioneering work on the subject of macroeconometric modelling for developing countries is Klien(1965). On the 'uses' and possible 'abuses' of modelling particularly in developing countries, see Vernon(1966), Conrad(1968), Shourie(1972), Taylor(1979a), and Vernardakis(1979, chap 1 and 2). For a bibliography of econometric studies on developing countries prior to mid-seventies, see Klein, et al(1975).

counter-factuals, and counter-factuals require the use of either an explicit or an implicit model"(p163-182).

The analytical framework on which policy analysis is based is that of macroeconomic models in the 'Keynesian' and/or 'monetarist' traditions, and in recent years some in the 'structuralist' tradition. The typical macro-analytical model and its econometric counterpart would include all major macroeconomic variables such as the components of aggregate demand, government revenues and expenditures, the money supply, the volume of bank credits, interest rates, wages and prices, output, and the exchange rate.[5] The national income and product account provide both the data base and the underlying conceptual framework for policy analysis at the macroeconomic level. Macro policies at the Ministry of Finance level are undertaken mostly on an ad hoc basis without formal modelling of trade-offs and policy implications. With the availability of more data, development of new economic and econometric theories and tools, and the progress in computer technology this ad-hockery and informalism seems unnecessary and inefficient. Macroeconometric models can provide a clear understanding of the

[5] Nerlove(1966) provides one of the early surveys of macroeconometric models for developed countries, followed by Fromm and Klein(1973), Nerlove(1974), and Waelbroeck(1973) for the United States models, the United Kingdom models, and for selected other country-models, respectively. Also, see Shapiro and Halabuk(1976) for a survey of assorted country-models. No general survey on developing country-models is available. For a survey of some Indian macroeconomic models, see Desai(1974)and Pani(1977), and for models on East Asian countries, see Ichimura and Ezaki, eds.(1985)

structure of the economy, and furthermore, can be used as effective tools for short-term policy analysis(Rao,1987).

Needless to say that beyond the role of effective tools in the hands of finance ministry, macroeconometric models are in many respect complementary to long-run planning models. It could be argued that the emergence of planning models has actually enhanced, if not necessitated, the parallel construction of short and medium term econometric models. Usually a planning model is concerned with the use of mobilized resources to attain the 'desired' long-run targets. The question of, for example, how to mobilize these required resources is not directly addressed. In this respect a macroeconometric model could shed important insights about the working of the system and its potential and may help to identify the appropriate policies necessary to mobilize required resources consistent with the long-run development strategies.

It is often the case that short-run stabilization problems will have a lasting impact on a country's development strategy and on the pace and structure of growth in the medium term(Dervis, et al, 1982). If the short-run macroeconomic relationships are not adequately understood, and if the short-run policies are not properly integrated into the long-run development strategy, the attainment of the latter objectives would most likely be seriously affected.

1.2 OBJECTIVES, METHODOLOGY, AND MOTIVATION OF THE STUDY

The major objectives of this study are as follows: (i) to formulate a short-run, disaggregated, dynamic macroeconometric model for the Bangladesh economy, flexible and detailed enough to accommodate various aspects of the reality of the developing country but which also remains close to economic theoretic propositions, (ii) to collect, organize, and develop a consistent economic time-series of the Bangladesh economy necessary for the present study, mainly from available published sources, (iii) to estimate the structural model using suitable econometric techniques, and (iv) to conduct structural analyses and macroeconomic policy simulation experiments with the solved full model of the economy, with a view to examine the possible consequences of various alternative fiscal, monetary, and balance-of-payment policies.

The primary objective of the study is to develop and subsequently estimate a structural model for Bangladesh economy in terms of a system of equations relating to the various sectors of the economy which will provide a useful analytical framework for studying the behaviour of key macroeconomic variables such as output, prices, money, and the balance of payments of the country. The model is specifically designed to be an effective aid in understanding and appraising the observed developments of the economy, in particular, the growth of sectoral outputs, aggregate income, changes in balance of payments, international reserves, bank credits, money supply, prices and wages. The model will also provide guidelines for formulating reasonable short-run policies for stabilizing macro variables such as income, prices and international reserves. Finally, the model could also be seen as a useful aid in developing consistency between short-run macro policies and the long-run development strategy of the country.

The methodology followed here in developing the model is as follows: First, a great deal of effort was made to specify individual behavioral relationships based on economic theory. Secondly, aggregate accounting identities and various economic agents' budget constraints are explicitly incorporated and the postulated behavioral relationships are made compatible whenever possible with these budget constraints.

In many cases lack of data and resource costs, however, restricted from engaging in detailed search for the 'true' structural specifications. The initial specifications for some of the endogenous variables in the model are, as one would expect, also influenced by other existing econometric studies on developing countries. Since economic theory is not helpful in the choice of a 'true' model from a set of alternatives, 'experimentation' with alternative specifications were conducted to get a firm hold on 'reality'. This search for valid hypotheses and the testing of hypotheses are particularly difficult in developing countries like Bangladesh for which very few empirically tested propositions are available and as a result the choice set is very large. Standard statistical tests and criteria were applied to select the final equation to be included in the full-model. To determine the reliability and stability of the model, historical simulations (validations) and sensitivity analyses are conducted.

The present study on Bangladesh is motivated by many factors.[6] The econometric models constructed so far on Bangladesh have emphasized either a particular sector of the economy or followed a particular model built for the developed economies.[7] Furthermore, these models are structured in a way to answer only specific questions and cannot serve to answer many important questions regarding the structure of the economy and policy effectiveness typically raised by economists and policy planners in Bangladesh.

The present study provides for the first time a general and consistent framework reflecting both economic theory and the structural features of the country to analyze the key macroeconomic variables of Bangladesh. The model is dynamic

---

[6] It will be apparent that the answer to this to some extent dictates the modelling strategy adopted in this study.

[7] A critical assessment of the traditional economic models, particularly of the Keynesian models, from the developing country perspectives can be found in Rao(1952), Reddaway(1963), Bottomley(1965), Hasan(1971), Myint(1971) and Seers(1967). For a favourable view on the relevance of Keynesian economics in developing countries see Raj(1979), Chakravarty(1979), and Singer(1985).

and sufficiently disaggregated, with almost all the major macroeconomic linkages, accounting identities and budget constraints, and as such it can be used for analyzing most fiscal, monetary, and balance of payments policy issues of the country within a single framework.

Secondly, the Bangladesh experience itself is of considerable importance because it possesses the usual characteristics of a typical under-developed country and because it has included a wide range of macroeconomic policy objectives and tools under government with substantially varying political and economic philosophies. In general, understanding of the structures of developing countries is very limited and fragmentary. In addition to data inadequacies, studies are often based, perhaps quite inappropriately, on the transplantation of assumptions about functional forms and parameter values from developed to developing countries or from one developing countries to another. The present study, in addition to providing a better understanding of the working of Bangladesh economy, may also provide helpful insights for modelling other similar developing countries.

Thirdly, for developing countries including Bangladesh, macroeconomic policy framework is usually guided by the traditional Harrod-Domer aggregate growth models, Lewis-Fei-Ranis labour surplus models, Leontief fixed-coefficient input-output models, linear-programming models and Chenary 'two-gap' models.[8] These models usually include real phenomena and impose various _a priori_ assumptions and ignore certain macroeconomic constraints, leaving no scope for testing those assumptions or for analyzing the implications of the omitted constraints. The present study includes many of these assumptions directly as testable propositions, and builds in all the macroeconomic constraints and accounting identities so that it would be possible to develop, what Stephen J. Turnovsky(1977) called, a "logically consistent macroeconomic model" of the country. Such a model can also be used to analyze short-run stabilization policy issues, which have become an important policy concerns in most developing countries, particularly in the wake of recent bouts of high and variable inflation world-wide. The traditional planning models simply ignore most of these short-run policy concerns, and in fact, they are not built to address these questions. As such, recent years have witnessed a great surge in macroeconomic modelling for developing countries, mostly in the tradition of Keynesian income-determination models, all too often, however, the structure of these models has been transplanted from aggregate demand models of developed countries, with little or no adjustment for the behavioral patterns of economic agents, constraints, and structural features typical to the developing countries. The necessity to incorporate these structural features, con-

[8] For a survey of the state of art regarding the use of these economy-wide models for developing countries, see Blitzer, et al, ed.(1975).

straints and behavioral patterns into the model is a basic precondition for a 'logically consistent macroeconomic model' of Bangladesh.

1.3 ORGANIZATION OF THE STUDY

This is an econometric study of the economic structure and of the impact of macroeconomic policies in Bangladesh during the period of 1959/60 - 1982/83. Chapter two begins with a general introduction to economic performance and macroeconomic policy regimes in Bangladesh during the sample period, followed by a critical survey of some of the existing econometric studies on the economy.

Chapter three sets out the theoretical macroeconomic model for Bangladesh, and Chapter four presents the estimated structural equations with a critical assessment of the parameter estimates and their partial equilibrium implications. On the basis of both economic theoretic and statistical considerations, the preferred estimated equation for each structural relationship is identified. These preferred estimated functions are than combined with identities, constraints, and equilibrium conditions to form the complete-system model for the economy. Historical simulation or validation of the complete model is undertaken in Chapter five followed by some experiments with macroeconomic policy and exogenous shock simulations for the country. Finally, Chapter six provides a brief summary of the major findings of the dissertation and makes some concluding comments regarding the strengths and weaknesses of the present study, suggesting future directions for research on the topic.

Chapter II

BANGLADESH ECONOMY: A SURVEY

> With careful attention paid to local institutional peculiarities, to differences in behavioral characteristics, and to differences in economic structure, we can probably piece together useful models of developing countries.
>
> Lawrence R. Klein(1965, p324)

2.1 INTRODUCTION

This chapter begins with an overview of the Bangladesh economy, highlighting the behavior of macroeconomic variables during the sample period: 1959/60 to 1982/83. As such it is not intended to provide an overall description or detail study of the performance of the economy,[9] rather to give a brief summery view of the economy in terms of the major macroeconomic variables that form the core of the structural model for Bangladesh developed in the following chapter.

Another objective of this section is to provide a survey of selected major econometric studies on Bangladesh. Seven such studies are surveyed in some detail, while a few additional works are briefly dealt with. The main idea is to bring out the salient features of these models as well as to identify their strengths and shortcomings.

---

[9] For a general introduction to Bangladesh economy and various problems facing the nation, see Khan(1972, 1976), Robinson and Griffin, eds.(1974) and Islam(1976).

2.2 BASIC FEATURES AND ECONOMIC PERFORMANCE: 1960-1983

2.2.1 Bangladesh

Bangladesh emerged as an independent country on December 16, 1971, after a nine-month liberation war with the Pakistan army. Until 1971 it was the eastern province of Pakistan known as East Pakistan, separated from the western wing by a thousand miles of alien territory. Pakistan was created out of British India in 1947. During the twenty-five years of political, economic, and military domination of the East by the West, East Pakistan's development potential was grossly neglected and unexploited. East Pakistan became virtually a colony of the Western wing. Massive transfer of real resources occurred throughout the period from the relatively disadvantageous region of East to the prosperous West, despite the fact that East had relatively higher savings rate, larger foreign exchange earnings, and over fifty-four percent of the country's population.

According to one conservative estimate,[10] about "four to five percent of East Pakistan's income has been transfered annually to West Pakistan" (Haq 1963; p102) during the decade of the fifties. In the following decade the magnitude of transfer was less but still, according to another conservative estimate, a hefty 2.9 percent of the East's regional income(Islam 1983; p253). The twenty-five years of plunder of East's economy culminated in total transfer of resources

[10] Mahbub ul Haq, who was also one of the masterminds of this skillful transfer of resources.

for the entire period between a conservative estimate of sixteen billion rupees[11] (Islam 1983; p253) to as high as thirty billion rupees(Planning Commission, Government of Pakistan; 1970). The mechanism and devices through which such a massive transfer of real resources was accomplished were often subtle and skillfully concealed under the cloak of central government finances and policies. Among these devices two are worth noting here. First, the allocation of almost all the foreign aid and assistance to the West only.[12] Secondly, deliberate maintenance of an exchange control system through quantitative restrictions, tariffs, import licensing and an over-valued exchange rate which were significantly in favour of the West's economy and it's traders and entrepreneurs but were highly costly for the less industrialized major export earner East.[13] East's economy remained stagnant while West became industrialized, in addition, due to policies such as allocation of disproportionately large share of public investment funds[14] as well as

---

[11] The offical nominal exchange rate for rupee vis-a-vis the United States dollar had been fixed at 4.76 rupees per dollar through out the fifties and sixties.

[12] According to one estimate (Sobhan 1981), till 1960/61 West Pakistan utilized one-hundred percent of all external resource inflows of Pakistan government and between 1961/62 and 1968/69, East received only eleven percent of these inflows.

[13] See Grifith and Khan(1972) and Islam(1983) for details on the magnitude of transfer and the methods through which it occured.

[14] East's share of development expenditures until 1965/66 did not exceed thirty percent of the total. During the fifties the share was twenty percent only(Islam 1983; p243).

government revenue expenditures to the western wing and the provision of a larger share of finance capital to the West Pakistani factories and businesses.

The three successive five-year plans[15] under a 'united' Pakistan did very little to pull the East's economy out of stagnation or to reduce the growing regional disparities between the two wings. Rather the regional disparities widened significantly over the years; West's per capita income was only seventeen percent higher than the East in 1949/50 while at the end of 1969/70 the gap rose to sixty percent, according to one conservative estimate(Islam 1983; p236). The disadvantageous region not only stagnated in terms of growth of income, output, and employment, it also suffered in terms of overall developmental drive and confidence due to prolonged and often bitter political battle between the two wings and the military repression of the West over the East. The long twenty-five years of economic plunder, political deprivation, and military repression finally gave rise to Bengali nationalism to fight back for independence when in March 1971 the West Pakistan army began an all-out attack on civilians in the East to crush Bengali aspiration for economic and political justice.

The post-independence Bangladesh faced the enormous task of rebuilding the war damaged economy. At the same time it also witnessed a massive nationalization of all banks and

[15] Plan years: 1955-60, 1960-65, and 1965-70.

insurance companies, a large portion of the industrial sector including all jute and cotton textiles industries and the major parts of the foreign trade sector. Despite this initial surge in nationalistic zeal and the proclamation of a vague and ill-defined notion of 'socialism' as one of the state principles in the country's First Five-year Plan(1973-78), the country as a whole remained a mixed economy with the private sector dominating the agriculture, small and cottage industries, and the domestic trading sectors.

The First Five-year Plan is a failure by most indicators, despite a massive influx of foreign assistance. The period was also marked by internal chaos, corruption, a famine(1974), widespread political unrest and breakdown of law and order and by overall economic uncertainties about the future of the country. The second half of the seventies began with a major change in political power structure. The Two-year Plan(1978-80) was designed to 'catch-up' with the unfulfilled expectations of the First Five-year Plan and to give a breathing space before launching the Second Five-year Plan(1980-85). Due to the poor performance of the nationalized sector, the change of political regime, and due to a growing international pressure, the subsequent military governments in Bangladesh gradually began to undertake the policy of denationalization of industries and other enterprises. Mounting domestic resource constraints and international pressure also forced the subsequent governments to resort to greater use of market forces and less government subsidies and control, and to relax the controls over foreign trade and payments. Nothing spectacular, however, was achieved as a result. For many, in the midst of political instability, and with the country under the control of military-bureaucratic-elite alliance, whose interest is served most by maintaining the status-quo, the country may have to remain in the vicious circle of poverty for a long time to come.

Today Bangladesh remains near the bottom of the list of low income countries of the world. Economic stagnation, structural bottlenecks, mass poverty, widespread unemployment and underemployment, high and variable inflation rates, large and continuous balance of payments deficits, chronic food deficit and threat of famine, large population, continuous drainage of the country's resources into conspicuous consumption, the flight of capital by the rent seeking previllaged classes under the umbrella of the ruling military-bureaucratic-elite alliance, and the inability to mobilize sufficient domestic resources for development and to reduce dependence on foreign aid are the major problems facing the country. In the following sub-sections the basic data on the structure of the Bangladesh economy are presented to highlight the magnitudes of some of the basic economic problems and the performance of the economy over the sample period.

2.2.2 The Structure of Output:

The sectoral contributions to gross domestic product(GDP) for selected years are presented in Table 2.1. Several notable features can be identified here. First, overall the structure of sectoral contributions did not change much over the sample period. Second, agriculture dominates the scene throughout the period contributing close to half of the gross domestic product at the end of the sample period. Third, the share of agriculture has been declining, that of industry has gained slightly, but the bulk of gain occured in the services sector.

Table 2.1
Sectoral Contributions to GDP in Bangladesh
for Selected Years

Sectors	1959/60	1969/70	1972/73	1979/80	1982/83
		(Percentage of total)			
Agriculture	69.43	61.4	57.86	49.01	48.26
Industry					
Manufacturing	6.38	8.3	6.42	10.05	9.69
Construction	2.03	4.6	3.39	3.67	3.73
Infrastructure*	4.31	4.8	7.75	7.18	7.3
Trade & Banking+	8.06	8.0	9.73	16.76	16.74
Housing	5.35	4.4	5.44	4.56	4.44
Other Services**	4.44	8.5	9.42	8.78	9.83
GDP,mill taka#	33,212	51,260	45,112	69,199	76,287

Note: * includes utilities and transportations; + includes insurance; ** including public administration and defense; and # Millions of constant taka(1972/73=100), where the exchange rate for domestic currency vis-a-vis the United States dollar was 23.76 taka per dollar in 1982/83.
Source: See DATA appendix.

Within the agricultural sector rice and jute are the two major crops--close to ninety percent of the cultivable land area being devoted to these two crops alone. Only in recent years has wheat production gained some momentum. In general, considerable substitution has occured between rice and jute lands over the years in response to variations in relative profitability signals. The 'other' agricultural commodities contribution remained more or less stagnant. Although the total acreage planted has increased from 26.48 million in 1959/60 to 32.7 million acreages in 1982/83--over twenty three percent increase--, the acreage growth was mainly concentrated in the food-grains sector only, from 21.29 million to 27.44 million acreages--about thirty percent increase(see Table 2.2). The annual trend growth rate of food-acreage was little over one percent for the entire sample period, while no trend was noticeable in jute acreage. It has already been mentioned in the previous section East Pakistan's economy, particularly the agricultural sector was highly neglected under Pakistani rule. This is much more evident in the performance of the crop yield statistics, where input availability, agricultural investment, and bank credits play an important role. The agricultural credit in real terms do not show any growth during this period compared to close to twenty-seven percent trend growth of real bank credits to non-agriculture over the same period, which in regional terms favoured the West most since a significant part of the East's non-agricultural activities were owned or controlled directly by the firms in the West. Yields of food-grains stagnated, while a negative trend in jute yields growth had occurred during the period. Significant improvements were made, however, in both yield statistics during the post-independence period as indicated by over two percent trend rate of growth. The agricultural credit situation vis-a-vis non-agriculture has reversed during the post-war period(see table 2.8).

Table 2.2
Characteristics of Agricultural Output in Bangladesh: 1959/60 to 1982/83

Variables Unit	Simple Mean: 1960-83	S.D.	Growth Rate** 60-83	60-70	72-83
Acreage					
Food, mill acres	24.33	1.92	1.17	1.86	1.25
Jute, ,,	1.83	.36	-0.01*	5.07	-2.4*
All, ,,	30.23	1.93			
Yields					
Food, maund/acre#	12.78	1.19	1.24	0.01*	2.27
Jute, ,,	15.3	1.78	-0.006	-3.74	2.17
Production					
Jute, mill maunds	27.69	4.68	-1.2	1.3*	-0.2*
Food, mill tons	11.49	1.91	2.42	2.67	3.48
Food-grains import ,,	1.31	0.66			
Fertilizer, 000 tons	380.7	313			
Bank Credits, Agri.+	886	1,018	14.6	2.7*	20.61
Other Agri. Output+	10,032	1,305	1.4	4.06	2.98
All Agri. Output+	29,923	3,963	1.95	3.11	3.18

Note: S.D. Standard deviation; * Coefficient is statistically insignificant at the five percent level; ** Annual percentage trend rate of growth; + millions of constant taka with base year 1972/73=100; # 27.22 maunds = 1 ton.
Source: See Data Appendix.

As such significant real growth in food-grains output(3.5 percent compared to 2.7 percent) is being observed during the post independence period, which helped to register a growth rate of 3.1 percent in overall agricultural value-added during the same period despite the negative growth in jute output and the fall in growth rate of all 'other' agricultural output. It should be noted here that much of the growth during the pre-war period came from acreage expansion, while post-war growth resulted mainly from yield improvements. The impressive growth in food-grains production, particularly, during the post-independence period--over half a percentage point above the average annual rate of growth of population--, however, was not sufficient to meet up the country's growing demand, nor was the rate sufficient to narrow the food-gap over the sample period. The average food-gap in relation to total supply was 10.26 percent for the entire sample period and 10.51 percent at the end of the sample period(1982/83).

The growth rate of manufacturing sector was rapid at the beginning of the sample period largely due to the small initial base, but the rate subsequently tapered off. The post-independence period witnessed an impressive close to nine percent growth in manufacturing output compared to about seven percent during the pre-independence period. A large part of this post-independence growth, once again was due to initial rapid recovery of output by improving the war-damaged industrial capacity and later increase in productivity(see Table 2.3). A large part of the manufacturing sector in Bangladesh is jute manufacturing, and is almost entirely produced for the export market. In general, within the manufacturing sector whatever structural changes occurred is mainly in the direction of agriculturally based industries. The intermediate products manufacturing constitutes less than ten percent and the engineering industries a mere six percent of the total value added.

Table 2.3
Characteristics of Non-Agricultural Sectors in Bangladesh: 1960-83(millions of constant taka, 1972/73=100)

Variables	Simple Mean: 1960-83	S.D.	Mean % of GDP	Growth Rate** 60-83	60-70	72-83
Industry output						
Manufacturing	4,740	1,812	9.0	5.84	6.84	8.78
Capacity Utiliz.#	0.870	0.158		0.7*	0.8*	5.27
Productivity 000 taka/worker	19.961	2.497		0.3*	1.2*	3.39
Construction	1,738	747	3.3	7.72	19.1	6.48
Infrastructure	3,200	1,404	6.1	7.24	5.48	4.97
Services output				6.91	5.91	7.48
Trade and Banking	6,513	3,479	12.4	8.31	4.69	10.84
Housing	2,425	519	4.6	3.19	2.41	4.93
Other Services	4,524	1,528	8.6	5.31	5.96	6.41
Non-Agricultural GDP/ total GDP+	0.415	.072		2.72	2.46	2.21
GDP	52,661	13,240	100	3.86	4.44	5.25
GDP per capita++	724	60		1.06	1.71	2.85

Note: S.D. is Standard deviation; * coefficient statistically not significant at five percent level;# percent; + real number; ** Annual percentage trend rate of growth; ++ Constant taka per person(1972/73=100).
Source: See DATA appendix.

Other sectoral production performances show considerable variations and variable rates of successes during the sample period, and between the pre-and post-liberation Bangladesh. All the sectors except construction and infrastructure have recorded above average mean percentage growth rate during the post-independence period. Among these sectors, both housing and trade, banking and insurance sectors have more than doubled the rate of growth of output. Despite the impressive post-war growth of manufacturing and services outputs, the total output(GDP) grew only at the rate of five-and-a quarter of a percent mainly due to relatively poor performance of the key sector--agriculture. The relatively poor performance of the construction and the housing sector is an indication of both low levels of economic activities and household real income.

2.2.3 The Structure of Demand:

The major characteristics of aggregate demand variables for Bangladesh are summarized in table 2.4. During the sample period aggregate real consumption expenditures averaged close to ninety-three percent of gross national product. Although aggregate consumption kept pace with the rate of growth of national income, public consumption demand grew at a much faster rate both during and after the independence. It will be seen later that this was possible mainly due to much higher growth of public revenues during the periods and in particular due to higher inflow of foreign funds during the post-war periods. Per capita private consumption, however grew at less than one percent rate. Aggregate real investment averaged around twelve percent of domestic output during the sample period, and was around sixteen percent at the end of the sample period. Bulk of both the level and growth of investment have occured in the public sector. The neglect of agriculture during the Pakistan period is evident from the absence of any growth in real monetized investment in the sector. In the post-war period the larger share of investment in total domestic products reflects increased mobilization of both external and domestic resources, this is particularly true for the latter part of the period. Although, the first five-year plan sought to limit the role of private sector, the subsequent plans gradually lifted various controls over private investment. As a result, a significant growth is observed in the sector during the later part of the period. Private investment in Bangladesh is largely financed by equity capital supplemented by institutional credit from specialized agencies. The activities of the latter are strengthened during the latter halves of the period as part of the policy to support and encourage private investment.

During the sample period export averaged six percent of national product, while imports averaged little over eleven percent of national product. In general export growth performance has been very poor. Raw jute and jute manufacturing together averaged close to eighty percent of total export earnings during the sample period(Table 2.5). The only major change in the structure of export items is that jute manufacturing exports have replaced raw jute exports as the leading item. At the close of the sample period exports earnings from raw jute constitute over half of total exports of goods. In recent years, both as a result of various exports promotion policies and increased international demand, the non-tradition exports sector has registered a significant growth rate of close to twelve percent annually when the total exports have been growing at the rate of less than three percent. Although, there are indications that the country has the required capacity to expand the non-traditional exports sector, the ultimate success of this sector will depend upon the international demand conditions and in particular the developed countries' willingness to give Bangladesh, a late comer in these markets, a 'fair' and continuous access to their markets. Since this is purely an uncertain area, the performance of this sector in the future cannot be judged simply based on previous or even current growth records.

Table 2.4
Characteristics of Aggregate Demand in Bangladesh: 1960-83
(Millions of Constant taka: 1972/73=100)

Variables	Simple Mean: 1960-83	S.D.	Mean % of GDP	Growth Rate** 60-83	60-70	72-83
Consumption Demand						
Private	46,044	10,856	(86.63)	3.94	4.44	4.42
per capita				1.17	1.71	2.09
Public	3,369	1,206	(6.34)	4.74	6.57	9.53
Total	49,412	11,954	92.97	4.00	4.59	4.75
Investment Demand						
Private	2,603	1,462	4.9	8.34	8.93	15.86
Agriculture	258	170	0.5	-0.8*	-2.8*	38.21
Manufacturing	446	258	0.8	-2.3*	9.2	45.76
Public	3,353	1,580	6.31		13.07	12.14
Total Manufacturing	988	433	1.86	1.2*	9.77	22.62
All Investment	6,165	2,929	11.60	6.83	11.33	12.79
Exports of Goods						
Raw Jute	1,097	366	(34.4)	-4.59	-1.4*	-2.1*
Jute Manufacturing	1,409	355	(44.2)	3.77	9.09	2.61
Other Goods	682	310	(21.4)	-2.8*	5.4*	11.69
All Exports, Goods	3,188	519	6.0	-0.7*	3.83	2.68
Imports of Goods						
Food-grains	1,211	758	(20.6)	8.47	14.73	-3.94
Other Consumr Goods	1,164	353	(19.8)	-0.8*	8.12	5.21
Raw Materials	2,029	488	(34.5)	2.58	7.37	5.62
Capital Goods	1,472	668	(25.1)	3.39	16.81	12.95
All Imports, Goods	5,875	1,572	11.05	2.8	10.78	4.40
Net Factor Services+	145	328	0.17#			
Net Private Remitt.+	1,765	3,675	2.1#			
Current Acct. Bal.+	-7,807	9,845	9.28#			
Capital Acct. Bal.+	8,045	10,309	9.57#	28.86	12.51	23.29
Disposable income	50,103	12,842		3.98	4.36	5.02
GNP	52,889	14,280		4.15	4.51	5.64
Population, millions	72.714	12.794		2.77	2.73	2.33

Note: + Variable is in nominal terms; # Mean percent of nominal GNP; ** Annual percentage trend growth rate; S.D. is Standard Deviation.
Source: See DATA appendix.

In general, the sluggish growth of total exports earnings is mainly due to low elasticity and stagnation in demand for Bangladesh exports, specially for jute and jute goods, despite the favourable exports price movements.

Table 2.5
Commodity Composition of Exports of Bangladesh
(percent)

Commodities	1959/60	1969/70	1982/83	Average 1960-83
Raw Jute	47.72	29.19	23.96	34.41
Jute Manufacturing	22.87	39.35	50.75	44.19
All Other Goods	29.41	31.45	25.29	21.40

Source: See DATA appendix.

The broad commodity composition of imports has not changed much over the sample period (see Table 2.6). The volume of food-grain imports is mainly determined by the domestic supply and as such fluctuates with the domestic food-grain production. It seems that the fluctuations in food-grain imports have been accommodated in most part by restricting 'other' consumer goods imports and to some extent intermediate goods imports, ceteris paribus. Although imports of food-grain show a positive and significant trend growth over the sample period, an important observation is its negative trend growth for the post-war period. This was possible due to a rapid growth of domestic production of food-grains(3.5 percent) and a positive trend growth of per capita production(1.2 percent) during the period. Another notable feature is the rapid and sustained growth of non-competitive capital goods imports, indicating increase dependence of domestic capacity creation on foreign machinery and equipment in the development programme. The moderate rate of growth of other consumer goods during the pre- and post-war periods was due to the constraints imposed by the exchange control system on rapidly rising demands for income-elastic durable and secondary goods. In case of Bangladesh the growth of intermediate goods and raw materials imports is much less than is suggested by the frequent characterization of import substitution for consumer goods leading to increased dependence on intermediate goods. However, this low growth may be due to the exchange constraint imposed by the government as indicated above.

Table 2.6
Commodity Composition of Imports of Bangladesh
(percent)

Commodities	1959/60	1969/70	1982/83	Average 1960-83
Food-grains	6.88	24.59	22.74	20.61
Other Consumer Goods	26.82	18.16	13.23	19.8
Raw Materials and Intermediate Goods	44.05	31.13	33.11	34.53
Capital Goods	22.25	26.12	30.92	25.05

Source: See DATA appendix.

The fluctuations of imports around corresponding secular trends have been considerable for some of the imports categories, particularly for other consumer goods. This to some extent indicates that the governments in Bangladesh generally succeeded in their intention to curtail 'postponeable' imports at times of foreign exchange shortages.

The trade balance was positive in most of the pre-war years but since than has continuously and rapidly moved towards record deficits during the post-war period. In

1982/83 the deficit recorded close to thirty-two billion taka, which is about fourteen percent of national product. It should be noted here that the current account deficit in the post-independence period would have been much worse had it not been for an increased flow of migrant workers' remittances from abroad, specially during the later half of the period. At present this source of foreign exchange is the second largest source, second only to jute manufacturing exports earnings. At its peak in 1982/83 total remittances were as high as six percent of national income.

Bangladesh's capital account of the balance of payments is completely dominated by foreign aids and grants. For the entire sample period the capital account balance has averaged over nine percent of national product, and at its peak in 1982/83 it recorded over thirty-two billion taka. International private capital flow is almost negligible in Bangladesh, although there are evidences of substantial capital outflows from the country through various legal and illegal channels. The balance of payments, or the change in net foreign reserves show considerable fluctuation during the sample period. During the twenty-two year time period the reserves show a decline for thirteen times. On balance the capital account shows a much higher growth rate of inflows during the post-war years.

2.2.4 The structure of Government and Financial Sector

The basic characteristics of major components of government expenditures and revenues and financial sector variables in Bangladesh over the sample period are presented in table 2.7. Total government expenditures, which averaged over sixteen percent of domestic product during the sample period are almost equally divided into current consumption and investment expenditures. Both of these expenditures have been growing at a rate faster than gross domestic product. The growth of current public consumption was, however, less than that of total government revenues in real term. The total government revenues averaged close to ten percent, while the average budget deficit for the period was close to seven percent of gross domestic product during the sample period. A substantial part--on average close to eighty percent--of public investment expenditures, which is roughly equivalent to the size of the deficit is being financed by foreign aid and grants. The aid inflow for the period averaged close to nine percent of domestic output. However, almost all of the growth in aid flows has occured during the post-independence period.

Government revenues are highly inelastic in Bangladesh as in most other developing countries. The major source of revenues has been indirect taxes. Direct taxes over the sample period have averaged only about sixteen percent of total tax revenues. Within the indirect taxes customs duties is the most dominant source, accounting for close to half of all indirect taxes. The overwhelming importance of indirect taxes in general and customs duties in particular is common to many developing countries mainly due to inefficient tax system, low income, poor tax administrative capabilities, and the resistance on the part of the ruling class to share the costs of government and overall developmental expenditures.

Table 2.7
Characteristics of Government Sector in Bangladesh:1960-83
(millions of current taka)

Variables	Simple Mean: 1960-83	S.D.	Mean % of GDP+	Growth Rate** 60-83	60-70	72-83
Total Government Expenditures	13,537	14,762	16.37	19.39	15.57	22.39
Consumption	5,867	6,439	7.1	19.04	11.31	21.89
Investment	5,771	6,521	6.98	19.92	17.27	25.35
Subsidies	1,153	1,212	1.39	29.93	27.48	12.05
Interest Payments	555	665	0.67	18.29	26.27	31.89
Total Revenues	7,992	8,739	9.66	19.41	12.77	25.75
Taxes	6,114	6,876	[100]+	20.80	12.29	25.98
Direct Taxes	984	1,027	16.1	16.53	7.49	28.93
Income taxes	831	966	(84.4)	21.82	10.74	29.68
Indirect taxes	5,130	5,856	83.9	21.94	14.68	25.57
Excise Taxes	1,442	1,576	(28.1)	22.38	20.93	21.65
Sales Taxes	1,029	1,200	(20.1)	20.77	8.2*	30.38
Customs Duties	2,462	2,938	(48.0)	22.88	13.12	27.86
Other Taxes	197	256	(3.8)	15.00	12.26	16.34
Non-Tax Revenues	1,878	1,875	2.27	15.93	11.71	24.96
Budget Deficits	5,545	6,228	6.70	19.31	20.29	20.49
Foreign Aids	7,240	9,519	8.76	51.26	-8.8*	21.90
Govt.Borrowings from						
Scheduled Banks	1,403	1,187	1.70	15.20	8.83	12.74
Central Bank	4,550	5,124	5.50			15.27

Note: ** Annual percentage trend growth rate; * Coefficient is insignificant at five percent level; S.D. Standard deviation; + Individual tax revenues are expressed as mean percentage of total taxes.
<u>Source</u>: See DATA appendix.

A comparative analysis of the structure of tax revenues show that a significantly higher growth rates have been achieved during the post-war period both in nominal and real terms. The growth of income taxes in real terms has been close to eighteen percent during this period, while gross national product has been growing at close to six percent rate. A significant part of this growth was due to two main reasons; low base period income tax returns and more efficient tax administration.

The open market instruments are not developed in Bangladesh, as such government deficits is financed either by borrowings from the central bank or by selling government securities to the scheduled banks. A significant part of deficits has always been financed by money creation. Over the sample period government borrowing from the central bank averaged about five-and-a half percent of gross domestic product, while that from the scheduled banks averaged close to two percent.

In general the financial sector in Bangladesh, as in many developing countries, is underdeveloped. However, in the formal sector the financial markets are well integrated, the rural financial market, dominated by informal rural financial institutions, is yet to be integrated with the formal market. The recent trend is however encouraging. Table 2.8 presents some of the characteristics of major financial sector variables over the sample period. Apart from changes in the central bank policies, money supply is also affected by changes in fiscal demands and net foreign exchange reserves. The supply of monetary base is mainly given by the central bank's net foreign assets, credits to the government and to the scheduled banks. On the other hand the demand for or the use of monetary base consists of scheduled banks demand for reserves and the non-bank public's demand for currency. Over the sample period the monetary base averaged six percent of gross domestic product, and it has been growing in real terms at a rate of little over one percent. However, the growth of monetary base was much higher during the post-war period compared to pre-war period. It has also been more than two percentage point above the growth of real output. Broad money, defined as M1 plus time and savings deposits with the scheduled banks in Bangladesh has been about double the size of narrowly defined money(M1), which averaged over nine percent of domestic product. Both during the pre- and post-war periods real money supply has been growing at a rate higher than the growth of real income. The growth rate differences were less than one percent. The growth rate for the broad money, however, has been much higher-- around four percent.

An important change to be appreciated is the behavior of money multiplier, which has been growing at one percent rate during the pre-war period but shows no trend growth during the post-war period. An examination of the growth performance and the volatility of the proximate determinants of money multiplier, namely, public demand for currency relative to demand deposits, demand for time deposits relative to demand deposits, and the scheduled banks demand for reserves, reveal that both the growth and volatility of these variables have indeed declined during the post-war period. The steady monetization of the economy is also evident from the decline of currency holdings and rise of holdings of demand deposits and time deposits. At the close of the period the time deposit to national income ratio rose to about thirteen percent compared to the average rate of close to nine percent for the entire period.

For scheduled banks in Bangladesh, bank credits to the private sector and public sector corporations and investment in government securities are the two major assets--on average the former constitutes eighty-three percent while the later is ten percent of total bank assets. Commercial banks are required to keep twenty percent of their deposits in liquid assets which may include government securities. A significant switch in monetary policy regarding the allocation of bank credits have occured during the post-war period. The growth in agricultural credits, in real term, has recorded a rate of over twenty percent compared to thirteen percent for the non-agricultural sector. The growth rates of bank credits for the agricultural sector vis-a-vis other sectors were just the opposite during the pre-war period as we have already mentioned above. This reflects a relatively greater emphasis on agricultural development activities by the subsequent governments since independence.

Table 2.8
Characteristics of Monetary Sector Variables in Bangladesh: 1960-83(millions of current taka)

Variables	Simple Mean: 1960-83	S.D.	Mean % of GDP	Growth Rate** 60-83	60-70	73-83
Money Supply						
Narrow Money(M1)	7,790	7,017	9.42	14.56	9.65	16.31
Broad Money(M2)	15,037	16,338	18.18	18.89	13.03	19.79
High Powered Money	4,972	4,352	6.01	13.27	8.47	16.80
Money Multiplier	1.505	0.135		1.14	1.09	-0.4*
Currency Circulation	3,532	2,610	4.27	10.89	7.43	14.13
Currency/D. Deposits	1.311	0.671		-7.49	-6.03	-3.35
Demand Deposits	4,258	4,442	5.15	19.19	13.91	17.96
Time Deposits	7,247	9,391	8.76	29.20	28.16	23.47
Time/Demand Deposits	1.204	0.557		8.40	12.50	4.68
Scheduled Banks						
Total Reserves				22.64	19.38	18.39
Excess Reserves	343	370	0.42	20.61	18.96	12.79
Total Credits	11,623	14,418	14.05	26.31	28.48	23.72
Agriculture	2,002	3,293	(2.42)	29.41	8.12	31.69
Non-Agriculture	9,620	11,237	(11.63)	26.04	31.06	22.20
Central Bank Loan	2,533	4,077	(3.06)	32.42	21.31	42.52
No. of Branches				18.80	21.21	16.17
Interest Rates++						
Bank Rate	0.0634	.0229		5.18	3.30	7.05
Bank Credits	0.1064	.0230		2.83	1.70	4.13
Time Deposits	0.0720	.0417		9.18	6.86	9.42
Govt. Securities	0.0470	.0086		2.46	4.10	5.17
Net Foreign Assets of Central Bank	2,233	2,180	(2.7)	13.09	-.01*	15.30
Total Private Wealth	38,787	42,599	(46.9)	20.27	13.40	22.50

Note: ** Annual percentage trend growth rate; * Statistically not significant at five percent level; ++ percent; # real number and S.D. is Standard deviation.
Source: See DATA appendix.

2.2.5 The Structure of Prices, Wages and Employment

Major characteristics of selected prices, wages, and employment variables for Bangladesh over the sample period are presented in table 2.9 and 2.10 below. Bangladesh like many other countries enjoyed relative price stability during the sixties and faced an increasingly volatile inflation situation during the seventies and eighties, specially during the early years of the seventies. The aggregate price level grew at a rate close to twelve percent over the sample period, while the rate was less than four percent during the pre-war period. On the other hand, both the trend growth rate and variability of annual rate of inflation were close to three times higher during the post-war sample period, which coincides with major international commodities and oil price shocks and domestic crises such as the 1974 famine and several major crop failures and natural disasters.

For sectoral product prices substantial variations in trend growth rate and as well as in the ratio of standard deviation from the secular trend to the mean of sectoral product prices (column four, table 2.9 and 2.10) exist over the sample period. Once again these variations are much more pronounced during the post-war period. An important observation can be noted here. The sectoral relative price stability compared to aggregate inflationary trend indicates that there is a positive association between the degree of volatility and the extent to which goods are tradeable internationally.

The data presented also indicate substantial variance for the mean sectoral wage rates. Both in nominal and real terms the mean wages in agriculture has been higher than that in the manufacturing over the sample period, a result which is opposite to what is observed in other developing countries.[16]

[16] It is possible that the wage data for manufacturing may be biased downward because of the possibility of systematic underreporting in order to lessen employers' social security and tax contributions and because of the existance of considerable non-wage benefits in this sector relative to the agricultural sector. In the absence of detailed information, the magnitude of bias cannot be determined at this point.

Table 2.9
Characteristics of Sectoral Prices, Wages and Employment: Bangladesh 1960-83(indices, 1972/73=100)

Variables	Simple Mean: 1960-83	S.D .	Trend % of Mean+	Growth Rate** 60-83	60-70	73-83
Sectoral Prices						
Food-grains	124.43	101.14	18.7	13.88	5.60	9.06
Jute	129.03	87.97	31.8	10.05	0.2*	9.97
Government Prices#						
Food-grains	116.78	95.49	18.2	15.20	6.57	9.20
Jute	113.00	77.51	31.4	11.12	4.52	9.56
Fertilizer	214.96	222.49	-3.5	16.58	3.19	19.64
Sectoral Deflators						
Agriculture	135.29	102.96	23.9	12.92	4.30	9.19
Manufacturing	104.05	67.04	35.6	10.19	2.04	7.57
Construction	195.94	154.90	20.9	12.47	2.04	13.23
Infrastructure	149.01	99.14	33.5			
Trade and Banking	123.08	62.11	49.5	7.43	3.26	7.67
Housing	197.11	162.29	17.7	13.68	3.68	13.06
Other Services	138.03	105.73	23.4	12.45	3.74	11.49
GDP Deflator	135.38	97.65	27.9	11.81	3.72	9.64
Inflation Rate++	0.1171	0.2088	-78.3			
Sectoral Wages						
Agriculture	168.87	131.82	21.9	12.14	4.43	14.49
Agriculture, real	137.78	25.53	81.5	1.70	0.6*	2.6*
Manufacturing	144.66	115.93	19.9	11.64	4.81	15.63
Manufacturing, real	107.55	24.45	77.3	-2.65	0.1*	1.7*
Aggregate Wages	161.82	131.30	19.0	12.08	4.88	15.87
Sectoral Employment$						
Agriculture	21.21	3.27		2.43	2.57	1.71
Manufacturing	0.24	0.82		5.47	5.20	5.22
Productivity##						
Agriculture	1,419	99.24		0.51	0.4*	1.45
Manufacturing	19,961	2,467		0.4*	0.7*	3.39

Note: S.D. Standard deviation; ** Annual percentage trend rate of growth; * Statistically not significant at 5 percent level; ++ Percent; + Standard deviation from trend as percentage of mean; $ Millions of workers; and ## taka per workers.
Source: See DATA appendix.

A comparison of sectoral product prices and nominal wages reveals that the sectoral real wages in fact decreased over the sample period. For the agricultural sector the real wages grew only at 1.7 percent annually, while the manufacturing real wages recorded a negative trend growth of 2.7 percent. Part of the differences may be explained by no trend growth in manufacturing productivity as opposed to low but positive trend growth of productivity in agriculture. A relatively higher growth rate for cost-of-living for urban sector is another factor. The real wages situation has not improved during the post-war period despite the showing of a much higher growth in labour productivity in both agriculture and manufacturing. A simple calculation reveals that given the annual increase of per capita income at a rate of 1.4 percent, the real income of wage earners in Bangladesh most likely has decreased relative to the national average, over the sample period. This observation remains valid when the pre- and post-war periods are considered separately. In fact the situation has become worse over time, given the fact that a much higher growth rates for productivity as well as per capita income(3.3 percent) have been recorded during the post-war period.

The behavior of the remaining price indices over the sample period are summarized in table 2.10. The consumer price index has been growing faster than the gross domestic product deflator, as one would expect. Two major factors for this are substantially higher growth rates for prices of imported goods and for the domestic food-grains. The difference between the two inflation rates has been widening over the sample period.

Bangladesh experienced a secular deterioration of its international terms of trade over the sample period. All the imports prices have been rising at a substantially higher rate than the domestic prices during the sample period. This phenomenon, however is not valid for the pre-war period. In fact, during this period all import prices either show a negative trend or no trend growth at all. The post-war import price inflation has reached a level more than double the domestic commodity price inflation. As such a higher than average inflation rate is observed in the sectors using imported imputs. Both exports and imports prices remained stagnant during the pre-war period, while both the level and volatility have increased significantly during the post-war period. Individual tradeables also show varying rates of volatility and growth during this period.

Table 2.10
Characteristics of 'Other' Prices in Bangladesh: 1960-83(indices: 1972/73=100)

Variables	Simple Mean: 1960-83	S.D .	Trend % of Mean+	Growth Rate** 60-83	60-70	73-83
Consumer Price Indices						
Rural	136.32	115.02	15.6	14.05	3.83	11.62
Urban	155.61	134.52	13.6	14.60	4.74	13.67
Aggregate	145.66	124.99	14.2	14.46	4.06	12.71
Wholesale Prices						
Manufacturing	131.42	106.98	18.6	13.56	2.03	10.90
Raw Materials	152.95	108.48	29.1	11.43	1.3*	10.32
Aggregate	142.43	113.27	20.5	13.65	4.17	11.28
Investment Price Index	135.21	102.51	24.2	12.31	3.71	11.78
Exports Prices						
Raw Jute	141.65	102.62	27.6	11.00	1.1*	12.70
Jute Manufacturing	139.56	122.97	11.9	13.34	1.9*	15.73
All 'Others'	236.64	231.91	2.0	15.85	3.7*	22.57
Aggregate	160.77	139.82	13.0	13.07	1.9*	17.35
Imports Prices						
Food-grains	174.00	161.50	7.2	15.87	-0.4*	13.49
Other Consumers Gds.	231.98	253.69	-9.4	19.29	-0.2*	20.82
Raw Materials	247.83	266.20	-7.4	17.60	-0.5*	21.85
Capital Goods	207.58	212.31	-2.3	16.28	-3.91	20.48
Aggregate	217.98	225.91	-3.6	17.36	-1.32	19.43
Exchange Rates						
Nominal Rate				8.92	0.00	10.69
Effective Rates##						
Raw Jute	8.932	5.4265		8.96	1.59	9.46
Jute manufacturing	11.941	6.0174		6.83	1.65	10.78
World Income++	78.24	39.66		9.33	10.63	2.56

Note: S.D. is Standard deviation; ** Annual percentage trend growth rate; * Statistically not significant at 5 percent level; ## taka per U.S. dollar; ++ Weighted average of major trading partners incomes; and + Standard deviation from trend as percentage of mean.
Source: See DATA appendix.

2.3 A SURVEY OF ECONOMETRIC STUDIES ON BANGLADESH

Macroeconometric modelling has now become a well established research agenda in developing countries. In recent years several attempts have been made to build econometric models for the Bangladesh economy. Most of these works are unpublished. The purpose of this section is to survey some of the important macroeconometric studies on the Bangladesh economy. Seven such models[17] are surveyed here, of which three are unpublished. Two of the studies were done before the independence of Bangladesh and deal with both East Pakistan and West Pakistan jointly.[18] The section also discusses briefly some additional econometric studies on Bangladesh economy which do not strictly fall under the conventional macroeconometric models but nevertheless have some kind of underlying macroeconomic framework which is worth noting to highlight the distinctions between these studies and the present study.

The model built by Islam(1965) represents the first serious effort to deal with the economy of the united Pakistan. There are in total fifty equations, of which twenty are stochastic, and sixty-two variables in the model. Structurally the model is an effective demand model of the Keynesian type with some supply side modifications. It is an annual model

---

[17] The seven models are Islam(1965), Imam(1970), Hussain(1973), Lackman and You(1979), Rashid(1980), Kabir(1981), and Jahan(1983).

[18] Islam(1965) and Imam(1970).

and the system of equations are linear both in parameters and variables. The estimations were done using the ordinary least squares(OLS) technique, and for most of them the data used were for the period 1950-60. Four key sectors are identified, namely, agriculture, manufacturing, foreign trade, and the government. Agricultural production for food-crops and cash crops are explained by the lagged sectoral relative prices. The model highlights the independence between the primary sector and the rest of the economy, as only the manufacturing output depends upon the availability of raw materials from the primary sector. Government expenditures and budget deficits are assumed exogenous, although five different tax functions are estimated to explain government revenues. The crucial sectors from which short-run fluctuations originate in the economy are changes in export volume, explained by endogenous relative price of export and by exogenously given world income and changes in export prices, exogenously given imports prices, and agricultural production.

In the agricultural sector, however, the model does not allow for short-run fluctuations due to variables such as the availability of inputs and government policies. Heavy emphasis is placed on climatic conditions. Similarly, the industrial sector does not adequately recognize supply variables or costs of production. On the other hand the model also does not explain the demand determined services sector at all. The financial sector is completely absent, the only link between the real and the monetary sector is provided through the exogenously given bank credits in the private investment function. The role of government sector, particularly, government investment and fiscal and trade policies are also ignored. Finally, from a systems point of view the model also suffers from specification errors since it fails to incorporate explicitly various budget constraints and the endogeneity of many of the monetary and fiscal variables.

While Islam's model completely ignores the financial sector, Imam(1970)'s main objective is to build a structural model of the united Pakistan's monetary sector within a macroeconomic-framework. The monetary sector is modelled in some detail, and a highly aggregated model of income generation is added to it to 'close' the model. This enables the model to capture some of the feed back effects between the monetary and the real sector. The model is comprised of a system of twenty-two equations including ten identities and in total forty-eight variables. The model is estimated by the OLS technique using annual time-series for the period 1950-66. A particular feature of the model is its explicit modelling of endogenous money supply determination through the interactions of the behavior of scheduled banks, the central bank, and the private sector. One objective of the study is to "examine how variations in the scheduled banks' portfolio behaviour transmit the effects of monetary-policy changes throughout the economy"(p360). The model explicitly incorporates government budget constraint but it fails to incorporate household budget constraints explicitly or implicitly. A serious drawback of the model is the neglect of supply side. The model's finding that the 'impact multipliers' for monetary policy 'are not very large' may be due to inadequate representation of the transmission mechanism of monetary policy variables. For example the effects of bank credits variable on various producing sector via investment functions as well as through the working capital channels are either completely ignored or given only a cursory treatment.

Hossain(1973) is the first serious attempt to formulate a small macroeconometric model for the newly independent country. The model is primarily "designed for use as a planning model"(p127)--so the author declares, and as such does not fall within the family of Tinbergen-Klein macroeconomic modelling tradition. Despite the intent of the author, the structure of the model is very much in line with the conventional macroeconometric models. The model has in total seventeen equations including four identities and thirty-two variables. Single equation estimation methods are used for estimation, using annual data for the period 1950-70. The structural relationships are described through the interaction of production, savings, investment and external trade. Production functions for five producing sectors, namely, agriculture, manufacturing, social overhead, trade and banking, and general services, are postulated based on the Harrod-Domer fixed proportion hypotheses with capital as the limiting factor. The complete model is simulated to test the stability of the model and to calculate the impact multipliers. According to the findings of the study, the greatest impact on gross domestic product comes from weather conditions followed by capital stock and exogenous exports.

Several important features of the Bangladesh economy have been brought out in Hossain's study. The findings of the absence of technological progress and the presence of decreasing returns to scale are noteworthy, and, if valid, would have serious implications for the developmental potential as well as strategy of the country. The study, however, is not free of short-comings; as such his results must be taken with caution. Financial sector is completely ignored. Many inter-sectoral linkages are either completely ignored or weakly specified. Several key structural features of the economy are compromised due to high level of aggregation. As such it is not surprising the model finds the greatest impact effects on output coming from weather condition. The study also fails to make the distinction between the demand-determined producing sectors and the supply-determined sectors. Moreover, the absence of prices, wages, and employment determination from the model makes it less than suitable for any longer term policy analysis.

Finally, many of the model's structural equations are suspect for misspecification. For example, money demand is defined in nominal terms while the only explanatory variable in the equation--gross domestic product--is defined in real terms! Direct taxes are postulated to depend on current income, while income taxes in Bangladesh are assessed on previous year's income. No explanation is given for the presence of total investment variable in the government current expenditure function. Similarly, the failure to distinguish between the private and public investment behaviour also introduces errors of misspecification in the model.

A simple and highly aggregated model is built by Lackman and You(1979) to 'evaluate the consistency and feasibility of the the First Five-year Plan' of Bangladesh(1973-1978). The model is a replica of the traditional Keynesian effective demand model built for the developed countries without giving any consideration to the structural features and the desired specification of the country under study. The model consists of seven equations including two identities and has altogether eighteen variables. The estimation is done with the OLS technique using quarterly data for the period 1956:III to 1973:II. The quarterly data on relevant variables are derived by the process of 'quarterization', using 1969/70 seasonals for national product data on annual data for the relevant variables. The missing data for the war years are obtained through interpolation. The model is simulated for stability tests, and for a consistency check of first five-year plan. In general, the model finds that "the Plan targets were reasonably consistent with the model projections except for price level and nominal import taxes".

The model has serious weaknesses and deficiencies, and as such the validity of its findings are suspect. Apart from the usual problems associated with the mechanical and rigid method of quarterization of annual data as well as the simple interpolation of intra-war period data, the study has limitations in terms of both structural specification and estimation.[19] In actual estimation no seasonal dummies are introduced for quarterly variations, neither the data are de-seasonalized. The estimated marginal propensity to consume of 0.58 for a developing country like Bangladesh is absurd. All the equations except one suffer from the problem of autocorrelation but the issue is left unaddressed. Regarding the structure of the model, it is incomplete and fails to incorporate the basic structural features and constraints facing the country.

A small short-term macroeconometric model is constructed by Rashid(1980), which according to the author is "oriented towards forecasts of the major national accounts aggregates" and can be used "to indicate the impact of policy changes on key macroeconomic variables"(p23). There are in total sev-

[19] Correspondence with one of the author(Prof. You) reveals that not much faith can be put on the data as well as estimation of the model(Personal correspondence; 1984).

enteen equations including nine identities and thirty six variables. Single equation estimation methods are used for parameter estimations using annual data for the period 1959/60 - 1978/79, excluding the war-year 1970/71. All the estimated equations are linear in both parameters and variables. A dynamic simulation of the model is performed to test the stability of the model.

On the demand side, the aggregate real private consumption depends on, in addition to real income, also on nominal(?) money supply and the interest rate variable. The investment demand follows neo-classical investment behaviour. Aggregate production function is of Cobb-Douglas type with total labour supply and capital stock as the arguments. Money supply is determined by solving the monetary authorities identity.

Rashid's model has several important features. It attempts to incorporate some of the structural features of the economy explicitly into the model. An attempt is also made to integrate the real and the monetary sectors of the economy keeping in line most of the balance sheet identities. The model incorporates a capacity utilization function along with the aggregate production function. However, the model has limitations both in behavioral specifications and structural representation. The inclusion of nominal money supply in the aggregate consumption function introduces usual money illusion problem which has not been addressed in the study. Failure to treat separately private and public investment demands introduces serious problems of misspecification as the author's own discussion admits that the two expenditures are dictated by separate behavioral rules. The inclusion of aggregate capital stock and imported capital as two separate variables in the production function is misconstrued since the aggregate capital stock has already included both domestic and imported capital goods. Short-run adjustment mechanisms are not explained, nor is explained the behaviour of expectational variables. The government budget deficit identity is incomplete since it does not include the public investment expenditures. Similarly the money supply identity is also incomplete since it does not follow from the financial sector's identities. It is surprising to find that the author 'closed' the model without specifying the aggregate demand-supply identity or equilibrium condition. Finally, the model ignores structural features such as the role of agriculture, particularly, food production, prices and imports, wages and employment, and the behavioural responses of the financial sector.

An interesting model of the Bangladesh economy is constructed by Kabir(1981). The most noteworthy feature of the model is that it is perhaps the first serious attempt to develop a structural model for Bangladesh with many of the structural features built-in and with necessary disaggregation in some of the key sectors. The main purpose of the model is to "examine how the various sectoral prices are determined and how these sectoral prices ultimately determines the general price level and also the cost of living index". There are fifty-five equations in the model including twenty-three identities and definitions. The model is block-recursive, and the estimation of each blocks are done using single equation estimation techniques and non-linear least squares methods. The data are annual for the period 1953-77.

This model, unlike most other models discussed so far, attempts to model explicitly the different behavioral characteristics of the agricultural or rural sector and the non-agricultural or urban sector of the economy. Also, within the agricultural sector the dynamics of food-grains production vis-a-vis jute production is also recognized. Neo-classical production function and profit maximization assumptions are invoked to derive supply functions in agriculture and industry. Prices in these sectors are determined by the interaction of sectoral demand and supply functions. The services sector's output is purely demand determined. Contrary to usual practice imports are assumed exogenously determined while both exports volumes and prices of jute and non-jute manufacturing are endogenously determined in their respective sectoral blocks once again through demand supply identity. Labour markets for agriculture and manufacturing sectors are also specified along the neo-classical tradition and each are solved in their respective production blocks. A small financial sector is added with the lone behavioral equation for supply of bank credits and a banking sectors identity. The link between the real and the monetary sector is established through the bank credits variable. The stability of the model is tested through a series of simulation experiments. The major conclusion of the study is that rigidity in food supply coupled with a growing population and food demand are the main causes of inflation in Bangladesh.

Although Kabir's model is a much improved one over the shortcomings of the previous models, it too faces criticism of inadequate structural representation but more importantly now it faces the criticism of rigid assumptions regarding the structure and operation of the economy. The assumptions of full-employment, specifically, in a short-run model, perfect competition, instantaneous market clearing in goods market, and profit maximization for a developing country like Bangladesh make one uncomfortable. The model downplays the role of aggregate demand in the economy, particularly in the determination of the price level. The treatment of import demand as exogenously given is highly questionable, and as such cuts off an important channel of effects on inflation via aggregate demand. The financial sector of the model is very much rudimentary, and particularly the endogeneity of the money supply process in Bangladesh through its link with the foreign exchange reserves, government deficit, and domestic credits is ignored. Therefore, additional important channels of inflationary pressure via these foreign and domestic sources of disturbances are not adequately captured in the model. The model's findings regarding the major causes of inflation in Bangladesh is not surprising as such.

The last model to be discussed in some details is that of Jahan(1983), which attempts to build a quarterly econometric model for the post-liberation Bangladesh economy. The major objective of the model is to develop a "monetary model for Bangladesh in order to provide a useful analytical framework for studying the behavior of key macroeconomic variables such as money, prices, output and the balance of payments". The complete model contains in total twenty-nine equations which include eighteen identities. The model is linear in parameters but non-linear in variables. Single equation estimation methods are applied using quarterly data for the period 1972:III - 1981:II. One notable feature of the study is its attempt to estimate quarterly data for some of the variables from their annual data using estimated seasonal indices. Another feature is the models explicit treatment of adjustment mechanism for each behavioral equations, and also the explicit treatment of expectational variables. The monetary sector is described by four behavioral equations for demand deposits, time deposits, scheduled banks excess reserve holdings, and their borrowing from the central bank. These are explained by the corresponding relevant income variables and opportunity cost variables. Money supply is given by the product of reserve multiplier and high powered money, which are themselves in turn determined by the behavior of the non-bank public, the scheduled banks, the central bank, the government, and the performance of the foreign sector. A small real sector with seven behavioral equations are added to the monetary sector. Aggregate domestic supply function is determined by solving the usual neo-classical production function, while the corresponding price level is determined by solving the excess demand function for the domestic goods, which is measured by a proxy--the excess supply function for money. The general price level in the model is then determined as the weighted average of domestic price level, export prices, and imports prices. The model is tested for stability through simulation experiments.

The model is a monetary model, and in particular it is an application of what is known as the "monetary approach to the balance of payments". As such this is the first rigorous attempt to test the model using Bangladesh data. One major criticism of the model is that the demand side has not been adequately dealt with. Consumption and investment demand do not play any independent roles in the model. Endogeneity of many of government expenditures are ignored. On the supply side, the treatment of an aggregate supply function conceals the key role and feed back effects of the agricultural sector, particularly, the role of food supply, food prices and imports in the determination of both domestic and general price level. Of course many of these limitations are not strictly applicable given the objectives of the model which is not to build a 'truly' macroeconomic model but to develop a structural model to answer some specific questions. This observation also applies to many of the models discussed above.

The seven studies surveyed above all have one common major objective, that is to build a structural model for the Bangladesh economy. There are few more econometric studies in which the major objective is not the construction of structural model as such, yet they either contain a framework for structural model as a tool for achieving the models' objectives or have some features that are to some extent relevant for our topic. A selected number of such studies are briefly discussed here.

Although regional data for East Pakistan are available for most production and income accounts published by the respective government departments, no such data breakdown are reported for most of the central government expenditures, financial sectors, and the producing units under the central government control. Alamgir and Berlage(1974) is the first serious attempt to estimate the national income-expenditure data for the than East Pakistan. In the process of data estimation, the study also provides single equation estimation of various macroeconomic relationships for the economy. A similar study on the financial flows for the than East Pakistan period is also done by Alamgir and Rahman(1974). These two studies are as such of great value for any macro study of Bangladesh economy, particularly, for the pre-war period. World Bank(1974) macroeconomic model is a planning model developed along the line of UNCTAD(1968) model for united Pakistan economy. The model is based on the 'two-gap' theory. Similarly, the Planning Commission's(1980) macro-model[20] is also based on 'two-gap' theory of growth. Starting with a growth target it works out the import-exports gap and saving-investment gap associated with the growth target and examines whether the available foreign aid will be enough to close the larger of the two gaps. These models are basically accounting models, they are not econometric models. For econometric modelling, the benefits one derives from studying these models are the knowledge about various accounting identities and constraints facing the country and their growth implications. A highly disaggregated general equilibrium sectoral model for agriculture, known as 'Bangladesh Agriculture Model' or BAM(1983) is built and periodically updated at the Centre for World Food Studies in the Netherlands[21] by a group of

---

[20] In collaboration with the World Bank.

[21] Under a collaborative arrangement with the Bangladesh Food Policy and Monitoring Unit of the Planning Commission.

researchers. A comprehensive general equilibrium model is developed incorporating agricultural production, prices, income distribution, demand, imports, exports, savings, and other sectoral variables. The model is useful for understanding the dynamics of supply, demand, income and price formation in Bangladesh agriculture.

Inspired by Klein's(1965) suggestion for integration of input-output model with the macro-model to "build a more general system", Chowdhury(1984) constructed "an aggregate demand model with a view to integrating it with the 1976-77 input-output table of Bangladesh"(p71). For this purpose, according to the author, 'a very simple model'(p10) is built for the final demand component of the country. The demand model contains in total seven equations including two identities and fourteen variables. The model is static and linear, both in parameters and in variables. Annual data for the period 1960-81 are used to estimate the demand block. The model suffers from serious drawbacks such as inadequate structural representation of the aggregate demand sector, misspecification of some of the demand functions, no role for the financial sector, and failure to incorporate government budget constraints and other sectoral identities and constraints. These limitations are to some extent understandable given the objective of the study.

The econometric models surveyed above clearly cannot serve to achieve the objectives of the present study. Some of the studies are sectoral, some are outdated. Some are highly aggregative such that they miss the essential structural features of the economy. Most of the seven models are essentially demand oriented models with very little considerations given to the supply side as emphasized by Rao(1952), Klein(1965, 1974), Behrman(1977), and others. Some of the models are tuned to answer specific questions, such as the major causes of inflation, or testing the validity of the monetary approach to balance of payments in an underdeveloped country like Bangladesh. Asking specific questions are all-right, but to get the answer, tuning up of the structure of the economy is certainly questionable. The findings of such studies are likely to be biased due to the a priori choice of a particular structure of the economy and the neglect or misspecification of some of the key structural features. The search for the 'true' structural model continues in steps, and as such the limitations of previous models are the starting point for approaching the 'reality'. For "(P)rogress in economics consists almost entirely in a progressive improvements in the choice of models" (Keynes, 1944; XIV, pp297).

Macroeconometric models for developing countries should address themselves to problems inherent in those economies. As such to address the issues of short-run to medium term macroeconomic adjustment problems a fully articulated model of the economy is needed. Key structural features, such as the role of agriculture, foreign trade, food deficit, foreign exchange reserves, bank credits, role of government, etc. should be given adequate attention. The significance of the foreign sector as a source of non-competitive intermediate inputs and of capital goods, as well as of a significant proportion of government revenues should be well integrated into the model. Similarly, the degree of endogeneity of fiscal and monetary variables should be appreciated such that the policy options are not overstated.

Although the demand side should be well represented even in case of a developing country like Bangladesh, more emphasis should be put on the supply side. As such the standard model should be modified sufficiently. An alternative is to incorporate the supply side details through the integration of an input-output model with the final demand block, as suggested by Klein(1965). This approach is not taken here for several reasons. The inter-industry flows in Bangladesh are very weak. A macroeconomic model to be consistent with the input-output model will have to have a very respectable dimension, which given the very weak inter-industry flows is neither necessary nor efficient. Still another objection is the question of reliability of input-output data in a developing country such as Bangladesh, and also the problems associated with the assumption of invariant structural coefficients in the table.

In the next chapter an attempt is being made to build a macroeconomic model for the Bangladesh economy by addressing all of the issues and problems mentioned, and also to pay heed to Klein(1978)'s advice: "it is wise for the development economist to be forearmed with a full model for analysis of both supply and demand sides"(p6).

Chapter III

A MACROECONOMIC MODEL FOR THE BANGLADESH ECONOMY

> The first step in seeking to understand the functioning of a system is to build a theoretical model. All models are inevitably simplifications of reality, and the model builder seeks to capture the fundamental feature of the system being studied.
>
> J. Johnston(1984, p2)

3.1 INTRODUCTION

The purpose of this chapter is to develop a macroeconomic model for the Bangladesh economy. It is an attempt to describe the structure of the economy with all its multi-dimensional complexities in terms of a system of equations or functions relating to the various sectors of the economy. In addition to a better understanding of the structure of the Bangladesh economy, the model would also enable us to discern more clearly than is otherwise possible the major economic linkages[22] among various sectors, sub-sectors, and economic agents in the economy, and to evaluate quantitatively the relative 'strengths' of those linkages. Furthermore, such a quantitative framework may be effectively applied to get important insights as to how and why the eco-

[22] Concentration on only economic linkages here should not be taken as though only these linkages matter. Often non-economic linkages exert much greater influences and predominate over economic linkages in several areas. But exploration of these are not the focus of this study.

nomic system behaved in the way as it has in the past and how and why the system will produce different desired-results when some specified conditions are realized(Tinbergen 1956; Brown, 1970).

For expositional clarity, the macroeconomic model presented below has been subdivided into four major sub-models, each of which is in turn divided into several blocks.[23] The four major sub-models are: (1) production or supply; (2) expenditure or demand; (3) government policy variables; and (4) prices and wages. The model is a simultaneous equation system in nature, with interrelationships and feedbacks among variables both within each sub-model and across the sub-models.

3.1.1 Nature of the Model

The model has been constructed to integrate three main ideas that are already mentioned in chapter one. The first is that macroeconomic relationships should be postulated based on economic theoretic propositions. In particular, marcoeconomic behavioral relationships, whenever possible, given microeconomic rationale. However, building a complete and logically consistent microeconomic rationale for the macroeconomic relations, based upon 'choice-theoretic' formulation, is not attempted here. It is not an objective of this study either. Neither it is thought to be necessary.

---

[23] This does not imply that the model is block-recursive.

"Macroeconomic model should be regarded as a separate entity, that is, as more than just the aggregation of microeconomic theories or a characterization of empirical regularities"(Masson, et al;1980, p12). Macroeconomics is a blend of shrewed reasoning about aggregate behavior, theorizing from empirical regularities, 'as if' reasoning from microeconomic theory, as well as rigorous aggregation from individual optimizing behavior. As such the macroeconomic model must be seen as a whole, not just as concatenation of single equations. Our proposed macroeconomic model has four types of agents: households, firms, banks, and the government. The behavioural specification of each agent must be consistent across the group.

The second idea is that the macroeconomic model should allow for the possibility of disequilibrium in some markets.[24] It is well known that studies such as Patinkin(1956), Clower(1965), Leijonhufvud(1968) and Barro and Grossman(1971) have provided a more solid theoretical rationale for the existence of a Keynesian type consumption function and for the existence of unemployment. In the short run, adjustments are made through quantities as well as through prices, a central idea in Keynes(1936), where the level of activity appears as an adjustment variable just as much as the interest rate or other price variables(Benassy;

---

[24] For an excellent synthesis of research on disequilibrium macro analyses in open economies, see Cuddington, et al(1984). Also, see Benassy(1986) for analytics of macroeconomic models within a non-Walrasian methodology.

1986). It is well known that the existence of disequilibrium in both labour and commodity markets are very common in most developing countries.

The third, and perhaps somewhat less important, idea is that the macroeconomic model should account explicitly for balance-sheet and flow-of-funds constraints as emphasized by Christ(1968) and Brainard and Tobin(1968), among others. "Any logically consistent macroeconomic model must have the property that the behavioral relationships it includes are compatible with the underlying budget constraints facing the decision makers in the economy"(Turnovsky, 1977,p38).[25] These constraints apply to both private and to public sectors.

It is generally accepted that the treatment of 'expectations' and 'lag structure' is critical in any macroeconomic model.[26] In this model individual agents are postulated to

---

[25] Although Christ and others have demonstrated that Keynesian multipliers formulated are mistaken because they ignore budget constraints, Sargent(1979) rejects this and demonstrates that the "textbook Keynesian model is totally immune from this charge"(p108).

[26] As indicated at the beginning, the current state of economic theory offers very little help on the question of correct functional form and the appropriate lag structure. "Economic theory is mostly about equilibrium situations and contains little in the way of systematically developed dynamic theory. Thus it cannot be expected to yield strong insights about lag structure. Nor can it be expected to indicate the correct functional form"(Johnston 1984; p501). Certain amount of interaction between theory and data, therefore,, would be both inevitable and desirable. For an entertaining and enlightening treatment of this interaction process, see Leamer(1978). Also, see Klein(1982) on the role of economic theory in macroeconometric modelling.

form their 'expectations' on the basis of a limited set of information: the set of information that is available to the agent at the time of decision making. Since agents have incomplete or imperfect knowledge about the complete or 'true' model and since their expectations are on the average different from the model's predictions, the expectations formation mechanism is not 'rational'. The 'nonrationality' of expectations leads to expectation errors, which in turn produce disequilibrium in the system. Furthermore, agents here form expectations not only on price signals, but on quantity signals as well. With respect to the lag structure both due to adjustments and to the formation of expectations, they are represented by simple lagged values. Some general remarks about the lag structure and expectation formation mechanisms assumed for economic agents in this study are in order.

The structural equations system developed in this chapter is assumed to be characterized by short-run flow equilibrium. This is a temporary state in the process of moving towards the long-run equilibrium, which is continually being disturbed by various exogenous shocks as well as by the internal dynamics of the system. As such the current state may be described as in disequilibrium since both stock and flow demands are not equal to corresponding supplies. A simple one period lag structure has been introduced into the most structural relationships to capture this disequilibrium phenomenon. The main reason for such lags or implied adjustment functions are as follows: (i) psychological (e.g., due to the force of habit or inertia), (ii) technological(e.g., the long gestation period for newly installed capital goods), (iii) institutional (e.g., contractual obligations in labour market or in money market), and (iv) the uncertainty about the future course of prices, interest rates, etc.

The details about the derivation of the postulated relations or adjustment functions for each behavioral functions are not provided. In the relevant cases, only the underlying specific adjustment model(s) is identified. The models adopted here are the adaptive expectation[27] model(Cagan 1956, Friedman 1957), the stock-adjustment[28] model(Nerlove; 1958), and a purely 'ad hoc' expectation formation mechanism. For some behavioral representation a combination of these models has been adopted. The specific form of the adjustment function and the derived behavioral function will depend upon the particular model(s) chosen. Here an attempt is made to show the derivation of the general forms of the behavioral functions specified in this chapter based on the adjustment models mentioned above.

---

[27] Due to uncertainty about the future course of the variable. Also known as the 'error learning' process.

[28] Due to inertia, rigidity, contractual obligations, cost of changes, etc. Also known as partial adjustment model.

Let the desired level of variable Y(t), denoted by Y(t)* depend upon a vector of exogenous variables Z(t) and a vector of expected variables X(t)⊛, which may or may not be present in any particular model:

$$Y(t)^* = \emptyset_0 + \emptyset_1 Z(t) + \emptyset_2 X(t)^{\circledast} + u(t) \qquad \text{F.1}$$

Suppose, Y(t)* follows the partial or stock adjustment process, which may be represented as follows:

$$Y(t) - Y(t-1) = \gamma \ll Y(t)^* - Y(t-1) \gg \qquad \text{F.2}$$

where, γ, such that $0 < |\gamma| < 1$, is the coefficient of adjustment. If $\gamma = 1$, it means instantaneous adjustment or Y(t) = Y(t)*, and if $\gamma = 0$, it means that nothing changes or static adjustment or Y(t) = Y(t-1). The adjustment coefficient *a priori* may have either positive or negative values. For example, in case of demand analysis, a positive coefficient reflects Houthakker-Taylor(1970) habit formation or the need for more than one year to adjust actual realized quantity to desired level. Implicitly, an assumption of geometric distributed lag structure for the adjustment process is also made here. On the other hand, a negative adjustment coefficient indicates a Houthakker-Taylor inventory effect. The stock built up from the previous periods realized quantity diminishes the demand for current goods. It may be noted here that the Houthakker-Taylor inventory effect cannot be derived exactly from the neoclassical theory. Also note that, in some cases the two opposing effects might cancel each other, leaving an insignificant coefficient of adjustment despite the presence of significant adjustments.

After simple algebraic manipulation the above two equations can be reduced to

$$Y(t) = \gamma\emptyset_0 + \gamma\emptyset_1\, Z(t) + \gamma\emptyset_2\, X(t)^{\bullet} + (1 - \gamma)\, Y(t-1) + v(t) \qquad \text{F.3}$$

where, $v(t) = \gamma\, u(t)$. Now, in our model the expected variable, $X(t)^{\bullet}$, may follow either (i) the adaptive expectation process, or (ii) the partial or stock adjustment process, or (iii) a purely <u>ad</u> <u>hoc</u> process.

(i) Suppose, $X(t)^{\bullet}$ follows the adaptive expectation process, which may be represented as follows:

$$X(t)^{\bullet} - X(t-1)^{\bullet} = \beta \,«\, X(t) - X(t-1)^{\bullet} \,»$$

$$\text{or,} \quad X(t)^{\bullet} = \beta \sum_i (1 - \beta)^i\, X(t-i) \qquad \text{F.4}$$

where, β, such that $0 < |\beta| < 1$, is known as the coefficient of expectation, and $i = 0,1,2,....n$. If $\beta = 1$, or $X(t)^{\bullet} = X(t)$, expectations are realized immediately and fully,[29] and if, on the other hand, $\beta = 0$, expectations are static. Substituting equation F.4 into F.3, we obtain

$$Y(t) = \gamma\emptyset_0 + \gamma\emptyset_1\, Z(t) + \gamma\emptyset_2\beta \sum_i (1 - \beta)^i\, X(t-i)$$

[29] Equation F.4 may alternatively be specified as $X(t)^{\bullet} - X(t-1)^{\bullet} = \beta \,«\, X(t-1) - X(t-1)^{\bullet} \,»$, in which case the immediate realization of expectation would imply $X(t)^{\bullet} = X(t-1)$.

$$+ (1 - \gamma)\, Y(t-1) + v(t) \qquad \text{F.5}$$

If the higher powers of $(1 - \beta)$ are ignored, since they decline geometrically for more distant past, equation F.5 may be written as:

$$Y(t) = \gamma\emptyset_0 + \gamma\emptyset_1 Z(t) + \gamma\emptyset_2\beta X(t) + \gamma\emptyset_2\beta(1 - \beta)X(t-1)$$
$$+ (1 - \gamma)\, Y(t-1) + v(t) \qquad \text{F.6}$$

Alternatively, applying a Kyock transformation, equation F.5 becomes:[30]

$$Y(t) = \gamma\emptyset_0 + \gamma\emptyset_1\, Z(t) - \gamma\emptyset_1(1 - \beta)\, Z(t-1)$$
$$+ (2 - \gamma - \beta)\, Y(t-1) - (1 - \gamma)(1 - \beta)\, Y(t-2)$$
$$+ \gamma\emptyset_2\beta X(t) + w(t) \qquad \text{F.7}$$

where, $w(t) = v(t) - (1 - \beta)\, v(t)$.

(ii) On the other hand if $X(t)^{\bullet}$ follows a partial or stock adjustment process similar to the dependent variable Y(t), then for X(t) we may have

$$X(t) - X(t-1) = \alpha \ll X(t)^{\bullet} - X(t-1) \gg \qquad \text{F.8}$$

where, α, such that $0 < |\alpha| < 1$, is the coefficient of adjustment for X(t). Expressing equation F.8 in terms of $X(t)^{\bullet}$ and substituting into equation F.3, the third genreral form is obtained for behavioral specification:

$$Y(t) = \gamma\emptyset_0 + \gamma\emptyset_1\, Z(t) + \gamma\emptyset_2/\alpha\, X(t) - \gamma\emptyset_2(1 - \alpha)/\alpha\, X(t-1)$$

[30] Note that the variable X(t) in equation F.7 will be replaced by X(t-1), if the adaptive expectation hypothesis in equation F.4 is stated alternatively, as indicated in the footnote above.

$$+ (1 - \gamma)\ Y(t-1) + v(t) \qquad \text{F.9}$$

(iii) Finally, a purely 'ad hoc' expectation model may be that the expected value of X(t) is simply the current value of X(t) if it is known in advanced or if the agent has a clear knowledge about the future, or it is given by the past year's value of X(t):

$$X(t)^{\circledast} = X(t) \quad \text{or,} \quad X(t)^{\circledast} = X(t-1) \qquad \text{F.10}$$

Note that this implies, in terms of previous discussion, either $\beta = 1$ or $\alpha = 1$, that is instantaneous adjustment process. As such the general form of the equation will be as follows:

$$Y(t) = f\text{«}\ Z(t),\ X(t) \text{ or } X(t-1),\ Y(t-1)\ \text{»} \qquad \text{F.11}$$

It may be noted here that the adaptive and partial expectation adjustment models although similar in appearance(equation F.6 and F.9), are conceptually very much different. We have seen above that depending upon the specific adjustment and expectation processes, the corresponding derived structural relationship will take either one of the general forms: F.6, F.7, F.9, or F.10.

The macroeconomic model developed in this chapter has all the five main distinguishing features, which according to Challen and Hagger(1983; p3) are the major characteristic features of what the authors prefer to call the "KK(short for Keynes-Klein) macroeconometric system". These features are as follows: the product market always clears economy wide, allowing for the existence of disequilibrium in one or more sectors within the economy; the model is formulated in discrete time; it is a dynamic model; the model incorporates some non-linear relations, although, in this study, with suitable transformation linearity is retained to avoid computational difficulties; and finally, the model is stochastic.

However, there are substantial differences both with respect to scope and importance of behavioral relationships between the present macro model and the standard so-called KK-macro model widely used in both developed and developing country studies. Among major differences, one is that the present model explicitly recognizes that the availability of inputs in a developing country like Bangladesh is at least as important as demand factors in determining aggregate output. The supply side has been emphasized by disaggregating the output sector into several key sub-sectors(Klein, 1965, 1978). The extent of sectoral disaggregation, however, has been dictated by the special characteristic features describing the economy and also by the objectives of this study.[31] In addition to the supply side details, the model stresses the role played by the institutional factors, government policy variables, 'duality', food shortage, balance of payments problem, etcetera, each of which have their own way of producing shocks and imbalance in the economy. In

[31] The objectives are outlined in chapter one above.

the following sections the complete specification of macroeconomic relationships are given along with their theoretical underpinings, both for individual relations and for interconnections and feedbacks among various sectors in the model. The model contains in all 101 equations of which 55 are stochastic--behavioral and quasi-behavioral--and the rest are identities, definitions and equilibrium conditions.

All variables throughout this study refer to current time period magnitudes, real or nominal, unless otherwise mentioned. In case of a lagged variable a subscript -i, where i = 1,2,.. indicates number of periods lagged, is added. Finally, all variables are measured in constant taka[32] with 1972/73=100 as the base year, unless otherwise mentioned.

3.2 PRODUCTION OR SUPPLY SUB-MODEL

3.2.1 Introduction

In the literature production or supply constraints are widely considered to be much more relatively important in the developing countries[33] than in the developed countries. In fact the traditional macroeconomic models for developing countries--all emphasize supply considerations only. A detailed study of the supply side is now considered not only imperative, but a new frontier in modern macroeconomic mod-

---

[32] Taka, in short Tk, is the domestic currency name since 1972. Before 1972 rupee, or in short 'Rs', was the currency-name. In 1984 the domestic quasi-free market exchange rate vis-a-vis US$ had been US$1 = 30 takas.

[33] Rao(1952) is one of the early studies along this line.

elling both for developed and developing countries(Klein, 1978).

This section considers domestic production relationships for the Bangladesh economy. Total output is first disaggregated into three broad sectors: (i) Agriculture; (ii) Industry; and (iii) Services. Each sector is in turn divided into a number of sub-sectors, the choice of disaggregation being determined by several factors, of which one is their importance as either suppliers or users of foreign exchange resources. The divisions are as follows: Agricultural sector produces (1) Foodgrains, which include rice and wheat, (2) Jute, and (3) "All other" agricultural outputs; Industrial sector consists of (4) Manufacturing,[34] and (5) Construction; and Service sector includes (6) Infrastructure, which includes public utilities, transportation, and communication, (7) Trade and Banking (and insurance), (8) Housing (ownership of dwellings), and (9) Other Services, including public administration and defence.

It is postulated that there exist a real value added production function for the producing sectors outlined above. At the sectoral level, it has been demonstrated in the literature that the gross sectoral output is properly a function of intermediate inputs, labour and capital inputs--all sector designated(Klein, 1978). Furthermore, it has been

[34] Bangladesh has a very small mining sector(value added is about 0.001 percent of GDP in 1982/83), which is included under manufacturing sector in this study.

emphasized that in an open economy, intermediate imports must be treated like primary factor inputs even at the aggregate level. Nevertheless for a predominantly primary commodity producing economy like Bangladesh with very little inter-sectoral flows,[35] value added postulate may not be an unreasonable one.

In general macroeconomic models contain production of value added in some sectors expressed in the form of demand rather than supply relationships. The explanatory variables in these sectors are elements of aggregate final demand. However, Behrman and Klein(1970) have demonstrated that these equations can still be seen as some transformations of an input-output type of production process. For instance, the system may be written in matrix form as:

$$[\mathbf{I} - \mathbf{A}] \cdot [\mathbf{Ygi}] = [\mathbf{Fi}] \qquad \mathbf{F.12}$$

where, **A** is the inter-industry flow coefficient matrix $[\alpha ij]$, **Ygi**'s are gross sectoral output, and **Fi**'s are final demands for sector i=1,2, ,,, n. By inverting the expression we obtain

[35] Alauddin and Mules(1980) estimates a very high "retention ratio" (89.12 percent in 1977/78) for the Bangladesh agriculture. This implies that in 1977/78, only about 11 percent of the total output generated by final demand for the output of this sector found its way to the non-agricultural sectors. The study further indicates that there is only about 27 percent inflow and outflow of intermediate inputs and outputs into and from agriculture respectively, during the period 1972/73-77/78. Finally, an examination of the Bangladesh input-output tables also indicate that inter-industry flows are indeed very insignificant.See, Tim(1968) and Planning Commission(1975).

$$[Y_{gi}] = [I - A]^{-1} \cdot [F_i] \qquad \text{F.13}$$

We assume that value added in each sector is proportional to gross output of the corresponding sector.[36]

$$[Y_i] = \beta_i \cdot [Y_{gi}] \qquad \text{F.14}$$

Therefore, we write

$$Y = \beta_i \cdot I \cdot [I-A]^{-1} \cdot F \qquad \text{F.15}$$

In other words,each sector's value added is a linear function of sectoral final demand components, **Fi**'s. But, unfortunately regular time series observations are not available on **Fi**'s. However, these **Fi**'s, which are elements of GNP(consumption, investment, government expenditures, exports, and imports) demanded by each sector, can be approximated by replacing them selectively in each equation by GNP elements that are closely related to **Yi**'s. It is in this sense that the demand determined value-added production system may be seen as some transformation of input-output relationship. From these considerations, Behrman and Klein(1970) suggest that these are not purely demand relationships, but are based on production or supply side considerations. But, admittedly these demand-oriented functions do not go far enough to incorporate supply factors into the model. In this study, such demand determined pro-

[36] The coefficient β for agriculture has been estimated to be 0.797 and 0.807 for the years 1972/73 and 1977/78 respectively. The figures are calculated from Table IIA and IIB in Alauddin and Mules(1978).

duction relations are limited to the services sector only. In other sectors supply side considerations are introduced in greater detail and with sufficient disaggregation. The key sectoral production functions are specified in the traditional form. Individual sectoral production relations and their rationale are given under appropriate sections below.

3.2.2 GNP Identities

The identities or definitional equations, given below, simply state that the value added at various levels of aggregation is a sum of the relevant elements of the production sector.

$$Ygd = Yag + Ymf + Ycn + Ysr \qquad 2.1$$

$$Yag = Yfd + Yjt + Yoa \qquad 2.2$$

$$Ysr = Yin + Ytb + Yho + Yos \qquad 2.3$$

$$Y = Ygd + (NR/P) \qquad 2.4$$

$$Ygn = Y - (Tid - SUB) / P \qquad 2.5$$

$$Yna = Ygd - Yag \qquad 2.6$$

where, Ygd is real gross domestic product(GDP); Y is real gross national product(GNP) at market prices; Ygn is real GNP at factor costs; Yag is real value added in total agricultural sectors; Yfd is real value added in food-grains sector; Yjt is real value added in jute(cash-crop) sector; Yoa is real value added in 'other agriculture' sector; Ymf is real value added in total manufacturing sectors; Ycn is real value added in construction sector; Ysr is real value added in total services sector; Yin is real value added in 'infrastructure' sector; Ytb is real value added in trade and banking sector; Yho is real value added in housing services sector; Yos is real value added in 'other services' sector; Yna is real valued added in all non-agricultural sectors; NR is net factor income from abroad defined as net private remittances(NPR) less net factor income payment(NFIp) expressed in current domestic currency prices using the nominal exchange rate; and Tid is indirect taxes; SUB is government subsidies to agriculture and other sectors; and P is the general price level.

3.2.3 Agricultural Production

Short-run fluctuations of agricultural output in Bangladesh are caused to a large extent by changes in climatic and weather conditions. These conditions enter into agricultural production function as limiting factors. However, given these limiting factors there still exist substantial scope for increased aggregate production in the short-run, particularly through efficient utilization of other inputs, increased investment, the availability of key inputs and services, and the removal of market barriers. At individual crop level the annual fluctuations in the production of a particular crop or a group of crops are mainly influenced by economic considerations. Here the major inputs like land, labour and fertilizers can be shifted among various types of crops and the farmers may switch in between crops in response to changes in relative prices and profitability[37] thereby contributing to fluctuations in output.

Total agricultural sector, as mentioned above, is divided into three broad output groups, namely: food-grains(which include rice and wheat), jute, and "all other" agricultural outputs (including[38] forestry, livestock, and fisheries). This disaggregation was done in view of the fact that the rate of growth of food-grains production has been a critical constraints[39] in the development process of the Bangladesh economy and that jute is not only the major cash crop[40] but also is the major foreign exchange earning commodity[41] for the country. In explaining the production of food-grains and jute, acreage under crops and yield per acre have been considered separately. The farmers' responses, and allocation decision among these two crops are accounted for by the Nerlovian adjustment mechanism. Details of this mechanism

---

[37] Several studies provide evidence that farmers do respond to market signals. See, in particular, Schultz(1964), Nerlove(1958), Behrman(1968) and Krishna (1967).

[38] In 1982/83, these three together contributed 21.15 percent of total agricultural value-added.

[39] The country has been running on an average 10 percent food deficit for more than a decade now.

[40] Over 90 percent of the crop is marketed in Bangladesh, mainly for export.

[41] In 1982/83, raw jute and jute goods exports together contributed over 70 percent of total merchandise exports earnings in real term. The share was over 80 percent before the independence and during the first half of the seventies(World Bank: 1984).

and its rationale has been well addressed in the literature(Nerlove 1958, Krishna 1963, Behrman 1968).

3.2.3.1 Foodgrains Production

Total area under food-grains[42] is expected to respond positively to expected relative farm-gate price of food-grains, relative yield, and the government procurement price variables, respectively, and negatively to food-grains relative 'price risk' and the expected relative prices of input to output. It is well known that jute and food-grains are competing crops in Bangladesh. Land, labour and agricultural equipment are readily inter-changeable between the two with low transaction costs. The competition between these two crops is modeled by incorporating relative price and yield variables. Government procurement price policy in Bangladesh became an effective policy instrument in boosting production only in recent years, hence, *a priori*, the variable is not expected to be significant. Jute is the major cash crop for farmers in the country. Assuming that farmers

[42] As mentioned earlier 'food-grains' in our case include all varieties of Rice(namely, aus, aman, and baro) and wheat, contributing on the average nearly 55 percent of total agricultural value added in the early eighties. Clearly 'food-grains' is by far the largest single output category in terms of share in total GDP(on the average 30 percent of GDP during the same period). Among rice and wheat, the latter's contribution has been insignificant with some indication of momentum beginning in the later part of the seventies(the contribution of wheat averaged less than 0.6 percent of total value added in rice and wheat until mid-seventies and since then has grown to over 6 percent in early eighties by-passing the contribution of jute crop into GDP)(World Bank: 1984).

tend to keep their cash income(from jute and other cash crops) relatively constant,[43] an increase in jute yield is expected to have a positive effect on food-grains acreage and vice versa, ceteris paribus. However, an increase in food-grains yield, given that food-grains is a subsistence crop, may induce farmers to plant more substitute crops(cash crops), reducing acreage for the former. The resulting ambiguity in the sign of relative yield variable is removed by considering institutional factors and historical behavior pattern of farmers in response to high unemployment and price uncertainty in the post-harvest seasons, indicating that farmers tend to hedge their risk by planting food-crops.

Acreage decision is also affected by various agronomic variables that affect soil moisture content, mainly, water from irrigation (measured by the proportion of area under irrigation) and rainfall during the sowing months. Separate data on these variables are not available, hence are not included in the estimated equation. Finally, since the possibilities of bringing new areas under cultivation is limited in Bangladesh, any increase in acreage must come either in the form of land development or increasing cropping intensity or by substitution of jute-crop land and the land used for 'other' agricultural production. Therefore, in case of forecasting future values, a ceiling constraint on

---

[43] Mahmood(1985) found empirical support for this hypothesis.

total acreage may have to be imposed.

Due to both technological and institutional constraints and to some extent psychological reasons, it is postulated that farmers in Bangldesh follow a partial adjustment framework about their acreage decision. For the price expectation variables, a purely 'ad hoc' expectation process is assumed--expected relative prices are simply the corresponding lagged prices. One exception is for the expected price of fertilizer input. Since fertilizer is supplied by the government at a pre-announced fixed price, the expected price of it is simply the current price.

Once the acreage decision is taken, the food-grains yield per acre depend negatively on the expected relative price of inputs to output, and on various agronomic variables, such as the proportion of area under irrigation and the amount of rainfall during the growing season, etc. A key input variable, fertilizer, has been provided with high government subsidy, and the availability of the same has been an important limiting factor for production over the sample period. The total fertilizer used per acre is expected to have a positive effect on the yield for obvious reasons, ceteris paribus.[44] For the rainfall variable, since excessive rainfall leads to floods, and insufficient rainfall to droughts and the effects on yield of the two are not symmetric--

---

[44] The implied monotonic relationship, however, is not theoretically sound since diminishing returns will set in sooner or later.

draught is assumed to be worse than excessive rainfall-- a Gamma type distribution is assumed to be appropriate.[45] Availability of bank credits to farmers may induce higher yields by providing the required cash and incentives to invest and also by smoothing the cash-flow problem of farmers. A time trend is added to capture the effects of left-out variables such as technological changes on the yields. Finally, the product of yield and acreage provides an estimate of total production of food-grains. After solving for partial adjustments in acreage decision and substituting for expectational variables for relative prices the postulated equation for food-grains production sector may be written, which in terms of our previous discussion follows the general form as specified in equation F.11 above, as follows:[46]

---

[45] The Gamma distribution between yield(YL) and rainfall(RNF) is given by the following: $\ln YL = \alpha - \beta\ RNF + \gamma \ln RNF$. Note that if symmetry is assumed, normal distribution would be appropriate. See, Lahiri and Roy(1985) for details.

[46] An alternative way of modelling this sector would be to estimate a standard production function of Cobb-Douglas type with constant returns to scale, as follows:

$$Yfd = Y_1 [\ Lag,\ RNF,\ FT,\ CIf,\ TW,\ t\ ]$$

where, Lag is labour in agriculture, TW is number of tube-wells used for irrigation purpose (or, total area irrigated may be substituted instead) and CIf is cropping intensity (measured as the share of total cultivated area as a proportion of total cropped area). Note, that by invoking neo-classical optimization behaviour this equation can be solved to derive input demand functions for the sector. See, PIDE(1983) for modelling agriculture along this line.

$$ACf = f_1[\ (Pf/Pj)_{-1},\ (YLf/YLj)_{-1},\ PRf/PRj,\ ACf_{-1},\ Pfg,\ Pft/(Pf)_{-1},\ D_{71}\ ] \qquad 2.7$$

$$f^1,\ f^2,\ f^4,\ \text{and } f^5 > 0\ ; \qquad f^3 \text{ and } f^6 < 0$$

$$YLf = f_2[\ CRag/Pag,\ FT/ACf,\ Pft/(Pf)_{-1},\ \exp\langle\langle \beta RNF + \gamma \ln RNF\rangle\rangle,\ t,\ D_{71}\ ] \qquad 2.8$$

$$f^1,\ f^2,\ f^5,\ \text{and } f^6 > 0\ ; \qquad f^3 \text{ and } f^4 < 0$$

$$Qf = ACf * YLf \qquad 2.9$$

where, ACf is acreage of food-grains; YLf is food-grains yield per acre; YLj is jute yield per acre; Pfg is government procurement price for food-grains; CRag is total bank credits to agricultural sector; Pag is agricultural price index or deflator; Qf is total domestic food-grains production; FT is fertilizers used in agriculture; t is a time trend; D_{71} is a dummy variable taking the value of one during the post-independence period 1972/73-1982/83 and of zero otherwise; Pf is price of food-grains(growers); Pj is price of jute(growers); RNF is average rainfall in Bangladesh; Pft is price of fertilizer; and PRf and PRj are the 'price risk' variables for food-grains and jute, respectively to capture the farmers' responses and preferences due to variations in prices, measured as a four-year moving average of standard deviation(SD) of monthly farm-gate price of the respective crop:

$$PR,t = 0.25\sum_i SD(t-i)\ ; \qquad \text{where, } i = 1,2,3,4 \qquad (2.7.1)$$

The <u>a priori</u> sign of the partial derivatives are indicated below each equation, where, for example in equation 2.7, f^1

is the partial derivative(or elasticity, when in double-log form) of food-grains acreages relative to the 1st right-hand side variable-- relative food-grains price(Pf/Pj), f^2 is the partial derivative(or elasticity, when in double-log form) of food-grains acreages relative to the 2nd right-hand side variable-- the relative yield variable(YLf/YLj), and so on.

Several components of aggregate demand are defined and their behavioral relationships specified under appropriate sections below. Lack of reliable data, however, do not permit us to estimate separate demand relationships for domestic food-grains. A demand function for imported food-grains, however, has been estimated separately in the foreign sector block. The identity describing the total availability of food-grains in any period is given by the following:

$$TQf = Qf_{\blacksquare} + QMf + QSf_{-1}; \quad Qf_{\blacksquare} = (1 - 0.10) * Qf \qquad 2.10$$

where, TQf is total availability of food-grains, QMf is total food imports, and $(QSf)_{-1}$ is stock of food-grains at the beginning of the period. Total domestic food-grains production is adjusted by 10 percent for seeds, wastages etc. This equation coupled with the demand side determines the food-grains price.

3.2.3.2 Jute Production:

The acreage and yield equations for jute production has been specified along the same lines as for food-grains.

$$ACj = f_3[\ (Pj/Pf)_{-1},\ (YLj/YLf)_{-1},\ PRj,\ ACj_{-1},$$
$$Pjg_{-1},\ Pft/(Pj)_{-1},\ DCi,\ D_{71}\ ] \qquad 2.11$$
$$f^1,\ f^4,\ \text{and } f^5 > 0; \quad f^2,\ f^3 \text{ and } f^6 < 0$$

$$YLj = f_4\ [\ CRag/Pag,\ FT/ACj,\ Pft/(Pj)_{-1},$$
$$\exp«\beta RNF + \gamma \ln RNF»,\ t,\ D_{71}] \qquad 2.12$$
$$f^1,\ f^2,\ f^5,\ \text{and } f^6 > 0; \quad f^3 \text{ and } f^4 < 0$$

$$Qj = ACj * YLj \qquad 2.13$$

Where, ACj is acreage of jute; DCi is a dummy variable to capture the effect of direct government controls over raw jute trade; Pjg is government procurement price for jute; PRj is 'price risk' variable for jute[47] as defined above(equation 2.7.1). In case of jute acreage decision the own 'price risk' is the relevant variable rather than the relative price risk, since jute is a cash crop in Bangladesh and farmers responds quickly to jute price variability by adjusting acreages.

On the demand side there are jute-mills demand, raw jute export demand, and stock demand, and the demand-supply identity for the raw jute sector is given by the following:

$$Qj_{\blacksquare} = QJmf + QXj + \Delta STj\ ; \quad Qj_{\blacksquare} = (1 - .10)\ Qj \qquad 2.14$$

where, QJmf is domestic jute-mills' demand, QXj is export demand and ΔSTj is changes in stock of raw jute. Total domestic production of raw jute is adjusted by 10 percent

---

[47] Since jute price shows marked fluctuations at farm-gate level, a 'price risk' variable should be included in the acreage equation(Just, 1975). Ahammed(1980), and Rahman(1981) incorporated a risk variable in their jute simulation models for Bangladesh and both have found the variable to be significant.

for seeds, wastages, etc.

The gross outputs of food-grains and jute are related to respective value-added by the following equations:

$$Yfd = \alpha_{15} \; (Pf * Qf^{\blacksquare} / Pf^{73}); \quad 0 < \alpha_{15} < 1$$

$$Yjt = \alpha_{16} \; (Pj * Qj^{\blacksquare} / Pj^{73}); \quad 0 < \alpha_{16} < 1$$

Where, Yfd and Yjt are real value added in food-grains and jute crop sectors, Pf^{73} and Pj^{73} are base year(1972/73) price of food-grains and jute, and α_{14} and α_{15} are the 'coefficients of proportionality' between the real value added and gross real output for food-grains and jute, respectively.

3.2.3.3 All Other Agricultural Production:

Production in 'all other' agricultural sector[48] is postulated to be mainly demand determined:

$$Yoa = f_5 \langle\!\langle\, C, Ig, CRag/Pag, D_{71} \,\rangle\!\rangle \qquad 2.15$$

$$f^1 \text{ and } f^2 > 0; \quad f^3 = \pm$$

Where, Yoa is value-added in all other agriculture, C is aggregate real consumption; Ig is real public investment; CRag is the volume of bank credits available to the agricultural sector; and Pag is price index for agriculture. It is

[48] 'All other' agricultural outputs include value added in agricultural crops except rice, wheat and jute(for example, vegetables, sugarcane, tea, spices, pulses, fruits, oil seeds, etcetera), and in forestry, livestock, and fishery. Total value added in these categories as a proportion of value added in total agriculture comes to little over 40 percent, in current prices, for the year 1982/83, of which livestock, fishery and forestry together constitute approximately 26 percent(World Bank: 1984).

expected that all other agricultural production will respond positively to aggregate demand variables, probably with most likely unitary elasticities. Total public investment in general will have positive impact on agricultural production. However, the response to real bank credit is not unambiguous, since the sign of the coefficient is partly dependent upon whether the variable dominates production as a supply side variable or as a demand side variable. As a supply side variable the effect is very likely to be negative, since any increase in agricultural credits will generate greater efforts at the subsistance crop, food-grains, and the major cash crop, jute, diverting at least part of the resources away from production of other agricultural goods.

Finally, total agricultural output is given by the following identity:

$$Yag = Yfd + Yjt + Yoa \qquad 2.16$$

3.2.4 Industrial Production

Industrial production is composed of manufacturing and construction. This particular breakdown of industrial production has been mainly dictated by the nature of production and the availability of data. A more appropriate breakdown, given the structure of the economy, would have been either large-scale manufacturing and small-scale manufacturing or jute-manufacturing, non-jute manufacturing and others. Since government plays a significant role in domestic capital formation and owns a major share of the industrial sector, yet another alternative breakdown would have been along the line of private and public ownership of production processes. Neither of these alternatives can be considered here mainly due to the non-availability of relevant data. On the other hand the breakdown adopted here, however, has some advantages. With respect to various input classifications there will be relatively less aggregation bias. Furthermore, distortions in both factor markets[49] and in output markets from private and public sources will be in most cases more uniform along the industry-breakdown adopted here.

It is important to note, at the outset, that the purpose of having sectoral production function in this model is not to predict labour employed, as is the case in most macroeconomic models. Our main objective for having these relations is to predict output.

3.2.4.1 Manufacturing Production

[49] Trade unions are active and successful mostly in manufacturing, particularly in large-scale manufacturing. Government's minimum wage law is also mostly effective in this sector. While a large part of manufacturing sector is government owned, the construction section is mostly privately owned.

The functional specification for production technology in this sector is assumed to be of neo-classical type.[50] Utilized total capital stock, and employed labor are assumed to be the major input variables. The production function for the manufacturing is postulated as follows:

$$Ymf = f_6 \ll (CUmf*Kmf),\ Lmf,\ t,\ Dn,\ D_{71} \gg \qquad 2.17$$

$$0 < f^1 < 1; \quad 0 < f^2 < 1; \quad f^3 > 0$$

Where, Kmf is real capital stock in manufacturing; Lmf is labour employed in manufacturing; Dn is a dummy variable for the nationalization of major industries in 1973; and CUmf is an index of capacity utilization rate in manufacturing. The real capital stock is determined by the following equation:

$$Kmf = (1 - \beta_{18}) * (Kmf)_{-1} + Imf; \qquad 0 < \beta_{18} < 1 \qquad 2.18$$

where, β_{18} is the rate of deprecation of the capital stock; and Imf is aggregate real investment in manufacturing. The specific structure of the production technology is left open for empirical verification. Past studies on Bangladesh have found evidence of either constant returns to scale or decreasing returns to scale in manufacturing. One study(Hussain, 1972) also found the absence of technological progress in the sector.

The capacity of real value added in manufacturing is defined by the 'trend-through-the-peaks' method.[51] One obvi-

---

[50] Some earlier studies on Bangladesh manufacturing technology provides empirical support for such a representation. See, for example, Rahman(1973), Hussain(1972), and Rashid(1983).

[51] Also called "Wharton School Method", in which output peaks are connected linearly and the ensuing path denotes

ous problem with this approach is that some of the peak points will not represent the true maximum output.[52] However, no attempt is being made here to adjust for, if any, such distortions. The capacity utilization rate(CUmf) is the actual value added obtained in a period as a percentage of the calculated capacity value added for that period.

In equation 2.17, it is assumed that the 'utilization factor' is more important with capital than with other input factors. Studies on several developing countries have demonstrated that there is substantial underutilization of capital in the manufacturing industries of these economies.[53] Since, "utilized capital" is the appropriate capital input variable in the production function, therefore it is quite justified to have the utilization factor with the capital stock input. But the same should be the case with labour input too, as well as with other inputs, if any, in the production function. However, as Evans(1969) pointed out, the labour input would have already been adjusted if it is expressed in terms of man-hours. The exact form of trans-

---

the full capacity value added.
Alternative to this method is the 'trend method', where the exponential growth rate(g) of the value-added is calculated. Here, capacity output(CU) is defined as

$$\ln CU = \ln Yo + g.t$$

where Yo is the observed value-added in the initial year.

[52] For a full description of this method, see Klein and Preston(1967), and for a comparison of several indicators of capacity utilizations, see Phillips (1963).

[53] For example, Behrman(1977) on Chile, Islam(1980) on Bangladesh.

formation[54] of the production function due to capacity utilization factor is an empirical question, and results in Evans show that the specification similar to equation 2.17 yields "the most reasonable results"(page 251).

Empirically, it has been observed, both in developed and developing countries, that the degree of capacity utilization rate(CUmf) fluctuates over time. Behrman's study(1977) on Chile found that "the primary determinants of fluctuations in the rates of sectoral capacity utilization in most sectors seem to be the conditions in factor and product markets(including the state of aggregate demand)."

To explain the low rates of capacity utilization, three sets of determinants can be isolated.[55] First, there are factors such as inadequate demand, non-remunerative output price, high-costs or non-availability of critical raw materials, intermediate and capital goods(especially imported ones), and labour unrest etc. Second, there is the factor such as the non-availability of short-term funds (bank credits and retained earnings). Finally, factors related to various natural conditions, for example, rainfall, drought and earthquakes, also affect the capacity utilization rate. This last set of determinants, of course, are more relevant

---

[54] Other possible transformation for a simple Cobb-Douglas Production function are

$$\text{In } Ymf = \text{In } A + (a_1 - a_2 CUmf) \text{ In } Lmf + (b_1 + b_2 CUmf) \text{ In } Kmf + \alpha t$$

$$\text{In } Ymf = \text{InA} + c_1 \text{ In } (CUmf.Lmf) + d_1 \text{ In } (CUmf.Kmf) + \beta t$$

[55] See Behrman(1977), pages 150-156 for details.

in the case of agricultural capacity utilization. The following functional relationship is postulated to explain the capacity utilization rate in manufacturing.

$$CUmf = f_7[\ NWmf/Pmf,\ Pmr/Pmf,\ (Mr/Pmr)/Ymf,\ Y,\ CRmf/Pmf,\ D_{71}] \quad 2.19$$

$$f^1 \text{ and } f^2 < 0; \quad f^3,\ f^4, \text{ and } f^5 > 0$$

where, Pmf is price of manufacturing goods; NWmf is wage rate for manufacturing workers; Pmr and Mr are imported raw material prices and quantities, Y is aggregate demand, and CRmf is bank credits to manufacturing sector.

The input demand functions for the manufacturing sector may be derived from the above production function by invoking the assumption of optimizing behavior for the producers.[56] In a developing country such as Bangladesh neoclassical investment behavior is not a realistic representation. Investment opportunities abound and opportunity cost calculation is less important than the availability of funds. Since the interest rate in the formal market is fixed at below the market clearing level, excess demand exits, and as such, credit rationing is widely applied. The unsatisfied

---

[56] See Varian(1984) for the derivation of input demand functions under alternative assumptions regarding the production technology and costs conditions. A related approach, known as the labour requirements approach to input demand, solves the production function for the labour required, and obtains labour demand as a function of output and other inputs in the production function: Lmf = f« Ymf, Kmf, ,,, ». This may be combined with a labour-adjustment model allowing gradual adjustment of labour input to its equilibrium level. Using simple stock adjustment framework the labour demand function becomes Lmf = f« Lmf_{-1}, Ymf, Kmf, ,,, ». This is the approach taken in the Brookings Model. Yet another variant of labour demand function is where desired labour is related to the wage level: Lmf = f« Lmf_{-1}, Wmf ».

demand then will have to be met by other sources of funds such as internal resources, retained earnings, private remittances from abroad, or from the informal market. Both the level and the opportunity costs of these factors would be relevant for the realization of actual investment. On the other hand the institutional credits and interests costs are also important since they act as shift parameter in the marginal cost calculation.

Labour demand function for total manufacturing:

$$Lmf = f_8\langle\langle\ NWmf/WPImf,\ Ymf,\ (EERmk * Pmk^0/NWmf),\ t,\ D_{7073},\ D_{71}\ \rangle\rangle \qquad 2.20$$

$$-1 < f^1 < 0; \quad 0 < f^2 < 1; \ f^3 = ?; \quad f^4 > 0;$$

Investment demand function for total manufacturing:

$$Imf = f_9\langle\langle\ (Ymf)_{-1},\ rTD,\ Pinv/WPImf,\ NR/Pm,\ (CRmf/Pmf),\ Kmf_{-1},\ Dn,\ D_{71}\ \rangle\rangle \qquad 2.21$$

$$1 > f^1 > 0; \ f^2 < 0; \ f^3 < 0; \quad f^4 > 0; \ f^5 > 0; \ f^6 < 0$$

Where, Pinv is investment price index, WPImf is manufacturing price index, EERmk is effective exchange rate for imported capital goods,[57] Pmk^0 is foreign currency price(unit value) index for imported capital goods; Pm is price index for all imports; and rTD is interest rate on time and savings deposits, the opportunity cost variable, and D_{7073} is a dummy variable for the period of widespread labor unrest and political instability taking the value of 1 during 1969/70 to 1972/73 and of zero otherwise. Note that

[57] The effective exchange rate is defined as the nominal rate(ER) adjusted for tariff rate(ti) and subsidies or 'bonus expenditure rates'(bi) for the ith importables. That is, EER = ER * (1 + ti + bi).

this is an aggregate investment function for manufacturing which includes both private and public investments. Strictly speaking, this amalgamation is not appropriate, given the differences in behavioral responses and in overall constraints the two sectors face. As such we have modelled the private and public investment behaviors separately in the aggregate demand block. The import demand function for imported raw materials is modelled in the import demand block later.

3.2.4.2 Construction Output

In the absence of reliable data on sectoral capital stock and labour inputs, the production function for the construction sector is not specified in the traditional form. Total real value added in construction is determined by the aggregate activity variable--gross domestic product, the relative prices, the rate of structural changes, and by sector specific policy variables. The general form of the function may be written as follows:

$$Ycn = f_{10}\langle\langle Ygd,\ Pcn/Pgd,\ Yna/Yag,\ I,\ Dcn,\ D_{71} \rangle\rangle \qquad 2.22$$

$$f^{1},\ f^{3},\ \text{and}\ f^{4} > 0; \quad f^{2} = ?$$

where, Pcn is price deflator for construction output; I is aggregate real investment(private and public); and Dcn is a dummy variable for government policy changes in the construction industry. It is expected that the output in this sector will respond positively to aggregate economic activity variable, Ygd, the rate of structural transformation of the economy or the degree of urbanization-- measured by the ratio of non-agriculture to agricultural output(Yna/Yag), and to total investment demand in the economy. Apart from the income effects, there may be relative price effects. However, the sign of the effects is not unambiguous *a priori*.

3.2.5 Services Production

As in many other countries, both developed and developing, the services sector in Bangladesh has been growing at a relatively higher rate in comparison with both the agricultural and the industrial sector.[58] But, particularly due to the difficulty of measuring the services output, the difficulty of obtaining data because of heterogeneity of activities in this sector, and the large role of non-profit or

[58] In almost all the developed countries, it has been observed that, employment grows more rapidly in services than in the rest of the economy, and in recent decades, this is true even if we look only at nonagricultural employment. Among others, the following are suggested as possible causal factors for such a shift: (i) the income elasticity of demand for services may be significantly higher than that for both primary and secondary production, (ii) output per worker has risen more rapidly in agriculture and industry than in services, and (iii) a differential change in the quality of labour may be a major factor in explaining differential rates of growth of output per worker(Fuchs, 1969). Kravis, et al(1983) on the other hand finds no clear evidence of income elasticity differences, but observes that the services prices rise relative to commodity prices as income rises. They conclude that the growth of the sector is due to evolution of technology rather than the change in wants associated with rising income.

non-private organizations[59] in the services sector and the difficulty of analyzing their behaviour--all of these have served to limit our understanding of the factors affecting production, employment, and productivity in this sector.[60]

In this study, services sector output refers to value added in the sector. We have disaggregated this sector into four broad categories of services, namely; (1) Infrastructure, which includes "power, gas and water supplies", and "transport and communication":[61] (2) Trade and Banking, which includes "trade services" and "banking and insurance"; (3) Housing or "ownership of dwelling"; and (4) Other services, which include "public administration and defence" and "Professional and miscellaneous services".

---

[59] In case of Bangladesh, a significant portion of the services sector operation is owned and controlled by the Government, particularly after 1971.

[60] For an excellent discussion of these and other important issues relating to the service sector, see Fuchs(1969) and Kravis, et al(1983).

[61] There are disagreements among the economists as to the proper classification of these sectors. Studies by Victor R. Fuchs on the U.S. economy(for example, in Fuchs(1965)) treated 'transport and communication' as a goods industry, while studies such as Worton's(1969) on Canada treated the same as a service industry.

On the other hand, particularly because of the special nature of the output, "power, gas and water supplies", or in short "utilities" may be treated as either goods or services industry. The two studies mentioned above treated them as a goods industry. In this study, it is treated as a services industry.

Due to several institutional, political and sociological factors the service sector in Bangladesh has received relatively larger share of investment, both private and public.[62] We also observe that the sector is labour-intensive and that the capacity in this sector can be expanded very rapidly even in the short run(with some exceptions, such as in the case of electricity generation). Furthermore, the supply of unskilled labour to the urban economy can be considered as infinitely elastic within relevant ranges, given the country's very high unemployment, underemployment and migration rate. While skilled labour in some areas are in scarce supply,[63] given the country's resources and existing facilities unskilled labour can be trained rapidly, thus making the supply curve of skilled labour quite flat. Therefore, it could be inferred, as a good approximation, that supply is not the determining constraint in the services industry. Besides, the nature of the output in this sector dictates absence of inventories. It is quite logical, therefore, to assume that the quantity of services forthcoming in the economy is determined by the conventional

---

[62] Vernardakis(1979) observes the same for Greece.

[63] Mark Blaug's(1982) study on unemployment among skilled and educated population found comparatively higher unemployment rate among educated(post secondary) labour force, in urban areas. With respect to technical/skilled labour force, there are evidences(Blaug, 1982, Islam, 1983) of"surpluses" in certain professions, such as doctors, pharmacists and engineers. These "surpluses" mainly reflect the inadequate absorptive capacity vis-a-vis supply of these professionals. However, in some skilled categories, such as auto-mechanics, electricians, nurses, etcetera, there are evidences of shortages(World Bank 1984, and Blaug 1982).

interaction of an infinitely elastic supply curve with a downward-sloping domestic demand curve. The position of the supply curve (or the market price of services) is dependent, among others, on the wage rate, determined largely by institutional and historical rates of pay as modified from time to time in response to changes in the institutional environment and the average product of labour in agriculture,[64] and on other input costs. With these general observations, value added production function for four categories of services production are modelled as follows:

Infrastructure:

$$Yin = f_{11}\langle\langle Y, Yna/Ygd, Yin_{-1}, C, Iin, Pin/Pgd, Dn, D_{71} \rangle\rangle \quad 2.23$$

$$f^1 > 0;\ f^2 > 0;\ f^4 > 0;\ f^5 > 0;\ f^3 > 0;\ f^6 = ?$$

Trade and Banking:

$$Ytb = f_{12}\langle\langle Y, Yna/Ygd, Ptb/Pgd, Ytb_{-1}, Dn, D_{71} \rangle\rangle \quad 2.24$$

$$f^1 > 0;\ f^2 > 0;\ f^3 = ?;\ f^4 > 0$$

Housing

$$Yho = f_{13}\langle\langle Y, Yna/Ygd, CRho/Pho, Pho/Pgd, Yho_{-1}, Dho, D_{71} \rangle\rangle \quad 2.25$$

$$f^1 > 0;\ f^2 > 0;\ f^3 > 0;\ f^4 = ?\ ;\ f^5 > 0;$$

Other Services:

$$Yos = f_{14}\langle\langle Cg, Yna/Ygd, Pos/Pgd, Yos_{-1}, D_{71} \rangle\rangle \quad 2.26$$

[64] Since the average product of labour in agriculture affects the reservation wage of urban labour market(See Papanek: 1980). To be more precise, the wage level established in the traded-goods industries--mainly agriculture and manufacturing--will determine the wages in the industries producing non-traded goods--mainly services.

$$f^1 > 0;\ f^2 > 0;\ f^3 = ?\ ;\ f^4 > 0;$$

Where, Cg is government current expenditure; Iin is investment(private and public) in infrastructure; Dho is a dummy variable for government policy change in housing; Pin, Ptb, Pho, and Pos are price deflators for infrastructure, trade and banking, housing, and other services, respectively; and CRho is bank credits to housing. It is expected that the proxy variable, Yna/Ygd, for distribution of income and level of urbanization will affect the services output positively. Lagged services output has been included on the assumption that there is habit formation and the sign of the adjustment coefficient is unambiguously positive since the Houthakker-Taylor inventory effects can be ignored for most services. Apart from the income effects--measured by the activity variables, C, Y, and Cg--there may be relative price effects. The sign of the effect is, however, not clear, *a priori*.

3.3 EXPENDITURE OR DEMAND SUB-MODEL

3.3.1 Introduction

In all traditional models for developing economies such as in the Harrod-Domar aggregate growth model, Chenery-Strout two-gap model, Lewis-Fei-Rannis surplus-labour model, and the Leontief fixed-coefficient model, supply bottlenecks[65] play the major role in macroeconomic scenario.

---

[65] Usually due to insufficient supply of capital and or foreign exchange.

Aggregate demand is largely ignored. However, as we have already indicated above, the presence of excess capacity and the evidence of its response to aggregate demand,[66] the existence of significant short-run price responses, and the 'capacity-creation' effects of investment in addition to Keynesian direct multiplier effects,[67] do suggest that the exclusion of demand considerations may be very costly. In particular this exclusion will result in a misspecified model thereby giving a distorted picture of the structure of the economy, and the policy evaluations and prescriptions based on such a model are bound to be biased.

This section investigates the components of aggregate final demand. Several of these components' behavioral specifications and explanations are, however, given elsewhere in this study mainly for convenience. For example, tax functions, government current expenditures, demand for and supply of money are studied in the following section, while we have already encounter the investment function for total manufacturing sector in the previous section.

---

[66] For evidences on under-utilization of capacity see Behrman(1977) for Chile, Lecraw(1978) for Thailand, Winston(1970) for Pakistan, Saxsena(1969) reported in Healey(1972) for India, and Zaman(1980) and Islam(1982) for Bangladesh. In some cases under-utilization is due to constraints such as non-availability of some critical imported raw material, spare parts, etcetera, that have no domestic substitutions.

[67] See Mathur(1965), Krishna(1963), and Yotopoulas and Nugent(1976).

The following identity gives the breakdown of aggregate real consumption demand(C) into private consumption demand(Cp), and public or Government consumption demand(Cg).

$$C = Cp + Cg \qquad 3.27$$

It is important to note that the two consumption functions must be specified separately since the underlying behavioral responses and constraints are different for the two sectors. For same reasons the investment functions for Bangladesh must also be specified separately for public and private investments. As such aggregate real investment demand is composed of private gross fixed investment(Ipf), public gross fixed investment(Igf), and changes in inventories(Igs), both public and private. Due to non-availability of data on private inventories, only changes in public inventories are considered separately here.

$$I = Ipf + Igf + Igs \qquad 3.28$$

Private gross fixed investment is further disaggregated into three sectoral investment demand components. Also, total public investment(Ig) is composed of public fixed investment and changes in inventories:

$$Ipf = Ipa + Ipm + Ipo \qquad 3.29$$

$$Ig = Igf + Igs \qquad 3.30$$

Where, Ipa, Ipm, and Ipo are private gross fixed investment in agriculture, manufacturing, and all other sectors, respectively, and Igs is public investment in(food) stocks.[68]

Finally, the following identities describe the major components of foreign sector aggregate demand. Trade deficit(FD) is defined as the difference between total imports(M) of goods and non-factor services and total exports(X) of goods and non-factor services, all expressed in current taka and using the nominal exchange rate of taka.

$$FD = M - X; \qquad \text{or, } FDr = M/Pm - X/Px \qquad 3.31$$

where, FDr is trade deficit in real terms, while Pm and Px are domestic aggregate weighted average imports and exports price(unit value) indices, respectively. The current account balance(CA) expressed in current domestic currency prices is given by the following identity:

$$CA = X - M + NR$$

where, NR is net factor income from abroad defined as net private remittances(NPR) less net factor(investment) income payments(NFIp). The CA is further explained later. The capital account and current account balances together determines the balance of payments of the country.

[68] Separate and consistent data on public stock investment in non-food items are not available. But available rough information as well as some expert opinions suggest that this is not a significant investment in pre-independence period, but not so since independence for jute stock). Data on private stock investment is also not available. Admittedly, this exclusion of private stock formation processes is a serious drawback of the present macroeconomic model.

The capital account in the balance of payments is treated as exogenously determined. Three important reasons for such a treatment are worth mentioning here. First, capital inflows in Bangladesh are largely determined by exogenous factors such as domestic political stability[69] and aid-doners "confidence" in the performance of the domestic economy.[70] Secondly, wide spread exchange control and the practice of interest rate ceiling makes interest rate responsiveness of foreign capital inflow either negligible or nonexistent. Furthermore, capital market in Bangladesh is highly rudimentary as in most other developing countries. Finally, the following condition balances the aggregate demand and supply:

$$Y = Cp + Cg + Ip + Ig + X/Px + Xsn/Px - M/Pm - Msn/Pm \qquad 2.32$$

where, Xsn and Msn are non-factor services exports and imports, and Px and Pm are exports and imports prices, respectively.

3.3.2 <u>Consumption Demand</u>

Aggregate consumption demand is composed of private consumption demand and public consumption demand. Both functions are specified in real terms.[71] Nominal consumption and

---

[69] See, Islam(1978) and Faaland & Perkinson(1977).

[70] See, Faaland & Perkinson(1977), and World Bank(1982).

[71] Evans(1969: p55) showed that there are both economic and statistical reasons for which consumption functions should be specified in real magnitudes. From a statisti-

nominal disposable income are both deflated using the private consumption deflator[72] to get corresponding real magnitudes. Consumption demand is interpreted as expenditure flow inclusive of all spending on consumer durables. A disaggregated consumption expenditures model, for example, one for nondurables, one for durables, and one for services would have been preferable, but non-availability of such a disaggregated data-set constraint the present study to an analysis of aggregate consumption behaviour only. Several studies(for example, Islam 1965, Alamgir 1974, and Salehuddin 1983) have indicated the differences in consumer behaviour among rural(mostly agricultural income earning group, which in Bangladesh constitutes over 80 percent of all households) and urban households. Once again due to data

---

cal point of view if both money income and money consumption rises due to price increases only, this would produce an element of spurious correlation into the relationship between the two nominal variables. On the economic-theoretic point of view if price changes reflect inflation only, then real variables are the most appropriate since all the hypotheses are based on theories involving real quantities(See Bridge 1971: p71). However, if price changes reflect more of quality changes rather than inflation and the role of quality changes is emphasized(as in Duesenberry's (1949: p23) study), then a current price consumption function may be justified.

[72] There is disagreement among economists about the correct deflator for the nominal disposable income. Evans(1969: p56) defended the use of consumption deflator specifically on two grounds. There is the "purchasing power" argument, according to which the chosen price deflator should be such that the deflated magnitude of disposable income indicate the amount of physical goods that can be bought. The other argument is based upon the neoclassical assumption of micro-level consumption function being homogenous of degree zero in prices and income and that the macroeconomic relation should retain that microeconomic behavioral restriction.
However, several econometric studies have used GNP defla-

limitation any such sectoral study could not be undertaken here. The model utilized in this study to explain private consumption behaviour[73] hypothesizes that the savings-consumption decisions depend mainly on an appropriate income variable, with modifications due to a number of factors elaborated below.

3.3.2.1 Private Consumption

The private consumption behaviour in Bangladesh is postulated to approximate the following specification:

$$Cp = f_{15}\langle\langle\ Yd,\ Cp_{-1},\ WLT/CPI,\ Yag/Yna,\ \dot{P},\ NPR/CPI,\ D_{71} \rangle\rangle \qquad 3.33$$

$$0 < f^1 < 1;\ 0 < f^2 < 1;\ f^3 > 0;\ f^4 > 1;\ f^5 = ?,\ f^6 > 0$$

where, Yd is domestic disposable income, Yag/Yna is ratio of agricultural to non-agricultural output, $\dot{P}$ is aggregate inflation rate, WLT is aggregate nominal wealth of the private sector as defined in the monetary block later, and NPR is net foreign private remittances.. The domestic component of real disposable income Yd is defined as

$$Yd = \langle\langle\ (Y - Tid) - (Tdi - SUB)/P\ \rangle\rangle - NPR/P \qquad 3.34$$

---

tor to deflate disposable income; see for example, Klein-Goldberger model(1955) and Ball and Drake(1964). Bridge(1971; p71) concluded that a convincing answer to the deflator problem would be a careful study of the aggregation processes which is lacking in the literature.

[73] Private consumption includes households, non-profit institutions, and businesses consumption expenditures and is derived in the national accounts of Bangladesh as a residual after deducting public(or government) consumption from total consumption spending.

where, Tid is nominal indirect taxes, Tdi is nominal direct tax revenues(personal and corporation income taxes) and SUB is nominal government subsidies.

The Keynesian theory of consumption suggest that the major determinant of real per capital consumption is the real per capita disposable income. However, empirical evidence since the debut of Keynes' absolute income hypothesis suggest that current income alone is inadequate and in some cases misleading,[74] and that there are additional, important factors that ought to be considered in explaining all the puzzles in consumption behaviour.

T. M. Brown in a 1952 article writes,

> Habits ... associated with real consumption previously enjoyed become 'impressed' on human physiological and psychological systems and this produces an inertia or 'hysteresis' in consumer behaviour (p359).

---

[74] Empirical studies based on absolute income hypothesis reported large forecast error, in most cases underprediction, even though common indicators such as R , t-ratio etcetera indicate a good-fit for the postulated functional form. See, for example, Davis(1952) and Ferber(1953) for forecasting error using U.S. data. See also Bridge(1971; Ch 2).

[75] Brown did not specify the consumption function in per capital terms, while Houthakker and Taylor(1966) in a study of consumer demand in the United States used a continuous habit persistence consumption function in real per capita terms.
According to some observers, for example Burress(1973), Keynes in his General Theory(1936, p96-97) did anticipate the Habit persistence hypothesis long before Brown, or Duesenberry and Modigliani did!

Thus consumers are shown to react to changes in income.[75] Brown postulates that "the decline of the effect of past habit is continuous over time, rather than discontinuous as the Modigliani-Duesenberry hypothesis suggests".[76] The importance of lagged consumption variable is further underscored by both longsighted and shortsighted wealth theories[77] of consumption behaviour. Several empirical studies on developing countries, for example Vernardakis(1978) on Greece, have found lagged consumption a significant variable in the aggregate consumption function.

Besides current disposable income and previous consumption there are other relevant factors to be reckoned with to approximate correct specification for aggregate consumption

---

[76] Brown(1952, p370).

[77] Longsighted wealth theories--the permanent income hypothesis (see Friedman, 1957) and the Life-cycle hypothesis(see Ando and Modigliani, 1963)--maintains that the household optimizes by choosing a consumption stream over time and their current decisions are based on distant future events. While uncertainty may affect the future occurrences, still longsightedness prevails--that the presence of uncertainty does not dissuade the consumer from maintaining an inter-temporal-perspective. However, with suitable transformation, for example using Koyck-type distributed lag transformation in "permanent income hypothesis", the lagged consumption becomes an additional explanatory variable in the consumption function.
The shortsighted wealth theory, first developed by Ball and Drake (1964), maintains that due to uncertainty about the future, households tend to be shortsighted and consumer precaution restrict households from making a lifetime plan of consumption but instead tie consumption decisions to present circumstances. The aggregate consumption function derived from such a behavioral hypothesis contain lagged consumption in addition to current income as explanatory variables.
It is interesting to note that after suitable transforma-

behavior. Liquid asset holding, which in this study is approximated by the broad definition of real balances in this study, is one such variable. It is argued either that the liquid assets are a good proxy variable for wealth or that they are a strategic component of wealth for influencing consumption.[78] The usual hypothesis is that a rise in real balances will induce extra expenditures, and vice versa, ceteris paribus.

Different income groups may have vastly different consumption behaviour. It therefore becomes desirable to include a "distribution of income" variable as an explanatory variable in the consumption function. In particular, the greater the inequality of income in a country the greater would be the significance of an "income distribution" variable.[79] The distribution of income in Bangladesh is highly

---

tion of longsighted, and shortsighted wealth theories, and partial adjustment mechanisms based consumption functions--all produce similar aggregate consumption function with current income and lagged consumption as explanatory variables. The differences are in parameter values and restrictions, and of course, in underlying theoretical underpinnings.
For a lucid review of theoretical arguments justifying the inclusion of various lagged terms in consumption function and its implication in macroeconomic model, see Gapinski(1982, Ch 5 & 6).

[78] See Patikin(1965), especially Appendix M.

[79] Klein's 1963 model of the U.S. economy contains ratio of wage to property income as a separate variable in consumption function, but found the coefficient not-significant. Evans(1969) pointed out this may be due to the degree of income inequality in the postwar U.S. economy since the study on Japan by Klein and Shinkai(1963), where there is a relatively higher inequality of income, found the coefficient significant.
Vernardakis's(1978) on Greece, Gupta's(1970) study on

uneven as in many developing countries.[80] Unfortunately, no reliable data on income distribution, for example wage income and non-wage income, are available for Bangladesh. Therefore, a proxy variable--the ratio of agricultural income--to non-agricultural income is selected to capture the effects of income distribution on consumption. The rationale for such a choice is that the income distribution in Bangladesh is uneven among urban and rural areas(Osmani 1982, and Alamgir 1974) and the gap between the two has been widening over time. Since the rural sector is basically all agricultural and urban sector non-agricultural, the agriculture-non agriculture gap may be assumed to closely approximate rural-urban inequality.

The inclusion of the rate of inflation is based on forced-saving hypothesis. Finally, remittances from abroad in Bangladesh mostly translate into satisfying unsatisfied consumption demand and purchase of durables and real assets. Since, at least in the short run, this foreign source of income is considered transitory, *a priori*, it is expected that the corresponding marginal propensity to consume would be higher than that for adjusted disposable income.

India and Islam's (1965) on Bangladesh found the "income distribution" variable significant. Also, see Musgrove(1980) and Williamson(1969) for more evidence.

[80] See Osmani(1982), particularly Chapters 5 and 6, which calculate Gini coefficient for Bangladesh in 1973-74 for consumption distribution in current prices to be 0.231, compared with 0.129 in 1963-64. See also Alamgir(1974).

3.3.2.2 Public Consumption:

The behavioural specification for government real current consumption is postulated to depend on real government revenues(TR/WPI), real non-food-grains foreign aid and grants(AIDnf/WPI), price of food (Pf), and lagged real government consumption.

$$Cg = f_{16}\langle\langle TR/WPI,\ AIDnf/WPI,\ Cg_{-1},\ Pf,\ D_{75}\rangle\rangle \qquad 3.35$$

$$0 < f^1 < 1;\ f^2 > 0;\ 0 < f^3 < 1;\ f^4 > 0$$

where, WPI is wholesale price index, and D_{75} is a dummy variable taking the value of one during the famine year 1974/75 and of zero otherwise.

A priori, it is difficult to predict government current expenditure, particularly because a considerable part of government expenditure is determined by the caprice of domestic and international politics. However, the empirical evidence in UNCTAD(1973), Beltran del Rio and Klein(1974), Pani(1977), PIDE model(1983) and Behrman(1977)--all for developing countries--do support the specification postulated above. The postulated relationship can be explained by the fact that in the final analysis government consumption is constrained by total tax revenues(not by disposable income), even though in the short-run the government can resort to deficit financing or use external assistance to cover government current expenditures. Thus, barring abnormal years when the government has to finance large-scale relief programmes due to crop failure, famine, etcetera, one can hypothesize a stable relationship between government current expenditure and receipts. The factor that shifts the public consumption function in abnormal years is approximated by the price of food-grains. It is expected that the higher the price of food-grains, the greater will be the need for the public sector to procure additional food supplies at a "reasonable price" and distribute these to affected households at a subsidized price through the public rationing system, or to undertake unanticipated relief works to ease the burden of abnormalities on affected households. In either case, there will be a rise in government current consumption. Therefore, a rising food prices is expected to raise the government current expenditure, and vice versa, ceteris paribus.[81] Finally, lagged government expenditure variable is added to capture the effects of forces of inertia and institutional rigidities in government expenditures.

3.3.3 Investment Demand

The investment opportunities in most developing countries including Bangladesh are almost unlimited.[82] Availability of domestic funds and/or foreign funds are the two important limiting factors. Since, one principle determinant of investment in Bangladesh is the availability of imported capital goods,[83] adequate supply of foreign funds becomes

---

[81] See Pani(1977, p152-53).

[82] Klein(1965).

[83] Domestic capital goods sector in Bangladesh is virtually

all the more crucial to further industrial production. In Bangladesh, as in many other developing countries Government is heavily involved in investment particularly in the large-scale manufacturing and infrastructural facilities. Furthermore, government, through quantitative restrictions on imports and through controls on the allocation of foreign exchange, regulates the volume and type of foreign capital goods to be imported. Additionally, there is also the system of controls on private investment in order to achieve the "desired pattern" of private investment envisaged in the Five-Year Plans. These factors coupled with an under-developed capital market and the practice of administered interest rate, act as the major inhibiting factors in private investment demand. In specifying private and public investment behaviour below these supply restrictions are taken into consideration both implicitly and explicitly.[84]

3.3.3.1 Private Investment:

Three sectoral private investment functions are specified; for agriculture, manufacturing, and for 'all other' sectors--each reflecting respective sectoral peculiarities.[85]

---

non-existent.

[84] The available data on Bangladesh do not permit the separation of sectoral gross investment into replacement and net components. Therefore, throughout this study gross investment demand is assumed only.

[85] Particularly, due to data limitations involved in specifying a more rigorous investment function which is satis-

Private investment in agriculture:

Real private investment in agriculture is determined by the following: real value added in agriculture(Yag)-- an indicator of demand conditions; availability of bank credits to agricultural farmers in real terms(CRag/Pag); lagged agricultural price relative to agricultural wage«$(Pag/Wag)_{-1}$» as a proxy for profitability of investment in agriculture; and private remittances from abroad(NPR/P) in constant taka. Two Dummy variables are also included for 1971 Bangladesh Liberation war(D_{71}) and for the governments policy of extended and comprehensive coverage of agriculture credit[86] beginning 1974(Dgp). The functional specification for private agricultural investment demand, may be approximated by the following:

$$Ipa = f_{17}\langle\langle Yag, CRag/Pag, (Pag/Wag)_{-1}, Ig, NPR/P, Dgp, D_{71} \rangle\rangle \quad 3.36$$

$$f^1 > 0; \; f^2 > 0; \; f^3 > 0; \; f^4 > 0; \; f^5 > 0$$

Private investment in manufacturing:

Real private investment in total manufacturing depends on changes in real output of the sector(Δ Ymf), capacity utilization rate(CUmf) to reflect the demand pressures, total public investment(Ig), total real bank credits made avail-

---

factory on theoretical grounds, the approach adopted here is an avowedly ad hoc, or at best, a "reduced-form" one.

[86] Note that only the government credits to agriculture are considered here, although the rural non-institutional credits and retain earnings or personal savings may be more important, particularly in the earlier years, in investment decision making for rural Bangladesh. See Khan(1972), and World Bank(1981).

able to the private non-agricultural sector(CRna/Pinv), total inflow of foreign funds to the private sector in real terms(net private remittances, NPR, is used as a proxy), and price of investment relative to output price(Pinv/Pmf)--a measure of profitability of investment in the sector.

$$Ipm = f_{18}\langle\langle \Delta Ymf,\ CUmf_{-1},\ Ig,\ (CRna/Pinv),\ (NPR/Pinv)_{-1},\ Ddn,\ Pinv/Pmf,\ D_{71}\rangle\rangle \quad 3.37$$

$$0 < f^1 < 1;\ f^2 > 0;\ f^3 > 0;\ f^4 > 0;\ f^5 > 0;\ f^6 < 0$$

Two dummy variables are also included to capture the effects of the Bangladesh Liberation War and the nationalization of all major industries in 1972/73, D_{71}, and to isolate the impact, if any, of the private investment liberalization program(such as the lifting of ceiling on maximum amount of investment in any particular branch, de-nationalization of some key industries, etcetera) that began in 1978,Ddn.[87]

Theoretical justifications for the inclusion of variables in the investment function can be found in Evans(1969, Chs. 4 & 5), Behrman(1972 and 1977, Ch 4), Wai and Wong(1982) and Leff and Sato(1975). However, a brief explanation of each of the variables included in the above investment function would be helpful in explaining the empirical results below.

It is now generally accepted that "firms make their original investment decisions based on variables lagged slightly more than a year"(Evans 1969, p105). Output, capital stock,

---

[87] The investment demand function adopted here is similar to the Brooking--SSRC model(Duesenberry, et al, eds. 1965). See also Evans(1967a).

and financial variables(such as cash flow and interest rates) are most important of these variables.[88] Several techniques are now available to determine the lag structure, but to avoid complication only one-period lag in relevant variables are assumed here. Additionally, it is assumed that, particularly, because of the abundance of investment opportunities,[89] the underdeveloped nature of the capital market and the practice of administered interest rate practice in most developing countries, the relevant major financial variable for these countries in influencing investment demand is the availability of finance and not the usual concept of cost of fund.

Of the five major sources to finance private investment, namely, (1) the retained profits and depreciation, (2) borrowing from banks, (3) borrowing in the bonds market, (4) borrowing through equity financing (the stock market), and (5) the inflow of foreign capital to private sector, the first two are the major sources in Bangladesh, as in most other developing countries. But, unfortunately no reliable data on the first source are available for Bangladesh. On

---

[88] The underlying theoretical model considered here is based on modified flexible accelerator hypothesis.

[89] This may not be a realistic assumption for some developing countries. Fei and Ranis(1968) study on two-gap model and Weisskopf's(1972) econometric tests suggest that the assumption of abundant profitable investment opportunities abound is invalid when a foreign exchange constraint appears to be binding. The exchange rate policy adopted in several countries has simply destroyed the incentives to invest. Weisskopf's study classifies Pakistan, Sri Lanka and Thailand in this category.

the third and fourth sources suffice to say that the bonds market and the stock market are virtually non-existent in Bangladesh, over the sample period. Finally, in Bangladesh foreign direct and portfolio investment is also negligible and only since 1974/75, net factor income from abroad(mainly workers' remittances) has become an important potential source of foreign funds for domestic investment.[90] The major part of foreign capital inflow is in the form of official aid, a significant part of which goes mainly to finance food imports. Thus, total bank credits available to the private sector[91] at the time of investment decision-making, and the current level of net factor income from abroad are the two "financial variables" included in the investment function.

---

[90] Although there are evidences that domestically these funds are mostly spent on conspicuous consumption, land purchases, etcetera, with little going to private investment; see Mahmud and Osmani(1980).
However, whatever the domestic end use of these foreign funds(in domestic currency) may be, the availability of extra foreign exchange(through the "free" foreign exchange trading market, since the middle of the seventies can be viewed as providing some "breathing space" to private investors in a situation where foreign exchange component is critical in most investment projects(since most capital items, materials, spare parts etcetera have to be imported).

[91] Several studies have emphasized the role of credit in private investment decision. There is the argument that credit availability helps capital formation by easing the pressures on entrepreneur for the day-to-day operations (Bain, 1973). Recent financial approach to economic development literature(McKinnon, 1973; Shaw, 1973) maintains that the "complementarity between money and capital" in developing countries helps capital formation. Also, credit availability reduces potential cash flow problems in undertaking new investment, which in most developing countries requires a significant amount of imported capital goods and therefore advance import

For a number of reasons, private investment, particularly in developing countries, is hypothesized to be positively related to government investment.[92] In an economy with a huge unemployment and underemployed resources government investment keeps up and/or create demand, which tend to encourage private investment.[93]

Private investment in other sector:

Private investments in all "other sectors" are lumped together and assumed exogenously determined:

Ipo = Ipo~

This classification includes all private fixed investments in transport, construction, all services, and in the non-monetized sector.[94]

---

deposits.
Empirical studies such as, Leff and Sato(1980) on six developing countries, DePrano and Nugent(1966) on Ecuador reported in Yotopoulos and Nugent(1976), Wai and Wong(1982) on five developing countries, and Kabir(1981) on Bangladesh have found "credit" variable significant in explaining private investment behaviour.

[92] See Wai and Wong(1982) and Behrman(1977).

[93] In a survey of government and capital formation, von Furstenberg and Malkeil(1977) observe that "Government investments are frequently complementary to private investments and thus stimulate business capital formation"(p860). In particular, government investment in infrastructural facilities, such as transport, communication, electricity, irrigation, etcetera reduces costs of production or generates scale economies and thereby boost-up private investment. Also, government investment in certain areas, such as research and development, agricultural extension facilities, breeding stations, etcetera act as an important catalystic agent in reducing costs and increasing productivity and therefore induces higher private investment.

[94] Between 1975/76 and 1979/80, private investment in servi-

3.3.3.2 Public Investment:

Total Public investment in Bangladesh is composed of public fixed investments(Igf) in different sectors disbursed under the Annual Development Plan (ADP),[95] investment in Food-for-Work programs, and investment in public food stock(or public inventory investment, Igs)

$$Ig = Igf + Igs$$

Due to the fact that the public investment is aid-financed and to some extent constraint by the size of total public revenue, and also that it is concentrated significantly in long-term projects(infrastructural), the following relationship is hypothesized to explain total public fixed investment:

$$Igf = f_{19}\langle\langle\ Igf_{-1},\ TRA,\ CAP/Pinv,\ D_{71}\rangle\rangle \qquad 3.38$$

$$0 < f^{1} < 1; \quad 0 < f^{2} < 1; \quad 0 < f^{3} < 1; \quad f^{3} > f^{2}$$

---

ces including transport amount to only 7 percent of total monetized private industrial investment(World Bank 1981, Table 8.14). period, the non-monetized sector private investment averaged 45 percent of total(including monetized and non-monetized sectors) However, the Planning Commission of Bangladesh estimates show that over the same private investment in Bangladesh. Therefore, investment in "other sectors", in terms of volume, is a significant(close to half) component in total private sector investment (see World Bank 1984, Table 2.6).

[95] The ADP is mainly financed by foreign aid and loans. Sectoral break-downs of fixed investment under ADP are not available. In 1982/83 total ADP expenditure was 31,262 million Taka(13.2 percent of GDP) of which 20,438 million Taka(49 percent of total investments), was fixed investment, the rest being public consumption, transfer payments, etcetera.
In 1982/83 public and private investments was 52.6 percent of the total investment.

$$TRA = (TR - NCG) / Pinv \qquad 3.39$$

where, TRA is adjusted total public revenues, TR is total current revenues of government, NCG is total nominal current public consumption expenditures; CAP is net foreign capital inflow or the capital account balance; and Pinv is price of investment goods.

Separate data on inventory investment are not available for the Bangladesh economy over the sample period. Only data on public investment in food stock(Igs) is available separately and is assumed to be exogenously given.

3.3.4 <u>Foreign Sector Demand</u>

3.3.4.1 Import Demand Functions

Total import demand[96] is composed of demand for goods(Mg) and for services(Ms), while the former is further disaggregated into imports of food-grains (rice and wheat, Mf), other consumer goods(Mc), capital goods(Mk), and raw materials or intermediate goods(Mr), all expressed in domestic currency prices:

$$M = Mg + Ms \qquad 3.40$$

$$Mg = Mf + Mc + Mk + Mr \qquad 3.41$$

In 1982/83 total imports of goods and services(M) averaged 25 percent of GDP of which only 39 percent is privately undertaken, the rest being undertaken by the government,

[96] Islam(1981) is an excellent treatise on foreign sector in the two decades(1950-70) of growth and development of the United Pakistan.

nationalized industries and semi-government agencies.[97] During the same year imports of goods constitute 87 percent of total imports and the rest(13 percent) being services import. Within the goods category the following is the composition of four broad categories[98] of imports in 1982/83: food-grains(11.8 percent), other consumer goods(14.4 percent, capital goods(25.6 percent), and intermediate/raw materials(48.2 percent).[99] Furthermore consumption imports(Mf + Mc) averaged slightly less than 4 percent of total consumption(C), while capital imports averaged 23 percent of total investment during the same period. All invisible imports(payments) including non-factor services are explained along with their export counterparts later.

In the context of wide spread quantitative restrictions and foreign exchange control and also large-scale dependence on foreign aid and loans to finance imports,[100] the hypothe-

---

[97] In contrast exports of goods and services(excluding workers remittances) in Bangladesh averaged only 9 percent of GDP of which 52 percent is privately undertaken, in 1982/83. While the private-public composition of imports remain the same over the seventies, the composition for exports changed dramatically in 1976/77. Before the independence the private sector export-share was over 95 percent. Large-scale nationalization of industries after the independence changed this composition in favour of the public sector(about 50 percent).

[98] Unfortunately, data on private-public composition for these broad import categories are not available.

[99] Compare this with 1975/76, the year following the famine of 1974 and the crop-failure in 1974/75: food-grains(26.6 percent), other consumer goods(14.7 percent), capital goods(14.2 percent), and intermediate/raw materials, 44.5 percent(BBS Monthly, December, 1983).

[100] In 1982/83 over 50 percent of imports(both visible and

sis of endogenous imports demand becomes less tenable. However, within this control system, there is ample scope for choice between types of importables. Furthermore, the "limit" imposed by the total availability of foreign exchange in any particular year seems to be a flexible one as is evidenced by the erratic movements in the official foreign exchange reserves. To a considerable extent this testifies the presence of at least some endogeneity in imports demand.[101]

For a general specification of a country's imports demand functions,[102] economic theory suggests three major explanatory variables.[103] First, the price of imports relative to the price of domestic goods will affect the demand for imports. However, in the presence of widespread use of

---

invisible) were foreign aid and loan financed. Exports earnings(both visible and invisible, excluding workers remittances) during the same period could finance only 35 percent of total imports bill. In recent years, worker's remittance, has become an important source (24 percent of total imports bill in 1982/83). (BBS Monthly, 1983).

[101] Both Islam(1965) and Alamgir and Berlage(1974) studies on Bangladesh for earlier periods confirm this. In most developing countries certain categories of imports are directly linked with domestic production and there are others, for example, food-grains, (in food deficit countries) which cannot be kept strictly within the limits ascertained by the current availability of foreign exchange.

[102] This general specification also applies to the exports demand function. This specification has its root in generalized demand function in consumer theory.

[103] A useful discussion of relevant variables in imports and exports functions appear in Leamer and Stern(1970) and Thirlwall(1980). Also, see Khan(1974).

import restrictions and exchange controls, the real effective exchange rates (REE)[104] are more appropriate variables to capture the effect of changes in relative prices on the level of imports.[105] Second, the level of domestic expenditure(or income) will affect the demand for imports, indirectly, through its impact on private consumption and other expenditures.[106] However, for some sectoral imports demand functions, instead of total income corresponding to sectoral domestic expenditure/income, which is believed to be the service from which the particular imports demand originates, may be used as the scale regressor. Third major explanatory variable is the capacity to produce and supply the importables domestically.[107] For many developing countries a significant portion of imports are non-competitive with domes-

---

[104] The real exchange rate is defined as the relative purchasing power of domestic output: $REm = ER. Pm^0 / Px$; where REm is the the real exchange rate for importables, ER is the nominal exchange rate, Pm^0 is the foreign-currency price of foreign(imported) goods, and Px is domestic currency price of the domestic(exportable) goods. If the distinction between traded and non-traded goods is ignored, one can use the domestic price level(Pgd) or the respective domestic commodity price level(in case of a disaggregated import demand functions), instead of Px.
Given the definition of REm, the real effective exchange rate for imports in Bangladesh can be defined as:

$$REEm=(1 + tm + bm).REm = (1+tm+bm).ER.Pm^0/Px$$

where, tm is weighted average tariff rate and bm is 'bonus expenditure rate', on imported goods. (See Kenen 1985, and Islam 1981).

[105] Behrman(1977) on Chile, Atta(1981) on Ghana, and PIDE (1983) on Pakistan are examples of macroeconomic models which have used REE, while UNCTAD(1973) models for developing countries and Vernardakis(1979) on Greece used relative prices as the relevant variable.

tic goods because these countries do not have physical capacity to produce them. The demand for competitive imports will depend partly on the ability of domestic producers to supply the substitutes. Due to the predominance of non-competitive imports, capacity variable does not appear in most developing country studies. In addition to these three major factors, several other variables are also suggested in the literature. Lagged imports enter to reflect among others the influence of established trade patterns.[108] A time trend to capture the effects of import substitution, one or more dummy variables to capture the effects of non-quantifyable factors, an income distribution variable to see the effects on 'superior' importables, and the total availability of foreign exchange are also suggested for import demand functions.

---

[106] The composition of total expenditure will also be important to the extent that import content of different components of expenditure differs. If it is assumed that the import contents of different expenditure categories are the same, than one can use income as a proxy for expenditure in the import demand function(Thirlwall, 1980; p196).

[107] Note, however, that a capacity or supply variable belongs to the imports demand function, in addition to a relative price variable, only if excess demand at home is not eliminated by a change in the domestic price level. And, domestic prices may not change for reasons such as; high elasticity of demand for domestic goods(importables), monopoly power, and high elasticity of supply of imports.

[108] A stock-adjustment model may be hypothesised on the ground that it takes time for importers to adjust imports to the desired level. From this model short- and long-run elasticities of demand for imports can be estimated.

Economic theory further suggests that the demand function is homogenous of degree zero in money, income, and prices(assuming that there is no money illusion). Also, for disaggregated imports demand functions, the functions must be additive in the sense that the sum of expenditures on each individual commodity must equal total expenditure. Most investigators use a multiplicative(linear in the logarithms) form, implying a constant elasticity of demand for imports with respect to the independent variables, to specify imports demand function. In this form homogeneity condition is satisfied but it is not clear what it takes to guarantee the additivity condition(see, McKenzie 1976, p153-154).

The imports demand functions in this study are specified in real terms, using corresponding import price indices and all are estimated in log-linear form.

Foodgrains imports:

$$(Mf/Pmfo) = f_{20}\langle\!\langle\, (ER*Pmfo^{0}/Pf),\ GAPf,\ Yd,\ Mf/Pmfo_{-1},\ STf_{-1},\ AID/WPI,\ D_{75},\ D_{71} \,\rangle\!\rangle \qquad 3.42$$

$$f^{1} < 0;\ 1 \geq f^{2} > 0;\ f^{3} > 0;\ 0 < f^{4} < 1;\quad f^{5} < 0;\quad f^{6} > 0$$

$$GAPf = \langle\!\langle\, (\emptyset_{43} * POP) - Qf^{\bullet} \,\rangle\!\rangle\ ;\qquad Qf^{\bullet} = Qf_{-1} \qquad 3.43$$

where, ER is nominal exchange rate(Taka per unit of US dollar); $Pmfo^{0}$ is foreign currency price unit value index of food-grains imports; Pf is wholesale price index of food-grains; $\emptyset_{43}$ is per capita "norm" of food-grains requirements estimated to be 15.5 ounce/day/person; GAPf is domestic expected food-gap; Qf^e is expected net domestic production of food-grains, assumed to be equal to lagged production; and STf is the stock of food-grains held by the Government.

Import of food-grains into Bangladesh for the most part has been undertaken by the Government. A significant portion of this comes through aid on concessional terms(such as PL 480 programme of the U.S.A.). Only in recent years Government has become to some extent active in cash purchase of food-grains from International markets, mainly due to either insufficient availability of food-aid or due to an unexpected short-fall in domestic food production(as a result of crop failure). The Government's decision to import food-grains seems to be guided most importantly by the expected gap between 'need' and domestic production of food-grains,[109] the level of buffer stocks of food-grains held with the Public Distribution System, the availability of foreign aid, and the expected demand pressure (per capita real GDP is used as a proxy) on the food-grains market. In addition to these, the import price of food relative to the domestic price may also affect total food-grains imports, particularly, for two reasons: (1) the higher the domestic price of food-grains(reflecting widening supply-demand gap), the greater would be the pressure on public distribution

---

[109] Food ministry of Bangladesh routinely estimates this gap in setting their import target. The 'need' demand(different from 'market' demand) for food-grains is calculated, as mentioned above, by assuming 15.5 ounces/day/person(or 160.39 kg/year/person) as the minimum psychological demand(need) and multiplying it with an estimated population figure.

system to broaden their scale of operation requiring more imports in the short-run, and vice versa; (2) the lower the relative price of imported food-grains the greater would be the tendency to build-up a healthy food-stock through food-imports when the price situation is favourable, and vice-versa(this applies mostly with cash-purchase of food-grains). Therefore, a rise in domestic food prices, ceteris paribus, would have adverse effect on the current account balance.

Other consumer goods imports:

$$(Moc/Pmoc) = f_{21}\langle\langle\, Yd,\ REEmoc,\ (Moc/Pmoc)_{-1},\ t,\ D_{75}, D_{71} \rangle\rangle \quad 3.44$$

$$f^1 \geq 1; \quad f^2 < 0; \quad f^3 = \pm\ ; \quad f^4 > 0$$

$$REEmoc = ER * (1 + tc + bc) * Pmoc^0 \ / \ CPI \qquad 3.44.1$$

where, tc is weighted average tariff rate on consumer goods imports; bc is bonus expenditure rate on consumer goods imports; $Pmoc^0$ is foreign currency price unit value index of other consumer goods imports; REEmoc is real effective exchange rate for other consumer goods; and t is time trend to capture the effects of import substitution.

Capital goods imports:

$$(Mk/Pmk) = f_{22}\langle\langle\, Imf,\ REEmk,\ (Mk/Pmk)_{-1},\ t,\ D_{75},\ D_{71} \rangle\rangle \quad 3.45$$

$$f^1 > 0; \quad f^2 < 0; \quad f^3 = \pm\ ; \quad f^4 > 0$$

$$REEmk = ER * (1 + tk + bk) * Pmk^0 \ / \ WPImf \qquad 3.45.1$$

where, tk is weighted average tariff rate on capital goods imports; bk is bonus expenditure rate on capital goods imports; Pmr^0 is foreign currency price unit value index of capital goods imports, REEmk is real effective exchange rate for capital goods; and WPImf is domestic wholesale price of manufacturing goods.

Raw materials and intermediate goods imports:

$$(Mr/Pmr) = f_{23}\langle\langle\ Ygd,\ REEmr,\ (Mr/Pmr)_{-1},\ t,\ D_{75},\ D_{71}\rangle\rangle \qquad 3.46$$

$$f^1 > 0; \quad f^2 < 0; \quad f^3 = \pm\ ; \quad f^4 > 0$$

$$REEmr = ER * (1 + tr + br) * Pmr^0 / Prm \qquad 3.46.1$$

where, Ygd is real gross domestic product, tr is weighted average tariff rate on intermediate goods imports; br is bonus expenditure rate on intermediate goods imports; Pmr^0 is foreign currency price index(unit value) of intermediate goods imports; Prm is price index of domestic industrial raw materials and intermediate goods; REEmr is real effective exchange rate for imported raw materials and intermediate goods, and t is time trend to capture among other things the effects of import substitution.

3.3.4.2 Exports Functions:

Total exports(X) is composed of exports of goods(Xg) and exports of services (Xs).[110] While the latter being

[110] One weakness of modelling the jute sector(and most other producing sectors as well) here is the absence of any stock formation process and its impact on market structure and performance.
According to one study by the World Bank(1981 p115-117) total stocks of raw jute held at the end of each year within the country have averaged roughly one third of the annual jute production since the independence(1971). These stocks are held mainly by the public sector jute corporations(70 percent), but also by farmers and private traders(30 percent). In addition to raw jute stocks, public sector jute corporations(BJMC) also holds

explained in the following section(section 2.3.4.4) the former(Xg) is further sub-divided into three broad categories of exports, namely, raw jute(Xj), jute manufacturing(Xjm), other traditional and non-traditional goods(Xot).

$$X = Xg + Xs \quad 3.47$$

$$Xg = Xj + Xjm + Xot \quad 3.48$$

The general specification of exports function for four broad groups of exportables is similar to that specified for the country's imports demand functions, though the explanatory variables are expected to differ in relative importance. In the case of exports demand function, the level of foreign(trading partners) income and expenditure will be the appropriate demand variable instead of domestic income. The volume of exports also depends upon the responsiveness of domestic supply to meet the demand which depends partly on capacity and partly on the domestic pressure of demand. The only exception is in the case of 'other' exports function, where it is assumed that domestic capacity is the major limiting factor. As in the case of imports demand, once again, real effective exchange rate for exports[111] would be the

---

sizeable stocks of jute goods each year--12.5 percent of total jute goods production in 1980/81(World Bank 1984, Tables 3.6 and 8.3). Furthermore, the study reports that for both commodities the year to year stock fluctuations have been substantial(for raw jute stocks, the variance was 1.05 with mean 1.9 billion bales over the period 1970/71 - 1982/83 (calculated from Table 7.17 in World Bank 1984) over the sample period.

[111] The real effective exchange rate for the ith exportables in Bangladesh may be defined as follows:
$REExi = (1-tx + sx)*RExi$
where tx and sx are tariff rate and subsidy rate on

appropriate variable to capture the effects of changes in relative prices on the volume of exports. Finally, lagged exports enters into the export equations to represent either the distributed lag adjustment of actual to desired real sectoral exports over several periods due to adjustment costs, or an inventory effect. The latter is in the sense that large real sectoral exports in one year result in inventory depletion and smaller exports in the subsequent year, other things remaining unchanged.[112]

The behavioural specifications for three groups of exportable goods are discussed below. Of these three exportables, raw jute and jute manufacturing are produced mainly for the exports market; domestic consumption of these have averaged less than 10 percent of total domestic production(BBS, 1982).

Raw jute exports:

$$Xj/Pxj = f_{24}\langle\langle WYj,\ EERj,\ Pxj^0/Pxjs^0,\ (Xj/Pxj)_{-1},\ CRj/P,\ D_{65},\ D_{75},\ D_{71}\rangle\rangle \qquad 3.49$$

$$f^1 > 0;\quad f^2 < 0;\ f^3 < 0;\quad f^4 \geq 0;\ f^4 > 0;$$

exportables, respectively, and RExi is real exchange rate for the ith exportables defined as; $RExi=ER*Pxi^0/Pi$, where, i=three categories of exportables, and Pxi^0 is foreign currency price of respective exportables.

[112] Note that the *a priori* expected signs due to these two effects - the adjustment effects and the inventory effect - are opposite. Therefore the two effects may cancel each other out partially or completely.
In particular, if the inventory effect is dominant, the short-run elasticity will exceed the long-run elasticity. The opposite will be the case where the adjustment effects are dominant. (See Behrman, 1977; p181-182).

$$EERj = ER * (1 - tj + sj) \qquad 3.49.1$$

jute manufacturing exports:

$$Xjm/Pxjm = f_{25}\langle\langle WYj, EERjm, Pjm^0/Pxjms^0, CUmf, CRjm/P, (Xjm/Pxjm)_{-1}, D_{65}, D_{71}, \rangle\rangle \qquad 3.50$$

$$f^1 > 0; \quad f^2 < 0; \quad f^3 < 0; \quad f^4 > 0; \quad f^5 > 0; \quad f^6 \geq 0;$$

$$EERjm = ER * (1 - tjm + sjm) \qquad 3.50.1$$

Where, WYj is an index of major jute consuming countries' real GDP, tj is weighted average tariff rate on raw jute exports, sj is rate of subsidy on raw jute exports, Pxj is unit value index of raw jute(f.o.b.) exports, Pj is domestic price index of raw jute(at mill-gate), CRj is bank credit to raw Jute exporters and traders, tjm is weighted average tariff rate on jute manufacturing exports, sjm is the rate of subsidy on jute manufacturing exports, Pxjm is unit value index of jute manufacturing(f.o.b) exports, Pjm is domestic price index of jute manufactures at the mill-gate, Pjm* is an index of world price(of major jute exporting countries) of jute manufactures, Pxjs is an index of world price of jute substitutes, Pxjms is an index of world price of jute manufacturing substitutes; CUmf is capacity utilization rate in the manufacturing sector, and CRjm is bank credits to jute manufactures exporters and traders.

The international market for both raw jute and jute goods can be characterized as oligopolistic.[113] Bangladesh is the

[113] There are only few exporters of raw jute and jute manufactures in the world market, and of these the three major exporters, namely, Bangladesh, India, and Thailand account for over 88 percent and 90 percent of world raw

largest exporter of jute in the world market for jute, selling over 50 percent of all internationally traded raw jute[114] and over 45 percent of jute goods[115] in recent years. Jute has been the single most important exports earning commodity for Bangladesh: accounting over 80 percent of merchandise exports receipts up until the fiscal year 1975 and since then the share has been declining but nevertheless, accounts over 60 percent of total exports earnings at the end of the sample period. Over the last three decades the exports composition of raw jute and jute manufactures has switched from the dominance of raw jute to jute manufactures.[116]

---

jute and Jute goods exports in 1974/75, respectively(FAO, Various Issues).

[114] For several reasons, the share of jute exports in Bangladesh has been declining steadily over the last three decades, from over 98 percent in 1951-56(average) to 76 percent in 1961-66, and at present, to little over 50 percent. Entry of new exporters(for example, India, after the 1965 India-Pakistan War), neglect of domestic raw jute production sector, export taxes on raw jute exports during the sixties, increase in domestic demand for raw jute by jute manufacturing sector, and the competition from synthetic substitutes are the major reasons suggested to explain the declining shares(See, World Bank 1981, Mujeri(1979), Ahammed(1980), and the articles on jute sector of Bangladesh in Alamgir and Rahman(1977).

[115] Bangladesh has emerged as a major exporter of jute goods only recently. Furthermore, in recent years exports earnings of raw jute have gradually been replaced by jute manufactures exports earnings, as the single largest earner of foreign exchange(through visible trade). This replacement occured as the jute milling capacity within the country has been built up substantially and to a considerable extent due to a systematic government

Although Bangladesh is the largest exporter of raw jute and one of the three major exporters of jute manufactures in the world jute market, it is maintained here that both demand and supply considerations influence the flow of jute exports from Bangladesh.[117] In explaining the real exports of raw jute and jute manufactures the supply responsiveness is postulated to be captured by the ratio of the f.o.b. export price of jute to the domestic price at mill-gate. But, in view of widespread exchange control and trade 'distortion' in the country, the real effective exchange rates for the two exportables have been used to capture the responses. For jute manufactures the relative price of the commodity vis-a-vis major synthetic substitutes in the world market has been added as an explanatory variable to take

---

policy biases(through export tax on raw jute during the sixties, tax holiday's, preferential import quota, liberal exchange rate policy, etcetera for jute manufactures) towards the jute manufacturing against raw jute exports.

[116] In 1962/63 total jute exports was composed of 72 percent raw jute and 28 percent jute manufactures, while the composition in 1982/83 switched to 26 percent and 75 percent respectively(World Band, 1984, and Alamgir and Berlage, 1974). See also footnote 107 above.

[117] This has been thoroughly researched and established in several recent studies on the Bangladesh jute sector. See for example, Ahammed(1981), Mujeri(1979), Ahmed,(1979), and World Bank(1981).
Thomas(1979) concludes that Bangladesh faces far more elastic demand schedule for jute manufactures than for raw jute. For raw jute, the estimated elasticities indicate either inelastic but close to unity, or unitary elastic demand. With respect to jute manufactures, the presence of strong competitors in jute manufactures and the synthetic substitutes greatly reduces the country's ability to exercise any control over the market through variations in price.
However, for raw jute, using a simultaneous equations

care of substitution possibilities. The demand considerations are covered by a weighted average indices of GDP of major Jute importing countries.[118]

The government is heavily involved in the jute sector with a set of policy instruments. These policies are adopted, it is claimed, to attain domestic objectives of stability in prices, production and exports.[119] Bank credits given to the jute mills and raw jute exporters, tax-subsidy, and export tariffs are among these policies designed to exert important influences on export flow of jute in the country. Finally, three dummy variables are included to test the effects, if any, of the 1965 India-Pakistan War and the subsequent trade embargo, the 1971 Bangladesh Liberation War and the nationalization of jute industries in 1972, and the 1975 devaluation of domestic currency.

Other traditional and non-traditional exports: [120]

$$Xot/Pxo = f_{26}\text{«}\ Ygd,\ REEot,\ (Xot/Pxo)_{-1},\ D_{75},\ D_{71}\text{»} \qquad 3.51$$

---

model, Ahammed (1981) found the short-run price elasticity for Bangladesh to be - 1.17. The comparable estimate for jute goods was found to be -2.65.

[118] This incorporation of demand characteristic makes the two exports functions more of a reduced-form, market-clearing relationships than export-supply functions.

[119] For a critical analyses of these policies see World Bank(1981) and Ahmed, et al. (1979).

[120] Commodities included under this category are tea(3.5 percent), leather and leather products(6 percent), newsprint and paper(0.80 percent), and neptha, furnace oil and bitumen(0.6 percent), where the figures in parentheses represents corresponding commodity share in total merchandise exports- expressed in constant prices of 1973/74(World Bank, 1984).

$$f^1 > 0;\ f^2 < 0;\ \ f^3 \geq 0$$

$$REEot = «ER * (1-to+so) * Pxo^0»/Pgd \qquad 2.51.1$$

where, Ygd is gross domestic product, 'to' and 'so' are tariff and subsidy rates respectively in this sector, Pxo is unit value index(weighted) of f.o.b. exports of all other items, and Pgd is the GDP deflator.

3.3.4.3 Trade in invisibles:

Total trade in invisibles has traditionally been classified under three broad headings: non-factor services, factor(investment) income, and transfers. The current account balance(CA) expressed in current domestic currency prices is defined as follows:

$$CA = Xg + (Xsn + Xsy) - Mg - (Msn + Msy) + NPR \qquad 3.53$$

where, Xsn and Msn are exports(receipts) and imports(payments) of non-factor services, Xsy and Msy are exports(receipts) and imports(payments) of factor(investment) income abroad, respectively, NPR is net private unrequited transfers(workers' remittances),[121] and

$$Xs = Xsn + Xsy$$

$$Ms = Msn + Msy$$

[121] Textbook definition of transfers include both private remittances, and government pensions and other transfers. But here transfers is assumed the former only, to make the definition consistent with the grouping of World Bank data.

The two preceding sections postulated the behavioral relationships for components of Xg and Mg. In what follows an attempt is being made to explain the rest of the variables in the current account, namely, Xs, Ms and NPR.[122]

Non-factor services(NFS): [123]

Total imports(payments) and exports(receipts) of non-factor services are explained by the following functions, respectively:

$$Msn = f_{27}\langle\langle P*Y/POP,\ (Xg+Mg),\ ER*Pms^{0},\ Msn_{-1},\ D_{75},\ D_{71}\rangle\rangle \quad 3.52$$

$$f^{1} > 0;\ f^{2} > 0;\ f^{3} < 0;\ 0 < f^{4} < 1$$

$$Xsn = f_{28}\langle\langle P*Y/POP,\ (Xg+Mg),\ ER*Pxs^{0},\ Xsn_{-1},\ D_{75},\ D_{71}\rangle\rangle \quad 3.53$$

$$f^{1} > 0;\ f^{2} > 0;\ f^{3} < 0;\ 0 < f^{4} < 1$$

where, Pms and Pxs are NFS imports and exports deflators respectively.

For both receipts and payments of NFS, demand considerations are attempted to capture through two variables--domestic per-capita GNP, and total trade(exports and imports) in

---

[122] Despite the fact that trade in services have assumed a substantial volume of total world trade, surprisingly, most textbook treatment of the sector is scanty, if not non-existent. There seems to be a wide spread a priori opinion that the determinants of trade in services either are of non-economic nature or are essentially the same as the factors determining trade in goods--hence separate treatment is unwarranted. However, in view of the rising importance of this sector in recent years, an increasing number of researchers have attempted to enrich both the analytical apparatus and empirical content of trade theory in services. See, for example, Sapir & Lutz(1980 and 1981).

[123] NFS categories include the following five items: shipment, other transportation(passenger fares and part services), travel, other private services, and other government services(for details, see IMF, 1977).

commodities. It is postulated that the higher the per-capita income of a country, the greater would be the country's both receipts and payments from travel and other private services.[124] Similarly, it is hypothesized that the larger the volume of a country's merchandise trade, the greater will be the demand for shipping(freight and insurance) and part services, therefore the larger would be both the receipts and payments in NFS, for a given size of merchant fleet registered in the country.[125] To capture the relative price effects on payments of and receipts of NFS, indices of real exchange rates for services payments and receipts are included in the two equation, respectively. Finally, a lagged exports in NFS term is added to represent either the distributed lag adjustment or inventory effect.[126]

Factor(investment) income: [127]

---

[124] Given that the richer a country, (a) the more will be spent on travel and other services by its citizens, and (b) the greater will be the tendency for foreigners to travel and buy services in that country, to the extent the level of per-capital income reflects among other a measure of affluences, a modernizing service sector, and comfort for the travellers in the country.

[125] The fleet size may be considered as an explanatory variable in the two equations for NFS above, but is left out on the ground that the effect of this variable will be insignificant. This is due to the fact that the size of fleet has negative effect on receipts of and positive effect on payments of part services, while exactly the opposite effects will result on receipts and payments of shipping, thereby cancelling, if not altogether, a significant portion of effects of the size of fleet on NFS (For details see Sapier and Lutz, 1980).

[126] See above for more on these two effects.

[127] Investment income receipts include interest receipts on reserves held by the Central Bank and other private and official interest and investment income. The payments

The total net factor income(Msy - Xsy) payments in Bangladesh over the sample period primarily reflects payments of inerest on external debt, IMF service charges, and payments to a small foreign-owned factors particularly in banking and pharmaceutical industries. These net movements in absolute term have averaged 5 percent of the value of exports during the period 1972-82. Since the major portion of these payments are determined by forces outside the country--by the IMF and the World Bank--therefore the total net factor income payments is hypothesized to be exogenously determined.

$$NFIp = (Msy - Xsy) = NFIp^0 \qquad 3.53.1$$

Net private remittances(NPR):

Net private remittances has become the major source of foreign exchange earnings in Bangladesh only recently.[128] During the sixties the NPR remained below 5 percent of total commodity exports value, while it averaged over 28 percent of the value of merchandise exports during 1972-81, with the figure being less than 15 percent over 1972-76. Only after 1976 a sharp rise in NPR can be observed, particularly, as a result of the opening up of labour markets in the Middle East to Bangladeshi workers and coincidentally the governments attempts to attract maximum remittances through vari-

---

counterpart include interest payments on external public multi-lateral debt, IMF service charges, and other private and official interest and investment income payments(World Bank 1984, Table 3.2).

[128] In 1980/81, NPR amounts to 68 percent of the country's total merchandise exports value.

ous policies such as exchange liberalization programs and opening up of various profitable investment opportunities at home for migrant workers. Due to the special nature of data and the fact that the factors determining the volume and the duration of migration of workers from Bangladesh are largely determined by outside factors, the net private remittances is assumed to be exogenously determined in this model.[129]

$$NPR = NPR^0 \qquad 3.53.2$$

3.4 GOVERNMENT POLICY SUB-MODEL

3.4.1 Introduction

Government policy variables are studied under three broad headings: Fiscal policy, Monetary policy, and Other policies.[130] Such a separate and somewhat comprehensive treat-

---

[129] Alternatively, a model with behavioral specification for NPR will fail to explain adequately the variations in data in the validation exercises.
However, for forecasting purposes, a behavioral specification may be incorporated in the model:

$$NPR = NPR\langle\langle\ MY_{-1},\ ER(1+sw),\ rTD\ ,\ D_{71},\ D_{76}\rangle\rangle \qquad 3.53.3$$

where, MY is an index of GNP of major Middle Eastern countries, sw is the premium given under Wage Earners Scheme(WES) on foreign exchange earnings over and above the official foreign exchange rate, rTD is an weighted average index of interest rate/yield of savings certificates, bonds, etcetera offered to wage earners, and D_{76} is a dummy variable to capture the effects of the opening up of Middle Eastern labour market to Bangladeshi workers in 1976.

[130] For a lucid discussion on the various ways of building government sector and integrating with the macro-economic models, see Bank of Canada's modelling of the sector in RDX1, by Helliwell, Evans, Jarrett, and Stephenson(1969). See also Eashag(1983) for a general discussion on problems of fiscal and monetary policies in

ment of the government sector is necessary in view of the fact that the Government in Bangladesh, like many other developing countries, occupies a leading role, both as a direct agent and as a catalyst in the development process.

In analyzing the characteristics of government policy variables, the present study, like several other studies on developing countries,[131] also takes the position that these policies have been, for the most part, very much limited in their scope for discretionary action. In the realm of fiscal policy, many government expenditures are previously committed and/or are associated with politically susceptible public employment. On the other hand, total government revenue in any particular period depends, in addition to the legal tax rates, on the activity levels and the degree of compliance. These latter variables in turn are affected importantly by inflation expectations and foreign exchange costs. Moreover, the overwhelming predominance of indirect taxes in Bangladesh and because of the nature of and the factors affecting indirect taxes, scope for discretionary precision is further limited.

In the sphere of monetary policy, because of balance of payments considerations in a fixed exchange rate regime and domestic fiscal constraints, the Central Bank of the country has limited control over the size of the monetary base.[132]

---

developing countries.

[131] See, for example Behrman(1977), p81-82.

Central Bank's ability to regulate money supply through changes in reserve, discount rate and other available policies, for a given monetary base, is also greatly impaired due to the behavior of scheduled banks and of the non-bank public.[133] In the balance of payment account the capital account is virtually 'closed'. Domestic assets--both taka and bonds-- are not internationally traded, neither domestic residents were allowed to hold foreign currency accounts.[134] Currency substitution is almost non-existent. The capital account of the country alternatively may be termed the 'aid flow account'.

In the case of other policies--foreign sector policies and income distribution policies--discretion exists over the fixing of nominal exchange rates, tariff, subsidies, etcet-

---

[132] This has been explained further later.

[133] Questions may be raised regarding the separate treatment accorded here to fiscal policy and monetary policy, since in most developing countries they are not technically and politically separable. In most of these countries, markets for non-monetary government debt is virtually non-existent or underdeveloped and there is a lack of political will and/or other impediments in pursueing an independent monetary policy. The Central bank more or less automatically finances government deficits, therefore, monetary and fiscal policy are essentially one(Tobin, 1985). Nevertheless, a separate treatment of the two policies may be justified at least on two grounds. The policies are designed and executed by two separate agencies(to a great extent independently), and the intended effects of the two policies are often different in both degree and immediate targets.

[134] In recent years government has relaxed some of the constraints on foreign capital and the capital account transactions. Restrictions on foreign currency accounts for domestic residents have been lifted to a limited extent.

era as well as over many domestic income policies including the fixation of minimum-wages, price and input subsidies-mainely in agriculture, tax rates, and direct transfers. However, even here the extent of discretionary policy making is limited. For example, in the face of an inadequate and dwindling foreign exchange reserves, the preference for and maintenance of overvalued exchange rates ultimately lead to a balance of payments crisis and often calls for distasteful but unavoidable pressures for policy changes.

However, the above should not be mistaken to mean that there is no scope for discretionary policy. Rather, a judicious search for characteristics of government policies also makes evident that even with a limited degree of exogeneity there are a moderately large number of policy tools available to policy makers in Bangladesh for discretionary manipulations. More importantly, as Behrmen(1977) has demonstrated for the Chilean economy, these policies are expected to have quite heterogeneous effects across different sectors of the economy.

Before proceeding to the specifications of government policy variables, a general comment about the specifications is in order. Unlike other sectors in the model, most specifications in this sector do not necessarily embody a rigorous economic theoretical underpinnings. This is due to the fact that the nature of these relations is conditioned by the tax laws, the structure of government expenditures, the nature of monetary, fiscal and foreign sector administration and the respective policy enforcement mechanisms, and other institutional factors obtained in the economy over the sample period. Hence, institutional considerations and accounting identities are dominant in providing rationale underlying most of the structural specifications in the following sub-sections. The equations are alternatively known as policy reaction functions.

3.4.2 Fiscal Policy Variables:

For economic analysis it is more appropriate to identify government budgetary receipts and expenditures based on the distinction between discretionary and nondiscretionary budget items. The former are determined by current administrative proposals and Parliamentary or Ministerial action and are often considered to be independent of GNP or economic activities in the country.[135] The latter depends on the effects of the current economic environment on a structure determined by past legislation.[136] As it will be seen in the following sections, there are a large number of budgetary items, both on the receipts and expenditure sides of the budget, that can be described as nondiscretionary items. In explaining government policy variables in the following sections these considerations have been emphasized.

---

[135] In reality, the size of some of these "discretionary" expenditures are also at least indirectly depends upon the level and/or the growth of the GNP.

[136] Levy(1963, p91).

It is now well recognized in economic literature that government operations have important links with money creation, and that its activities both directly and indirectly affects income, prices, and economic activities. The link between government operations and economic activities is generally emphasized through its revenue generating mechanisms and/or expenditure programmes. These policies or programmes have income redistributive as well as income generating potential. However, an analysis of government budget constraint also reveals that these expenditures have a counterpart in money and debt creation. In particular, the way the government finances its budgetary gap(by issuing more securities to be held by domestic public, by additional money creation('printing money') or by borrowing externally) has considerable differential impact on the economy. In addition to appreciate the importance of and to correctly specifying the government budget constraint, the above factors also call for a detailed investigation of the role of monetary sector and the interlink between this and the real sectors of the economy. An attempt is therefore being made in the following pages to this direction.

3.4.2.1 Government Current Revenues:

Total Government current revenues(TR) is composed of tax revenues(T) and non-tax revenues(NT),[137] where total tax

[137] Total government revenues in Bangladesh averaged close to 12 percent of GDP in 1981/82. The major source of revenues has been taxes(77 percent in 1981/82). Income

revenue is further classified into direct taxes(Tdi) or taxes on income and corporations(Tin), and land revenue taxes(Tln)[138] and indirect taxes(Tid) or excise taxes(Tex), sales tax(Tse), custom duties(Tcs), and other taxes(Tot).[139] The following identities describe these accounting relationships for government revenues:

$$TR = T + NT \qquad 4.54$$

$$T = Tdi + Tid \qquad 4.55$$

$$Tdi = Tin + Tln \qquad 4.56$$

$$Tid = Tex + Tsl + Tcs + Tot \qquad 4.57$$

Four major taxes dominate the tax system in Bangladesh over the sample period. These are excise, sales, customs, and income taxes, accounting for over 90 percent of the total tax revenues. However, total revenue from direct taxes account for on the average only around 15 percent of the

---

from nationalized sectors, interest receipts, registration fees and various government departments made up the remainder(of which 73 percent comes from the nationalized sector, railway, and the interest receipts) (World Bank, Table 5.2, 1984).

[138] Land revenue tax was virtually abolished in 1974 together with the imposition of the moratorium on agricultural income tax but reinstated in 1976/77.

[139] Other taxes include stamp(both Judicial and non-Judicial) taxes, motor vehicle taxes, entertainment taxes, electricity duties, estate duty on agricultural land, taxes on immovable property, gift taxes, capital gains tax, jute tax(abolished in May, 1975), toll taxes, betterment tax on commercial establishments, and other levies.

[140] This contrasts sharply with the much higher rates for several developing countries and also for most developed countries where more than 70 percent of the tax revenue

total.[140] While total indirect taxes[141] account for the remainder, or 85 percent, of which the top three categories of indirect taxes contributed over 90 percent during the same period; custom taxes(49 percent), excise taxes(26 percent), and sales taxes(17 percent).[142] The structure of the tax system has been very much the same as described above with only minor variations over the sample period.[143]

Tax functions:

The aim of the tax equations is to explain the tax income of the government. Clearly the major explanatory variable in a tax function must be a variable that represents the tax base. However, there are at least three different methods of formulating numerical relationships between tax income and the explanatory base variables.[144]

---

is collected as direct taxes. Note that Tdi here also includes agricultural income tax- a tax on agricultural income existed before 1971/72 and reinstated in 1976/77.

[141] Tid contains some minor direct taxes also, which was not possible to disentangle due to the available grouping of data.

[142] World Bank(1978, 1981, and 1984).

[143] The percentage distribution of taxes in Bangladesh for fiscal year 1980 was as follows: (i) Taxation on goods and service, 85.4 percent; of which customs, 45.1 percent; excise, 18.7 percent; sales, 18.7 percent; and other, 2.1 percent. (ii) Taxes on income, 12.5 percent, of which Individuals, 4.2 percent; private companies, 2.1 percent; nationalized companies, 5.6 percent. (iii) land development tax, 2.1 percent; and (iv) other taxes and duties, 0.7 percent. (World Bank, 1981, p23).

[144] See, STUPIDE(1984, p37-138), and Helliwell et al(1969).

The most widely used methods is the "econometric" method, where a properly specified equation is estimated by means of econometric techniques using time series data covering the sample period. The usual assumption is that the parameter estimates remain constant over the sample period. However, if the fiscal policy parameter were changed during the estimation period, then the estimated equation 'endogenizes' policy to some extent. On the other hand, if the fiscal policy parameter remains unchanged over the sample period, it might be possible to interpret the estimated coefficients as policy parameters. In simulation exercises these estimated coefficients may then be changed exogenously representing assumed changes in fiscal policy.

The second method may be called the "construction" method. Here the equation is constructed directly from the given tax rules, hence is valid as long as the rules are valid. The equations are in fact a schematic descriptions of the actual tax rules. The third method which may be called the "calibration" method relates the tax income of each period of the model to the base variable of the same period, where it is assumed that taxes are related to one single base variable only. Following this method one gets a separate equation for each period within the sample period. Therefore a calibrated equation can hardly be used for extrapolations and forecasts. Like in most other macroeconomic models, the present study follows the 'econometric' method to estimate tax functions.

Once the general method to be followed has been decided, three important issues must now be dealt with to facilitate the specific formulation of tax functions: first, the question as to whether the tax equations should be stochastic or simply identities; second, the rationale for inclusion of a lagged explanatory variables; and finally, whether the functions be specified in real or nominal terms.

In most macroeconomic models total tax collections or effective tax rates are assumed to be exogenously determined by government policy. But in reality, governments in most developing countries including Bangladesh have less than perfect control over taxes: It establishes legal rates but the effective rates are often much different. With respect to legal rates, there exist different rates for different commodities, for different values of the same item, and for different income groups. Therefore, calculation of average tax rates for broad aggregates of taxable items such as imports, domestic sales of groups of items, income, etcetera, involve an accurate assignment of weights to the various item-wise rates. Since these weights are not available for Bangladesh(due to data limitations), the tax equation based on broad aggregates of tax income and tax bases would most certainly be plagued by measurement/aggregation errors. Furthermore, tax evasion, delay, and misappropriation of tax revenues have been prevalent in Bangladesh over the sample period, hence even if weighted actual tax rates were available the use of these rates over the tax base will overestimate the actual tax collections. Therefore, a stochastic formulation of tax equation is legitimate whereby the error term would capture measurement/aggregation errors and such unexplained variations in tax revenues as those due to tax evasion etcetera.

The issue of lagged explanatory variable depends upon the specific tax system in effect over the sample period. If for example, the amount of delayed income tax paid in one year roughly equals the amount of postponed tax for that year, lagged income as a tax base would be a poor regressor in the tax function. For most indirect taxes delay in tax payment is unlikely, since tax payment precedes the transactions or receipts of items upon which taxes are levied. Delay may be pronounced with regards to tax payments on income, profits, land holdings, etcetera. However, in case of Bangladesh because of the prevailing system of income tax administration wherein taxes are assessed and levied on last year's income, lagged income becomes the sole tax base in the income tax function.

Finally, it has been decided to specify all tax functions(as well as most other government revenue and expenditure variables and functions) in nominal terms, following the logic provided in the Bank of Canada's(RDX1) modelling of the sector in Helliwell et al(1969, p2-3 and 9-10).

Income and corporation taxes(Tin):

The total receipts from income and corporation taxes depend on the aggregate non-agricultural income--a product of two endogenously determined variables, Yna and Pna--,[145] and agricultural income--also product of two endogenous variables(Yag and Pag), all variables defined in nominal terms. Since income and corporation taxes are assessed and levied on the last year's income, the tax base is lagged one year to reflect this institutional feature.

$$Tin = f_{29}« (Yna * Pna)_{-1}, (Yag * Pag)_{-1}, (\Delta DTi , D_{71}» \qquad 4.58$$

$$0 < f^1 < 1; 0 < f^2 < 1; f^1 > f^2;$$

where, ΔDTi is dummy variable for discretionary policy changes in various taxes. The above formulation leaves out such variables as changes in exemption limits, varying rates of allowances, etcetera due to both non-availability of accurate data as well as difficulty in quantifying these variables.

Excise taxes:

$$Tex = f_{30}« (Yna * Pna), \Delta DTi, D_{71} » \qquad 4.59$$

$$0 < f^1 < 1$$

Sales taxes:

$$Tsl = f_{31}« (Ymf * Pmf), (Mg - Mf), \Delta DTi, D_{71} » \qquad 4.60$$

$$0 < f^1 < 1; \quad 0 < f^2 < 1$$

Custom duties:

$$Tcs = f_{32}« Mc, Mr, Mk, (Xj + Xjm), \Delta DTi, D_{71} » \qquad 4.61$$

[145] Note that in all tax functions the independent variable is not a simple current Taka expenditures, rather a product of constant-taka expenditures and the relevant prices explained elsewhere in the model.

$$0 < f^1 < 1; \quad 0 < f^2 < 1; \quad 0 < f^3 < 1; \quad 0 < f^4 < 1;$$

Other taxes:

$$Tot = f_{33} \langle\!\langle (Y * Pgd), \Delta TDi, D_{71} \rangle\!\rangle \qquad 4.62$$

$$0 < f^1 < 1;$$

The total nominal receipts from excise taxes in Bangladesh is explained by variations in nominal value added in the non-agricultural sector.[146] The choice of this as a tax base is an approximation, since the data on appropriate tax base for excise taxes(e.g., total values of exciseable items or the total value of aggregate consumption expenditure on exciseable commodities) are not available. The sales tax is imposed on various goods, both domestically produced, mainly manufacturing, and imported. In the absence of detailed data on consumer expenditures on different types of goods subject to sales tax, the value-added in manufacturing and imports of goods, both in nominal terms have been chosen as explanatory variables for the sales tax equation.[147] The

---

[146] The excise tax system in Bangladesh is comparatively broader-based, in contrast to most countries, where excise duties are narrow-based and restricted to goods such as tobacco products, alcoholic beverages, motor cars, and petroleum products. While excise tax revenues on tobacco products and petroleum products account for over 65 percent in recent years, excise taxes on other domestically manufactured goods represents a significant and growing proportion of total excise taxes in Bangladesh (World Bank, 1981, p25).

[147] Sales taxes are levied <u>ad valorem</u> on all goods produced in or imported into Bangladesh unless specifically exempted. In principle, the sales tax provides the foundation for a broad-based general tax on economic activity, but a variety of constraints and exemptions, particularly in domestically-manufactured items, made the sales tax in Bangladesh virtually a tax on imports; over 92 percent of sales tax revenues is collected at

major tax bases for customs duties is non-food imports; Over 95 percent of revenue from customs duties are derived from Import duties, the rest from export duties, in which raw jute alone accounts for over 95 percent of the total. Import duties on non-food items are based on end-use,with relatively high rates on final consumer goods and lower rates on intermediate and capital goods. Due to these differential rate structures, and numerous exemptions varying across the three import categories, nominal values of imports of consumer goods, intermediate goods, and capital goods are chosen as three major explanatory variables for the customs duties equation. Finally, other taxes include a number of smaller taxes and duties of both direct and indirect in nature, each contributing insignificantly to the total. The rate structure and exemptions for these taxes are variable and complex, but the total revenue from this category shows a steady growth with moderate variances over the sample period, with few exceptions. Owing to the nature and structure of 'other taxes' in Bangladesh, nominal revenue from these taxes are related to nominal GNP of the country.

Numerous changes were instituted affecting the tax structure obtained in Bangladesh within the sample period. Discretionary changes in tax rates both across taxable items in

---

the customs point on imported items, 7 percent is collected on exciseable commodities and only 1 percent is collected on non-exciseable domestic manufactured goods, in recent years(World Bank 1981, p25).

any given year and over time have been undertaken quite often, particularly since independence to improve government revenue performance and make 'desired' changes in the tax structure. The effect of only the major discretionary changes in tax rates on revenue performance were attempted to capture using dummy variables to reflect such discretionary changes.

Non-tax current revenues:

The non-tax current revenues as classified in the budgets is a heterogeneous group of items comprise of, in order of quantitative importance(in 1981/82), the interest receipts on loans extended by the government(mainly to various public sector units and cooperatives), receipts from the nationalized sector and the state-owned Railway, forests and registration fees, and miscellaneous receipts. It should be noted that some of these receipts are flows and not all of them are expressed on a net basis,[148] for example, the Railway receipts are gross receipts, which are, however, overcompensated by the expenditures shown under total government expenditures in the next section. On the other hand, Post Office and Telephone and Telegraph receipts are net

[148] Ideally, all of these flow receipts should be included on a net basis and expenditures should be calculated in terms of true economic costs, not just accounting costs. However, due to data limitations, only the Railway's receipts are expressed on a net basis and total current government expenditures have been adjusted for this accordingly. Note, also that non-tax current revenues from government assets holdings are added, to the flow revenues by taking annual changes in asset values.

receipts. Although revenue from these sources account for a significant part - over 20 percent of total current revenue, the significance will certainly diminish greatly if all the flow receipts are expressed on a net basis and expenditures are calculated in terms of true economic costs. Given the structure and nature of non-tax revenues and also because the determinants of different items in this category of revenues would be so difficult to specify, the non-tax current government revenues are simply assumed to vary with the level of overall economic activity, measured by nominal income(Y*Pgd).

$$NT = f_{34} \langle\!\langle\ (Y * Pgd),\ \Delta TDi,\ D_{71}\ \rangle\!\rangle \qquad 4.63$$

$$0 < f^{1} < 1$$

3.4.2.2 Government Current Expenditures:

Government expenditure policies in Bangladesh greatly determine the pattern of consumption and investment and also profoundly influence the general welfare and growth of the economy. Total government expenditure is composed of government current and development expenditures.[149] There has been a steady increase in the level of government expendi-

[149] The former expenditures fall under the Revenue Budget, while the latter fall under the Annual Development Plan(ADP) or Development Budget. However, the distinction between the two expenditures is not a clear-cut one. Development expenditures include a large element of current (consumption) expenditures and similarly, current expenditures also contain some capital items but the total amount is relatively small. For the present study, adjustments are being made for these discrepancies.

tures since independence. Total nominal government expenditure relative to GDP at current factor cost increased from 13 percent in 1973/74 to 22 percent in 1982/83. The major components have been current public consumption(close to nine percent of GDP in 1982/83, of which six percent under the revenue budget and the rest under the development budget),[150] public fixed investment(9.2 percent),[151] and transfer payments(4.0 percent) including debt service payments(1.1 percent).[152] Following to economic classifications, total flow of nominal government expenditures(NG) in any fiscal year can be defined as follows:

$$NG = Cg * WPI + Ig * Pinv + SUB + RD + TP \qquad 4.64$$

---

[150] Public consumption includes government current expenditures on wages, salaries, goods and services.

[151] Including investment under the Food-for-Work Program(0.6 percent), which is added without making adjustment for imported food-aid, to reflect the true opportunity costs of aid.

[152] Transfer payments figures are greatly underestimated due to the government of Bangladesh's method of food and agricultural inputs subsidy valuation. The method is to estimate 'cash' transfer to represent compensation for the losses incurred on estimated sales of grains that are from 'own-resource purchases' only. The method has serious limitations, for example, it excludes aid financed imports-representing the bulk of food-grains distributed through the rationing system-from the measurement of subsidy. World Bank estimates for food subsidy based on 'Full Valuation Basis' (making necessary adjustment's for the limitations of the government method) indicate that the cash subsidy valuation based on government method may not have accounted for more than 40 percent of the "actual subsidy" in any one year(see World Bank, 1978).

where, SUB is government transfer payments in the form of subsidies on food grains, agricultural inputs, etcetera; TP is all other transfer payments from government to households; and RD is total interest payments on government debt. When the necessary adjustments are made for the aid financed imports, Food-for-works programs, etcetera--to reflect respective opportunity costs while calculating the actual subsidies--and also when due account for changes in public food stock is taken care of, the resulting adjusted total nominal government expenditure(NG*) may now be defined as:

$$NG^* = Cg.WPI + Igf^*.Pinv + Igs^*.Pf + SUB^* + TP^* + RD \qquad 4.64.1$$

where, an asterisk indicates that the corresponding variable has been adjusted for reasons mentioned above; and Igs* is the adjusted real investment in public food stock.

In conventional macroeconomic analysis, the total government expenditure is usually assumed to be exogenously determined. The present study assumes only some of the components of this expenditure being exogenous while the rest being determined endogenously for reasons explained below.[153]

---

[153] Most macro-econometric models, both on developing and developed countries, treat at least some components of government expenditure endogenously determined(see, for example, Behrman 1977, PIDE 1983, Pani 1980, the MPS and the DRI models for the USA, and the RDX models for Canada).

One implication of endogenizing a portion of government spending is that an autonomous increase in the exogenous component of government expenditure now results in a larger increase in budget deficit than

Government current consumption expenditure:

In most macroeconometric models this expenditure category is often assumed to be directly policy determined. As mentioned earlier, in the context of Bangladesh and many other developing countries, experiences indicate that the government does not have much short-run discretionary power or, even if it has, is unwilling to exercise the power over these expenditures for several reasons. One such reason is the existing commitments to, for example, government employees (a dominant and organized wage-earning group in most developing countries), which can be changed in the short-run often only at a high political costs. Furthermore, administrative and other sorts of delay in the completion of public projects--a common feature in Bangladesh like many other countries--and the bureaucratic tendency and their manipulation of political power to expand the size and power of the bureau[154] and the asymmetric information flows between the bureaucrats and the government, also limit the scope for discretionary short-run changes in government consumption expenditures . Hence, government consumption expenditure is assumed to be endogenous in the complete system model.

---

would occur when the total government expenditure is endogenous. Also, endogenizing certain portions of government spending yields a different steady state multiplier expression. See Choudhry(1976, p410) for details.

[154] See Niskanen(1975, 1979).

The structural specification for real government consumption expenditures is discussed in section 3.3.2 above together with the specification for private consumption expenditures. To convert nominal government consumption expenditures into the corresponding real magnitude, endogenously determined WPI has been used as the deflator. The major determinants of government consumption are real government revenues, real foreign aid, and price of food-grains.

Transfer payment, subsidy, and interest on public debt:

As mentioned earlier, these expenditures are composed of government domestic transfer payments(available data, unfortunately, do not permit to investigate the individual components under this category), interests paid on government debt, and a variety of government subsidies. Most of these expenditures have strong endogenous elements, at least in the short-run; in turn, these expenditures directly affect the level of disposable income and therefore private consumption and savings behaviour. However, several items under TP and SUB are subject to the government's discretionary control. Governments in Bangladesh have indeed, from time to time, resorted to such policy changes, though, often under international pressures(for example, the so-called 'IMF conditionality' for reduced food-grains and input subsidies) or simply to make the government policies economically more sensible. The political risk of such changes of existing policies, however, acts as an automatic deterrent for governments to effectively manipulate these expenditures in its advantage. With respect to inerest payments on government debts, to the extent government is willing and able to manipulate the administered interest rates on government securities in an underdeveloped financial market as obtained in the country, this can also become a discretionary item.

Government subsidies:

Governments in Bangladesh over the sample period provided numerous subsidies to households and businesses. The notable subsidies are food subsidies through the public rationing system, fertilizer and other agricultural input subsidies, food-grains procurement subsidies, and exchange rate subsidies(for example, subsidies through 'over-invoicing' of capital goods imports before the independence and through the 'wage-earners scheme' after the independence). Given the data limitations, not all of these subsidies can be calculated for the Bangladesh economy. It seems that the currently available published statistics on government subsidies are underestimated due to insufficient coverage of subsidy items. There is, however, another important reason for which these statistics were even more underestimated. This is particularly true with respect to items that are related with aid financed imports. For example, as mentioned earlier, the government budget reports "cash subsidy on food" based on estimates of the loss on the quantity of food sold by the government from its own purchased stock.[155] Even this is often underestimated, and moreover, it does not cover the actual or potential loss of resources on food procured under various aid programs. Therefore "cash subsidy on food" as reported in the budget, has limited meaning for measuring the true size of the total food subsidy, particularly, in terms of its purchasing power effects on the economy. For economic analysis, or for national-income accounting purposes, an estimate of the "actual subsidy" based on full value estimates of the food aid and the domestically procured food items would be more meaningful and desirable. World Bank studies have attempted to provide such an estimate for 'actual subsidy on food', which indicates that "cash subsidies" reported, albeit not in a comprehensive way, in the Budget have always been around or less than 40 percent of the 'actual subsidy' during the seventies.[156] The present study, to the extent data permits, calculates both of these two measures of subsidies, and uses the 'cash subsidy' estimates for government budget constraint and the 'actual subsidy' estimates for national-income-expenditure accounts.

[155] From budgetary point of view nothing is wrong or unusual with this practice, since with food aid no cash outlay is incurred by the government, except of course transport charges and storage and distribution costs.

[156] World Bank 1984.

Households in Bangladesh receive food subsidy via the Food Rationing System, which distributes food-grains and some other essential commodities, mostly collected from food aid, at the rationed prices much below the market prices.[157] Related with this is the procurement subsidies in recent years, where government purchases food-grains and jute from farmers at the pre-announced prices higher than the corresponding market prices.

Similarly, large sums are also allocated(and distributed) annually in the budget for the provision of agricultural inputs to the farmers free or at prices below their costs to the Government. The most outstanding are fertilizer and irrigation water subsidies. Subsidies on pesticides and seeds are relatively small. With fertilizer, the rates of subsidy during the early eighties have been around 30-35 percent of the corresponding non-subsidized retail price. The rates of subsidy varied over time and between inputs. Once again, World Bank estimates, albeit incomplete in coverage, of these subsidies are used for the present study. Although, available rough estimates indicate that additionally a substantial amount of subsidy is also provided through 'soft term' and low interest bank credits to agriculturalests, traders, and industrialists, but due to non-availability of reliable data no account of these subsidies were undertaken here.

[157] Towards the end of the sample period the differences have been narrowed down.

Finally, the foreign exchange subsidy, which has been mainly procured by the industrialists, traders, speculators, and beneficiaries of the Wage Earners Scheme, results mainly due to the maintenance of an overvalued exchange rate. One subsidy was realized by cashing in the over-invoiced[158] part of the government approved foreign exchange(for purchasing capital items), which is purchased at the overvalued official exchange rate, at the higher free market(or black market) rate.[159] Thus over-invoicing can be seen as a transfer of resources from the public treasury to the industrialists and traders for whom the real costs of imported capital goods are decreased substantially below the actual costs incurred. Another example of foreign exchange subsidy is due to the introduction of the "Wage Earner's Scheme', effective July 1972, paying a premium(over 58 percent initially) over the official foreign exchange rate for remittances sent by the Bangladesh nationals working abroad.[160] However, this policy has been subsequently withdrawn and

---

[158] Over-invoicing was common during Pakistan period in the sixties.

[159] See Winston(1970) for details.

[160] This scheme was known as the Premium Scheme for Home Remittances, through which wage earner's were paid Taka 30/- per pound sterling, when the official exchange rate was fixed at Taka 18.9677 per pound sterling. This scheme was withdrawn subsequently when Taka was devalued(second time since the independence; first time on January 1972) on 17th May 1975 to Taka 30 per pound sterling. At the time of devaluation the Taka price of pound sterling under the wage earners scheme shot up to Taka 70 per pound which after devaluation came down to Taka 37 per pound sterling in the open market (Ministry of Finance, 1976).

replaced by a system of benefits through trade licensing and quotas linked with the earnings of wage earner's abroad. Unfortunately, a reliable data series on these could not be estimated, therefore, like many other open and hidden subsidies, exchange rate subsidies were also left out in the final estimation of total government subsidies.

Given the nature and composition of subsidy items included, the total public subsidy is postulated to depend upon the lagged value added in agriculture(Yag*Pag), total government revenues(TR), and a time trend(t), which has been added to denote the fact that subsidies have tended to increase over time.

$$SUB = f_{35}\langle\langle (Yag * Pag)_{-1}, TR, SUB_{-1}, t, \Delta DSi, D_{71}\rangle\rangle \quad 4.65$$

$$-1 < f^1 < 0; \quad 0 < f^2 < 1; \quad 0 < f^3 < 1; \quad 0 < f^4 < 1;$$

where, a negative relationship is expected between subsidies and value added in agriculture since in years of increasing farm income subsidies tended to decline, and a positive relationship between subsidies and total government revenue is postulated. ΔDSi is a dummy variable to represent discretionary policy changes in various subsidies. Lagged government subsidies variable is added to capture the institutional rigidities and the forces of inertia in government subsidies in Bangladesh.

Interest payments on public debt:

Total interest payments on Government debt is expected to vary positively with the nominal value of government borrowing from scheduled banks(GBsb), the nominal interest rate paid on the public debt(rGB), and on lagged RD:

$$RD = f_{36}\langle\langle\ GBsb,\ rGB,\ (RD)_{-1},\ \Delta DRi,\ D_{71}\ \rangle\rangle \qquad 4.66$$
$$0 < f^1 < 1;\quad 0 < f^2;\quad 0 < f^3 < 1$$

Other transfer payments:

This is assumed exogenous in the complete model system.

$$TP = TP^0 \qquad 4.66.1$$

However, an alternative specification such as the following can be justified on the ground that transfer payments to households are mainly determined by urban adult population size(POPu), price of food-grains(Pf), and lagged transfer payments, where the latter variable captures the 'inertia' factor into these types of expenditures inherent in politically unstable countries.

$$TP = TP\langle\langle\ POPu,\ (TP)_{-1},\ Pf,\ \Delta Dsi,\ D_{71}\ \rangle\rangle \qquad 4.66.2$$
$$0 < f^1;\quad 0 < f^2 < 1;\quad 0 < f^3$$

Public investment:

Of all the expenditure components discussed so far this is much more under the government's discretionary control-- at least in nominal terms. Nominal expenditures in public investment is less constraint by the availability of revenues, since the Central Bank is there to provide necessary credits whenever asked by the government.[161] Therefore, nom-

---

[161] As mentioned earlier, in countries with the policy environment as obtained in Bangladesh, monetary policy and fiscal policy under certain conditions can be shown to

inal public investment may be assumed as a government policy variable in the complete system model. However, the real value of public investment is postulated to be an endogenously determined variable, and a behavioral specification has been provided in section 3.3.3 above along with the specifications for private investments. Since there are some constraints from the revenue sides, the real public investment is postulated to depend, among other things, upon the availability of funds.

Government budget constraint:

The government budget deficit is defined by the following identity:

$$BD = NG - TR \tag{4.67}$$

which is an overall deficit for the government sector in the sense that both current and development budgets are considered in the estimation of NG and TR. The data reveals that the budget deficit since the independence averaged around ten percent of GDP at factor costs. Excluding the year(1972/73) following the independence, the data also indicate a sharp upward trend in deficit from close to five percent of GDP in 1973/74 to eleven percent in 1982/83. Financing of this enormous size of increasing government deficits was done over the years mainly from two sources; (1) Foreign grants and loans(averaged over seventy percent); and (2) Deficit financing.

---

be essentially the same.

$$BD = \Delta GB + AID \quad 4.68$$

$$\Delta GB = \Delta GBp + \Delta GBbb + \Delta GBsb \quad 4.69$$

where, ΔGB is changes in total government borrowing and the right hand side ΔGB's with p, bb, and sb stands for borrowings from public, the central bank, and scheduled banks, respectively. Government financing and its monetary implications are further discussed in the following section.

3.4.3 Monetary Policy Variables

The quantity of money in macroeconomic models traditionally has been assumed to be an exogenously determined variable controlled by the monetary authorities.[162] The validity of this assumption, however, has been questioned in several studies on both developed and developing countries. Similarly, the ability of the monetary authorities to effectively control the stock of money[163] by controlling the monetary base has also been challenged.

It has now become customary to present the determination of money supply as a process behavior of various economic agents in the economy--the commercial banks, non-bank public

---

[162] For an excellent survey of issues and evidence on money and monetary policy in less developed countries see the volume edited by Coats and Khatkhate (1980), and Eshag(1983).

[163] The monetary authorities ability to control money stock depends on whether the link between the monetary base and bank reserves, and between bank reserves and the money stock(the monetary base--bank reserves--money stock linkage) is fairly tight and therefore predictable. See Fand(1970) and Park(1973) for further details.

sector, the central bank and the Government--constrained by the institutional framework within which this behavior occurs rather than as a process dominated solely by the monetary authorities.[164] The simultaneous determination of both supply of and demand for money has been emphasized and modelled, for example, by Teigen(1964) and Gibson(1972) for a developed economy such as the U.S. In recent macro-econometric models, however, it has become customary to describe monetary policy by including central bank reaction functions. For a small open developing economy, such as Bangladesh, the endogeneity of money stock may even be more pronounced given the underdeveloped nature of its monetary and financial system, the dominant role of agriculture and recurring crop failure, and the developmental needs of the country--all of these result in a heavy reliance on international trade and payments, foreign aid and a continuous deficit financing policies.[165]

---

[164] To elaborate, the money supply at a point in time is the result of portfolio decisions by various economic agents in the economy: the Central Bank 'determines' the amount of high-powered money or monetary base; the government sector budget constraint determines the volume of deficit financing; the commercial banks determine the volume of loans and other assets that they will acquire and the quantity of reserves they will hold as excess and free reserves; and the public(including the non-bank intermediaries) determines how to allocate their holdings of monetary wealth among various financial assets such as, currency, demand deposits, time and saving deposits, etcetera. It may be noted here that the idea of endogenous money stock has received new and powerful support from the "New View" approach in monetary economics(Tobin, 1969).

[165] Deficit financing has further implications. Sargent and Wallace(1973) and Aghevli and Khan(1977) have demonstrated that there is a two-way causation between money

Nevertheless, the central bank in Bangladesh, known as the Bangladesh Bank, has been able to control the stock of money at the margin through its loans, interest rate ceilings, quantitative restrictions on credit expansion, rediscount policy, and required reserve rates on demand and time deposits. However, the control has been far from complete. The effectiveness of such control very much depends on the validity of the assumption that the monetary authorities can offset the influence of the balance of payments deficits, fiscal deficits and, for that matter, any variations in the money multiplier on the quantity of money by employing policy instruments. Unfortunately, the central bank's ability in most developing countries, including Bangladesh, falls far short of what is implied in that assumption.

The central bank in Bangladesh has not been independent of the country's fiscal needs: It has been generally required to accommodate those needs. Bank credit to the public sector is substantial and has been increasing over

---

supply and inflation. The expansion of money supply leads to price increases, but the resulting higher inflation also increases government deficit which the authorities finance by further money creation. In a later study Sargent and Wallace(1981) further demonstrated that the monetary policy cannot be manipulated independently(exogenously) when the growth path of government expenditures and the tax structure are both fixed. For a clearer exposition of this view see Miller(1983). Also, see Darby(1984) for a criticism of this view.

For a view that emphasizes the important, if not central, influence of the balance of payments upon the domestic stock of money in developing countries see Drake(1980), particularly chapter 5 on the Money Supply.

the sample period. Both private sector and commercial banking sector behavior influence the size of the money supply. Furthermore, the central bank's control over many of the foreign sector aspects of monetary policy has often been less than direct, if not altogether absent. Also, there is an important asymmetry in the implementation of monetary policy in less developed countries including Bangladesh. The monetary authorities may be able to expand money supply, say through deficit financing, but it would be very difficult for them to contract the money supply. This occurs particularly due to the size and nature of the unorganized sector in these countries. In such countries much of the direct and indirect effects of an expansionary monetary policy will be ultimately absorbed by the huge unorganized credit market.[166] On the other hand, the impact of any restrictive monetary policy will be at first felt mainly in the organized sector and in particular a credit restriction will affect the industrial or organized sector more than the unorganized sector, since the scope and coverage of monetary policy instruments in these countries are limited.

Finally, certain behavioral functions, such as the propensity of commercial banks to generate credit as a result of a given increase in their deposits,[167] and the propensity

---

[166] Much of this expansion will dissipate in speculation, hoarding, conspicuous consumption, and investment generating inflationary pressures. See Park(1973).

[167] A detailed study of Pakistan's monetary sector by Imam(1970) for the period 1949/50 to 1965/66 takes the view that "the scheduled banks' propensity to vary the

for the public to hold their wealth in cash as opposed to bank deposits, upon which money supply depends, are not under the effective control of monetary authorities. This lack of control, therefore, generates elements of endogeneity into the determination of money supply. Thus, changes in both domestic conditions(for example, balance of payments deficit induced contraction in foreign exchange reserves) may instill substantial endogeneity in domestic money supply apart from the impact of any desired policy changes of the Central Bank.

In this section, different components of the money supply and their behavior in the context of Bangladesh have been specified, followed by an attempt to specify a function representing the demand for real balances in the country. However, before presenting the equations, it is worthwhile to spell out clearly certain basic assumptions that are made regarding the behaviour of economic agents, in particular the banks and the private non-banking sector in Bangladesh.[168]

As mentioned earlier, all economic agents are assumed to act 'rationally'. Likewise, the scheduled banks attempt to maximize own profits subject to their own solvency con-

---

levels of their excess and borrowed reserves in response to the demand for commercial loans by the public and private sectors provide an important reason for treating money supply, or at least part of it, as endogenous."

[168] See Jahan(1983) for a quarterly econometric model of post-independence Bangladesh, which highlights the monetary sector of the economy.

straints and the monetary policy regime under which they have to operate. Similarly, the non-bank public attempts to maximize some objective function subject to a budget constraint(or wealth constraint) and the over-all policy regime that imposes additional constraints upon their actions. In general, banks and non-bank public's asset demands and borrowings are determined by relative yields, relative risks,[169] real income, prices, and the level of real wealth(Cameron 1984, p439). For the government and the central bank, demands and supplies in asset markets are assumed to be exogenous. They are the product or by-product of policy decisions made to stabilize the economy.

For the scheduled banks, the supply of demand and time deposits are perfectly elastic at zero and at institutionally-set interest rates, respectively. Therefore, demand and time deposits are purely demand determined. Furthermore, this constraint along with the monetary authority's fixation of the required reserve ratio and the liquidity ratio[170]

---

[169] Although the literatures on asset demand have emphasized the role of relative risk variable it is not explicitly incorporated into such functions in this study mainly due to non-availability and/or unreliability of relevant data series. The only risk variables introduced in this study are agricultural price risk variables in section 3.2.3 above.

[170] The statutory cash reserve requirement of the scheduled banks(reported under the heading: "balances with the Bangladesh Bank") continued to be 5 percent of their total demand and time liabilities, as it was during the Pakistan period, while the prescribed liquidity ratio of the scheduled banks has been fixed at 25 percent and 20 percent of their total demand and time liabilities during the Bangladesh period and Pakistan period respectively. The liquidity ratio is defined as banks' hold-

implies that the scheduled banks have no control over the level of their required reserves as well as over some of the reserve assets. The banks 'effective' wealth constraint on their demand for financial assets is given by what may be called, total disposable deposits, which, in our case is simply the difference between total demand and time liabilities and total reserves of the scheduled banks. Borrowing by the Banks from the central bank to finance acquisition of asset items is not a common practice in Bangladesh, since this is considered as an indicator of financial weakness[171] (Jahan 1983, p124). However, banks do borrow heavily(increasingly more so in recent years) from the central bank mainly to smooth out their daily transactions and partly to finance the government securities holdings and thereby releasing their own funds for more attractive investment

---

ings of cash, reserves, and unencumbered securities in proportion to their total liabilities, where unencumbered securities are those which are not serving as collateral for borrowing from the Bangladesh Bank. For scheduled banks in Bangladesh a significant portion of these securities(over 80 percent before the independence and close to 70 percent since then) were government securities and Treasury bills, which is a strong indicator of the narrowness of security markets in the country(the comparable figures for India and the USA are around 30 percent (see Annual Report of Bangladesh Bank, and Report on Currency and Finance, State Bank of Pakistan, various issues). For a detailed specification of the monetary sector in Pakistan see Imam(1970), which uses a twenty-two equations econometric model. See also Porter(1965) Snyder(1964 and 1970), Masih(1978) and Jahan(1983).

[171] It is interesting to note that the scheduled banks in Bangladesh carry a substantial amount of excess reserve(on the average over 20 percent during the seventies) and also maintain a liquidity ratio twice the ratio set by the law.

opportunities.[172]

The Interest rates in Bangladesh, as in many other developing countries, are either institutionally fixed or flexible within limits at a relatively low level and are revised very infrequently.[173] For scheduled banks, portfolio management is assumed to be mainly concerned with three interest rates, namely the bank rate, the government bonds rate or yield(weighted average), and the banks commercial/other-loan rate(weighted average). On the other hand, the non-bank public's relevant interest rates are the banks commercial/other-loan rate, the government bonds rate, interest rate paid on time deposits and the interest rate prevailing in the unorganized money market.

Finally, the following four simplified sets of assets and liabilities statements or T-accounts are used for the Bangladesh Bank, the scheduled banks, the Government, and the non-bank public sectors to explain the structure of the financial sector and the determination of money supply:

---

[172] Several studies pointed out that the monetary effects of debts held by the central bank and the commercial banks are effectively the same -- both in the end will alter the stock of money--in most developing countries. However, Coats and Khatkhate(1978) have demonstrated that for many developing countries government borrowing from the commercial banks will generally have no effect on the money supply.

[173] For example, since 1972 the rates were revised only three times. However, these changes were brought about to make the interest rates more realistic, albeit far below the "market rate", in the light of changing domestic and international conditions.

Bangladesh Bank		Government		Scheduled Banks		Non-bank Public	
A	L	A	L	A	L	A	L
NFA BR GBbb	CC VC RRS ERS		GB BRg	VC RRS ERS CR GBsb	DD TD BRsb	CC DD TD GBp	CR Bp
OAbb		Kg	NWg	Bp	-OAsb	Kp	NWp

where, CC is currency in circulation; VC is vault cash held by the scheduled banks; RRS is required reserves; ERS is excess reserves; DD is demand deposits; TD is time deposits; NFA is net foreign assets of the central bank in domestic currency; BR(= BRsb + BRg) is total borrowing from the central bank by the scheduled banks(BRsb) and the government(BRg); CR is scheduled banks credit to non-bank public; GB(=GBbb + GBsb + GBp) is total amount of government debts outstanding held by the Bangladesh Bank(GBbb), the scheduled Banks(GBsb), and the non-bank public(GBp); Bp is net bonds outstanding issued by the non-bank public; Kg and Kp are nominal values of real capital assets of the government and non-bank public respectively; -OAsb is scheduled banks net equity including net other liabilities(negative of net other assets); OAbb is net other assets of the Bangladesh bank, and NWp and NWg are net worths of non-bank public and government, respectively.

The above accounts enable us to specify the nominal wealth of all households and firms, i.e., the schedule banks and non-bank public sectors, as follows:

$$WLT = (CC + VC + RRS + ERS) + (GBsb + GBp) + Kp*Pinv \qquad 4.70$$

which may be simplified as WLT = H + B + Kp*Pinv, where, H = CC + VC + RRS + ERS; and B = GBsb + GBp. Unfortunately, a consistent data series on Kp for Bangladesh is not available. Nevertheless we have attempted to estimate the Kp data from private investment data series(Ip) using the following equation:

$$Kp = (1 - \beta_{76}) Kp_{-1} + Ip \qquad 4.71$$

There are three assets in our model; two are monetary assets--money and 'bonds'--and one real assets. Of the two monetary assets we have modelled the money market equilibrium only. Invoking the Walras's law, the equilibrium in the other market may be assumed to be guaranteed as long as the money market equilibrium is maintained.

3.4.3.1 The Supply of Money

The total supply of money in the economy is explained by the following relation.[174]

---

[174] A more general framework would be

$$M = mm * R \qquad 4.72.1$$

where R is some reserve aggregate concept for which a number of candidates have been proposed including the monetary base, unborrowed reserves plus currency, total reserves, unborrowed reserves, and the reserves available to support private deposits.

$$M1 = mm * H \tag{4.72}$$

where, M1 is the stock of money, defined as currency in circulation (CC) plus demand deposits(DD), mm is the 'money multiplier', and H is the 'monetary base' or high powered money defined as the sum of currency in circulation and the scheduled banks' deposits with the Bangladesh Bank and cash in bank vaults:

$$M1 = CC + DD \tag{4.73}$$

$$H = CC + VC + RRS + ERS \tag{4.74}$$

An examination of the monetary structure of the country reveals that the monetary base is mainly influenced by the factors such as, the central bank's credit(or Monetary) policy to the scheduled banks, its net holdings of foreign assets, and the government deficit financing policy. Of these only the first has been used as a discretionary instrument of money control in Bangladesh as in many other countries. The 'money multiplier', on the other hand, is determined by the scheduled banks, and the non-bank public's behavioral responses and also by the monetary authorities' statutory regulations. Using the 'narrow money' definition, and the 'monetary base' as the appropriate reserve aggregate we may derive the money multiplier identity(mm) as follows:

$$mm = (1 + CC/DD)/\langle\langle (RR/D + ER/D)(1 + TD/DD) + CC/DD + VC/DD \rangle\rangle \tag{4.75}$$

Alternatively, the money multiplier function may be specified in a stochastic framework as follows:

$$mm = f_{37}\langle\langle CC/DD, TD/DD, ERS/D, VC/DD \rangle\rangle \tag{4.75.1}$$

$-1 < f^1 < 0; \quad -1 < f^2 < 0; -1 < f^3 < 0; -1 < f^4 < 0$

where, D = TD + DD. The four ratios in equation 4.75 are the desired ratios of currency, excess reserves, and time deposits to demand deposits and the required reserves to total deposits. These magnitudes do not necessarily remain constant; rather they are determined by non-bank public and the banks preferences and a host of other variables and therefore may exhibit considerable variances over time. In particular, the ratio CC/DD is determined by the public's preference for currency over demand deposits in real term which in turn is assumed to vary positively with the market rate of interest(rTD) and inflation rate(p*)--opportunity costs variables, inversely with the level of real income(Y), and real wealth(WLT/Pgd) and, in the long-run, such institutional factors as the degree of monetization, the growth of the banking sector, and finally, income distribution may also affect the desired ratio.[175] To capture the effects of these long run variables, total number of bank branches(NOB), and rural-urban income ratio(Yna/Ygd) or a catch-all variable or time-trend(t) may be substituted. Collecting all these hypotheses the equation for CC/DD becomes

$$CC/DD = f_{38}\langle\!\langle \; rTD,\ p^*,\ Y,\ Y^2,\ WLT/Pgd,\ (CC/DD)_{-1},\ Yna/Ygd,\ NOB,\ t,\ D_{71} \rangle\!\rangle \qquad 4.76$$

$f^1 > 0,\ f^2 = ?\ ,\ f^3 > 0,\ f^4 < 0,\ f^5 > 0,\ f^6 > 0,\ f^7 < 0,\ f^8 < 0,\ f^9 < 0$

[175] In addition to these a 'relative risk' variable should also be included in all asset demand equations but is left out due to data limitations and measurement problems.

Similarly, the desired ratio for time deposits, is specified to depend directly on its own yields(rTD), inversely on yields on its substitute assets(p*), directly on the real wealth of the private sector(WLT/Pgd), urban-rural income distribution variable(Yna/Yag), and the time trend(t).

$$TD/DD = f_{39}\langle\langle\ rTD,\ (rTD * t),\ p*,\ ,\ WLT/Pgd,\ (TD/DD)_{-1)}\ ,\ Yna/Ygd,\ t,\ D_{71}\rangle\rangle \qquad 4.77$$

$f^1 > 0;\quad f^2 < 0;\quad f^3 < 0;\quad f^4 > 0;\ f^5 > 0;\quad f^6 > 0;\quad f^7 > 0$

As mentioned earlier, scheduled banks in Bangladesh do carry excess reserves which may be dictated by all or a combination of (i) transaction, (ii) precautionary, and (iii) speculative purposes. The optimum or desired level of excess reserves is hypothesized to depend upon the opportunity costs or relative yields, relative risk, and the wealth constraint.

$$ERS/D = f_{40}\langle\langle\ rTD,\ rBR,\ rCR,\ p*,\ WLT/Pgd,\ (ERS/D)_{-1},\ t,\ D_{71}\rangle\rangle \qquad 4.78$$

$f^1 < 0;\quad f^2 < 0;\quad f^3 < 0;\quad f^4 < 0;\ f^5 > 0;\ f^6 > 0;\ f^7 > 0$

where, rBR is the bank rate or rediscount rate; and rCR is interest rates on bank credits. Once again the effects of relative risk variable could not be tested due to reasons mentioned earlier.

Supply of bank credits:

The total bank credits available during a particular period is derived from the banking sectors identities as follows:

$$CR = CR_{-1} + (1 - rr - ERS/D) * \Delta D + \Delta BRsb - \Delta GBsb - D * \Delta ERS/D - \Delta OAsb \qquad 4.79$$

Where, rr is the required reserve ratio. Alternative to this is to specify stochastic equation for the total credits variable. Total credits to the households and firms are constrained not by factors generating demand for it[176] but by the availability of loanable funds given by the flow of new deposits(ΔD), changes in borrowings from the central bank(ΔBR) and changes in or the stock of excess liquid assets or excess cash reserves of the previous period(ERS_{-1}, ΔERS_{-1}). In addition, interest rate on bank credits(rCR) or on its substitute government securities(rGB) may be included as explanatory variables but are not expected to be significant since the marginal efficiency of investment in a sheltered home market such as in Bangladesh is very high relative to the controlled market rate of interest set at below equilibrium level.[177] Finally, a time trend, and a lagged dependent variable, to take care of the stock adjust-

---

[176] It has been demonstrated by many that credit demand is highly elastic in most developing countries since there are almost unlimited profitable investment opportunities(Klein, 1965) and the loan rate is institutionally fixed at below the "equilibrium rate"(McKinnon 1973, Gurley and Shaw 1960).

[177] This has been supported by several studies on bank portfolio behaviours in developing countries. See, Masih(1978) for evidence on Pakistan.

ment hypothesis may also be added.

$$\Delta CR = f_{41}\langle\langle\ \Delta D,\ \Delta BR,\ ERS_{-1},\ rCR,\ rGB,\ \Delta CR_{-1},\ t,\ D_{71}\ \rangle\rangle \qquad 4.79.1$$

$$f^1 > 0;\ f^2 > 0;\ f^3 > 0;\ f^4 > 0;\ f^5 < 0;\ 0 < f^6 < 1;\ f^7 > 0$$

Scheduled banks' borrowings from the Central Bank:

Both the 'need' theory and the 'profit' theories of demand for borrowing may be invoked to specify the theoretical formulation here, even though, it is expected that in the context of a perennial shortage of loanable funds in Bangladesh, the former theory would be more realistic. It is postulated that the changes in banks' borrowing(ΔBR) will be affected by the 'need' to accommodate the demand for credits (CR),[178] the banks ability to produce government securities(GBsb), a 'profit' variable such as the difference between the bank rate and bank credit rate(rCR - rBB), scheduled banks total assets(Asb), and a stock adjustment variable:

$$BRsb = f_{42}\langle\langle\ CR,\ GBsb,\ p^*,\ (rCR - rBB),\ Asb,\ BRsb_{-1},\ D_{71}\rangle\rangle \qquad 4.80$$

$$f^1 > 0;\ f^2 > 0;\ f^3 > 0;\ f^4 < 0;\ f^5 > 0;\ f^6 = ?$$

Scheduled banks' holdings of government securities:

As mentioned earlier, the banks' holdings of securities are mostly of government origin and part of which is determined by the government through a quota system. Only

---

[178] Banks are often obliged to satisfy the big public sector and the private sector credit demands both because of the laters' influence and control over the banks and the governments selective credit programmes.

recently, other non-government securities are gaining some foothold in the banks' portfolio. Based on both theoretical and a priori considerations it is postulated that the holdings of securities will be determined by its own yield (rGB), interest rates on substitutes(rCR), total wealth of the scheduled banks(approximated by their total assets, Asb), the pressure of supply of government securities indicated by the extent of budget deficit(BD), and the stock adjustment variable:

$$GBsb = f_{43} \langle\langle\, rGB,\ rCR,\ p^*,\ Asb,\ \Delta BD,\ GBsb_{-1},\ D_{71} \,\rangle\rangle \qquad 4.81$$

$$f^1 > 0;\ f^2 = ?;\ f^3 > 0;\ f^4 > 0;\ f^5 > 0;\ f^6 = ?$$

Determination of the Monetary Base:

The supply of monetary base(H) consists of net foreign assets(NFA) of the central bank expressed in domestic currency, government net indebtedness to the bank including government bonds and securities holding(GBbb), total borrowing from the Central Bank including scheduled banks' borrowing from the central bank(BR) and other net assets(OAbb):

$$H = (H)_{-1} + ER * \Delta NFA^0 + \Delta GBbb + \Delta BR + \Delta OAbb \qquad 4.82$$

where, ER is the official exchange rate, and NFA^0 is net foreign currency assets of the central bank. An examination of the items in the above equation reveals that the Bangladesh bank's policy to affect H would involve essentially manipulating only the size of BRsb and OAbb, in particular the manipulation of the Bank's lending to the scheduled banks. This limitation occurs since the other two factors, $ER.NFA^0$ and GBbb, are in effect outside the control or the management of the central bank.[179] Government fiscal needs and the country's international payments positions are indeed not very much within the domain of influence of the monetary authorities except for some advisory roles. In particular NFA is determined by the current account balance(CA) and the capital account balance(CAP) of the country:[180]

$$\Delta NFA = CA + CAP \qquad 4.83$$

whereas GBbb, along with government debts to the scheduled banks (GBsb) and non-bank public(GBp) determines total domestic public debt and the total volume of this being determined by the country's fiscal needs or budget deficit and aid inflows(equations 4.68 and 4.69) :

$$\Delta GB = BD - AID \qquad (4.68)$$

$$\Delta GBbb = \Delta GB - \Delta GBp - \Delta GBsb \qquad (4.69)$$

---

[179] Theoretically the exchange rate can be manipulated for domestic monetary goals, but is not a realistic option, since the country's exchange rate policy is tied up to achieve other objectives such as to maintain a desired trade regime. Note also, the famous Mundell-Flemming policy dilemma under fixed exchange rate regime with imperfect capital mobility.

[180] Note that we have assumed here the concept of 'money account of the balance of payments'. In a fixed exchange rate system this concept best captures the net effect of international transactions on the domestic money supply process. See Rivera-Batiz, et al(1985, p198).

On the other hand the demand for(or the use of) the monetary base consists of the scheduled banks' demand for excess reserves(ERS) and required reserves(RRS) and the non-bank public's demand for currency(CC). Equations explaining the desired balances for two of these monetary assets have been specified above(equations 4.76 and 4.78). What is important to note here is that these variables exert influence on both the monetary base and the 'money multiplier' and ultimately real sector of the economy. For example, a change in monetary base due to a policy decision of the Bangladesh bank or due to deficit financing or due to economic influences from abroad will cause the optimal portfolios of the banks and of the non-bank public to deviate from the actual ones. In order to bring about the equilibrium portfolios the adjustment process induces a reallocation of financial assets which changes domestic credit variables, interest rates, price of capital goods, rate of inflation and the liquidity status. This in turn influences the real expenditures--consumption and investment demand and real income.[181]

From the demand side the stock of money is simply the sum of currency and deposits held by the non-bank public:

$$M1 = DD + CC = DD + H - RS \qquad (4.73)$$

$$M2 = DD + CC + TD \qquad 4.73.1$$

[181] See papers in Sawyer, ed.(1979) for details on portfolio equilibrium and balance of payments adjustment in macroeconometric models.

where, RS is the total reserve(VC+ERS+RRS) of the scheduled banks. Therefore, money supply at a point in time is determined by the actions of and interactions of the Central Bank, scheduled banks and non-bank public, government demand, and the balance of payments situation. We have outlined above that the monetary base may be altered, independent of the central banks policy, by the country's fiscal demands and by changes in international reserves. Furthermore, for a given monetary base, the stock of money will also be affected by changes in the desired asset composition of the non-bank public. However, within limits, the central bank in Bangladesh may have some control over the size of the money stock mainly through changes in the statutory reserve and liquidity ratio, interest rate policy or rediscount policy, selective credit control/rationing policy, exchange rate and trade control policies. In the macroeconomic simulation the share of total agricultural credits(MPCRag) is assumed to be purely policy determined while total non-agricultural credits(CRna) is derived endogenously from the total credits identity: CRna = (1 - MPCRag) * CR. All of these, one or more at a time, have been used by the bank in the past, though infrequently and the success of these policies is far from clear.

3.4.3.2 Demand for Money:

Following the portfolio approach in monetary economics(Tobin, 1969), the demand for money,[182] like any other financial assets,[183] depends upon three broad classes of factors, namely, the scale variables, the opportunity cost variables or relative expected yields, and other variables such as relative risks, the level of wages and the degree of monetization or financial development. Regarding the first factor, money's role as a medium of exchange dictates the use of income or some other measure of the volume of transactions, while the role of money as a store of value dictates a wealth measure as the relevant scale variable. In empirical works three commonly used scale variables are current income, nonhuman wealth, and "permanent income"--which includes both nonhuman and human wealth. The Keynesian theory suggests that both wealth and income might be relevant to the demand for money, but it is inherently difficult to empirically discern the separate influence of the two

---

[182] The demand for money is a widely researched area in economics, both at theoretical and empirical levels. Laidler(1985) is an excellent treatise on this subject. See also the volume edited by Coats and Khatkhate(1980) for theories and evidences on developing countries.

[183] A relevant question then arises--why treat one asset, i.e., money, separately. Money(narrowly defined) is universally acceptable and its market value is in general more predictable than that of other assets. Therefore, money is the most liquid of all assets. Furthermore, unlike other assets the yield on money is more or less fixed at or near zero, and the disequilibrium adjustment in money market occurs not through changes in its own yield but, instead, through changes in all other asset yields(Laidler, 1985, and Cameron, 1984). Finally, it is widely held in the literature that the desired holdings of money balances is an important macroeconomic variable in that it determines the relationship between the nominal money stock and prices, output and balance of payments.

since both wealth and income move closely over time. Although there are empirical evidence supporting the superiority of the wealth variable over income in both developed and developing country studies, the present study, in the absence of a consistent and reliable data on wealth variables, assumes current income as the relevant scale variable.[184]

The opportunity costs of relative expected yields of money include its own yield(for example, any explicit interest rate paid on money) and opportunity yields on substitute assets,both financial and physical. Money's(narrowly defined) own yield in Bangladesh, as in many other developing countries, has been institutionally fixed at zero.[185] However, with the occurance of inflation and deflation,[186] the real value of money holdings, denominated in nominal terms, will fall or rise, respectively. Rising or falling price levels provide a return to money holding. "The expected percentage rate of change of the price level must then be interpreted as an expected own rate of return to money holding"(Laidler 1985, p57). *Ceteris paribus*, the

[184] Attempts were also made to estimate the function using both income and financial wealth.

[185] For a broad definition of money or when interest is paid on demand deposits(e.g., daily interest chequeable account) the relevant interest rate paid on money would be considered as its own yield.

[186] Annual inflation rates in Bangladesh averaged over 17 percent during the seventies with a peak of 71.9 percent in 1974/75 and a trough of -23.5 percent in the following year.

higher the expected rate of return to holding money(i.e., the lower the expected rate of inflation), the more of it will be held, and vice versa.

Financial market in Bangladesh is repressed and underdeveloped. There are only a few alternative financial assets to money available, most important being time deposits and government securities. However, the market for these alternative assets are very much limited within the organized sector only. The rate of interest paid on many of these assets are institutionally set at below the equilibrium rate and are adjusted periodically basically in recognition of market conditions. Both a priori theorizing and empirical evidences overwhelmingly support the proposition that the demand for money is negatively related to the opportunity costs of holding it. For empirical purposes the weighted average rate of interest on time deposits has been used in this study to reflect the opportunity costs.[187] However, for the vast majority of people in Bangladesh the most important substitute assets to money is real assets such as inventories of commodities(for example, food-grains), land, gold and jewelries, houses, etcetera. The nominal yield on these assets is the expected rate of inflation. Therefore, as money's own opportunity yield or as the opportunity yield on substitute real assets, the expected rate of inflation enter

---

[187] There is no conclusive evidence in the literature on developing countries as to whether the demand for money is influenced by either long-term or short-term interest rates. See studies in Coats and Khatkhate, ed.(1980).

into the money demand function.[188] It is postulated that the higher the expected rate of inflation the lower would be the demand for money and vice versa.

Other variables included in the money demand function are as follows: a measure of degree of monetization and financial development (proxied by the ratio of population to bank branches), the real-wage, price level(to test the hypothesis of homogeneity of the function), and a dummy variable for the nationalization of all banks and other financial institutions after the independence.

Finally, since money is held for the services it provides its owner, and since these services arise from its being an "abode of purchasing power,"[189] it follows that the demand function for money is rightly a demand function for real balances. Collecting all the hypotheses postulated above, the behavioral relationship for the demand for real balances is given by the following:

---

[188] It has been argued that the effects of expected rate of inflation has already been included if a nominal interest rate variable appears in the money demand function, since from Fisher's equation we have

$$r = i + p^*$$

where, r and i are nominal and real interest rates, respectively and p* is the expected rate of inflation. But, because of non-market determination of nominal interest rate and underdeveloped nature of financial market, variations in nominal rates do not fully reflect variations in the expected rate of inflation rate, therefore, leaving a direct role for the latter to play in the money demand function over and above that played by the former.

[189] Friedman(1956).

$$M1/P = f_{44}\langle\langle\, Y,\ WLT/Pgd,\ RW,\ rTD,\ p^*,\ (M1/Pgd)_{-1},\ DM,\ D_{71},\ D_{73} \,\rangle\rangle \qquad 4.84$$

$f^1 > 0$; $f^2 > 0$; $f^3 = ?$; $f^4 < 0$; $f^5 < 0$; $0 < f^6 < 1$; $f^7 > 0$

where, DM is a measure of the degree of monetization, RW is an aggregate real wage rate variable measured as a weighted average of sectoral wages, and all other variables are as defined above.

Note that the function is imbedded in a stock adjustment framework which allows the observed money stock to adjust gradually to its desired level of demand.[190] Hence, the inclusion of a lagged money variable which will enable us to estimate both long-run and short-run elasticities.

The adjustments to excess demand or supply of money, as mentioned earlier, do not occur through changes in money's own direct yield(which is zero in our case) but through changes in opportunity yields on alternative assets including the expected rate of inflation. The transmission mechanism involved here will, in the process, affect both nominal and real variables in the economy. In Bangladesh, since interest rates in the organized sector are not allowed to respond fully to market conditions this transmission mechanism will operate mainly through changes in the expected

---

[190] Although empirical evidence suggests long lags in adjustment of money demand to changes in income, prices, and opportunity yields, no attempt has been made here to take care of such adjustments. It is worth noting here that a money demand function with a distributed lag structure in income, by a Koyck transformation, can be shown equivalent to the formulation derived from partial adjustment model adopted here.

rate of inflation to the extent it exerts influence on real magnitudes.[191] It is worth noting here that the inerest rates in the unorganized market--a major source of finance in Bangladesh[192]-- also have a role in the transmission process as long as there are links between the organized and unorganized market. Contrary to conventional presumption, such links do exist in Bangladesh, one channel is provided by the money lenders in unorganized market who borrow funds from organized market(see Ghatak 1981). Unfortunately, the rates in the unorganized market are not observable and hence no quantitative assessment of its importance is possible at this time.

In addition to the above Tobinesque neo-Keynesian type transmission mechanism of monetary impulses, there is a further channel, presumably more important in developing countries like Bangladesh, operating alongside with the former. In an imperfectly competitive financial market such as obtained in Bangladesh, monetary changes causes credit

---

[191] For example, an excess supply of money will lead initially to an excess demand for various financial and real assets, but mostly real assets which will, <u>ceteris paribus</u>, raise the prices of these assets. With nominal wages unchanged, this will create a discrepancy between the prices of real assets and their cost of production. For producer and consumer durable goods such positive discrepancy will provide extra incentive to expand production, while for real assets such as gold, land and agricultural commodities the same will only raise the prices with little increase in production so long as the supply of these goods are inelastic. See Park(1973).

[192] Over 50 percent of credit needs are served by this market at an absorbitently high rate of interest ranging between 30 percent to over 100 percent(See, World Bank 1981, 1984, and Hussain and Khan 1970).

rationing,[193] which in turn will influence aggregate demand and, therefore, output and employment. Note that there may be direct effects also on real output and employment to the extent 'finance capital' is an important argument in the production process. It is postulated that the credit variable plays an important role in this model, both on demand and supply side. To evaluate the quantitative influence it has been included as an explanatory variable in both supply and expenditure sectors above. Finally, to the extent that an increase in the quantity of money also increases the wealth, yet another transmission mechanism of monetary impulses can be identified through wealth effects on consumption and investment. Hence both functions have been specified above by incorporating some measures of wealth variables deemed appropriate to the respective functions. Of the three channels of monetary transmission mechanisms, the credit-rationing channel is likely to be the most direct and powerful one in Bangladesh as in many other developing countries.[194]

---

[193] Since interest rates either do not adjust at all, or are very slow to adjust in response to changes in market conditions, the banks are forced to ration credit. See Vane and Thompson(1979), p37.

[194] One reason for this is an almost unsateable demand for credit in these countries at the current market rate of interest in the organized market.

3.4.4 Other Policy Variables

Apart from fiscal and monetary policy variables there are other policy variables such as foreign sector policies and income redistribution policies. It should be noted here that in a country like Bangladesh the distinction between some of these policies are not clear-cut since many of them are indistinguishable from the point of operational impacts on the economy, and more importantly in some cases it may not be possible to undertake these policies independently of each other. To capture the impact of foreign sector policy changes, real effective exchange rates for various exportables and importables are incorporated, as well as dummy variables have been added for discretionary policy changes. Several of the income distribution policy variables such as government subsidies, taxes, and transfer payments, etc. have been introduced earlier.

3.5 PRICES AND WAGES SUB-MODEL

3.5.1 Introduction

This section addresses the question of determination of prices and wages Bangladesh over the sample period. Not all relevant prices and wages variables are explained here, however; this is due to, mainly the non-availability of data on relevant prices and wages series. Furthermore, non-availability of reliable productivity data--an important explanatory variable--also severely constraint the specification of whatever prices and wages data we were able to construct.[195]

Despite the existence of a large subsistence sector and of numerous direct and indirect government controls over resource allocation, the Bangladesh economy to a large extent may be characterized as a predominantly market economy.[196] A sizeable portion of production has been marketed in the agricultural sector, although more pronounced in recent years than in the past.[197] Both demand and supply responses to price changes, in general, are quite significant, although the elasticity values are very low in agriculture, specially in the short-run. These low elasticities naturally give rise to large fluctuations in food and cash crop prices and in quantities offered for sale. However, greater fluctuations in prices and the problems of inflation became

---

[195] even where reliable productivity data are available there is doubt as to how much could be explained since widespread government controls and subsidies must have distorted expected price formation in the country.

[196] Several studies contrary to the conventional presumption have demonstrated that agricultural farmers in Bangladesh are indeed price responsive(see, for example, Hussain 1964, Tolley, Thomas and Wong 1982, and references cited in section 3.2 above). Hussain(1964) found significantly positive price response(short-run) for both jute and rice in the early sixties. Recent studies put the figures for both short-run and long-run elasticities at a even higher level(see, Cummings 1974, Askari and Cummings 1976, and World Bank 1981).

[197] In fact, almost all the quantities produced are marketed in the case of cash crops. For food-grains, however, the marketed surplus sold in the market as a percentage of total production is estimated to be on the average 10.39 percent in 1959(see Raquibuzzaman 1970). For jute the estimate was 95.1 percent. Recent studies, however, put the rate at a much higher level(30 percent for food-grains, reported in Rahman, Haque and Ahmad 1984).

acute specially after the independence in 1971. Government policies, in addition to their direct impacts on the absolute level of prices and wages, also affect the economy by altering the relative prices.[198] Prices and Wages play a major role in determining output, investment and income distribution in Bangladesh. For these and other reasons the study of prices and wages and their determination is of considerable importance in macro-economic modelling of Bangladesh.

This section is broadly classified into three sub-sections: sectoral product prices, various price indices and aggregate price level, and Wages. Three sectoral product prices--for food-grains, non-food-grains(jute), and manufactured goods--are explained in the next section. The aggregate price level along with the consumer price indices(one for the urban, the other for the rural sector) and wholesale price indices are explained in the following section. The final section takes up two sectoral wage equations, one for the agricultural workers, and the other for manufacturing workers. Both wages equations are specified in nominal terms.

[198] According to Hansen(1973), these relative price effects are much more pronounced in developing countries than in developed countries.

3.5.2 Sectoral Product Prices

Of the nine sectoral product markets only the first three--all in agriculture--are assumed to be price-clearing, whereas the others reach demand-supply balance through changes in sectoral output. Price adjustments in agriculture follows a dynamic path involving price cobweb, auto-regressive price risk variables, and lagged yield variables with varying length and distribution. The supply side has been modelled separately in section 3.2 above, while the demand side can be found implicit in the aggregate demand module in section 3.3 above. Invoking the market clearing condition yields the respective sectoral price equations.

By contrast, the industrial and services sector prices are determined in the "short run" by following a mark-up-over-variable-cost pricing practice. Furthermore the mark-up is assumed to be relatively stable in the infrastructure and energy related sector, while it is postulated to be variable for others(manufacturing and services excluding the government). The existence of mark-up can be rationalized among others by the presence of excess capacity and dominance of non-competitive market structure with wide spread tariff protection from foreign competition. On the cost side, individual firms cost calculations involve labour costs as well as costs of intermediate goods and raw materials. In a more aggregative framework, however, the importent relevant variables are unit labour costs and costs of imported intermediate goods and raw materials. Assuming fixed unit labour costs and costs of imported intermediate goods(both measured in nominal terms), a simplified general specification for price formation in this sector may be given by the following:

$$Pi = (1+\gamma i)[NWi(\alpha i) + ER * Pmr^{0}(\beta i)] \qquad P.1$$

where, i represent the various industrial and services sectors; p is sectoral product price; γ is mark-up rate; NW is nominal wage rate; α is the inverse of average product of labour or labour-output coefficient; ER is the nominal exchange rate; Pmr^{0} is the foreign currency price of imported raw materials and intermediate goods; β is the intermediate import-output coefficient.[199]

The above price equation can be extended by including sectoral profit rates(Þi) and sectoral capital-output coefficient(Øi) as follows:

$$Pi = (Øi/(Øi - Þi))[Wi(\alpha i) + ER * Pmr^{0}(\beta i)] \qquad P.2$$

where, the profit rate(Þ) may be calculated by taking the difference between total sectoral revenue(Pi*Yi) and the corresponding sectoral total wages and import costs and dividing it by the value of sectoral capital stock(Pi*Ki). Implicit in the above calculation is a positive relationship between the profit rate and the mark-up rate and sectoral

---

[199] See Taylor(1983) for details of macroeconomic implications of such a price formation process in food importing developing countries.

output-capital coefficient: $Þi = «\gamma/(1+\gamma)»*\emptyset i$. In an underdeveloped country like Bangladesh, with inflation and financial constraints, firms must have working capital to pay inadvance for the services of inputs hired for production. Including interest costs(rCR) on working capital borrowed to pay for wage costs only, further modifies the above equation:

$$Pi = «\emptyset i/(\emptyset i-Þi)»[(1+i)*NWi(\alpha i) + ER*Pmr^{0}(\beta i)] \qquad P.3$$

To make the price equation more complete, however, demand factors must also be explicitly incorporated. For example, profit rate(Þ) and real rate of interest($r=i-p^{0}$) are two important variables in the investment demand function. Together with the saving-investment identity a new expression for the price equation may be derived involving, in addition to the variables listed above, real rate of interest, autonomous investment, and various aggregate demand shares and propensities. In particular, a rise in aggregate demand would push up the price(relative to money wage and thereby generate forced savings). An increase in nominal interest in this model would have ambiguous effect, since a rising i increases borrowing costs for working capital but it also may reduce investment demand. Also noteworthy in the above formulation is the role of imported inflation, the choice of trade regime, tax policy and capital formation efforts on the price determination in these sectors. Due to data limitations, however, only three sectoral product prices are explained here: food-grains, jute or non-food-grains, and manufactured goods. The general specification postulated here, as mentioned above, reflects the hypothesis that the sectoral prices are mainly determined by the gap between supply and demand in respective markets, where the pressure of aggregate excess demand may be approximated among others by total aggregate consumption demand or the nominal money supply or the ratio of currency in circulation to total sectoral output. Many of these variables have lagged effects.[200] Factors that are assumed to be important in determining the position and the rates of movement of demand and supply for individual products in Bangladesh are briefly explained in the respective sub-sections below.

3.5.2.1 Price of food-grains:

Economic theory tells us that the interaction of demand and supply determines the price of a commodity. Factors that are assumed to be important in determining the position and the rates of movement of demand and supply for food-grains in Bangladesh over the sample period are briefly explained below, followed by the specification for price of food-grains.

[200] For empirical support on this, see Behrman(1977), Pani(1977), and Papanek(1979) in Cline and Weintraub(1981,p402).

Equations 2.7-2.9 describe the total domestic production of food-grains which involve among others price cobweb, lagged yields, auto-regressive price risk, and some agronomic variables. The total supply of food-grains(equation 2.10) in a given year is composed of domestic production as well as imports and the stock of food-grains at the beginning of the period. In a predominantly family farming agricultural economy like Bangladesh the appropriate supply variable would be the marketed surplus of food-grains.[201] However, due to non-availability of a consistent data series on the marketed surplus, total supply of food-grains(or in per capita term) may be considered as a proxy variable.[202] A lagged total supply variable is also added to reflect possible stock adjustment effects in marketed surplus. Further supply side effect is explained by an intermediate input price variable to capture the 'cost-push' type effects, if any. Fertilizer price index is used to this end, and is expected to have a direct impact on the output price.

Since data on market demand for food-grains are not directly observable, an approximation may be resorted to[203]

---

[201] Rough estimates indicate close to 70 percent of domestic food-grains production is for self consumption in recent years.

[202] The implicit assumption being a constant share of marketed surplus, which, however is not an empirically valid assumption. Several studies have indicated that the share has been rising over time in Bangladesh.

[203] An alternative is to estimate aggregate demand for food-grains from the following equation:

$$Qf^* = Q_{60}.[1-\gamma].dY/Y$$

Three variables--one or more at the same time--may be suggested. The nominal supply of money[204] (or the rate of change of nominal money supply, in case of explaining the rate of change of prices), most likely with one or more lags, is expected to have considerable impact on prices mainly, directly or indirectly, through its effects on factor prices. Since money supply in this model has endogenous elements, any variation in the determining variables of it would have their ultimate effects on the prices.[205] For several valid reasons the ratio of nominal money supply to total food-grains supply may also be seen as the appropriate variable instead. Two reasons may be noted here: such a ratio would preserve the homogeneity condition, and also express the price in money units. The second influential variable from the demand side is the level of(or the rate of change of) real income generated in both the non-agricultural sectors and in the non-food-grains agricultural sector. Finally, the expected rate of inflation, which is a measure of the opportunity cost of holding money balances, may also

---

where, Qf^* is quantity of food-grains demanded, Q_{60} is the base year quantity of food-grains demand(may be assumed equal to total supply), Y is total income, and γ is income elasticity of food-grains, ranging between 0.5 and 0.7 in Bangladesh(see Alamgir 1974).

[204] Once again, the appropriate variable would be nominal money supply in the food-grains sector on the rural sector. In the absence of a consistent data series, it is assumed that a constant share of money supply is obtained in the rural sector. Empirically this may not be a valid assumption particularly due to increasing monetization of the rural sector.

[205] Note both the monetarist and structuralist causes of inflation are implicit in such a specification.

enter the function from the demand side. Lagged inflation rate is used to approximate for the expected rate of inflation.

Additional variables to explain the price of food-grains are also suggested. The disequilibrium pressure between demand and supply may be approximated by the ratio of the sectoral inventory levels to value added, and the sectoral capacity utilization rate. However, in the absence of consistent data, these variables are left out in the present study. It is often suggested that the changes in income distribution among households and output distribution among sectors may also affect the sectoral prices(or the rate of inflation) through changes in the composition of demand. The ratio of rural-urban income, approximated by the ratio of agricultural-non-agricultural value added, is used as a proxy for such distributional considerations. An additional set of variables may be suggested considering the impact of foreign sector variables and the government policy variables on both demand for and supply of food-grains. The expectational effects of the exchange rate, the cost-push factors related to imported intermediate inputs for food-grains(although not expected to be an empirically significant one, in case of Bangladesh), net foreign remittances, and government procurement price for food-grains are assumed to be the important ones in this set of variables. The specification for food-grains therefore, may be represented by the following:

$$Pf = f_{45}\langle\langle\ TQf,\ TQf_{-1},\ M1/TQf,\ Yd/POP,\ Yag/Yna,\ p^*,\ NPR/Pgd,\ Pfg,\ NWag,\ D_{75},\ D_{71}\ \rangle\rangle \quad 5.85$$

$$f^1 < 0,\ f^2 < 0,\ f^3 > 0,\ 0 < f^4 < 1,\ f^5 = ?,\ f^6 > 0,\ f^7 > 0,\ f^8 > 0$$

where, NWag is the nominal wage in agriculture, TQf is total supply of food-grains(equation 2.10), Pfg^0 is government procurement price for food-grains, D_{75} is a dummy variable for the 1974/75 famine year, and all the other variables are as defined above.

3.5.2.2 Price of non-food-grains(jute):

Since jute is the major non-food-grains output in the agricultural sector, only jute price is explained here. The supply side of the jute market has already been modelled above, while the demand side is composed of home consumption(both at the farm-gate and by the domestic jute mills), exports, and stock demand. Earlier we have explained the export demand for raw jute and jute manufacturing, which in turn explains the bulk of home consumption demand for raw jute. However, lack of reliable data precluded modelling of the stock demand for jute. Considering both demand and supply factors in the market for jute the jute price equation is given by the following:

$$Pj = f_{46}\langle\langle\ Qj,\ Qj_{-1},\ WYj,\ Ymf, CUmf,\ Pjs,\ Yag/Yna,\ D_{65},\ D_{71},\ D_{75}\rangle\rangle \quad 5.86$$

$$0 < f^1 < 1;\ f^2 > 0;\ f^3 = ?;\ f^4 > 0;\ f^5 > 0$$

where, $Qj^* = QJmf + QXj + \Delta STj$, D_{65} is a dummy variable for the 1965 India-Pakistan war, WYj is index of world income of jute importing countries, and all other variables are as defined above.

3.5.2.3 Price of manufactured goods:

Production or supply in manufacturing sector has been explained separately in section 3.2.4 above, while corresponding demand side can be found implicit in the aggregate demand module in section 3.3.2 above. The general nature of the pricing rule in these sectors has been outlined at the beginning of this section. Following the general rule and gathering other details contained in the respective demand-supply functions above, the price equation in the sector may be postulated as follows:

$$WPImf = f_{47}\langle\langle\ Ymf/Lmf,\ NWmf,\ Prm,\ Pmr,\ rCR,\ (Mr/Pmr)/Ymf,\ CUmf, D_{71}\ \rangle\rangle \qquad 5.87$$

$$0 > f^1;\ 1 > f^2 > 0;\ f^3 > 0;\ f^4 > 0;\ f^5 > 0;\ f^6 = ?;\ f^7 = ?$$

where, all the variables are as defined earlier.

3.5.3 <u>Aggregate Price Level and Other Price Indices</u>:

This section attempts to explain variations in the central price variable--the aggregate price level(Pgd), the consumer price indices--one for the urban sector and the other for the rural sector, the investment price index, sectoral value-added deflators and the wholesale price index. It is hypothesized that the variations in aggregate price indices are mainly explained by the variations in various sectoral prices which are in turn explained by the respective demand, supply and other variables. Some of these sectoral prices are explained above. Therefore, the general specification underlying the equations in this section is similar to that for the sectoral prices outlined in the above section. Hence, no further explanation is attempted here.

Aggregate Price Level:

It is well known that monetarists have emphasized the role of money supply and output in the determination of the general price level, while structuralists have identified some indices of structural bottlenecks as the central causal variable. The price formation mechanisms in various sectors were outlined above, and hence the determination of the general price level in the present model incorporates both structuralist and monetarist features.

The aggregate price level(Pgd) in this model is given by the weighted average of all sectoral prices:

$$Pgd = \Sigma wi * Pdi \qquad 5.88$$

where, i represent various sectors, w's are sectoral weights(value-added to total output), and Pd's are respective nine sectoral price deflators. The price deflators for agriculture(Pag), and manufacturing(Pmf), are in turn explained by their respective sectoral prices:

$$Pag = f_{48}\langle\langle\, Pf,\ Pj,\ Pag_{-1},\ t,\ D_{71} \,\rangle\rangle \qquad 5.89$$

$$Pmf = f_{49}\langle\langle \text{WPImf}, \text{Pag}, \text{Pot}, Pmf_{-1}, t, D_{71} \rangle\rangle \quad 5.90$$

The general price level is expected to be dominated by the agricultural prices, specially food-grains price, mostly because of the relative size of this sector in the economy. While the manufacturing sector, which produces only around ten percent of the GDP in recent years and where total wage payments is less than one-third of the industry value-added, is expected to have relatively less impact on the general price level. But with intermediate imports and interest costs added and given the country's trade dependence both in the food sector and the manufacturing sector, the general price level may be influenced by the manufacturing prices more than proportionately than the latter's share would indicate. Once the general price level is determined, the rate of inflation(p*) is derived by the following:

$$p^* = (Pgd - Pgd_{-1}) \,/\, Pgd_{-1} \quad 5.91$$

Wholesale Price Index:

The aggregate wholesale price index is used as the deflator to convert all the nominal government expenditures and taxes into corresponding real counterparts. The WPI is determined by the following relation:

$$WPI = f_{50}\ (\ \text{Pag}, \text{WPImf}, D_{71}\ ) \quad 5.92$$

Consumer Price Indices:

The consumer price index for the country as a whole is given by the weighted average of the corresponding urban and rural indices:

$$CPI = Wu * CPIu + Wr * CPIr \tag{5.93}$$

where, Wu and Wr are urban and rural weights given by the value added in non-agriculture and agriculture to GDP, respectively. CPI for the two sectors are explained by the following relations:

$$CPIu = f_{51}\langle\langle\ Pf,\ WPImf,\ Pho,\ Pm,\ CPI_{-1},\ t,\ D_{71}\ \rangle\rangle \tag{5.94}$$

$$f^1 > 0; \quad f^2 > 0; \quad f^3 > 0; \quad f^4 > 0; \quad 0 < f^5 < 1$$

$$CPIr = f_{52}\langle\langle\ Pf,\ t,\ CPIr_{-1},\ D_{71}\rangle\rangle \tag{5.95}$$

$$f^1 > 0; \quad f^2 > 0; \quad 0 < f^3 < 1$$

where, Pho is price index for housing.

Import and Export Price Indices:

All import prices are assumed to be exogenously given in the model. The aggregate implicit price(unit value) index for exportables is determined by the weighted average export price indices(f.o.b.) of various commodities/commodity groups. The weights are the respective years' values as a proportion of total exports of goods, all expressed in current prices:

$$Px = w_1*Pxj + w_2*Pxjm + w_3*Pxo + w_4*Pxn \tag{5.96}$$

where, all exports prices except for raw jute are exogenously given. Bangladesh is the largest exporter of raw jute in the world market. The export price of raw jute(Pxj) is related to the domestic price and the effective exchange rate for raw jute(EERj):

$$Pxj = f_{53}(Pj, EERj, D_{71}) \qquad 5.97$$

3.5.4 Wages

Bangladesh is a labour surplus economy with a 'segmented' labour market. Ideally, three markets can be identified; the market for un-skilled labour, the market for semi-skilled and skilled labour, and the market for professionals. The market for unskilled labour may further be classified into rural, and urban markets.[206] The other two markets are mainly located in the urban areas. In all of these markets, both demand and supply considerations may have important influence in wage determination, but the government minimum wage laws, trade union activities, and public sector pay scale may also have considerable impact on the over all wage rates obtained in these sectors. Unfortunatly, a consistent data on the labour market segments outlined above

---

[206] The urban market for unskilled labour is also 'segmented' into unprotected or informal urban and protected urban market. In the latter market, wages are mainly determined by government minimum wage laws, trade unions, and other institutional factors. In the former case, even though unprotected, for a number of reasons competitive wage rate is not obtained, involuntary unemployment exists and the current wage is not competed down to remove it. See Farasuddin and others(1979) for details on this in the case of Bangladesh. See, also Amin(1983) for an in depth study of the informal sector, including the labour market structure and performance, in Bangladesh.

are not available for the Bangladesh economy. Considering data availability, the labour market division adopted in this study is along the following broad product classifications: agriculture, industry, and services.

3.5.4.1 Agricultural Wage:

The agricultural labour market in Bangladesh is characterized by high unemployment and underemployment.[207] Nominal wage in such a labour surplus economy is hypothesized to be set "at the subsistence level" in Lewis(1956), or at some "nutritionally based efficiency wage" in Leibenstein(1957). However, recent studies have provided evidences that wage rates of casual workers in agriculture do respond to respective demand and supply factors over the relevant ranges.[208] In the present study it is postulated that the nominal wage in agriculture(for causal labourer) is determined by the interaction of both demand for and supply of labour in this

---

[207] Ahmed(1974) estimates average unemployment/underemployment rate of 32.6 percent for the sixties, while all the estimates for the post-independence period indicate even higher(some as high as 50 percent) rate of unemployment/ underemployment in agriculture. However, caution must be taken in interpreting these results. These rates are calculated assuming an agricultural labour market that includes all the categories of work-age population. Estimates by Ahmed(1981) indicate only 7.9 percent unemployment rate for the casual labourer in agriculture in an overall unemployment rate of 42.5 percent. The remainder is explained by (i) voluntary unemployment, 8.1 percent(rich landlords and other village elites) and (ii) voluntary underemployment, 26.5 percent, (family farm workers unwilling to enter labour market for social considerations). Besides, there is also seasonal factors to be reckoned with in interpreting these rates.

[208] See for example, Ahmed(1981).

sector, over the relevant ranges. Therefore factors affecting the positions and the rate of movement of demand for and supply of agricultural labour are included as explanatory variables. Both agricultural and industrial wages equations are estimated in log-linear forms:

$$NWag = f_{54}\langle\langle Pag, (Yag/Lag)_{-1}, NWag_{-1}, t, D_{71} \rangle\rangle \qquad 5.98$$

$$f^{1} > 0;\ f^{2} > 0;\ f^{3} > 0;\ f^{4} > 0$$

where, NWag is average daily nominal wage rate for an agricultural labour, Pag is agricultural prices, Yag is agricultural output, and Lag is estimated agricultural labour supply.

3.5.4.2 Industrial Wages:

A single industrial wage is explained for the total manufacturing sector. The demand for Labour in the sector is derived from the respective production function. The nominal wages, at least in the manufacturing, however, is not derived only by the simple forces of demand and supply but are also, importantly, affected by the government's minimum wage laws, trade union activities, and the public sector pay scale. The wage equation specified below considers some of these institutional features as well as the factors that are important in determining the position and the rate of movements of demand and supply in corresponding market for labour. The general specification adopted here is that of standard Phillips curve framework: nominal wage is expected to be explained mainly by the level of unemployment, sectoral price level and lagged nominal wage. Unfortunately, consistent aggregate and sectoral unemployment data are not available for Bangladesh. Sectoral capacity utilization rate(CUmf) is used, instead, as a proxy.

$$NWmf = f_{55}\langle\langle\ Ymf/Lmf,\ CUmf_{-1},\ WPImf,\ (\Delta CRmf/Pgd)/{*}Ymf,\ rCR,\ CPIu_{-1},\ TU,\ NWmf_{-1},\ D_{71}\ \rangle\rangle \qquad 5.99$$

$$f^{1} > 0;\ f^{2} > 0;\ f^{3} > 0;\ f^{4} = ?;\ f^{5} = ?;\ f^{6} > 0;\ f^{7} > 0;\ 1 > f^{8} > 0$$

where, TU is an index of trade union activities, and all other variables are as defined above. Economic theory of firm suggest changes in marginal revenue product of labour as an important explanatory variable. The real value added per worker(Ymf/Lmf) is included to approximate this. The profitability factor in wage setting is approximated by the output price(WPImf), although capacity utilization rates(CUmf) and total value added in the sector may account part of its influences on wage changes. The level of credit available to the sector(CRmf) may be an important determinant of the producers' ability to utilize productive capacity and thus maintain the labour force(Behrman, 1977). However, it should be noted that CUmf may have already captured part of the effects of this. On the supply side, inflationary expectational effects on wage demands are attempted to capture by lagged values of the consumer price index(CPIu).[209] The rate of unionization(TU) is another sup-

[209] Note, however, that the price expectational effects enter from both supply and demand side, and empirical identification of the two effects may be very difficult.

ply side variable, and is expected to have a positive effect on wage demands.

3.5.4.3 Other Wages:

Other wages(NWot) include wages in construction, transportation, utilities, and all services sectors. The activities in these sectors are mainly dominated by the public sector. Wages here are more or less institutionally determined. Also, separate data on demand, supply, and wages in these sectors are not available. Therefore, in the complete macroeconomic model, the wage determination in these sector and their sectoral labour demand and supply are not explicitly incorporated.

Total labour employment(L) is given by adding sectoral labor employments in agriculture, manufacturing and services sectors: L = Lag + Lmf + Lot. The aggregate nominal wage rate index for the country as a whole is determined by a simple weighted average of the wage rate indices for agriculture, industry and for 'all other' sectors:

$$NW = (Lag/L)*NWag + (Lmf/L)*NWmf + (Lot/L)*NWot \qquad 5.100$$

Finally, the aggregate real wage(RW) is given by the following :

$$RW = (Lag*NWag/CPIr + Lmf*NWmf/CPIu + Lot*NWot/CPIu)/L \qquad 5.101$$

where, CPIr and CPIu are consumer price indices for rural and urban sectors, respectively.

Chapter IV

THE COMPLETE ESTIMATED MODEL OF THE BANGLADESH ECONOMY

> Models constitute a framework or a skeleton and the flesh and blood will have to be added by a lot of common sense and knowledge of details.
>
> Jan Tinbergen(1981, p18)

4.1 INTRODUCTION

The broad rationale for the specification of various economic relationships of the model has been provided in the preceding chapter. The present chapter reports the prefered estimated structural equations of the model, along with a brief discussion of the statistical properties of the model, the magnitudes of the individual estimated coefficients, their plausibility in the light of theory and *a priori* expectations, and the limitations in interpreting those results.

In the previous chapter, while specifying the structural equations, we have also discussed issues such as the choice of the variables to be included(or excluded) in a particular equation, whether the chosen variables(endogenous and exogenous) be specified in real or nominal terms, *a priori* expectation about the sign and magnitude of the coefficients, and in some cases the appropriate functional form for an equation. The choice on the above issues has been made for the most part in the light of economic theoretical considerations. We have already noted in chapter one the limitations of the current state of economic theory, particularly on the issues of correct functional form, the lag structure and expectation formation mechanisms. Where economic theory was found to be inadequate or ambiguous,[210] previous econometric studies both published and unpublished, on Bangladesh and other developing countries, whenever available have been consulted. Good econometric research requires an optimal combination of economic theory, statistical methodology, institutional knowledge, and data analysis. Unfortunately, there is no magic formula to derive the optimal combination. As such some judgements have to be made. Macroeconomic modelling is both an art and a science.

The structural equations have been estimated mainly using the Ordinary Least Squares(OLS) method, using the data for the period 1959/60 to 1982/83, excluding the two war-year periods: 1970/71-1971/72. However, for some of the equations, where simulteneity is expected to be pronounced, system estimations(2SLS, or Zellner estimation in case of seemingly unrelated regressions: Zellner 1962) are also considered. The choice of the final version of estimated equations reported here has been made after going through

[210] On the limitations of economic theory in econometric works, see Klein(1984), Howery and Klein(1976), Johnston(1984) and Kmenta(1972)

what may be called a process of "experimentations".[211] For each relationship, several alternative versions of equations were estimated and a choice is being made based on both economic theoretic and econometric considerations.[212] As expected, the estimation process has encountered many problems, among others, most important being the problems of multicollinearity and auto-correlation, both of which, however, are expected to be common usually when time-series data are used. The former problem has been 'avoided' in some cases by dropping one of the highly correlated variables. For the later problem, the test for the presence of only first-order auto-correlation is conducted using the conventional Durbin-Watson statistics. Since many of the behavioral equations contain lagged dependant variable, due to either a distributed lag structure or due to some variant of expectation formation mechanism, the conventional DW statistics is not valid, instead, for such cases Durbin's 'h' statistics is calculated.[213] Auto-correlation may be due to

---

[211] A brief account of the pros and cons of such a practice can be found in Pindyck and Rubinfeld(1981, p401). Also, see Leamer(1978, ch.1).

[212] In particular four aspects of each specifications are compared. These aspects are (i) residual variance(or fit), (ii) signs and precision of specific coefficients, (iii) properties of the disturbance, and (iv) parameter stability(or predictive performance). To some extent the so-called "two-step Cairncross test"(Johnston 1984; p510) is also performed, formally or informally, with the model.

[213] Note that the 'h' statistics also becomes inappropriate when the product of number of observations(N) and estimated variance of estimated coefficient of lagged dependant variable is greater than one. Although, there are alternative methods suggested in the literature for such

misspecification, therefore when detected, first, alternative specifications were explored. If it fails to improve the results, the model is corrected for 1st order auto-correlation. A maximum-likelihood estimate of 'rho'--the first-order auto-correlation coefficient--is obtained by using the Grid Search method.[214] Maximum 50 iterations are allowed with an accuracy of 0.01. Also, to obtain estimates of the variances the residual sum of squares is divided by N instead of N-K, since it is believed that the model has only large sample properties.[215] In case when the DW test results in inconclusiveness no correction is attempted here. All the tests for auto-correlation are evaluated at the five percent level of significance unless indicated otherwise.

It will be noticed that many estimated equations do not contain the same set of explanatory variables as listed in the previous theoretical chapter. Some variables are dropped, while in some cases new variables are added or substituted. The general principles underlying 'specification search' have been the following(see, Leamer 1978): (i)

---

cases, we have not considered these methods here considering the associated computational difficulties and the net benefit of the exercise.

[214] Alternatively known as the Hildreth-Lu procedure (Hildreth and Lu; 1960). The Grid Search method is chosen over the more conventional Cochrane-Orcutt method, since the former provides a global optimum estimate for the 'rho', while with the later the final estimate for 'rho' may be a local optimum(in the sense that a local minimization of the sum-squared residuals is done).

[215] For more on the issue of appropriate 'divisia' see Theil(1968).

delete a variable when it is found statistically highly insignificant, (ii) delete or get a substitute variable when the sign or magnitude of the estimated coefficient is not theoretically meaningful, (iii) delete one of the highly correlated variables, if high correlation is detected, and (iv) use a proxy variable when a variable is suspect of measurement errors. However, in some cases exceptions are made regarding some statistically insignificant variables due to either theoretical considerations or the importance of the variable in the model.

The issues such as specification errors(particularly, omited variables and non-linearity), presence of outliers, and the non-normality of the disturbance term are given some attention, by an analysis of residuals for each equations and also by looking at the plottings of raw data. The non-linearity in specification, if detected, is 'avoided' by a suitable transformation of the model into a linear/log linear form, while if outliers are detected they are not discarded on the belief that they provide more relevant information about the regression. Finally, a Chi-square test is performed to test the normality of residuals in each equations. Non-normality, if detected, is only reported to caution that the usual significance tests may no longer be valid(although the least square estimates are still best linear unbiased). The solutions to non-normality of residuals as proposed in the literature, such as the use of alternative regression techniques or 'robust regression'(one example being the Least Absolute Residual or LAR technique), or the transformation of data so as to achieve normality are not attempted here due to both computational complexities and high resource costs.

In all the estimated equations reported below, the numbers in parentheses that appear below the coefficients are their respective t-statistics, R^2 is the coefficient of determination adjusted for degrees of freedom, DW is the Durbin-Watson statistics, h is the Durbin's statistics for auto-correlation in the presence of lagged dependant variable, 'p' is 'rho' or the estimated first-order auto-correlation coefficient, N is total number of observations, RMSE is root mean square of errors and X and SD are the mean and standard deviation of the corresponding dependant variables, respectively. Throughout this study an estimated coefficient is termed statistically significant when it passes the relevant test at the five percent level of significance, unless otherwise mentioned.

4.2 PRODUCTION OR SUPPLY SUB-MODEL

4.2.1 Agricultural Production Estimates:

The acreage response functions for food-grains and jute are estimated using both the OLS and Systems Method of estimations. The latter is done in the present case by using the Seemingly Unrelated Regressions(SUR) or Zellner estimation method. This is justified in order to obtain efficient parameter estimates by taking into account the possible contemporaneous correlation between the error terms across equations(for corresponding observations). In the present case, non-zero correlation across the two acreage equations may arise particularly due to the presence of cross equation restriction on total acreage. Although the two acreage equations are estimated jointly using the SUR method but the results are presented separately under the food-grains and jute sub-sections below chiefly for convenience. All acreage and yield equations are estimated in log-linear form.

Foodgrains Acreage Function:

For food-grains acreage(ACf) farmers in Bangladesh are expected to respond positively to lagged relative farm-gate price of food-grains(Pf/Pj), lagged relative yields(YLf/YLj), and government procurement prices(Pfg), respectively, and negatively to relative 'price risk'(PRf/PRj) and the expected fertilizer to output price ratio(Pft/Pf). The following estimated equation supports the <u>a priori</u> expectation:

<SUR> :

$$\ln(ACf) = 1.397 + \underset{(3.81)}{0.558}\ln(ACf)_{-1} + \underset{(2.47)}{0.043}\ln(Pf/Pj)_{-1}$$

$$- \underset{(-1.32)}{0.032}\ln(Pft/Pf_{-1}) - \underset{(-3.14)}{0.04}\ln(PRf/PRj)$$

$$+ \underset{(1.26)}{0.058}\ln(YLf/YLj)_{-1} + \underset{(2.19)}{0.032}\ln(Pfg) \quad (2.7)'$$

$R^2 = 0.90$, SEE = 0.02, h = -0.48, X = 3.19, SD = 0.08

<OLS> :

$$\ln(ACf) = 1.123 + \underset{(2.51)}{0.622} \ln(ACf)_{-1} + \underset{(2.17)}{0.087} \ln(PF/Pj)_{-1}$$

$$- \underset{(-0.94)}{0.034} \ln(Pft/Pf_{-1}) - \underset{(-1.72)}{0.034} \ln(PRf/PRj)$$

$$+ \underset{(0.65)}{0.053} \ln(YLf/YLj)_{-1} + \underset{(1.52)}{0.029} \ln(Pfg) \quad (2.7)''$$

$R^2 = 0.847$, $F=20.7$, RMSE = 0.031, $h = -3.83$, $p=-0.22$, $N=22$

Both the OLS and Zellner SUR estimates are presented and as expected the latter provided more efficient parameter estimates. The explanatory variables in equation (2.7)' together explain over ninety percent of the variations in (log of) food-grains acreage. All the signs of coefficients are as expected. Furthermore, all the variables except two, relative yields and fertilizer price to output price ratio, are found to be statistically significant. The short-run and long-run price elasticities for food-grains acreage are estimated to be 0.04 and 0.10, respectively. The elasticity values are low, as expected, given the subsistence nature of food crops in Bangladesh. Previous studies on Bangladesh and other similar countries have also found lower elasticity values for subsistence crops.[216] The relative 'price risk' variable indicates that farmers in Bangladesh are risk averse, and that a doubling of jute 'price risk' relative to food price will bring about, <u>ceteris paribus</u>, over four percent rise in food-grains acreage.[217] The positive sign of

[216] For example, Krishna(1963)'s estimate of 0.08 for wheat in Punjab(1914-1943), Hussain(1970)'s 0.04 for rice in Bangladesh(1948-1963) and Lahiri and Roy(1985)'s 0.03 for rice in India(1954-1978). See also Ashkari and Cummings(1978) for further evidences.

relative yield variable supports our hypothesis that farmers in Bangladesh tend to hedge their risk by always planting more food-crops after maintaining a certain level of cash income from jute crop. However, the variable is not statistically significant at the desired level of significance. Finally, it is likely that the government procurement price variable is also capturing upward trend factor thereby making the coefficient statistically significant. The statistical insignificance of the expected input to output price ratio(measured by the ratio of current price of fertilizer to lagged price of food-grains) may be explained by at least two factors: for the most part of the sample period fertilizer utilization has been low, even the recent increased utilization in an aggregate sense is also low. Secondly, fertilizer input has been highly subsidized by the govern-

---

[217] One implication of this result is worth noting here. Since the 'marketed surplus' of food-grains is only roughly 30 percent of the total domestic production(in recent years) and since it is this surplus(or the corresponding acreage) which is mainly sensitive to variations in prices, a doubling of relative food-grains 'price risk', *ceteris paribus*, would be more than enough to wipe out the whole of the marketed surplus in any particular year. This certainly would have serious consequences for the welfare of the rural population as well as for the whole economy. However, since the implied postulated relationships here assume a linear transformation function between food and jute crops in production(See Zarembka(p92-97; 1972) for comparative results on linear and convex transformation function), consequent increase in jute acreage and hence cash income would enable the country to import food-grains to compensate for fall in domestic production. But full compensation may not be possible and also regressive distribution and welfare effects may result since variables such as international demand conditions and commodity terms of trade are beyond the control of farmers or the domestic economy.

ment, and recent studies(for example, Islam:1980) have found that the value of marginal revenue product for fertilizer is greater than its marginal cost to the farmer. This in turn provides an indirect support that there is scope for fiscal restraint without significantly affecting domestic production. For example, using the partial-equilibrium estimates, a ten percent reduction in fertilizer subsidy would result in less than one-half of a percentage point decline in foodgrains production. It is worth noting here that the results also show that an effective government procurement price policy would have exactly the opposite effect on domestic production.

Foodgrains Yield Equation:

<OLS> :

$$\ln(YLf) = \underset{(-2.93)}{-3.554} + \underset{(1.97)}{0.033}\ \ln(FT/AC) + \underset{(3.25)}{0.055}\ \ln(CRag/Pag)$$

$$- \underset{(-4.32)}{0.021}\ RNF + \underset{(4.6)}{1.68}\ \ln(RNF) \qquad (2.8)'$$

$R^2=0.864$, $F=34.2$, $RMSE=0.034$, $DW=2.3$, $p=0.24$, $X=2.54$, $SD=0.09$

where, FT/AC is fertilizer per acre, CRag/Pag is real bank credits to the sector, and RNF is rainfall index. All the estimated coefficients have expected signs and are statistically significant. The yield response to fertilizer is found to be comparable to that obtained in other studies.[218] The significance of rainfall variables provides strong support for the hypothesis of a 'gamma' type distribution between

[218] For example. Islam(1980) found a value of 0.05 for Bangladesh using both cross-section and time-series data.

yield and rainfall implying that the detrimental impact of droughts is greater than of floods.[219] Simple calculations using the estimates yield that the peak of the yield response to rainfall is reached at an average rainfall of 82.87 inches. Real bank credits to farmers is highly significant although the size of the elasticity is very low. It may be noted here that a significant portion of agricultural credits(over 70 percent according to Khan:1972 and World Bank:1984) is spent on direct consumption.

The total output of food-grains is related to total acreage and corresponding yield per acre as given by equation (2.9)', which implies a unitary elasticity of output with respect to both variables. Therefore the output elasticities vis-a-vis the most of the explanatory variables in (2.7)' and (2.8)' are the same as corresponding acreage and yield elasticities.

Jute Acreage Equation:

<SUR>:

$$\begin{aligned} \ln(ACj) = -1.56 &+ \underset{(3.4)}{0.301} \ln(ACj)_{-1} + \underset{(5.4)}{0.423} \ln(Pj/Pf)_{-1} \\ &- \underset{(-0.18)}{0.012} \ln(Pft/Pj_{-1}) - \underset{(-4.11)}{0.131} \ln(PRj) \\ &- \underset{(-2.38)}{0.204} \ln(YLj/YLf)_{-1} \end{aligned} \quad (2.11')$$

R^2 =0.853, SEE=0.068, h=0.012, X=0.585, SD=0.199

<OLS>:

---

[219] It may be noted here that the 'gamma' type specification yield 'better' results(higher R^2, t values, etc.) compared with a monotonic specification.

$$\ln(ACj) = 0.538 + \underset{(2.73)}{0.369} \ln(ACj)_{-1} + \underset{(6.15)}{0.411} \ln(Pj/Pf)_{-1}$$

$$- \underset{(-0.57)}{0.048} \ln(Pft/Pj_{-1}) - \underset{(-1.59)}{0.08} \ln(PRj)$$

$$- \underset{(-2.1)}{0.27} \ln(YLj/YLf)_{-1} \qquad (2.11)''$$

$R^2 = 0.776$, $F = 15.6$, $RMSE = 0.094$, $h = 0.148$

The estimated equation reveals that the variations in jute acreage are fairly well explained by the explanatory variables. All the coefficients have expected signs and all but one--the fertilizer price to output price ratio as in the case of food-grains--are found to be statistically significant. The price elasticity of jute is fairly high compared to that for food-grains. This is expected, since jute is the main cash crop, while food-grains are subsistance crops in Bangladesh. The long-run elasticity is even larger(0.64). It may be noted here that the Nerlovian coefficient of expectation is much higher(0.7) for jute than for food-grains(0.44). One explanation of this result is that for jute, variables other than lagged acreage are more important compared to food-grains in explaining the long-run determination of jute acreage. Low adjustment coefficient(or static expectation) is more plausible for subsistence crops as opposed to cash crops. The sign of the relative yield variable supports our <u>a priori</u> hypothesis that the farmers in Bangladesh tend to hedge their risk by planting more food-grains when jute yield rises due to historical and institutional reasons. When jute yield rises relative to food-grains, farmers keep their cash income constant by planting less jute substituting for more food-grains to adequately meet the subsistence requirements and to hedge against future price and output risk. This latter factor coupled with the significant jute 'price risk' variable[220] and the relative jute price variable with elasticities -0.13 and 0.42, respectively, indicate the nature of conflicts in food-grains-jute choice for farmers and the importance for policy makers to maintain 'optimum' relative price structure that would contain the resulting destabilizing effects of the auto-regressive 'price risk' variable and relative price swings.

Jute Yield Equation:

The estimated jute yield equation adopted here is essentially a second-degree polynomial as suggested by the plot of yield data over time. This curve-fitting exercise for jute yield has been resorted to since all attempts to get a meaningful estimates of a theoretically plausible jute yield function as specified in the previous chapter resulted in failure.[221]

---

[220] Early studies on supply responses in agriculture failed to note the importance of the 'price risk' variable. Recent studies, for example, Ahammed(1980) and Rahman(1981) on Bangladesh, have found this variable quite significant. The estimated coefficients for 'price risk' variable in the two studies are -0.0025 and -0.08, respectively.

[221] Other studies on Bangladesh(Rahman:1982, Mahmood:1985) have also faced the similar problem. Inaccuracy of jute yield data, on which there are considerable agreements in the literature(See, World Bank:1974, 1984), may be

<OLS>:

$$\ln(YLj) = 2.769 - \underset{(-8.4)}{0.063}\, t + \underset{(5.1)}{0.002}\, t^2 + \underset{(1.35)}{0.048}\, \ln(CRag/Pag) \qquad (2.12)'$$

$R^2 = 0.80$, F=29.0, RMSE=0.051, DW=1.93, X=2.72, SD=0.115

All "Other" Agricultural Production:

The estimated equation for the real value added in all 'other' agricultural sector is as follows:

<OLS>:

$$\ln(Yoa) = 3.661 + \underset{(4.4)}{0.465}\, \ln(C) - \underset{(-5.4)}{0.106}\, \ln(CRag/Pag)$$

$$+ \underset{(3.88)}{0.173}\, \ln(Ig) \qquad (2.15')$$

$R^2=0.88$, F=52.3, RMSE=0.045, DW=1.33, p=0.23, N=22.

While the over all explanatory power of the estimated equation is not as powerful as one would expect for such a relationship, nevertheless the estimates do provide fairly strong support to the *a priori* hypothesis regarding the signs and magnitudes of the elasticity coefficients in the model. Public investment variable is significant, but the elasticity value is low, so is the case with aggregate consumption variable. The negative sign for the total agricultural credit variable may at first seem counter-intuitive. However, given the residual nature of this sector this is not unexpected. Agricultural credits in Bangladesh mainly

---

responsible for this failure. Other possible reasons are lack of appropriate data on the variables such as rainfalls during the jute growing months for jute growing areas, fertilizer applied to jute lands and bank credits to jute growers, whereas we have data for the agricultural sector as a whole. This lack of sectoral breakdown of data is not a serious problem for food-grains since food-grains constitutes close to three-quarter of all agricultural activities.

go to the rice and jute sectors only, and there is a deliberate bias in allocating credits to these two sectors from both supply(Banks and other financial institutions) and demand(farmers) side. There is some evidence(Pitt 1980) in the literature which supports this hypothesis of substitution of land and resources out of this sector to the two dominant crops sectors facilitated by government policy changes such as increased availability of credit to these two sectors and the goal of achieving food self-sufficiency 'over-night', so to speak.

Finally, the agricultural sector is being 'closed' by the following identity:

$$Yag = 0.787*Pf*0.9*Qf/Pf^{73} + 0.94*Pj*0.9*Qj/Pj^{73} + Yoa \quad (2.16')$$

where, 0.787 and 0.94 are the estimated coefficients[222] for real value added to constant taka gross output in food-grains and jute, respectively,[223] and Pf^{73}(=75.27) and Pj^{73}(=52.58) are respective unit prices for the base period(1972/73). It may be noted here that the agricultural output in real terms had been growing at 3 percent rate annually through out the sample period(with post-liberation growth rate of 3.18 percent and pre-liberation rate of 3.11

[222] Defined as α_{16} and α_{17} in the previous chapter.

[223] The estimated equations for the period 1973-83 for which data on all the relevant variables are available, using OLS technique are as follows:

$$Yfd = \underset{(36.96)}{0.787}\ Yf \quad ; R^2 = 0.798,\ DW = 1.79.$$

$$Yjt = \underset{(29.13)}{0.94}\ Yj \quad ; R^2 = 0.91,\ DW = 2.53.$$

percent) while the country's aggregate output(GDP) had been growing at the rate of close to four percent during the same period(with post-liberation growth of 5.25 percent and pre-liberation rate of 4.44 percent). A significant contribution to lower growth rate for agriculture as a whole came from relative stagnation of this "other" agricultural sector(constituting about one third of value-added in agriculture) despite the modest performance of the food-grains sector particularly during the post-liberation period.

4.2.2 Manufacturing Production Function:

The estimated production function[224] for the aggregate manufacturing sector is as follows:

<OLS>:

$$\ln(Ymf) = \underset{(1.35)}{0.783} + \underset{(6.92)}{0.425} \ln(CUmf * Lmf) + \underset{(3.3)}{0.246} \ln(CUmf * Kmf) + \underset{(5.28)}{0.0195}\, t \qquad (2.17')$$

$R^2 = 0.98$, $F=357.9$, $DW=1.66$, $p=0.156$, $N=22$, $RMSE=0.055$

where, CUmf is an index of capacity utilization rate for manufacturing sector, estimated by using the 'trend-through-the-peak' method, Ymf is real value-added, Lmf is total employment, Kmf is real stock of capital-- all in manufac-

---

[224] Our tests for appropriate functional form reveal that the assumed Cobb-Douglas formulation is not an unrealistic presentation, at least statistically. This may be concluded from estimating a generalized production function with 'Kmenta approximation'. Other studies on Bangladesh manufacturing technology(for example, Khan 1974, and Rushdi 1984) also provide support for an implied unitary elasticity of substitution between labour and capital.

turing sector, and t is time trend.

The estimated function uses both inputs adjusted for capacity utilization rate, although earlier we made the case for adjustment of capital input only. The labour input adjustment has become necessary since the data were available only in terms of total number of persons employed and not in terms of 'man-hours'. The explanatory power of the estimated equation is fairly strong. The results show relatively low capital intensity in Bangladesh manufacturing sector.[225] The output elasticity of capital is of the order of 0.25, which is comparable to other studies on developing countries.[226] However, the estimated marginal capital-output ratio is relatively large(7.8) for the sector.[227] The estimated coefficients for labour and capital and appropriate statistical tests suggest decreasing returns to scale which is also supported by a recent study on Bangladesh manufacturing sector using a translog cost model(Rushdi 1982). The results also suggest that significant non-zero exponential(disembodied) technological change at the rate of 1.95

---

[225] Although other studies have demonstrated that the large-scale manufacturing is characterized by a very high degree of capital intensity our results indicate a relatively high labour intensity for the <u>aggregate</u> manufacturing sector.

[226] For example, Pani(1980)'s 0.27 for India, Behrman(1977)'s 0.305 for Chile, and Hossain(1973)'s 0.22 for Bangladesh.

[227] Corresponding estimates for India ranges between 6 to 16 in various studies reported in Pani(1980, pp170-172). However, Bangladesh Planning Commission's macroeconomic model assumes the incremental capital-output ratio for the sector to be 3.3.

percent per year has occurred in the sector. It should be noted here that, since the data on both labour and capital are estimated with usual problems of aggregation and measurement errors, one must exercise great caution in interpreting the magnitudes of estimated coefficients. As noted earlier the capital stock data has been estimated by assuming a constant depreciation rate of 6.25 percent per year:

$$Kmf = (1 - 0.0625) * (Kmf)_{-1} + Imf \qquad (2.18)'$$

where, Imf is real investment in manufacturing (private and public). If we apply the marginal productivity conditions for labour and capital to derive input demand functions,[228] we obtain quite different input coefficients(for example, 0.69 for labour at mean values of relevant variables) than those obtained above. Furthermore, the magnitude of the coefficients also varies dramatically with alternative specifications of the production function. All the efforts to estimate a meaningful and statistically significant capacity utilization function for the manufacturing sector(CUmf) resulted in failure. In the macroeconomic simulations the variable is assumed to be exogenously given.

---

[228] For example,the input demand function for labour may be derived as follows:

$$Lmf = \alpha_1 * (Pmf * Ymf) / Wmf$$

where, Pmf is output price and Wmf is wage rate in manufacturing, and α_1 is the factor share of labour in total output of the sector, which may be estimated using usual regression techniques or simply taking mean values of relevant variables. It may be noted here that the Planning Commissions macro-model(1980) estimates this elasticity to be 0.80.

Input Demand Functions for Manufacturing Sector:

The estimated demand for labour and investment functions in this sector are as follow:

(i) Labour Demand Function:

<OLS>:

$$\ln(Lmf) = \underset{(14.03)}{7.478} + \underset{(8.01)}{0.554}\ \ln(Ymf) + \underset{(5.53)}{0.058}\ \ln(Ymf) * D_{71}$$

$$- \underset{(-0.27)}{0.032}\ \ln(NWmf/WPImf)$$

$$- \underset{(-6.17)}{0.347}\ \ln(Pmk/NWmf) - \underset{(-5.86)}{0.322}\ D_{7073} \qquad (2.20')$$

$R^2=0.973$, $F=156.6$, $DW=3.14$, $p= -0.62$, $N=22$, $RMSE=0.06$

(ii) Investment Demand Function:

<OLS>:

$$\ln(Imf) = \underset{(2.47)}{11.688} + \underset{(3.61)}{1.129}\ \ln(Ymf)_{-1} + \underset{(2.7)}{0.76}\ \ln(CRna/Pinv)$$

$$+ \underset{(2.7)}{0.0005}\ (NR/Pm)$$

$$- \underset{(-3.63)}{2.2}\ \ln(Kmf)_{-1} - \underset{(-7.88)}{1.505}\ D_{71} \qquad (2.21')$$

$R^2=0.855$, $F=25.5$, $DW=2.63$, $p= -0.11$, $N=22$, $RMSE=0.225$, $X=6.76$

Where, NWmf is nominal wage rate index in manufacturing, WPImf is wholesale price index for manufacturing, Pmk is price index for imported capital goods, CRna is bank credit to non-agricultural sectors, Pinv is investment goods price index, NR is net remittances from abroad, Pm is import price index, and D_{7073} is a dummy variable for the period 1969/70 to 1972/1973(the period of widespread labour unrest and political instability in the country). All the estimated coefficients in the labour demand function have expected signs and the magnitudes are within the expectations. In general, the performance of the investment demand function is less satisfactory. Many of the parameter estimates are unstable. The lagged investment variable is highly correlated with lagged capital stock and is dropped from the equation. Also interest rate variable is highly insignificant(t=-0.08) and therefore deleted from the equation.

4.2.3 All "Other" Sectoral Output Functions:

(i) Value-Added in Infrastructure:

<OLS>:

$$\ln(Yin) = 2.037 + \underset{(3.28)}{0.516} \ln(C) + \underset{(1.9)}{0.095} \ln(Igf) - \underset{(-0.3)}{0.02} \ln(Pin/Pgd)$$

$$+ \underset{(2.1)}{0.639} \ln(Yna/Ygd) + \underset{(6.77)}{0.374} \; D_{71} \quad (2.23')$$

R^2=0.994, F=752.4, DW=2.13, p= -0.11, N=22, RMSE=0.034, X=7.97

Where, C is total real consumption(both public and private), Igf if real public fixed investment, and Yna/Ygd is the share of non-agricultural sector used as a proxy for the extent of industrialization. The explanatory power of the equation is quite high. Also the DW statistics is satisfactory. In the absence of data on sectoral investment(Iin) total public investment(Igf) is used as a proxy. The relative price variable has correct sign but is statistically insignificant. In general, all the elasticity values are quite low.

(ii) Value-Added in Trade and Banking:

<OLS>:

$$\ln(Ytb) = -5.126 + 0.877 \ln(Y) + 0.445 \ln(Ytb_{-1})$$

$$\quad (2.45) \qquad (3.0)$$

$$- 0.513 \ \ln(Yna/Ygd) - 0.593 \ln(Ptb/Pgd) \quad (2.24')$$
$$(-1.07) \qquad\qquad (-3.43)$$

R^2=0.988, F=453.4, h=-0.93, p= -o.16, N=22, RMSE=0.057, X=8.61

Where, Y is gross national product(at market prices), Yna/Ygd is share of non-agricultural sector--a proxy for the extent of industrialization. The results indicate that the value-added in trade and banking is positively and significantly related to aggregate demand; the long run elasticity is 1.6. All the coefficients, except one have expected signs. The relative price variable is once again insignificant, although has the correct sign. The estimated coefficient indicates long run elasticity value of -1.07.

(iii) Value-Added in Housing(Ownership of Dwelling):

<OLS>:

$$\ln(Yho) = 0.603 + 0.59 \ln(Yho_{-1}) + 0.24 \ln(Y)$$
$$(4.1) \qquad\qquad (2.2)$$

$$+ 0.011 \ \ln(CRho/Pho) - 0.1 \ln(Pho/Pgd) + 0.064 D_{71} \quad (2.25')$$
$$(1.36) \qquad\qquad (-1.9)) \qquad\qquad (2.4)$$

R^2=0.985, F=272.9, h=-0.39, p=-0.07, N=22, RMSE=0.025, X=7.77

Where, Y is national product, NR is net remittances from abroad in current taka, Pm is import price index, CRho is bank credits to housing sector, and Pho is the value-added deflator for housing sector. Once again both short run and long run income and price elasticities are quite low. It may be noted here that part of the significant jump in the trend percentage growth rate of value-added in this sector during the post-liberation period(4.9 percent) over the pre-liberation period(2.4 percent) can be explained by the modest growth in workers' remittances from the middle-eastern countries during the post-liberation period(particularly, since 1975).

(iv) Value-Added in 'Other Services' Sector:

<OLS>:

$$\ln(Yos) = \underset{(5.66)}{5.031} + \underset{(7.7)}{0.664} \ln(Cg) - \underset{(-6.5)}{0.162} \ln(Cg) * D_{71}$$

$$+ \underset{(8.5)}{2.219} \ln(Yna/Ygd) - \underset{(-6.1)}{1.468} \ln(Yna/Ygd) * D_{71} \quad (2.26')$$

R^2=0.987, F=392.8, DW=1.76, p=0.03, N=22, RMSE=0.052, X=8.28

Where, Cg is real public consumption expenditures, and Yna/Ygd is the share of non-agricultural sector--a proxy for the extent of monetization and industrialization. The estimated relation has high explanatory power but the DW statistics lies in the indeterminate range. Although the trend percentage growth rate of value-added in this sector has been only about one half of a percentage point higher during the post-liberation period over the pre-liberation period, there have been a significant fall in the estimated elasticities with respect to both the public consumption variable and the relative size of the non-agricultural sector.

(v) Value-added in Construction Sector:

<OLS>:

$$\ln(Ycn) = -17.19 + \underset{(2.27)}{2.532} \ln(Ygd) - \underset{(-2.78)}{2.286} \ln(Ygd) * D_{71}$$

$$- \underset{(-0.4)}{0.206} \ln(Pcn/Pgd) + \underset{(1.83)}{2.578} \ln(Yna/Ygd) + \underset{(2.7)}{24.13} D_{71} \quad (2.22')$$

R^2=0.884, F=33.1, DW=2.3, p= -0.33, N=22, RMSE=0.196, X=7.35

where, Pcn is price index for the construction sector, and all other variables are as defined above. The value-added in construction is positively and significantly affected by the total activity variable--Ygd. However, the elasticity value falls drastically in the post-liberation period. Although the intercept dummy shows a significant upward shift in overall activity in this sector during the post-liberation period, the sharp drop in the intensity of activity in this sector(evidence by the drop in slope coefficient) during the same period is notable and also counter-intuitive at first sight.[229] One explanation for the drop in elasticity value may be found in the sharp drop in capital formation due to the decrease in replacement investment as well as due to virtual non-existance of net investment during the liberation war year(1971) and the politically unstable years before and after the war year. Indeed, the post-liberation Bangladesh experienced a sharp drop in real investment due to political instability, insecurity of assests, large-scale nationalization of major industries, and the uncertainty about the future of the country. Conse-

---

[229] The estimated trend percentage growth rates in this sector during the pre- and post-liberation period have been 19.1 and 6.48 percents, respectively. Given the importance of this sector in terms of both sectoral growth and capacities and aggregate economic growth in a developing economy, the twelve percentage point drop in the growth rate for this sector would explain much of the retardation in the overall growth performance and the creation of sectoral capacities in the economy. What is not clear here, however, is whether the drop has been the result of shortage of demand or due to supply bottlenecks. Alternatively, it is also possible that there is a decreasing returns to scale in this sector as the size of the economy passes a critical level.

quently, the country has experienced a significant rise in trading and related services activities, mainly at the cost of capital formation.[230] This dip in capital formation during the first half-decade of post-liberation period indeed puts a limit on the growth possibilities of the economy in the near future unless counteracting rapid growth in capital formation is observed. Another explanation may be provided by the following hypothesis: the marginal contribution to value-added in the construction sector proceeds at an exponential rate at the beginning of the growth process of a country and reaches a plateau sooner or later when the economy has reached a critical level in terms of its infrastructure development. Most observers would agree that the Bangladesh economy has not reached that critical stage at least in the early seventies, therefore, the explanation for such a sharp drop in elasticity must be sought elsewhere.

4.3 EXPENDITURE OR DEMAND SUB-MODEL

(i) Private Consumption Function: The estimated real private consumption function for the Bangladesh economy is as follows:

<OLS>:

$$Cp = \underset{}{-2232.93} + \underset{(18.55)}{0.974\ Yd} - \underset{(-2.68)}{0.164\ Yd{*}D_{71}} + \underset{(2.96)}{8484.1\ D_{71}} \qquad (3.33')$$

$R^2=0.993$, $F=979.4$, $DW=2.6$, $N=22$, $p= -0.37$, $RMSE=963.3$, $X=45{,}868$

---

[230] Note that the capital stock in manufacturing has been growing at the rate of 3.4 percent per year during the post-liberation period compared to a growth rate of 9.5 percent during the pre-liberation period--a full 6 percentage point drop!

where, Yd is real disposable income(not adjusted for net remittances). The results show a sharp drop in marginal propensity to consume during the post-independence period. The estimated marginal propensity to consume is comparable to available estimates for Bangladesh and other developing countries in the literature.[231] The overall statistical fit of the equation is satisfactory, however, the DW test result is inconclusive. It may be noted here that the explanatory variables such as real private wealth, real private remittances, and the ratio of agriculture to non-agricultural value-added are excluded from the consumption function either because they are found statistically insignificant or the estimated coefficients are not meaningful and theoretically implausible. Also, the lagged consumption variable is found to be statistically insignificant, implying complete adjustment of actual to desired private consumption within a year.[232]

---

[231] For example, the estimated MPC for Bangladesh is 0.84 in Alamgir(1974), 0.84 in Hussain(1973) and 0.88 in Naqvi and Khan(1982). Similarly, Pani(1980) estimated MPC of 0.84 for India, PIDE(1983) estimated 0.73 for Pakistan, and Naqvi and Khan(1980) estimated 0.72 for Sri Lanka. Note that the relatively lower mpc values for Pakistan and Sri Lanka are due to the separate treatment of workers' remmittences from disposable income in the consumption function.

[232] When the disposable income is divided into domestic(Yd - NPR/Pgd) and foreign(NPR/Pgd) components, as expected the marginal propensities are quite different, the latter being much higher than the former:

$$Cp = 3109.9 + \underset{(13.9)}{0.84}(Yd - NPR/Pgd) + \underset{(2.8)}{1.39}NPR/Pgd + \underset{(3.97)}{3525.2}\ D_{71}$$

$R^2=0.966$, F=198, RMSE=1259.7, DW=1.67, p=0.15, N=22

It may be noted here that the attempts to test alternative models of consumption function yield mixed results. Some of the findings are reported below. The estimated

Public Consumption:

The estimated equation for real government current expenditures on goods and services is as follows:

<OLS>:

$$Cg = \underset{(1.05)}{151.685} + \underset{(6.75)}{0.528}\ Cg_{-1} + \underset{(6.9)}{0.351}\ (TR/WPI)$$

$$- \underset{(-2.2)}{0.162}\ RAIDNF + \underset{(2.71)}{3.814}\ Pf - \underset{(-4.7)}{1504.4}\ D_{75} \qquad (3.35)'$$

R^2=0.974, F=159.5, h=0.87, n=22, p=0.05, RMSE=193.8, X=3,443.5, SD=1182.6.

where, TR is total government revenues, WPI is wholesale price index, RAIDNF is real non-food-grains foreign aids inflow, Pf is domestic price of food-grains, and D_{75} is a dummy variable taking the value of one for the famine-year 1974/75 and of zero otherwise. The estimated equation fits

---

consumption function in per-capita form is as follows:

<OLS>:

$$Cp/POP = \underset{(2.53)}{85.5206} + \underset{(16.18)}{0.7955}\ (Yd/POP)$$

R^2=0.93, F=261.7, DW=1.9, N=22, p= -0.15, RMSE=12.6, X=630.6
where POP is total population and Yd is real disposable income. The estimated marginal propensity to consume becomes much smaller(0.6) when the above function is estimated with the consumer price index as the deflator for both consumption and income. Interestingly, a significantly different results are obtained in the following specification:

<OLS>:

$$CPCPI = \underset{(1.66)}{4925.473} + \underset{(10.22)}{0.6789}\ YDNRC + \underset{(4.92)}{2.3147}\ NRCPI$$

$$+ \underset{(3.4)}{5845.55}\ (RWag/RWmf) + \underset{(1.74)}{1547.636}\ D_{71}$$

R^2=0.97, F=175, DW=1.85, N=22, p=-0.024, RMSE=1026.9.

where YDNRC and NRCPI are real disposable income adjusted for net remittances and real net remittances, respectively, both being deflated by the consumer price index, and RWag and RWmf are real wages in agriculture and manufacturing, respectively. The estimated marginal propenthe data well explaining over 97 percent of the variations in public consumption expenditure and the calculated Durbin's h-statistics indicates absence of serial correlation. The short-run and long-run marginal propensity to consume out of total revenue are 0.35 and 0.74, respectively.[233] The corresponding short-run elasticity at mean values is estimated to be 0.5, while the long run elasticity is as expected, not significantly different from unity(1.06). The level of food-grains prices has, as expected, a negative but statistically significant impact on public savings; the higher the price of food the greater would be the demand for public wage increases and food relief programmes and therefore the lower would be the public savings. However, the corresponding short-run and long-run elasticity at means are found to

---

sity to consume for adjusted disposable income is very low(.6789) compared to other estimates in the literature. Part of this discrepancy is explained by a much higher marginal propensity to consume for net remittances(2.314). Since workers' remittances enter as a separate income variable and since this component of the disposable income is mostly seen as transitory, at least in the short-run, a higher marginal propensity is very much likely. In addition, the the statistically highly significant relative real wage variable explains part of the variations. It is expected <u>a priori</u> that in a country like Bangladesh the marginal propensity to consume would be much higher for the rural or agricultural sector than for the urban sector. The relative wage variable captures some of the income distributional differences and thereby depresses the estimated marginal propensity to consume somewhat.

Finally, it may be noted here that the tests for possible structural shift in the consumption function due to the independence of the country in 1971 have failed to demonstrate such a shift.

[233] These estimates are comparable with findings for other developing countries; for example, 0.42 for Pakistan in PIDE(1983), 0.46 for Sudan and 0.27 for Nigeria in

be relatively small; 0.153 and 0.321, respectively. The estimated negative coefficient for the non-food-grains real foreign aid variable[234] is counter intuitive and is difficult to explain. A priori, it is expected that the higher the foreign aid inflow--which in Bangladesh finances over 70 percent of public investment expenditures--a even greater percentage of public investment could be financed as a result, thereby releasing a greater amount of domestic revenues to satisfy ever increasing domestic demand for public consumption, ceteris paribus. In the present case two factors may be responsible for the negative response coefficient for foreign aid. First, the correlation coefficient between the two variables Pf and AIDNF are quite high(0.7) indicating the possibility of multicollinearity. Many

---

UNCTAD(1980), and 0.33 for Chili in Behrman(1977).

[234] When total foreign aid(AIDR) is included instead, the resulting estimated equation is almost identical, although the over-all significance of the equation drops somewhat. However, it may be noted here that both the price of food-grains(Pf) and real foreign aid(total or non-food-grains) variables become statistically insignificant and their signs reversed when the dummy variable for the famine year(D_{75}) is dropped from the equation.

Finally, if the equation is estimated in nominal terms the results are not much different:

<OLS>:

$$\underset{(-3.5)}{NCG = -659.95} + \underset{(7.26)}{1.132\ NCG_{-1}} + \underset{(3.95)}{0.252\ TR} - \underset{(-4.18)}{0.454\ AIDNF}$$

$$+ \underset{(4.13)}{13.587\ Pf} - \underset{(-4.6)}{3195.52\ D_{75}}$$

R^2=0.997, F=1301.5, h=1.12, n=21, p=-0.31, RMSE=359.4, X=6,113.6

where NCG is nominal public consumption expenditures and AIDNF is nominal non-food-grains foreign aids.

observers have commented that both total aid as well as food-aid commitments are highly correlated with the domestic food-grains production situation; the higher the shortages and therefore the greater the domestic price of food-grains the more forceful is the claim for aid and the more willing would be the donors to increase aid flows. The other factor is that it is possible that the rise in non-food-grains foreign aid in Bangladesh occurs at the cost of food-grains aid--this is indeed the case in recent years--and as a result leaving relatively less funds to finance public consumption. Given the inelastic nature of government revenue collections, the result would be a decline in real government expenditures.

Investment Demand Functions:

(i) Private Investment in Agriculture:

Real Private investment in agriculture(Ipa) is found to be, as expected, positively related to real bank credits to the sector(CRag/Pag) and the agricultural price lagged one year(Pag_{-1}):

<OLS>:

$$Ipa = \underset{}{116.5} + \underset{(10.2)}{0.22CRag/Pag} + \underset{(1.31)}{158.28(Pag/NWag)_{-1}} - \underset{(-7.16)}{357.6D_{71}}(3.36)'$$

$R^2=0.877$, $F=50.7$, $Dw=1.8$, $N=22$, $p=0.04$, $RMSE=59.7$, $X=257.3$, $SD=174.1$.

While the overall statistical fit of the relationship appears to be satisfactory, the predictive performance of the model seems to be relatively poor(high RMSE). As expected, a significant downward shift in private investment has occured during the post-liberation period.[235] The estimated elasticities at means for both real bank credits and sectoral prices are positive and quite low: 0.65 and 0.22, respectively. The low elasticity parameter for real bank credit variable is not surprising , however, since available statistics indicate only a small portion of total agricultural credits comes from the formal institutional(banks) sources and that a significant part of these bank credits in turn is used for personal consumption expenditures.[236] For the other elasticity coefficient, either lagged price variable alone is not a good proxy for profitability in this sector or private investment in agriculture is not very much responsive to profit signals. In the absence of additional resources and detailed data, no conclusive evidences can be drawn here in favour or against one or the other hypotheses above.[237]

---

[235] No shifts in slope parameters were observed during the post- liberation period.

[236] See, Khan(1973), Islam(1981) and Mahmud(1981), for example.

[237] Note that the investment function proposed for this sector in the previous chapter contains many more variables than the one estimated here. The exclusion of some of the variables were necessary due to two main reasons: (i) high correlation exists between real agricultural value added and real sectoral bank credits, and between net private remittance and real bank credits. When all of these variables are included, implausible negative coefficients are obtained. (ii) Some of the variables are found to be statistically insignificant. The estimated full relation is as follows:

$$Ipa = \underset{(2.73)}{688.48} - \underset{(-2.07)}{0.023}\, Yag - \underset{(-.84)}{0.078}\, CRag/Pag + \underset{(1.72)}{195.1}(Pag/NWag)_{-1}$$

(ii) Private Investment in manufacturing:

The estimated private investment function for the manufacturing sector is as follows:

<OLS>:

$$Ipm = \underset{(-1.49)}{-742.89} + \underset{(1.34)}{0.049} \ll Ymf - Ymf_{-1} \gg + \underset{(2.13)}{912.53} \; Pinv/WPImf$$

$$+ \underset{(3.13)}{.0612} \; CRag/Pinv + \underset{(1.54)}{.0559} \; NPR/Pinv - \underset{(-2.5)}{382.719} \; D_{71} \qquad (3.37)'$$

R^2=0.87, F=28.63, DW=1.067, N=21, p=0.417, RMSE= 93.4, X=452.04.

where, Ymf is real value added in manufacturing, Pinv/WPImf is the ratio of price index of investment goods to wholesale price index of manufacturing goods, CRna/Pinv is real bank credits to non-agricultural sector, and NPR/Pinv is real net private remittances from abroad. The estimated 'accelerator' coefficient is statistically significant but on the low side.[238] Although the equation's overall statistical fitness is at acceptable level, the Durbin-Watson test for serial correlation indicates inconclusive results. Also, the RMSE is relatively high.

$$+ \underset{(1.77)}{0.049} \; Igf + \underset{(3.35)}{0.244} \; NPR/Pgd - \underset{(-5.19)}{268.54} \; D_{71} \qquad (3.37')$$

R^2=0.917, F=37.85, DW=2.36, N=21, p=-0.21, RMSE=50.14

where, NWag is nominal wage rate in agriculture, Igf is real public sector investment, NPR is net private remittances, and Pgd is aggregate price level.

[238] A similar function estimated for Pakistan in PIDE(1983) yields a coefficient of 0.25 for the accelerator, which is however, on the high side as the study correctly points out. For all private investment, Lackaman and You(1979) study reports accelerator coefficient of 0.14.

All the signs of estimated coefficients are correct except in one case. The perverse sign for the relative price or profitability variable(Pinv/WPImf) may be among others due to measurement problems. The price index for investment goods is estimated by taking an weighted average of relevant price indices, which also include the wholesale price index for manufacturing goods as a proxy for price index of domestically manufactured investment goods. Therefore, although a rise in manufacturing price index is associated with a rise in investment goods' price index, the relative price ratio of investment to manufacturing goods, however, decreases since manufacturing price enter into investment prices only as a fraction. As a result, a positive response coefficient for the variable is not unlikely. The bank credits variable has the expected sign and is statistically significant. The corresponding elasticity value at means is found to be reasonable(0.73). However, the net private remittances variable, although has the correct sign but is statistically insignificant. Furthermore, the implied elasticity value is also vary low(0.08). This is not surprising since several studies on the usages of the remittances in Bangladesh have found that most of these are used to meet up current consumption demands.[239]

(iii) Private Investment in 'Other' Sectors:

[239] See, for example, Islam(1981),World Bank(1980), and Mahmud(1982).

The estimation of private investment in all other sectors generated unstable results. One estimated equation is reported here:

<OLS>:

$$\underset{}{Ipo} = \underset{(-2.0)}{-2599.5} + \underset{(1.95)}{0.084}\, Ygd_{-1} - \underset{(-.273)}{0.046}\,(CRna/Pinv) + \underset{(2.55)}{921.3}\, D_{71}$$

$R^2=0.865$, $F=43.9$, $DW=1.47$, $N=21$, $p=0.244$, $RMSE=513.7$

where, Ygd is real gross domestic product and CRna/Pinv is real bank credits to the non-agricultural sector. The modified accelerator coefficient becomes negative when public investment variable is included. The coefficient for the real credit variable is also unstable.

Aggregate Private Investment:

Since the disaggregated private investment functions above yield less than satisfactory results, we have also estimated an aggregate private investment function(Ip), which will replace the disaggregated investment functions in the macroeconomic simulation exercises in the next chapter. It is expected that the simulation performance of the model will improve as a result since the disaggregated investment model framework together contains large errors. The estimated aggregate private investment function is as follows:

<OLS>:

$$Ip = \underset{(5.32)}{766.054} + \underset{(4.77)}{.088}\, «Ygd - Ygd_{-1}» + \underset{(3.88)}{0.192}\, CR/Pinv + \underset{(0.23)}{.019}\, Igf$$

$$+ \underset{(2.7)}{0.226}\, NPR/Pinv - \underset{(-8.3)}{1560.8}\, D_{7174} + \underset{(5.8)}{887.36}\, D_{71} \qquad (3.29)$$

$R^2=0.98$, $F=195.1$, $DW=1.9$, $N=22$, $p=0.04$, $RMSE=194.6$, $X=2,602.7$

Where, Ygd is real gross domestic product, Igf is real public investment, CRna/Pinv is real bank credits to the non-agricultural sector, NPR/Pinv is real net private remittances, D_{7174} is a dummy variable for the period of wide spread labour unrest and political instability in the country taking the value of one during the period 1970/71 to 1973/74 and of zero otherwise, and D_{71} is another dummy variable taking the value of one during the post-independence period(1970/71 to 1982/83) and of zero otherwise. The overall statistical fit of the equation is quite satisfactory. All the estimated coefficients have expected signs and all but one are found to be statistically significant. The public fixed investment variable does not seem to be vary much influential in inducing further private investment as was expected. The accelerator coefficient is 0.088.[240] There is strong evidence in support of private investment pessimism during the period of 1971 war of independence and the two years immediately following the war. The estimated elasticity value at means for all the explanatory variables show very low values. For example, the credit elasticity is 0.46, net remittances elasticity 0.06, real public investment elasticity 0.02, and the accelarator elasticity is 0.07. The low elasticity coefficients reinforces the commonly held view of sluggish private investment responses in most developing countries despite the near unlimited investment poten-

[240] Lackeman and You(1979) study on Bangladesh reports short-run accelarator coefficient of 0.14, while Imam(1971)'s study on Pakistan reports a coefficient of 0.097.

tials in these countries as emphasized by Klein(1965).

Public Fixed Investment:

Total public fixed investment in all sectors is estimated by the following relation:

<OLS>:

$$Igf = -35.7 + \underset{(6.7)}{0.9\ Igf_{-1}} + \underset{(3.88)}{0.818\ (TR - NCG)/Pinv}$$

$$- \underset{(-1.21)}{0.099\ CAP/Pinv} \qquad (3.38)'$$

R^2=0.864, F=45.4, h=-1.79, N=22, p=-0.31, RMSE=582.8, X=3,452.9, SD=1,546.2

where, TR is total public revenue, NCG is nominal public consumption, Pinv is price index for investment goods, and CAP is net foreign capital inflows. Overall the result is satisfactory. Tests for structural shift during the post-independence period show absence of such a shift.

Public investment in Bangladesh is overwhelmingly aid-financed--on average 70 percent during the sample period--while the remainder is determined by the availability of domestic surplus of public revenues after adjusting for current government expenditures on goods and services. Therefore, the foreign aid or capital inflow and the adjusted domestic public revenue are the important explanatory variables entering the public investment function. A priori, it is expected that the marginal contribution of foreign capital or aid would be higher than that for adjusted domestic public revenues. But the results obtained indicate just the opposite and several attempts to estimate alternative versions of public investment model failed to improve the results. The marginal contribution of adjusted public revenue variable is statistically significant but the magnitude of the estimated coefficient is very high(0.82), while the coefficient for the capital inflow variable has wrong sign and very low magnitude(-0.099) and is statistically significant only at 80 percent confidence interval. The lagged public investment variable is statistically significant but the coefficient is quite high(0.9), implying that only about 10 percent of the discrepancy between the desired and actual real public investment is eliminated in a year. Since the implied partial adjustment coefficient is very small(.0945) indicating very little changes in public investment over time--actual investment is close to last years observed investment--it provides support for the hypothesis of institutional rigidities, inertia, and shortages of funds for new investment in public investment allocation for most developing countries.[241]

---

[241] The estimated short-run elasticities are 0.29 for adjusted public revenue, -0.12 for foreign capital inflow, and 1.11 for unadjusted public revenue. Because of very low partial adjustment coefficient the implied corresponding long-run elasticities are quite large: 3.109, 1.243, and 11.728, respectively.In a pooled cross-section and time-series studies of 11 developing countries, Heller(1975) found public investment significantly influenced by foreign aid--marginal coefficients are 0.7 for grants and 0.24 for loans--and by the total public revenue--marginal coefficient being 0.49. For the Pakistan economy, PIDE(1983) reports a coefficient of 0.113 for foreign capital and 0.423 for total public revenue. However, both of these studies have used unadjusted public revenue, which indicates the possibility of misspecification of the relation.

It may be noted here that although the Durbin's h-statistics indicates that the equation is free of serial correlation at the desired five percent level of significance, but the null- hypothesis of no serial correlation gets rejected at the one percent level of significance. It is not uncommon to encounter autocorrelated disturbances in the presence of lagged dependant variable as an explanatory variable(see, Pindyck and Rubinfeld:1981, p237). In such a case the ordinary least-squares parameter estimates are inconsistent and biased, with the direction of the large sample bias relating directly to the sign of 'rho' or first order autocorrelation coefficients (Griliches:1971). Alternative specifications were tested but the results did not improve. Finally, the equation has been estimated using the maximum-likelihood estimation procedure. The resulting estimated equation, however, does not differ very much from the un-corrected one reported above.[242]

Foreign Sector Demand:

---

[242] The correction for serial correlation using the maximum-likelihood method yields the following function for public investment:

<AUTO: ML>:

$$Igf = -113.5 + \underset{(8.63)}{0.93}\ (1-p)*Igf_{-1} + \underset{(4.35)}{0.76}\ (1-p)*(TR - NCG)/Pinv$$

$$- \underset{(-1.4)}{0.091}\ (1 - p) * (CAP/Pinv)$$

$R^2=0.93$, DW=2.048, N=21, p=0.36(t=1.45), RMSE=577.29.

where p is the maximum-likelihood estimate of 'rho' or first-order autocorrelation coefficient.

This section first presents the estimated disaggregated imports demand functions followed by disaggregated exports functions. Finally, the section also presents two functions for imports and exports of non-factor services.

Imports Demand Functions:

In total four import demand functions are estimated: functions for capital goods, raw materials and intermediate inputs, food-grains, and other consumer goods. The general specification for all the imports demand functions is that demand depends on the level of domestic 'activity' in the relevant sector and the relative price of the imported commodities. In the previous chapter it is postulated that the relative price variable should be the real effective exchange rates for imports. Due to the nonavailability of a consistent data series import taxes and subsidies on different categories of importables, the effective exchange rates could not be estimated. The imports price indices in this study are simply the foreign currency(US dollar) unit value indices multiplied by the nominal exchange rate of Taka vis-a-vis US dollar. The lagged imports variable is added to capture the effects of partial adjustment of actual to desired level of imports. A priori, the lagged imports may have either a positive or negative coefficient. A positive coefficient would reflect Houthakker-Taylor(1970) habit formation or the need for more than one year to adjust actual to desired level of imports. On the other hand, a negative coefficient would indicate a Houthakker-Taylor inventory effects--meaning demand for current imports diminishing due to stock build-up from the previous periods imports.

Foodgrains Imports:

<OLS>:

$$\ln(Mfo/Pmfo) = \underset{(2.5)}{14.652} + \underset{(4.4)}{0.476} \ln(GAPf) - \underset{(-2.63)}{1.747} \ln(Yd)$$

$$- \underset{(-6.7)}{1.414} \ln(Pmfo/Pf) + \underset{(6.4)}{1.227} \ln(AID/WPI) \qquad (3.42)'$$

$R^2=0.88$, $F=39.5$, $DW=2.21$, $N=22$, $p=-0.11$, $RMSE=0.284$, $X=6.85$

where, GAPf is estimated food-gap,[243] Yd is real disposable income, Pmfo is price of food-grains imports, Pf is domestic price of food-grains, AID/WPI is total real aid flows. Food-grains imports demand is, as expected, found to be positively and statistically significantly responsive to estimated food-gap and real foreign aid inflows. The food-gap elasticity value of 0.5 indicates less than proportionate response of actual imports of food-grains to expected shortfalls in domestic production. This may be due to factors such as chronic shortages of foreign exchange, lags in delivery, systematic over-estimation of demand and under-estimation of domestic production and the neglect of stock management of food-grains.[244] The estimated food-gap elas-

---

[243] The food-gap is estimated by the following equation:

$$GAPf = « \gamma * POP - (1 - \emptyset) * Qf_{-1} »$$

where γ is estimated per-capita consumption norm for food-grains--assumed to be 4.297 maund, as estimated by the World Bank, POP is total population, $\emptyset$ is a fixed proportion--assumed to be 10 percent--of cereal outputs adjusted for seeds, wastages, etc. and Qf is total domestic production of food-grains.

[244] Due to data limitations a more realistic estimation of

ticity coefficient is almost identical(.5091) when the food-gap variable is used in per-capita term. The implied elasticity for domestic food-grains production is very low(-0.46).[245] The estimated relative price elasticity also has expected sign and is statistically significant. Food-grains import demand in Bangladesh is price elastic: a one percentage point fall in world price relative to domestic price of food-grains would increase imports demand by more than one and a quarter of a percentage point. The negative but statistically significant more than unitary income elasticity of imported food-grains is puzzling. The following may, however, help to explain part of the puzzle. In a predominantly agricultural economy such as Bangladesh, aggregate disposable income is very closely and positively associated with the domestic production of food-grains and a higher domestic production means higher disposable income but lower food-gap, therefore less demand for imports of food-grains. In addition, imported food-grains in Bangladesh may be an inferior good. Since, imported food-grains are mostly wheat, and there is an overwhelming preference for rice over wheat and within the rice group for domestic high quality rice over imported rice, a rise in disposable income

---

food-gap could not undertaken here. Also, data limitations do not permit us to model the food-grains stock management in Bangladesh.

[245] Our food-grains imports elasticity to domestic production is indeed very low compared to, for example, Pani(1977)'s -1.82 for India. Pani, however, considers all food imports, whereas we have considered food-grains only. A much larger elasticity value of -3.67 is reported for wheat imports of Pakistan in PIDE(1982).

may induce strong substitution infavour of domestic rice against imported wheat and domestic high quality rice against imported rice, <u>ceteris paribus</u>. This result, indeed, corroborates with the findings of a cross-sectional demand study on Bangladesh by Pitt(1983). Finally, the lagged food-grains imports variable is found to be statistically insignificant, indicating complete adjustment of actual to desired imports within one year time period.

Other Consumer Goods Imports:

<OLS>:

$$
\begin{aligned}
\ln(Moc/Pmoc) = & \underset{(-2.25)}{-8.749} + \underset{(4.53)}{1.506} \ln Yd \\
& - \underset{(-2.02)}{0.311} \ln(ER * Pmoc^{0}/CPI) - \underset{(-5.04)}{0.786}\, D_{71} \qquad (3.44)'
\end{aligned}
$$

$R^2=0.674$, $F=15.4$, $DW=2.39$, $N=22$, $p=-0.27$, $RMSE=0.195$
$X=7.055$, $SD=0.34$

Where, Moc is imports of non-food-grains consumer goods and Pmoc is the corresponding price index, Yd is real disposable income, ER is exchange rate of Taka vis-a-vis US dollar, $Pmoc^{0}$ is Unit value index of consumer goods imports in US dollar, CPI is consumer price index, and D_{71} is a dummy variable taking the value of one during the post-independence period of 1970/71 to 1982/83 and of zero otherwise. All the estimated coefficients are statistically significant and bear the correct signs. But the DW test result is inconclusive. The lagged consumer goods imports variable has been dropped on grounds of statistical insignificance. Actual consumer goods imports, like food-grains, adjust quickly to desired level within a period of one year.[246] The activity variable--real disposable income--have significantly non-zero coefficient. The income elasticity for consumer goods imports is 1.51, while the implied marginal propensity to imports at mean values is estimated to be 0.03. These estimates are comparable with those obtained in other similar studies on developing countries.[247] The imports price elasticity for consumer goods is statistically significant with correct sign but the magnitude is unexpectedly low(0.31).[248] The extensive use of quantitative restrictions, import tariffs and licensing systems may have obscured some of the import price responses. We have already mentioned that adjustments for such distortions were not possible due to data limitations. Finally, tests for struc-

---

[246] The estimated equation with the legged term is as follows:

$$\ln(Moc/Pmoc) = \underset{(-2.07)}{-6.44} - \underset{(-0.07)}{0.011} \ln(Moc/Pmoc)_{-1} + \underset{(3.87)}{1.29} \ln Yd$$

$$-\underset{(-2.08)}{0.326} \ln(Pmoc/CPI) - \underset{(-4.1)}{0.751} D_{71}$$

R^2=0.6729, F=11.287, h=-2.233, N=21, p=-.323, RMSE=.1928.

It should be noted here that the insignificance of the lagged term may be due two opposing effects--the inventory effects and the habit formation effects--cancelling each other, which is not an unrealistic pattern for certain consumer goods imports as noted by Behrman(1977) for the Chilean case.

[247] For example, the income elasticity for consumer goods is found to be little over unity and the implied marginal propensity to consume 0.024 for Pakistan in PIDE(1983). For Ghana, Atta(1981) found the marginal propensity to consume ranging between 0.028 to 0.05. Behrman(1977)'s study on Chile also reports similar coefficients.

[248] Studies mentioned above on Chile(Behrman:1977), Pakistan

tural shift in the function due to the separation of Bangladesh in 1971 support intercept shift only, with no significant shift in the slope coefficients.

Capital Goods Imports:

<OLS>:

$$\ln (Mk/Pmk) = \underset{}{0.116} + \underset{(1.79)}{0.192} \ln (Mk/Pmk)_{-1} + \underset{(7.27)}{0.838} \ln (Imf)$$

$$- \underset{(-4.15)}{0.863} \ln \text{«}ER * Pmk^{0}/WPImf\text{»} + \underset{(3.9)}{0.522} D_{71} \quad (3.45')$$

$R^2=0.859$, $F=32.9$, $h=-0.74$, $N=22$, $p=-0.124$, $RMSE=0.19$, $X=7.18$, $SD=0.5$.

Where, Mk is imports of capital goods and Pmk is corresponding price index, Imf is real investment in manufacturing--both public and private, ER is nominal exchange rate or Taka vis-a-vis US dollar, Pmk^0 is US dollar unit value index of capital goods imports, WPImf is wholesale price index for manufacturing goods, and D_{71} is a dummy variable taking a value of one for the post liberation period of 1971-1983 and of zero otherwise.

On an overall level the results seem reasonably satisfactory. The point estimates have the anticipated signs. No undue problems of serial correlation are apparent. The corrected coefficient of determination indicates that the hypothesized determinants are consistent with over 85 percent of the variances in the dependant variable. The posi-

---

(PIDE:1983), Greece(Vernerdakis:1978), and Ghana(Atta: 1982) all have found the import price elasticity for consumer goods close to unity. One difference between these studies and the present one is that these studies do not differentiate between food-grains imports and other consumer good imports.

tive sign for the lagged capital goods imports indicate the dominance of the adjustment or habit formation effects in this sector. The implied adjustment coefficient show that about 80 percent of the discrepancy between the desired and actual capital goods imports demand is eliminated within a year. Domestic investment demand exerts significant influence over the capital goods imports demand with a short-run elasticity of 0.84 and long-run elasticity at means of unity. These elasticity figures are comparable to short-run elasticity coefficient of 0.77 for Pakistan in PIDE(1982) and 0.85 for India in Pani(1977). The relative price elasticity for capital goods is found to be much higher(-0.87) than that for the other imports categories. Also notable is the upward shift of the function during the post-liberation Bangladesh in contrast to a downward shifts of the other imports demand functions. An increased demand for capital goods in war-devastated Bangladesh along with relatively easy terms and conditions on capital goods imports to promote import substitution industrialization policy explain part of this upward shift. Furthermore, there are evidences that the new industrialization efforts are biased toward capital-intensive techniques, and specially imported capital.

Raw Materials and Intermediate Goods Imports:

<OLS>:

$$\ln (Mr/Pmr) = \underset{(}{-8.968} + \underset{(7.57)}{1.543} \ln Ygd - \underset{(-2.24)}{0.274} \ln (ER*Pmr^{0})/Prm$$

$$- 0.271\ D_{71} \qquad (3.46)'$$

(-3.06)

$R^2 = 0.766$, $F = 23.9$, $DW = 1.88$, $N = 22$, $p = 0.06$,
$RMSE = 0.12$, $X = 7.587$, $SD = 0.247$

Where, Mr is imports of raw materials and intermediate goods and Pmr is the corresponding imports price index, Ygd is real gross domestic product, ER is nominal exchange rate of Taka vis-a-vis US dollar, Pmr^0 is US dollar unit value index of imported raw materials and intermediate goods, Prm is domestic price of raw materials, and D_{71} is a dummy variable taking the value of one for 1971 to 1983 and of zero otherwise.

The overall statistical fit of the estimated equation is reasonably satisfactory. All the coefficients have correct signs and are also statistically significant. The demand for raw materials and intermediate goods is a derived demand. The implied marginal propensity to imports is 0.06 with the income elasticity value of 1.54. These values are comparable to other similar studies on developing countries.[249] The estimated price elasticity coefficient of raw material imports is very low(-0.28). However, this is not surprising,[250] since domestic capacity expansion is very much limited and also domestic substitute for most of these

---

[249] For example, the income elasticity for imported raw materials and intermediate goods is estimated to be 1.3 for Pakistan in PIDE(1982), 0.82 for Thailand in Chaipravat, et al(1979), and 1.34 for Greece in Vernardakis(1978).

[250] Similar low price elasticity coefficients are obtained for some other developing countries also, for example, -.05 for Pakistan in PIDE(1983) and -.3 for Chile in Behrman(1978).

raw materials and intermediate goods are non-existance. The lagged imports variable has been found statistically highly insignificant, implying complete adjustment of desired to actual imports within a year. As such the lagged term has been dropped from the estimated equation. Finally, tests for structural shift during the post-independence period support intercept shift only.

Exports Functions:

Three exports functions--for raw jute, jute manufacturing, and 'all other' goods--are estimated and presented below. The general specification of all three functions is similar to that for the imports functions; the major determinants of exports are a 'scale' variable and the relative price variable. Since Bangladesh is a major producer and exporter of raw jute and in recent years also jute goods in the international market, the world demand considerations dominate in these two exports markets. While in case of exports of 'other' goods, which include both traditional and non-traditional goods, domestic capacity and other supply considerations are crucial. As such the exports function for this category of goods is a supply function.

Raw Jute Exports Function:

<OLS>:

$$
\begin{aligned}
\ln (Xj/Pxj) = 10.861 &- \underset{(-0.7)}{0.083} \ln WY - \underset{(-1.9)}{0.275} \ln EERj \\
&- \underset{(-5.4)}{0.658} \ln Pxj^{o} + \underset{(0.22)}{0.017} \ln Pjs^{o} \qquad (3.49)'
\end{aligned}
$$

$R^2 = 0.935$, $F = 61.1$, $DW = 2.06$, $N = 22$, $p = -0.067$,

RMSE = 0.088, X = 6.945

Where, Xj is exports of raw jute and Pxj is the corresponding price index, WY is the index of world income of major trading partners of Bangladesh, EERj is the effective exchange rate for raw jute, Pxj^0 is the foreign currency unit value index of raw jute exports, Pjs^0 is the world price index of major raw jute substitutes, and D_{75} is a dummy variable with a value of 1 in 1974/75--the year of US-Bangladesh-Cuba jute exports crisis--and zero otherwise. Although the overall fit of the equation is reasonably satisfactory, there are some apparently puzzling results that need to be explained. The negative sign for the world demand elasticity for raw jute is surprising.[251] Several features of the raw jute sector, however, may help to understand the unanticipated result. The world demand for raw jute has been declining for several decades now, particularly, in the face of increased technological innovation, improvements and cost efficiency in raw jute substitutes and, on the other hand, virtual stand-still in technological innovations and improvements in the usage of jute and jute goods. Furthermore, the secular decline in world demand for raw jute is reinforced due to gradual decline of input demand as the older jute mills in Europe and other countries

[251] In the literature, no studies have attempted to directly estimate the world income elasticity for raw jute. In general most observers believe or have indirectly derived that the income elasticity parameter is very low. None of them, however, investigated the possibility of Bangladesh's exports of raw jute being an inferior good in the international market.

are becoming obsolete and replaced by jute substitutes, which are relatively cost efficient and do not require dependence on foreign supply of raw materials. However, the coefficient for WY is statistically insignificant.[252] Also, surprising is that both the effective exchange rate and price of jute substitute variables, although have the correct signs, but are found to be statistically highly insignificant. The own price elasticity of raw jute exports has the expected sign and is statistically significant. The elasticity value of is relatively low(-0.66) compared to -0.96 obtained in Rahman(1981) and -1.17 in Ahammed(1981) both using a simultaneous system model for the jute sector of Bangladesh. In another study on Bangladesh, the elasticity value has been calculated to range between -0.5 to -1.1 depending upon the range of admissible parameter values for the world demand and supply functions(Thomas:1979). Surprisingly the dummy variable for the 1965 Indo-Pak war was found to be insignificant. The lagged exports variable is found to be statistically insignificant indicating fast adjustment of raw jute exports to desired level within a year. Finally, the tests for structural shift failed to recognize any such shift during the post-independence period.

Jute Manufacturing Exports:

<OLS>:

[252] Also, note that the parameter estimate is not robust; it ranges between -0.5 to +0.10 in alternative specifications and in some cases become insignificant.

$$\ln (Xjm/Pxjm) = 3.912 + \underset{(10.8)}{0.824} \ln WY - \underset{(-0.86)}{0.135} \ln Pxjm^0/Pxjms^0$$

$$+ \underset{(0.38)}{0.065} \ln EERj - \underset{(-1.11)}{0.162} \ln CUmf - \underset{(-6.71)}{0.689} D_{71} \quad (3.50')$$

$R^2 = 0.924$, $F = 51.8$, $DW = 2.0$, $N = 22$, $p = -0.035$, $RMSE = 0.077$, $S = 7.216$

Where, Xjm is exports of jute manufacturing and Pxjm is the corresponding price index, WY is the world price index of income of major trading partners of Bangladesh, EERjm is the effective exchange rate for jute goods, $Pxjm^0$ is the foreign currency unit value index for jute goods exports, $Pxjms^0$ is the world price of jute goods substitutes, CUmf is the capacity utilization rate for the domestic manufacturing sector, D_{71} is a dummy variable taking the value of one for the period 1970/71 to 1982/83 and zero otherwise.

The overall statistical fit of the equation is reasonably satisfactory. The world income elasticity coefficient of jute goods from Bangladesh is statistically highly significant and has the anticipated sign with the magnitude being being close to unity. This is in sharp contrast with that for the raw jute sector, for which we have found a low and negative coefficient. On the other hand, the price elasticity coefficient for jute goods, although has the correct sign, but is low and also statistically insignificant[253] as

---

[253] The statistical significance of the price elasticity coefficient improves somewhat when two of the other insignificant variables are dropped from the equation:

$$\ln (Xjm/Pxjm) = \underset{(12.1)}{3.999} + \underset{(9.74)}{0.84} \ln WY - \underset{(-1.53)}{0.122} \ln (Pxjm^0/Pxjms^0) - \underset{(-7.2)}{0.6419} D_{71}$$

opposed to statistically significant and close to unitary price elasticity estimate for the raw jute exports. Such a low elasticity is contrary to the a priori expectation. Most previous studies on Bangladesh, for example, Thomas(1979), have estimated or hypothesized more than unitary price elasticity coefficient for jute goods exports of Bangladesh. Our attempts to estimate alternative versions for jute goods exports equation failed to improve the result. Both the effective exchange rate and capacity utilization rate variables are found to be statistically insignificant. The disruption of the jute goods industrial capacity due to war-damages and subsequent supply bottle-necks along with the loss of exports market in Pakistan is captured by the significant downward shift in the exports function during the post independence period. Finally, the lagged exports variable is found to be statistically highly insignificant indicating a rapid adjustment of actual to desired exports of jute goods within one year time period.

All 'Other' Goods Exports:

<OLS>:

$$\ln (Xo/Pxo) = \underset{(-2.7)}{-5.765} + \underset{(5.99)}{1.205} \ln Ygd + \underset{(2.4)}{0.879} \ln Ygd * D_{71}$$

$$- \underset{(-10.99)}{1.106} \ln (Pxo/Pgd) + \underset{(7.32)}{1.114} \ln (Pxo/Pgd) * D_{71}$$

$$- \underset{(-2.8)}{11.04} D_{71} \qquad (3.51)$$

$R^2 = 0.91$, $F = 89.2$, $DW = 1.9$, $N = 22$, $p = 0.016$, $RMSE = 0.0758$

The new parameter estimates for both income and price elasticities, however, do not show any significant differences.

$R^2 = 0.968$, $F = 126.5$, $DW = 1.36$, $N = 22$, $p = 0.214$,
RMSE = 0.0925, X = 6.544

Where, Xo is exports of all non-jute commodities and Pxo is the corresponding price index, Ygd is the real gross domestic product and Pgd is the corresponding deflator, and D^{71} is a dummy variable taking the value of one for the period 1971 to 1983 and of zero otherwise.

The overall statistical fit of the equation is quite satisfactory, although the Durbin-Watson test for serial correlation failed to reject conclusively the null hypothesis of no serial correlation. In terms of corrected coefficient of determination the hypothesized relation explains over 96 percent of the variations in the dependant variable. Tests for structural shift due to the separation of the country in 1971 provide strong support for such a shift both in the slope coefficients and the intercept term.[254] The exports

---

[254] When the equation is estimated without the slope dummies the overall statistical fit of the equation drops noticeably:

$$\underset{}{\ln Xo/Pxo} = \underset{(-3.85)}{-16.2} + \underset{(5.49)}{2.17} \ln Ygd - \underset{(-1.97)}{0.32} \ln Pxo/Pgd - \underset{(-8.6)}{1.43} D_{71}$$

$R^2 = 0.78$, $F = 26.2$, $DW = 1.49$, $N = 22$, $p = 0.1$, RMSE = 0.2397

When the correction for serial correlation using the maximum likelihood procedure is done the following equation is obtained with very little improvement in the explanatory power of the equation:

$$\ln (Xo/Pxo) = \underset{(-3.57)}{-18.6} + \underset{(4.97)}{2.415} \ll \ln Ygd - p * (\ln Ygd)_{-1} \gg$$

$$- \underset{(-4.56)}{0.7} \ll \ln Pxo/Pgd - p * (\ln Pxo/Pgd)_{-1} \gg$$

$$- \underset{(-6.9)}{1.43} \ll D_{71} - p * (D_{71})_{-1} \gg + p * \ln (Xpo/Pxo)$$

elasticity to gross domestic product rosed from about 1.2 in the pre-independence period to over 2.0 during the post-independence period. On the other hand, the negative unitary price elasticity coefficient for the pre-independence period is almost completely nullified by the countervailing rise in elasticity coefficient during the post-independence period. Earlier, it was hypothesized that the exports function for 'other' goods category is supply determined. As such a non-negative price coefficient is expected. The result show negative but unitary(-1.11) coefficient for the pre-independence period but a positive but close to zero(0.008) price elasticity coefficient for the post-independence period. One explanation for such a swing in elasticity may be that exports of other goods were mainly world demand determined during the pre-independence period, while the supply forces gain importance during the later part of the sample period. This will not be an unrealistic proposition if one looks at the commodity composition of the exports under the category of 'other' goods over time. During the pre-independence period the 'other' goods category was dominated by few traditional items such as tea, leather, etc. Exports of these commodities to the then West Pakistan and the rest of the world was indeed demand determined and as such a unitary

---

R^2 = 0.7968, DW = 1.7917, N = 21, p = -.6507, RMSE = 0.2267.

The only parameter estimate that changed significantly is the price elasticity coefficient. All other coefficients remained almost unchanged. Although the DW statistics improved significantly, the RMSE has improved very little.

price elasticity of demand for these items are not unrealistic given the nature of these commodities. The post-independence Bangladesh exports of other goods faced two important developments; (i) Competitive and open exports market, since Bangladesh no longer has to supply exports to protected markets of Pakistan and (ii) a planned and increased initiatives to diversify the exports sector specially by promoting nontraditional items. Domestic supply factors, on both counts, became dominant factors in the determination of exports volume for 'other' goods during the post-independence period, specially the later part of that period.[255] As in case of the other two exports function, the lagged dependant variable in the present case also found to be statistically insignificant indicating an complete adjustment of actual to desired level of exports within one year.

Trade in Invisibles:

Two functions--one for non-factor services payments(imports) and the other for non-factor services receipts(exports)--are estimated and presented here. Two other components of invisible trade accounts, namely, net

---

[255] Although, exports volume in Bangladesh in general has suffered a secular decline in real terms during the entire sample period, the decline has been more so in case of other goods category mainly due to decades of negligence and a preference for imports substitution industrialization in the Western part of the joint Pakistan. A major source of foreign exchange to finance this industrialization came from the Eastern wing's exports earnings from jute and jute goods(Khan: 1974, Griffin & Khan: 1974, Islam: 1982). As such these two items were the main focus of exports policy during the pre-independence period.

factor(investment) income from abroad and net private remittances are assumed to be exogenously given in this model.

Non-factor Services Imports:

<OLS>:

$$Msn = -106 + \underset{(1.33)}{0.22}\, Msn_{-1} + \underset{(4.19)}{0.06}\,(Xg + Mg) - \underset{(-1.6)}{1.32}\, Pm \qquad (3.52)'$$

$R^2 = 0.987$, $F = 540.0$, $h = ?$, $N = 22$, $p = -0.11$,
$RMSE = 139.4$, $X = 974.16$

Where, Msn is total non-factor services payments of Bangladesh in current domestic currency, Xg is total exports of goods, Mg is total imports of goods, and Pm is imports price index. The overall statistical fit appears to be satisfactory. However, the Durbin's h test is inappropriate since the variance of estimated coefficient for the lagged dependant variable is greater than 0.05. Also, the RMSE is relatively large. More than 98 percent of the variations in the dependant variable is explained by the hypothesized relation. The coefficient of the 'activity' variable--total foreign trade volume--is not unrealistic, so is the implied elasticity value.[256] The per-capita income term, as hypothesised in the previous chapter, does not have statistically significant influence on the dependant variable and as such is dropped from the equation. Both the lagged dependant variable and the import price variable are statistically

---

[256] The implied short-run elasticity coefficient at means is 1.245, while the long-run coefficient is found to be 1.57. Our estimated marginal coefficient(.0607) for total trade volume is comparable to that of 0.074 for Ghana in Atta(1981) and 0.105 for Chile in Behrman(1977). Also comparable is the estimated corresponding elasticity value to that of 1.9 for Chile in Behrman(1977).

insignificant at the desired level, and are only significant at 80 and 90 percent confidence intervals, respectively.

Non-factor Services Exports:

<OLS>:

$$Xsn = \underset{(-1.11)}{-57.254} + \underset{(3.85)}{0.546}\, Xsn_{-1} + \underset{(3.4)}{0.049}\,(Xg + Mg)$$

$$- \underset{(-0.95)}{1.277}\, Px - \underset{(-1.45)}{147.87}\, D_{71} \qquad (3.53)'$$

$R^2 = 0.992$, $F = 658.9$, $h = -2.3$, $N = 22$, $p = -0.38$,
RMSE = 134.8, $\bar{X} = 1077.2$

<AUTO: ML>:

$$Xsn = \underset{(-.99)}{-35.8915} + \underset{(3.01)}{0.3814} \ll Xsn_{-1} - p * Xsn_{-2} \gg$$

$$+ \underset{(5.23)}{0.0681} \ll (Xg+Mg) - p*(Xg+Mg)_{-1} \gg - \underset{(-2.48)}{2.7465} \ll Px - p*Px_{-1} \gg$$

$$- \underset{(-2.64)}{179.99} \ll D_{71} - p*(D_{71})_{-1} \gg + p * Xsn_{-1} \qquad (3.53)''$$

$R^2 = 0.993$, DW = 1.68, N = 22, RMSE = 119.86, p = 0.55

Where, Xsn is total non-factor services exports, Xg is total exports of goods, Mg is total imports of goods,--all in current domestic currency, Px is exports price index, and D_{71} is a dummy variable taking the value of one for the period 1971 to 1983 and of zero otherwise. Although the overall statistical fit of the estimated equation using the ordinary least squares is satisfactory, but the equation fails to pass the Durbin's h test for serial correlation. A correction for autocorrelation is done using the maximum likelihood method and the overall explanatory power of the equation improves markedly as a result. All the coefficients are now statistically significant at the desired level, and the coefficients have correct signs. The estimated partial adjustment coefficient shows that about 45 percent of adjustment of actual to desired level of exports of non-factor services occur within a year. For trade volume, the implied short-run and long-run elasticities at means are 1.22 and 1.92, respectively,[257] while for exports price, the implied short-run and long-run elasticities are estimated to be -0.4 and -0.65 respectively. Once again, as in the case of non-factor services imports, the per-capita income variable is dropped due to statistical insignificance of the variable.

4.4 GOVERNMENT

The partial-equilibrium estimates of structural relations for the fiscal and monetary sectors as outlined in the previous chapter are presented below. Some major components of public expenditures have already been explained above under the aggregate demand section. The fiscal block below mainly deals with the public revenue functions, while the monetary block explains determinants of money supply and money demand in the economy. All the functions in this section are estimated in nominal terms except the real balance equation.

Government Revenue Equations:

---

[257] For Chile the corresponding short-run elasticity is estimated to be 0.7 in Behrman(1977). Using gross national product as the activity variable, PIDE(1983) have estimated the corresponding elasticity value of 1.8 for Pakistan.

Five tax revenue functions for income and corporation taxes, excise taxes, sales taxes, customs duties, and 'other' taxes are presented first, followed by the non-tax revenue function. The land taxes is assumed exogenously given in this model.

(i) Income and Corporation Taxes:

<OLS>:

$$Tin = \underset{(-2.83)}{-129.1} + \underset{(5.5)}{0.0214} (Ygd * Pgd - Yag * Pag)_{-1}$$

$$+ \underset{(1.85)}{0.007} (Yag * Pag)_{-1} - \underset{(-1.9)}{153.45} D_{7276} \qquad (4.58)'$$

R^2 =0.982, F = 375.4, DW = 1.81, N = 22, p = 0.09, RMSE = 130.9, X = 831.1

Where, Tin is income and corporations tax revenues, Ygd is real gross domestic product and Pgd is the corresponding deflator, Yag is value added in agriculture and Pag is the corresponding deflator, and D_{7276} is a dummy variable taking the value of one during the period 1971/72 to 1975/76 and of zero otherwise.

The overall statistical fit of the equation is quite satisfactory. All the coefficients have correct signs and are also statistically significant at the desired level except the tax policy change dummy(D_{7276},) which is significant at 90 percent confidence interval. Furthermore, the equation is also free from undue serial correlation problems. The estimated marginal tax rate coefficient for both non-agricultural income and agricultural income are, as expected, found to be very low. Moreover, the coefficient for agricultural income is much lower than that for the nonagricultural income, as one would expect in a country like Bangladesh. The implied elasticities at means are 0.33 for agricultural income and 0.85 for non-agricultural income.[258] The negative sign of the dummy variable correctly captures the effects of discretionary tax policy changes over the period 1971/72 to 1975/76, during which the government allowed tax exemptions on agricultural income. This is also the period of relatively easy tax regime with widespread tax-evasion, delays, and corruptions within the system. Finally, tests for structural shift due to the separation of the country in 1971 failed to provide any support for such a shift.

(ii) Excise Taxes:

<OLS>:

$$Tex = -124.85 + 0.045 \quad (Ygd * Pgd - Yag * pag)_{-1}$$

---

[258] Our estimated marginal coefficients and the implied elasticity values may be compared with the findings in other comparable studies: For example, the corresponding coefficients for non-agricultural income in Pakistan are estimated to be 0.025 and 0.85, respectively, in PIDE(1983). Surprisingly, in an earlier study on Pakistan, Tim(1968) have found a much higher coefficients of 0.04 and 1.29 respectively, for the period 1950's and early 1960's. This indicate that the share of direct taxes out of non-agricultural income have declined significantly over the sample period. It should be noted, however, that there are some contradictory evidences reported in the literature regarding the correct magnitude of these coefficients. Hossain(1973), for example, estimated a much lower marginal tax coefficient(0.001) for all Pakistan total income over the period 1959-68. On the other hand, Islam(1965) has found a much higher and unrealistic marginal tax coefficient of 0.23 for non-agricultural income for the period 1950-60. On other countries, Behrman and Klein(1970) have found tax elasticity coefficients of 0.37 and 0.46 for non-agricultural and agricultural sectors, respectively. In case of India Pani(1981) reports tax elasticity of .96 for total income.

$$(-2.3) \quad (26.4)$$

$$+ \underset{(1.12)}{125.66} \; D_{71} \qquad (4.59)'$$

$R^2 = 0.988$, $F = 837$, $DW = 2.69$, $N = 22$, $p = -0.35$, RMSE = 175.5, X = 1441.71

Where, Tex is total excise taxes, Ygd is real gross domestic product and Pgd is the corresponding deflator, Yag is real value added in agriculture and Pag is the corresponding deflator, D_{71} is a dummy variable taking the value of one for the period 1971 to 1983 and zero otherwise.[259] The overall statistical significance of the estimated model is satisfactory, although the DW test is inconclusive. The marginal tax coefficient for the scale variable is statistically significant and the magnitude is, as expected, large compared to that for income tax function.

(iii) Sales Taxes:

<OLS>:

$$Tsl = -41.41 + \underset{(4.35)}{0.98}\, Tsl_{-1} + \underset{(0.3)}{0.01}\, Ymf * Pmf + \underset{(1.54)}{0.07}\, (Ymf*Pmf)_{-1}$$

$$+ \underset{(2.73)}{0.052}\, (Mg - Mf) - \underset{(-5.38)}{0.086}\, (Mg - Mf)_{-1} \qquad (4.60)'$$

---

[259] Instead of all non-agricultural income, if we take manufacturing output as the relevant scale variable than the following function is obtained:

<OLS>:

$$Tex = \underset{(-2.24)}{-198.4} + \underset{(16.3)}{0.3004}\, (Ymf * Pmf) - \underset{(-1.51)}{303.33}\, D_{71}$$

$R^2=0.9688$, $F=327.36$, $DW=1.6$, $N=22$, RMSE=278.26

The corresponding marginal tax coefficient for manufacturing output is found to be 0.215 for all Pakistan during the 50's and early 60's, indicating the possibility of an increase in the share of this category of tax over time in Bangladesh. Islam(1965)'s estimated coefficient for the period 1950-60 is even lower(0.113).

$R^2 = 0.984$, $F = 265.16$, h=? , $N = 22$, $p = -0.31$,
RMSE = 150.14, X = 1028.99

Where, Ymf is real value added in manufacturing and Pmf is the corresponding deflator, Mg is total imports of goods, and Mf is imports of food-grains. The results are satisfactory, although Durbin's 'h' test is inappropriate because the variance of coefficient of lagged dependant variables is greater than 0.05. Tests for structural shift during the post-independence period fails to support any such shift due to change of government in 1971.[260]

(iv) Customs Duties:

<OLS>:

$$\underset{}{Tcs} = \underset{(-3.4)}{-242.41} + \underset{(8.1)}{0.221}\ Mk + \underset{(8.1)}{0.235}\ Mr$$

$$- \underset{(11.3)}{0.516}\ Mr*D_{7683} + \underset{(10.7)}{0.9}\ Moc*D_{7683} + \underset{(3.32)}{0.178}(Xj+Xjm)$$

$$+ \underset{(4.5)}{0.29}\ (Xj+Xjm)*D_{7683} - \underset{(-1.8)}{326.6}\ D_{7683} \qquad (4.61)'$$

$R^2 = 0.9996$, $F = 7827.3$, $DW = 2.97$, $N = 22$, $p = -0.51$,
RMSE = 57.5, X = 2462.4

Where, Tcs is total customs duties, Mk is capital goods imports, Mr is raw material imports, Moc is non-food-grains consumer goods imports, Xj and Xjm are exports of jute and jute goods respectively, and D_{7683} ia dummy variable taking the value of one for the period 1975/76 to 1982/83 and of zero otherwise.

---

[260] Note that the estimated marginal tax coefficients for imports(0.064) is lower, as in the case of income taxes, than Islam(1965)'s estimate (for consumer goods imports only) for the period 1950-60, but is higher than Tim(1968)'s reported coefficient(0.03).

The overall statistical fit of the equation is quite satisfactory. The equation provides strong support for the major changes in trade regime during the period 1976-83 following the 1975 devaluation of domestic currency Taka by over 60 percent and the change of political regime later in the same year. Customs duties in Bangladesh have traditionally been changed by the government from time to time to suite the announced commercial policy and domestic needs. The country maintained a fixed exchange rate regime with multiple individual commodity exchange rates through taxes and exemptions up until the 1975 devaluation. Since 1975, however, the exchange rate has become more flexible and a movement towards a unified exchange rate regime has started, although taxes and exemptions on tradeables are still there but now much less comprehensive than before. Our results indicate that marginal tax rate coefficients for both capital goods and raw materials and Intermediate goods have dropped during the period 1976-83, while the coefficient have significantly increased for the non-food-grains consumer goods during the same period. The implied elasticities at means for the period 1976-83 are as follows: 0.3 for capital goods imports , 0.7 for raw materials and intermediate goods imports, 0.9 for non-food-grains consumer good imports, and 0.6 for exports of jute and jute goods.[261] How-

---

[261] The corresponding tax elasticities at means for the period 1960-75 are 0.46, 0.45, 0.05, and 0.25, respectively.
When we estimated the function by lumping all imports together the estimated coefficient is 0.16, which is somewhat higher than the coefficient(0.137) obtained by

ever, the coefficient of imported raw materials for the period 1976-83 becomes negative, which is hard to explain. Also, the significant increase in the coefficient for exports of jute and jute goods over the same period is doubtful. The dramatic change in the place of consumer goods imports as a major source of revenues over this period is worth noting. At the same time the decline of taxes and duties on imports of capital goods and raw materials are in line with the governments attempts to promote rapid import substitution industrialization in the country.

(v) 'Other' Taxes:

<OLS>:

$$\underset{}{Tot} = \underset{(-1.74)}{-62.564} + \underset{(8.57)}{0.005\ Y * Pgd} - \underset{(-4.81)}{445.86\ D_{7683}} \qquad (4.62)'$$

$R^2 = 0.827$, $F = 51.3$, $DW = 2.0$, $N = 22$, $p = -o.06$, RMSE = 109, X = 196.89

Tim(1968) for joint Pakistan. Islam(1965) estimates two separate functions for import taxes and export taxes, and found import taxes coefficient of 0.13 and export taxes coefficient of 0.24. PIDE(1983)'s study on pakistan have used a three way breakdown of imports as we have done here, and found a very low and insignificant coefficient for consumer goods imports(.12). The other two coefficients are 0.37 for raw materials and intermediate goods imports, and 0.245 for capital goods. When we run the equation without the slope dummies, the following results are obtained:

$$Tcs = -540 \ \underset{\substack{(3.9)\\0.24}}{+0.17Mk} \ \underset{\substack{(-1.58)\\-0.27}}{-0.12Mr} \ \underset{\substack{(3.32)\\0.57}}{+0.55Moc} \ \underset{\substack{(7.3)\\0.64}}{+0.45(Xj+Xjm)} \ \underset{(1.31)}{+285.8D_{7683}}$$

$R^2 = 0.9978$, $F=1879$, $DW=2.29$, $N=22$, $p=-0.13$, RMSE=137.8

were the value under the t-ratio is the corresponding elasticity at means.

Where, Tot is all other taxes, Y is real gross national product and Pgd is the corresponding deflator, and D_{7683} is a dummy variable for changes in tax regime taking the value of one for the period 1976-83 and of zero otherwise. The overall statistical fit of the equation is satisfactory, and it is also free from serial correlation problems. All other public revenues are positively and significantly related to aggregate nominal income of the country. The dummy variable in the equation indicates that in general there is a significant downward shift in the function during the tax liberalization period of 1976-83.

Non-Tax Revenues:

<OLS>:

$$NT = \underset{(-.31)}{-88.04} + \underset{(16.5)}{0.051}\ (Ygd * Pgd - Yag*Pag) - \underset{(-1.74)}{412.65}\ D_{71} \qquad (4.63)'$$

$R^2 = 0.964$, $F = 282.9$, $DW = 1.14$, $N = 22$, $p = 0.21$, $RMSE = 355.4$, $X = 1878.04$, $SD = 1887.5$

Where, NT is total non-tax public revenues, Ygd is real gross domestic product and Pgd is the corresponding deflator, Yag is agricultural value-added and Pag is corresponding deflator, and D_{71} is dummy variable taking the value of one for the period 1971-83 and of zero otherwise. The estimated equation shows that the non-tax government revenues are positively and significantly related to the non-agricultural income. The implied elasticity at means is found to be 1.3. The downward shift in the function during the post-independence period is quite substantial. Although the hypothesized determinants jointly pick up over 95 percent of the variations in the dependant variable, the Dw test result is inconclusive and the RMSE is relatively high. Tests for structural shifts during the post-independence period show no evidence of such shift.

Government Expenditures:

Total government budgetary expenditures include expenditures on current consumption, public investment, subsidies, interest payments on public debts, and transfer payments. The estimated public consumption and investment functions are explained above. The remaining public expenditure functions are explained below.

Government Subsidies:

<OLS>:

$$SUB = \underset{(-.77)}{-44.85} - \underset{(-3.11)}{0.017} \ (Yag * Pag)_{-1} + \underset{(9.38)}{0.216} \ TR$$

$$+ \underset{(5.9)}{774.07} \ D_{7380} - \underset{(-3.63)}{986.82} \ D_{8183} \qquad (4.65)'$$

$R^2 = 0.982$, $F = 294.44$, $DW = 2.69$, $N = 22$, $p = -0.36$, $RMSE = 160.74$, $X = 1153.05$

Where, SUB is total public subsidies in current taka, Yag is real agricultural income and Pag is the corresponding deflator, TR is total public revenue, D_{7380} and D_{8183} are dummy variables taking the value of one for the periods 1973-80 and 1981-83, and of zero otherwise, respectively.

The overall statistical fit of the relation seems reasonably satisfactory. The point estimates have the anticipated signs and all of them are statistically significant at the desired level. Also, there is no undue problems of serial correlation. The corrected coefficient of determination indicates that the hypothesized determinants are consistent with over 98 percent of the variances in the dependant variable. Total subsidy payments is highly and positively responsive to total public revenues as indicated by the implied elasticity value at means of 1.49. On the other hand, its response to agricultural income is also significant but negative and inelastic.[262] Finally, the results provide strong support for an upward shift of the subsidy function during the liberal public subsidy regime(1973-80) and for a downward shift of the function beginning the period 1980/81, when the government started to take effective measures to cut subsidies due to increased domestic budgetary constraints and particularly due to growing pressures from international agencies and donor countries. However, tests show no evidence for a statistically significant changes in the slope coefficients during the two subsidy regimes.

Interest Payments on Public Debt:

<OLS>:

$$RD = \underset{(-1.4)}{-482.45} + \underset{(4.25)}{0.693}\ (RD)_{-1} + \underset{(2.5)}{0.308}\ GBsb$$

$$+ \underset{(1.13)}{10174.2}\ rGB - \underset{(-2.18)}{359.3}\ D_{71} \qquad (4.66)'$$

---

[262] The estimated elasticity at means is -0.58. The corresponding agricultural income coefficient and elasticity value for Pakistan are estimated to be -0.14 and -2.64, respectively(PIDE, 1983). Public subsidies in Bangladesh is relatively much less responsive to changes in income of the recipients.

$R^2 = 0.946$, $F = 93.25$, $h = -0.49$, $N = 22$, $p = -0.07$,
RMSE = 154.3, X = 554.6

Where, RD is total interest payments on public debts; GBsb is government borrowings from the scheduled banks; rGB is interest rate on government bonds; and D_{71} is a dummy variable taking the value of one for the period 1971-83 and of zero otherwise. The overall statistical fit of the equation seems reasonably satisfactory. The point estimates have anticipated signs and all but one of the explanatory variables are statistically significant at the desired level. The interest rate variable is significant only at 85 percent confidence level. Durbin's h statistics show that the equation is free of serial correlation and the corrected coefficient of determination indicates that the hypothesized determinants are consistent with over 94 percent of the variances in the total interest payments on public debts. The implied short-run elasticities at means for government bonds held by the scheduled banks and for interest rates on government bonds are 0.75 and 0.97, respectively.[263]

Government Transfer Payments:

<OLS>:

$$TP = \underset{(-.45)}{-359.96} + \underset{(8.3)}{0.9}\ (TP)_{-1} + \underset{(0.6)}{85.24}\ POPu$$

$$+ \underset{(0.2)}{0.793}\ Pf + \underset{(1.1)}{713.7}\ D_{71} \qquad (4.66.2)'$$

$R^2 = .977$, $F = 218.6$, $h = -2.44$, $N = 22$, $p = -0.42$,
RMSE = 511.4, X = 2794.7

263 The corresponding long-run elasticities are 2.44 and 3.16, respectively.

Where, TP is total government transfer payments in current taka; POPu is urban population; Pf is price of food-grains; and D_{71} is a dummy variable taking the value of one for the period 1971-83 and of zero otherwise. Although, the corrected coefficient of determination is quite high, the predictive power of the equation is not satisfactory and also all the major explanatory variables except the lagged term are statistically highly insignificant. The high coefficient(close to unity) for the lagged term indicates very little adjustment taking place in transfer payments within one year time period. As such, the public transfer payments variable is assumed to be exogenously given in the macroeconomic simulation exercises below.

Monetary Sector Equations:

Total money supply is determined by the interaction of preferences of various economic agents in the economy--the non-bank public, the scheduled banks, the central bank, and the government. The hypothesized major stochastic behavioral equations for these agents are estimated and presented first, followed by the estimated demand for real balances function. The non-bank public's behavior affecting money supply is attempted to be explained by two ratios: publics preferences for currency to demand deposits and preferences for time deposits to demand deposits. The scheduled banks behaviour affecting the money supply is endogenized by their preference function for excess reserves, holding of government bonds and securities, and their borrowings from the central bank. Some of these preferences directly affect the money multiplier, while the others in conjunction with the country's balance of payments determines the monetary base or the stock of high powered money. Total money supply is the outcome of the interaction of all of these variables in the economy.

Currency-Demand Deposit Ratio:

<OLS>: **(4.76)'**

$$CC/DD = \underset{(1.88)}{1.818} + \underset{(6.4)}{1.208}\,(CC/DD)_{-1} - \underset{(-5.4)}{1.126}\,(CC/DD)_{-1}{*}D_{71}$$

$$- \underset{(-1.85)}{24.408}\,rTD + \underset{(1.58)}{21.285}\,rTD * D_{71} - \underset{(-3.77)}{11.685}\,Yna/Ygd$$

$$+ \underset{(4.49)}{9.395}\,(Yna/Ygd){*}D_{71} + \underset{(3.61)}{0.00019}\,WLT/Pgd - \underset{(-3.33)}{0.00018}\,(WLT/Pgd){*}D_{71}$$

R^2=0.976, F=108.1, h=0.58, N=22, p=0.064, RMSE=0.1038, X=1.3113, SD=0.589

Where, CC/DD is currency to deposit ratio; rTD is interest rates on time deposits, Yna/Ygd is the share of real output in non-agriculture to total output, WLT/Pgd is real stock of private wealth, and D_{71} is a dummy variable taking the value of one in 1971 to 1983 and of zero otherwise. Over 97 percent of the variance in the dependant variable is explained by the hypothesized structural relation. The desired currency-demand deposit ration, as expected, varies inversely with the interest rate variable and the size of the non-agricultural sector relative to the aggregate economy.

The estimated relation is a good approximation of how the money supply is split between currency and demand deposits in a traditional society where currency is the principal monetary asset, but demand deposits has been gaining importance only slowly as the financial market begins to develop. The expansion of the non-agricultural sector is associated with greater monetization of the economy and consequently give rise to less currency demand and increased use of banking and financial services. The negative response to interest rate variable can be interpreted as the 'knowledge spread' effects of the advantages and gradual acceptance of institutional banking practices. The estimated coefficient is, however, found to be statistically insignificant at the desired level. An important finding is the significant structural shift in the function due to the separation of the country in 1971 and the subsequent nationalization of the banking sector.[264] The coefficient for the lagged currency-deposit ratio is very large(1.21) during the pre-independence period. Snyder(1970), using a similar model, have found a coefficient of 1.01 for all Pakistan including Bangladesh(1953-67). Consequently, the implied partial adjustment coefficient would be very small, indicating very slow response in the dependant variable--such a stationary response behavior is not unrealistic for a traditional economy at it's early stage of development. But post indepen-

---

[264] We found nop evidence of intercept shift, only the shift in slope coefficients are found to be statistically significant.

dence Bangladesh shows a dramatic shift in response pattern. The coefficient drops significantly to near zero(0.08)--a complete adjustment of actual to desired level within one year time period.[265] For both the interest rate variable and the relative size of the non-agricultural sector variable, the magnitude of the coefficients have declined sharply during the post-independence period. The country may have passed the critical 'knowledge spread' phase of institutional banking practices and capital market participation around the time of independence and the nationalization of the banking sector. Similarly, for the real wealth variable, as wealth grew initially currency demand relatively increased--indicated by the positive pre-independence coefficient--but after that critical phase the relative preferences for currency started to fall--indicated by the negative coefficient for the corresponding slope dummy variable. However, the net effect of real wealth on currency preferences in Bangladesh during the post-independence period is still positive.

---

[265] When the equation is estimated without the structural shift dummies, the adjustment coefficient for the entire sample period is found to be close to one half:

$$\underset{}{CC/DD} = \underset{(2.94)}{2.7829} + \underset{(3.78)}{0.49}\ (CC/DD)_{-1} + \underset{(.268)}{1.433}\ rTD$$

$$- \underset{(-2.68)}{6.22}\ (Yna/Ygd) + \underset{(1.81)}{0.000015}\ (WLT/Pgd)$$

R^2=0.9376, F=76.16, h=0.67, N=21, p=0.118, RMSE=0.147

Once again the intercept dummy D_{71} is found to be statistically insignificant. The interest rate variable has now positive sign and is statistically highly insignificant. The short-run and long-run elasticities are also quite different.

Time Deposits to Demand Deposits Ratio:

<OLS>: (4.77)'

$$TD/DD = \underset{(2.5)}{0.639} - \underset{(-1.7)}{10.97}\ rTD + \underset{(1.65)}{0.76}\ rTD * t$$

$$- \underset{(-1.0)}{0.00001}\ WLT/Pgd + \underset{(5.9)}{0.089}\ t + \underset{(1.22)}{0.111}\ D_{71}$$

R^2=0.982, F=227.8, DW=2.04, N=22, p=-0.09, RMSE=0.075, X=1.2

Where, TD/DD is time deposits to demand deposits ratio; rTD is interest rates on time deposits; t is time trend starting with one in year 1959/60; WLT/Pgd is real aggregate private wealth; and D_{71} is a dummy variable taking the value of one in 1971 to 1983 and of zero otherwise. Although the overall goodness of fit of the model is high, all the estimated parameters are insignificant except for the time trend.Interest variable do not have expected signs. Alternative specifications do not improve the results.

Scheduled Banks Excess Reserves:

Despite the efforts to estimate numerous alternative versions of the model, no economically meaningful and statistically acceptable relationship could be found for the Scheduled banks holdings of excess reserves.[266]

---

[266] The equation with the best over all statistical fitness obtained is as follows:

$$ERS/D = 0.04 + \underset{(0.18)}{0.105}\ rCR - \underset{(-0.12)}{0.067}\ rBB - \underset{(-0.77)}{0.000001}\ Asb \quad (4.80)'$$

R^2 = 0.02, F=1.1, RMSE=0.016, X=0.037

As such the variable is assumed to be exogenously determined in the macroeconomic simulation exercises next chapter.

Money Multiplier:

Although the money multiplier, in the previous chapter, is obtained mechanically from the accounting identities of the banking sector, we have presented here a stochastic model for the money multiplier relating it with it's major determinants explained above. Such a stochastic version is hoped to minimize the error build-up due to measurement errors, specification errors, etc. in it's determinants and also due to the possible error from the assumption of a simplestic banking system. The estimated equation for the money multiplier is as follows:

<OLS>: **(4.75.1)'**

$$
\begin{array}{llllll}
mm = & 1.799 & -\ 0.138\ CC/DD & -\ 0.029\ TD/DD & -\ 1.651\ ERS/D \\
 & (21.92) & (-3.82) & (0.54) & (-2.57) \\
 & & -0.237 & -0.024 & -0.046 \\
 & & & & \\
 & -\ .9463\ VC/DD & +\ 0.1282\ D_{71} & & \\
 & (-3.5) & (3.64) & & \\
 & -0.144 & & &
\end{array}
$$

$R^2=0.949$, DW=1.6, N=22, RMSE=.035,X=1.505, SD = 0.135

where, mm is money multiplier; CC/DD is currency-demand deposit ratio; TD/DD is time deposits-demand deposits ratio; ERS/D is scheduled banks excess reserves to total deposits(DD+TD) ratio; VC/DD is vault cash-demand deposits ratio; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. The values under the t-ratios are the corresponding elasticities at means. All the estimated coefficients have anticipated signs, and all but one are statistically significant at the desired level. However, the implied elasticity coefficients are very low, indicating that although the hypothesized determinants are important but the responses of money multiplier in Bangladesh to them are quite negligible.

Scheduled Banks' Holdings of Government Securities:

<OLS>: (4.81)'

$$GBsb = \underset{(-.15)}{-66.57} + \underset{(4.5)}{0.855}\, GBsb_{-1} - \underset{(-2.24)}{0.051}\,(BD - BD_{-1})$$

$$+ \underset{(0.38)}{3432.7}\,(rCR - rGB) + \underset{(0.5)}{0.007}\, Asb + \underset{(1.4)}{309.98}\, D_{71}$$

$R^2 = 0.979$, $F=88.2$, $h = 1.08$, $N=22$, $p=0.09$, $RMSE=171.96$, $X=1,456.2$, $SD=1,188.9$

Where, GBsb is scheduled banks holdings of all government bonds and securities; BD is government annual budget deficit; rCR is interest rates on bank credits; rGB is interest rates on government securities; Asb is total assets of all scheduled banks; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. Overall the result is satisfactory, Durbin's 'h' test indicates absence of 1st order auto-correlation. However, a number of parameter estimates are insignificant. The large coefficient for the lagged dependant variable indicates long adjustment lag in scheduled banks demand for government securities. The signs for all the coefficients are as expected.

Scheduled Banks Borrowings from the Central Bank:

<OLS>: (4.80)'

$$BRsb = \underset{(-1.7)}{-2325.7} - \underset{(-3.5)}{0.983}\, BRsb_{-1} - \underset{(-2.5)}{1.68}\, GBsb$$

$$+ \underset{(1.99)}{55493.3} (rCR - rBB) + \underset{(6.9)}{0.552} Asb - \underset{(-3.1)}{1931.1} D_{71}$$

R^2=0.98, F=212.3, h= ? , N=22, p=-0.48, RMSE=563.97, $\bar{X}$=2,653.7, SD=4,137.28

Where, BRsb is total scheduled banks borrowings from the Bangladesh Bank; GBsb is total scheduled banks holdings of government securities; rCR is interest rates on bank credits; rBB is the central banks discount rate; Asb is total assets of all scheduled banks; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. The equation has high coefficient of determination but the GBsb coefficient has wrong sign and the Durbin's 'h' test is inappropriate. Also the RMSE is relatively large.

Supply of Bank Credits:

The scheduled banks lending in Bangladesh to the private sector and public corporations is constrained by the availability of loanable funds given by the flow of new deposits(ΔD), changes in borrowings from the central bank(ΔBRsb), changes in government borrowings from the scheduled banks(ΔGBsb), changes in excess reserves(ΔERS), and the changes in official required reserve ratio(Δrr). In the macroeconomic simulation exercises next chapter this supply of total bank credits is determined from the banking sectors identity:

$$CR = CR_{-1} + (1 - rr - ERS/D)*\Delta D + \Delta BRsb - \Delta GBsb - D * \Delta(ERS/D) - \Delta OAsb \qquad (4.79)'$$

were, OAsb is all 'other' net assets of scheduled banks. However for macroeconomic simulation exercises next section, an alternative to this treatment of bank credit is also considered. This is done by making the bank credit equation stochastic, determined by the same set of variables in the above identity, except the variable OAsb, which will now be derived as a residual from the identity. This approach has an advantage in macroeconomic simulation, as mentioned in case of money multiplier equation, in that it will avoid error build-up in the bank credit variable due to measurement and specification errors in the determinants. The estimated bank credit equation is as follows:

<OLS>: **(4.79.1)'**

$$CR = \underset{(-0.03)}{-36.598} + \underset{(3.9)}{0.358}\ CR_{-1} + \underset{(6.07)}{0.471}\ D + \underset{(7.8)}{0.691}\ BRsb$$

$$+ \underset{(2.4)}{0.617}\ GBsb + \underset{(1.82)}{0.775}\ ERS$$

R^2=0.9995, F=8,417.6, h=1.0, N=22, p= -0.19, RMSE=321.99, X=12,159.8, SD=14,667.1

where, all the variables are as defined above. All the coefficients have expected signs, and the equation explains over 99 percent of variations in the dependant variable. Also, Durbin's 'h' test indicates absence of 1st order autocorrelation. Tests for structural shift during the post independence period fails to provide such evidence. Lag CR coefficient shows that only about 64 percent adjustment in desired CR is made within a year.

Demand for Money Function:

<OLS>: **(4.84)'**

$$\ln (M1/Pgd) = -3.624 + 0.53 \quad \ln (M1/Pgd)_{-1} + 0.669 \ln Y$$

$$\begin{array}{lll} (-.53) & (3.65) & (1.5) \end{array}$$

$$- 0.079\ INFP - 0.155 \ln rTD - 0.503\ D_{75}$$
$$\begin{array}{lll} (-0.4) & (-0.8) & (-4.1) \end{array}$$

$R^2=0.90$, $F=48.4$, $h=1.49$, $N=22$, $p=-0.079$, $RMSE=0.079$, mean=8.548, SD=0.245

Where, M1/Pgd is real money balances--money defined as currency plus demand deposits; Y is real gross national product; INFP is aggregate inflation rate; and rTD is interest rate on time deposits. Although the estimated equation explains 90 percent of the variances in dependant variable and is free of undue auto-correlation problem, the parameter estimates are not robust. Besides being statistically insignificant, income, inflation rate and interest rate variables all changes sign and magnitude in alternative model specification.

Lagged money demand variable is statistically significant and the estimated value suggests less than 50 percent of the discrepancy between actual and desired real balances is eliminated within a year. The short run and the long run income elasticities are 0.67 and 1.42, respectively.

4.5 PRICES

This section first presents the equations explaining the three sectoral product prices, namely, food-grains, jute, and manufacturing goods, followed by the equations for two sectoral value added deflators, one aggregate wholesale price index, and two consumer price indices for the rural and urban sector. In general prices in a particular market is determined by the level of excess demand in that market, which in turn depends upon the positions and rates of movements of the demand and supply curves in that market. As such, the price equations are quasi-reduced form equations. The competitive forces are dominant in the agricultural sector, as in many other developing countries, while monopolistic and oligipolistic elements are pervasive in the manufacturing sector. Prices in the services sector are assumed to follow the general pattern in the manufacturing and agricultural sectors and is not modelled separately due do data limitations. Once the sectoral prices are determined, the general price level is obtained from the aggregate demand and supply identity as the weighted average of either the sectoral value-added deflators or the national accounts deflators for the major final demand components. The section ends with the presentation of the two wages equations--one for the agricultural sector and the other for the manufacturing sector.

Prices of Foodgrains:

<OLS>: **(5.85)'**

$$\ln Pf = -\underset{(-2.02)}{6.788} + «\underset{(-0.8)}{-0.351} + \underset{(2.3)}{1.452}*D_{71}»*\ln(Qf + Qfm)$$

$$+ «\underset{(2.04)}{1.46} - \underset{(-2.78)}{0.38}*D_{71}»*\ln(Yd/POP)$$

$$+ «\underset{(5.45)}{.523} + \underset{(0.22)}{0.051}*D_{71}»*\ln Pfg + \underset{(6.88)}{0.63}\, D_{75}$$

$R^2=0.99$, $F=397.5$, $DW=2.89$, $N=22$, $p=-0.46$, $RMSE=.078$, $mean=4.46$, $SD=0.895$

Where, Pf is price of food-grains; Qf is total quantity of domestic food-grains production; Qfm is total quantity of food-grains imports; Yd is real disposable income; POP is total population; Pfg is government procurement price for food-grains; D_{75} is a dummy variable for the 1974 famine year taking the value of one in 1974/75 and of zero otherwise; and D_{71} is structural shift dummy variable taking the value of one in 1971-83 and of zero otherwise. The estimated relation explains over 99 percent of variances in dependant variable. The DW test, however, is inconclusive. While the coefficient for total food-grains during the pre-independence period has the correct sign, the corresponding post-independence sign is wrong. The per-capita disposable income variable has correct sign and is statistically significant; income elasticity of food price is quite large.

Price of Jute:

<OLS>: **(5.86)'**

$$\ln Pj = -6.323 + \underset{(1.2)}{0.515} \ln(Qj) - \underset{(-2.1)}{1.427} \ln(WYj) + \underset{(3.2)}{1.59} \ln(Ymf)$$

$$+ \underset{(1.83)}{0.514} \ln(Pjs) - \underset{(-1.12)}{0.413} \ln(Qj)_{-1} + \underset{(3.28)}{2.24} D_{71}$$

$R^2=0.888$, $F=28.7$, $DW=1.54$, $N=22$, $p= 0.17$, $RMSE=0.238$, mean=4.624, SD=0.696

Although the explanatory power of the equation is satisfactory the DW test result is inconclusive. Also, some of the parameters are statistically insignificant. The negative sign for the world income variable is counter-intuitive, unless jute is an inferior good. Domestic demand elasticity value is quite large(1.6), while domestic supply elasticity is small(-0.41).

Export Price of Raw Jute:

$$\ln(pxj) = -0.018 + \underset{(21.4)}{1.019} \ln(pj) \qquad (5.97)'$$

$R^2 = 0.96$, F=457.4, DW = 1.82, p=0.088, X=0.148

where, Pj is domestic price of raw jute. The export price of raw jute has unitary elasticity with respect to domestic price of raw jute. Tests for structural shifts show no evidence for such a shift.

Price of Manufactured Goods:

<OLS>: **(5.87)'**

$$\ln WPImf = \underset{(1.1)}{1.637} + \underset{(2.31)}{0.293} \ln NWmf - \underset{(-2.15)}{0.336} \ln (Ymf/Lmf)$$

$$+ \underset{(0.81)}{0.127} \ln(Mrr/Ymf) + \underset{(1.75)}{0.425} \ln(CUmf)$$

$$+ \underset{(2.93)}{0.188} \ln Pmr + \underset{(1.89)}{0.43} \ln rCR + \underset{(4.95)}{0.799} D_{71}$$

R^2=0.993, F=31.3, DW=2.34, N=22, p= -0.189, RMSE=.073, mean=4.525, SD=0.874

Where, WPImf is wholesale price of manufacturing goods; NWmf is nominal wage of manufacturing sector; Ymf/Lmf is average real productivity of labour in manufacturing; Pmr is price of imported raw materials and intermediate goods; rCR is interest rate on bank credits; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. The overall statistical fit of the equation is quite satisfactory. All the point estimates have anticipated signs and all but two are statistically significant at the desired level. The average import requirement variable and the capacity utilization variables are not significant. The wage costs, interest costs, and imports costs--all have elasticity parameters low and close to each other. The significant structural shift dummy captures among other things the change of weights for post-independance period in calculating the wholesale price index.

GDP Deflator for Agriculture:

<OLS>: **(5.89)'**

$$\underset{}{Pag} = \underset{(1.22)}{4.577} + \underset{\substack{(15.8)\\0.7958}}{0.877}\ Pf + \underset{\substack{(2.87)\\0.1702}}{0.169}\ Pj$$

R^2=0.99, F=971.07, DW=2.41, N=22, p= -.24, RMSE=10.165, mean=139.927, SD=103.1256

Where, Pag is value-added deflator for agriculture; Pf is price of food-grains; and Pj is price of jute. The values reported under the t-ratios are the corresponding elasticities at means. Ideally, the sectoral GDP deflators should be obtained as a weighted average of value-added deflators for goods produced within each sector. However, due to data limitations we are forced to accept the above specification to connect the individual agricultural commodity prices to aggregate price of the sector. In this we have considered the two major agricultural commodity prices only: food-grains and jute. The implied assumption is that the price of other agricultural commodities follow the same pattern, that is, move proportionately with the price of food-grains and jute. The estimated relation provide a good support for this hypothesis. When the residuals are calculated, we find except in on year the two prices do predict very closely all the ups and downs in the aggregate prices. In 1980/81, however, food-grains prices fell by over 16 percent while jute prices fell by 11 percent over the preceding years. However, the agricultural price deflator fell by only about 3 percent during the same period. This discrepancy could be either because of measurement error in the estimation of relevant data series or because of a sudden and unusual rise in other agricultural prices offseting the fall in the two prices. It seem that the measurement errors in data is the more likely cause, given the history of movement of other agricultural prices in Bangladesh.

GDP Deflator for Manufacturing:

<OLS>: **(5.90)'**

$$Pmf = \underset{(16.67)}{22.783} + \underset{\substack{(34.98)\\0.70}}{0.552}\ WPImf + \underset{(5.24)}{17.542}\ D_{71}$$

$R^2=0.997$, $F=3032.29$, $DW=1.167$, $N=22$, $p=0.26$, $RMSE=3.85$, mean=107.0557, SD=67.165

Where, Pmf is value-added deflator for manufacturing output; WPImf is wholesale price index of manufacturing goods; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. The values reported under the t-ratios are the corresponding elasticities at means. Although the overall statistical fit of the equation is quite satisfactory, the DW test for serial correlation is inconclusive.[267] The significant dummy variable correctly captures the effect of changes in weights for estimating the wholesale price index during the post-independence period.

Wholesale Price Index:

<OLS>: **(5.95)'**

$$\begin{array}{lllll} WPI = & 1.118 & + \; 0.252\ Pag & + \; 0.816\ WPImf \\ & (.36) & (2.15) & (7.34) \\ & & 0.24 & 0.75 \end{array}$$

R^2=0.9919, F=1231.4, DW=0.993, N=22. p=.483, RMSE=10.1998, mean=147.3865, SD=113.599

Where, WPI is wholesale price index; Pag is agricultural price index; and WPImf is manufacturing price index. This equation is, as the previous two, are statistical constructs to link various prices in the absence of appropriate weights and price indices. The war-dummy variable D_{71} is not significant in the present case, presumably because the change of weights occured on both the dependant variable WPI and one of the independant variable WPImf during the post-inde-

---

[267] When the equation is re-estimated with corrections for serial correlation, using the maximum-likelihood technique, the resulting equation does not show any marked improvements in terms of the explanatory powers of the equation. The estimated equation with maximum-likelihood correction for serial correlation is as follows:

$$Pmf = 22.5387 + \underset{(29.17)}{0.5523} \ll WPImf - p * (WPImf)_{-1} \gg$$

$$+ \underset{(4.64)}{18.20} \ll D_{71} - p * D_{-2} \gg + p * (Pmf)_{-1}$$

R^2=0.9945, DW=1.58, N=21, p= -.378(t=-1.37), RMSE=3.68

where, p is the estimated first-order autocorrelation coefficient obtained by using the maximum-likelihood method. Note that the RMSE improves by only about 5 percent.

pendence period. The DW test for serial correlation yields inconclusive results.[268]

Finally, it should be noted here that the wholesale price index is being related to two prices, one is correctly the wholesale price of manufacturing and the other, in the absence of consistent data on other wholesale price indices of industrial raw materials and agricultural outputs, is value-added deflator for agriculture. The implied assumption is that the these other wholesale prices move very closely and proportionately with the two major prices included in the equation.

Rural Consumer Price Index:

<OLS>: **(5.93)'**

$$\underset{}{CPIr} = \underset{(-2.73)}{-6.848} + \underset{\substack{(7.29)\\0.48}}{0.528\ Pf} + \underset{\substack{(10.85)\\0.66}}{0.684\ WPImf} - \underset{\substack{(-4.24)\\-0.09}}{25.27\ D_{71}}$$

R^2=0.997, F=1968.9, DW=2.35, N=22, p= -0.18, RMSE=6.7137, mean=141.16, SD=115.5

Where, CPIr is consumer price index for rural households; Pf is price of food-grains; WPImf is price of manufactured goods; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise.

---

[268] The maximum-likelihood corrections for serial correlation do not improve the result noticeably in terms of explanatory or predicting power of the equation:

<AUTO: ML>

$$WPI = \underset{(1.29)}{21.4576} + \underset{(2.16)}{0.172} \ll Pag - p * (Pag)_{-1} \gg$$

$$+ 0.75 \ll WPImf - p * (WPImf)_{-1} \gg + p * (WPI)_{-1}$$

R^2=0.94, DW=1.62, N=21, p= -0.9(t=7.13), RMSE=8.024

Urban Consumer Price Index:

<OLS>: **(5.94)'**

$$\underset{}{CPIu} = \underset{(1.78)}{5.32} + \underset{\substack{(2.87)\\0.22}}{0.273}\ Pf + \underset{\substack{(2.43)\\0.337}}{0.41}\ WPImf + \underset{\substack{(6.73)\\0.406}}{0.287}\ Pm$$

$R^2=0.997$, $F=2529.0$, $DW=1.75$, $N=22$, $p=0.1$, $RMSE=6.8$, mean=161.2, SD=135.2

Where, CPIu is consumer price index for urban households; Pf is price of food-grains, WPImf is price of manufactured goods; and Pm is price of imported goods. The elasticity values at means reported below the t-ratios indicate that urban cost-of-living is relatively more responsive to import prices than to prices of domestic food-grains and manufactured goods.

Wage rate in Agriculture:

<OLS>: **(5.98)'**

$$\ln NWag = -0.11 + \underset{(7.85)}{0.63} \ln NWag_{-1} + \underset{(0.11)}{0.04} \ln Yag/Lag + \underset{(4.47)}{0.37} \ln Pag$$

$R^2 = 0.994$, $F=1146.9$, $RMSE= 0.06$, $p=0.05$, $h=0.26$, $X=4.844$

Where, NWag is nominal wage rate for agricultural labourer; Yag is real agricultural output; Pag is price of agricultural output; and Lag is supply of agricultural labourer. The overall statistical fit of the equation is reasonably satisfactory. All the estimated parameters have anticipated signs, and the Durbin's 'h' test indicates absence of serial correlation However, the average product variable is insignificant and the elasticity value is quite low.[269]

---

[269] An alternative estimated equation is:

$$\ln NWag = \underset{(0.2)}{1.7} + \underset{(1.28)}{0.81} \ln Yag + \underset{(5.83)}{0.69} \ln Pag - \underset{(-2.48)}{3.1} \ln Lag + \underset{(2.12)}{0.09}\ t$$

Wage rate in Manufacturing:

<OLS>: **(5.99)'**

$$NWmf = \underset{(.69)}{2.2} + \underset{(4.8)}{0.531} \ln (Ymf/Lmf)_{-1} + \underset{(4.9)}{0.856} \ln WPImf$$

$$+ \underset{(1.1)}{0.174} \ln(NWmf)_{-1} + \underset{(2.14)}{0.018} t - \underset{(-3.4)}{0.548} D_{71}$$

R^2=0.996, F=1004.1, h = -1.71, N=22, p=-0.24, RMSE=.0475, mean=4.7o2, SD=0.72

Where, NWmf is nominal wage rate in manufacturing; Ymf/Lmf is average productivity of labour in manufacturing; WPImf is price of manufactured goods; t is a time trend beginning with one in 1959/60; and D_{71} is a dummy variable taking the value of one in 1971-83 and of zero otherwise. The manufacturing wages in Bangladesh is positively and significantly responsive to sectoral product prices. Both the short run and long run price elasticities are close to unity. It is

---

R^2=0.98, F=269.49, DW=1.06, N=22, p=0.456, RMSE=0.106,

Once the correction for serial correlation is done using the maximum-likelihood method, the results, show some improvement in the explanatory power of the equation and major changes in parameter estimate, but all but one of the explanatory variables now became statistically insignificant at the desired level.

$$\ln NWag = \underset{(-.05)}{-.3073} + \underset{(1.12)}{0.4383} \ll \ln Yag - p*(\ln Yag)_{-1} \gg$$

$$+ \underset{(4.25)}{0.459} \ll \ln Pag - p*(\ln Pag)_{-1} \gg - \underset{(-.53)}{0.7283} \ll \ln Lag - p*(Lag)_{-1} \gg$$

$$+ \underset{(1.72)}{0.0661} \ll t - p*(t)_{-1} \gg + p*(NWag)_{-1}$$

R^2=0.927, DW=1.7, N=21, p= -.756(t= -4.04), RMSE=.0844

The DW statistic improved significantly, indicating absence of serial correlation. Also the root mean square error has improved by about 20 percent. However, the labour supply variable is no longer statistically significant, and the new elasticity value is much lower than before.

also positively and significantly responsive to sectoral productivity and factors such as trade union demands, government wage-scale, etc. represented by the time trend variable. The significant downward shift of the function during the post-liberation period is puzzling. Although the over all statistical fit of the equation is satisfactory, the Durbin's 'h' test cannot accept the hypothesis of no serial correlation at 5 percent level of significance. The results indicate that the industrial sectors nominal wage is mainly determined by trend variables such as government wage scale, unionization of the labour force, etc. and the sectoral price level. The sectoral productivity plays greater role in wage determination in this sector than in the agricultural sector.

Chapter V

POLICY SIMULATION AND MULTIPLIERS WITH THE COMPLETE MODEL

5.1 INTRODUCTION

The complete estimated macroeconomic model for the Bangladesh economy has been presented in the previous chapter. The major objective of this chapter is to make use of this estimated model to conduct policy and exogenous shock simulations to explore the consequences of various policy changes and shocks on the performance of the economy. This multiplier analysis, however, would be a futile exercise unless the model's predictive accuracy and forecasts perform reasonably well. Therefore, it is imperative that such multiplier analysis is preceded by an evaluation of the predictive performance of the model, which is often referred to as 'model validation' or 'historical simulation' in the literature.

We begin this section with a discussion on the methodology of solution in section 5.2 followed by model validation or historical simulations in section 5.3. Dynamic stability of the model is tested through several sensitivity tests in section 5.4. Various macroeconomic policy and exogenous shock simulations are conducted in section 5.5 followed by a summary and conclusions in section 5.6.

5.2 METHODOLOGY OF SOLUTION

Two critical aspects dictating the choice of solution methodology are whether the model is a linear or a non-linear model and whether a static or dynamic structure of the economy is implied in the model, where the structure is defined 'dynamic' when lagged endogenous variables enter as independent/right-hand side variables in the model. The present model is non-linear, and the non-linearities are introduced due to the logarithmic treatment of some of the equations, presence of relative prices and non-linearity in some of the identities, and due to some variables entering in ratio form into the model. The structure of the present model is also dynamic due to the reason mentioned above. Because of the presence of non-linearities and the implied dynamic structure of the model, the solution methodology for macro simulations is limited to available non-linear solution algorithms. Three alternative methods--Newton, Gauss-Seidal, and Jacobi--are available with the computer package SAS. The Newton's method is finally chosen for the solution of the present model due to several desirable properties of this method over the others.[270]

---

[270] It may be noted here that initially we encountered several problems in obtaining the solution of the model. Convergence failed due to some endogenous variables expressed in logarithms returned with negative values in the solution process and the program is not flexible enough to handle logarithm of negative values in one of the internal iterations. However, convergence was finally achieved by changing and redefining several definitional identities and by changing the ordering of the equations.

The complete model version that is used for macroeconomic simulations contains in total 93 endogenous variables of which 43 are stochastic and the remaining 50 are definitions, equilibrium conditions, and various sectoral accounting identities and in total 70 are exogenous variables. One important modification in the complete model for simulation is worth noting here. The money multiplier(mm) variable, which has been endogenously determined through the bank deposit multiplier expression in chapter 4, is assumed exogenous in the complete model simulations. This was necessary because of large error build up in the variable since it is derived through an identity consisting of several endogenous variables and the nature of the variable is such that a small change(error build up) in the variable can cause unstable solution and the model to 'explode'.

Regarding the 'closure' of the model two alternatives have been considered. According to one closure rule the aggregate price level is determined by the following equation:

$$P = Pag * (Yag/Y) + Pmf * (Ymf/Y) + Psr * (Ysr/Y)$$

where, $Y = Yag + Ymf + Ysr + (NR/P)$, and P and Y refers to prices and output/income, respectively, and ag, mf, and sr refers to agriculture, manufacturing, and services sectors, respectively, and NR is net private remittances from abroad. Clearly in this formulation the supply side dominates the determination of the aggregate price level. The demand side affects the price level only through their indirect effects on the sectoral prices and output compositions. This closure rule has been used in many developing country models which emphasize supply side heavily. The other closure rule is where both supply and demand sides play direct roles in the determination of aggregate price level and is given by the same equation:[271]

$$P = Pag * (Yag/Y) + Pmf * (Ymf/Y) + Psr * (Ysr/Y)$$

but where, $Y = C + I + G + X - M$, and all the variables are as defined above. Both alternative closure rules have been used for all the macro simulations in this study. The differences in historical simulations between the two rules are not significant. To save space as well as for valid theoretical reasons we have limited our presentation to the results from the second closure rule in which both supply and demand factors have direct influence on the aggregate price level.

[271] See, for example, TRACE econometric model for Canada(Chowdhury, et al, 1972) and the Brookings model.

5.3 PREDICTIVE ACCURACY OF THE MODEL:MODEL VALIDATION

The purpose of validation exercise is to test how accurately the model tracks the historical path of the endogenous variables. Unfortunately, there are no universally accepted sets of tests or rules available to determine the predictive accuracy of a multi-equation simultaneous model. The widely used practice is to compare the actual series of an endogenous variable with the corresponding simulated series. Various alternative test statistics can be calculated to compare the two series(See Pindyck and Rubinfeld, 1981). Although several such statistics are routinely calculated by the computer package SAS, to save space only two such statistics are presented here. These statistics are the Root Mean Squared Percent Error and the Theil's inequality coefficient, henceforth referred as RMSPE and U1, respectively.[272]

[272] The RMSPE is defined as follows(See Pindyck and Rubinfeld 1981, p365):

$$RMSPE = \sqrt{(1/T) * \sum_t \{(P(t) - A(t)) / A(t)\}^2}$$

where, A(t) is the actual value of the variable, P(t) is the corresponding simulated value, T is the length of the simulation period, and t refers to the time period. The Theil's statistics U1 is defined as follows(see Maddala 1977, p346):

$$U1 = \sqrt{\sum_t \{(P(t) - A(t)) / A(t-1)\}^2 / \sum_t A(t)^2}$$

where, the variables are as defined above. Both RMSPE and U1 lies between zero and one. It is equal to zero if P(t) is a perfect forecast for A(t), and the opposite is the case for a value of one.

The RMSPE and U1 statistics and simulation graphs of selected variables are presented in the following pages along with brief comments regarding the simulation performance of the complete model. As a whole the predictive performance of the model appears to be very good. The model tracks the historical data well, with a relatively small margin of error. More than one-half of all the endogenous variables(as well as the stochastic variables) included in the model exhibit RMSPE within the range of 10 percent margin of error(see Table 5.1). More than three-quarter of all the stochastic variables show RMSPE of less than 20 percent and the remaining variables' error margin is limited within 35 percent. It may be noted here that the large RMSPEs for the five variables[273] are not unexpected since the variables can take both positive or negative values and one of the variables are expressed as percentage changes. An examination of the Theil's inequality coefficients--U1 also indicate a good fit for the model. As will be shown shortly, indeed, the model accurately captures most of the turning points in all the major endogenous variables with very few exceptions.

[273] These five variables--all are definitions or identities--are net foreign assets(NFA), inflation rate(INFP), discrepancies in aggregate price level(DISEP), discrepancies in aggregate output(DISEQ), and discrepancies in aggregate income(ES).

Table 5.1
Predictive Performance of the Model:
Distribution of RMSPE and U1 Statistics

Error Margin	0-5%	5-10%	10-20%	20-35%	35%-
		(a) RMSPE			
All Endog Vars.	17	33	16	22	5
(Cumulative %)	(18%)	(54%)	(71%)	(95%)	
Stochastic Vars.	5	18	10	10	
(Cumulative %)	(12%)	(54%)	(77%)	(100%)	
		(b) U1			
All Endog Vars.	21	34	16	17	0
(Cumulative %)	(23%)	(59%)	(76%)	(100%)	
Stochastic Vars.	8	22	6	7	
(Cumulative %)	(19%)	(70%)	(84%)	(100%)	

Source: Present Study.

Given the quality of data, and the size and complexity of the model, as well as the time bounds of the dynamic simulation, it is quite reasonable to conclude that the model performed very well in tracking the historical time path of the endogenous variables. A comparison of predictive performance of other models for developing countries such as for Pakistan(Naqvi, et al,1983), India(Pani, 1983 and Rao, 1987), Chile(Behrman, 1977), Greece(Vernardakis, 1979), Brazil(Behrman and Klein,1970), Bangladesh(Kabir, 1983, Rashid 1980, and Jahan 1983) and for Ghana(Atta, 1981) shows that error margin of more than 10 percent is not uncommon and in some cases are found to be very common. Comparatively, judging from the summary statistics, the performance of the present model is very encouraging.

In general, the predictive performance of the real sector--both production and demand--is found to be relatively superior to that of the monetary sector. In the agricultural sector the model predicts the time path of all the acreage, yield, production, and value-added variables with a fair degree of accuracy, catching most of the turning points in the data(see Table 5.2 and Fig. 5.1, 5.3, and 5.4). The only acception in this sector is the acreage of jute variable(ACj), which has fairly large RMSPE. The simulation graph for food-grains acreage(Fig. 5.4) shows that the model continuously over-predicts during the 1965-70 period, despite the relatively low values for both RMSPE and U1.

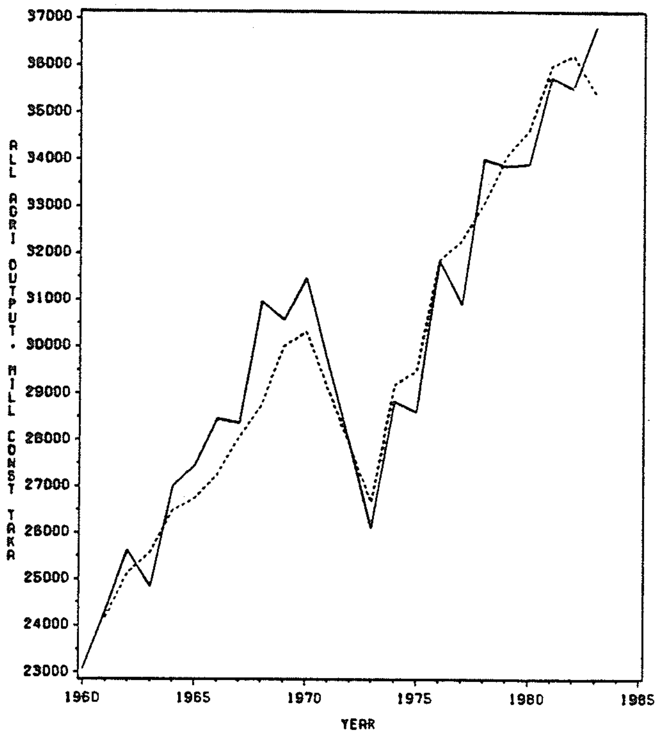
Table 5.2
Predictive Performance of the Production Sector

Endogenous Variables	RMSPE	U1
Food-grains Acreage(ACf)	0.0470	0.046
Food-grains Yield(YLf)	0.0295	0.028
Jute Acreage(ACj)	0.1778	0.169
Jute Yield(YLj)	0.0478	0.045
Food-grains Production(Qf)	0.0568	0.053
Jute Production(Qj)	0.1815	0.162
All other Agri. Output(Yoa)	0.0546	0.052
Agricultural Output(Yag)	0.0277	0.028
Manufacturing output(Ymf)	0.0637	0.055
Manufacturing Employment(Lmf)	0.0693	0.057
Manufacturing Investment(Imf)	0.4377	0.385
Capital Stock, Manufacturing(Kmf)	0.0473	0.044
Infrastructure, Value-added(Yin)	0.0364	0.034
Trade & Banking, Value-added(Ytb)	0.0667	0.062
Housing, Value-added(Yho)	0.0720	0.079
Construction, Value-added(Ycn)	0.1679	0.078
Other Services, Value-added(Yos)	0.0530	0.049
Gross Domestic Product(Ygd)	0.0247	0.024

Source: Present Study.

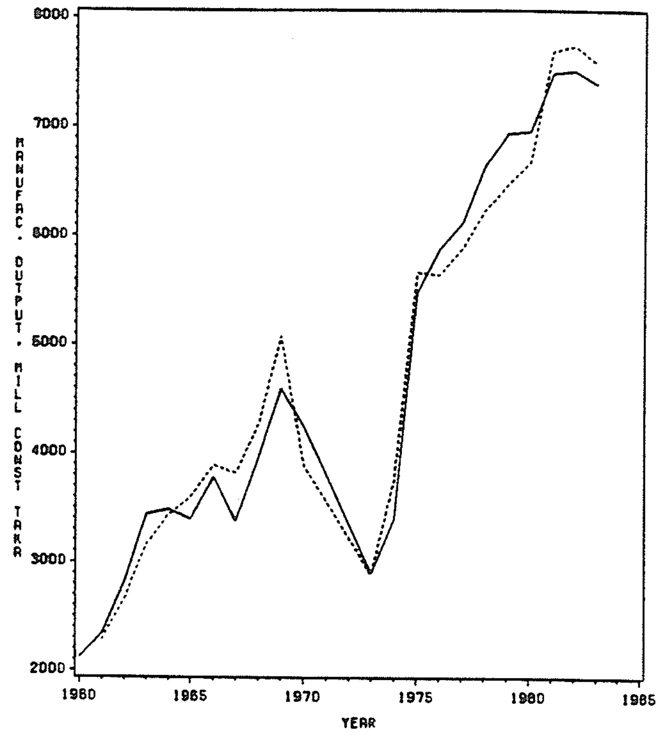
The actual and the simulated series of value added in all agriculture(Yag) are very close to each other: the RMSPE shows an error margin of less than 3 percent. The performance of this sector is quite satisfactory given the difficulty of modelling the sector due to the highly volatile nature of this sector.

FIG. 5.1 : DYNAMIC MACRO SIMULTION 1961–83
AGRICULTURAL OUTPUT, MILL CONST TAKA(YAG)
ACTUAL AND CONTROL SIMULATION



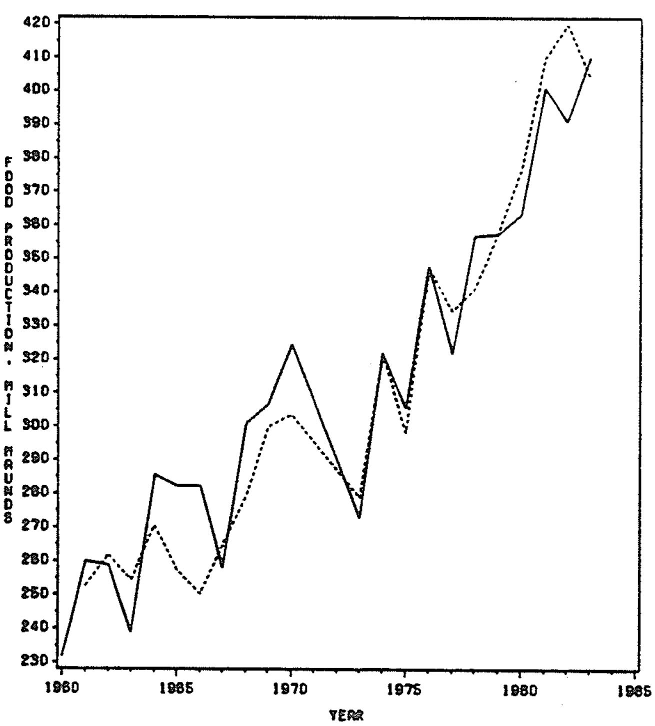
SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.2: DYNAMIC MACRO SIMULTION 1961–83
MANUFACTURING OUTPUT, MILL CONST TAKA(YMF)
ACTUAL AND CONTROL SIMULATION



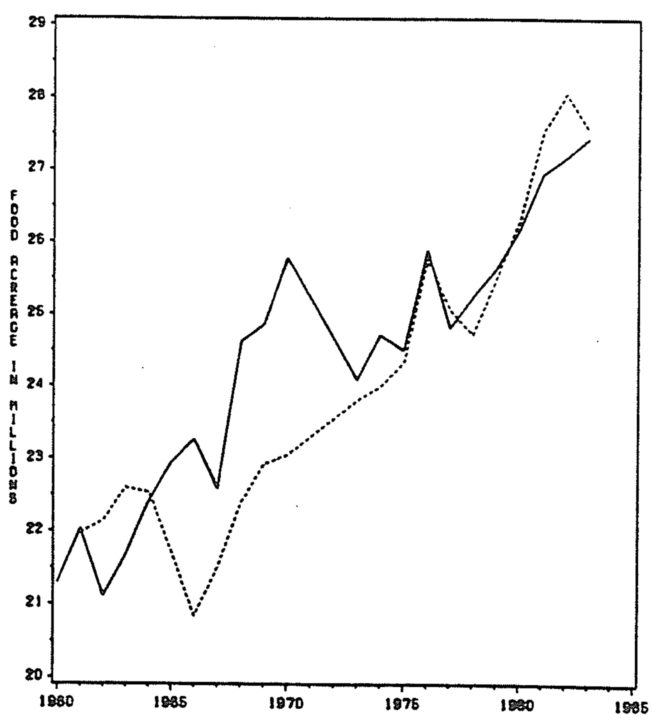
SOLID LINE = CONTROL SOLUTION
DOTTED LINE = CONTROL SIMULATION

FIG. 5.3: DYNAMIC MACRO SIMULTION 1961–83
FOODGRAINS PRODUCTION, MILL MAUNDS(QF)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION
1 TON = 27.22 MAUNDS

FIG. 5.4: DYNAMIC MACRO SIMULTION 1961–83
FOODGRAINS ACREAGE, MILL ACRE(ACF)
ACTUAL AND CONTROL SIMULATION

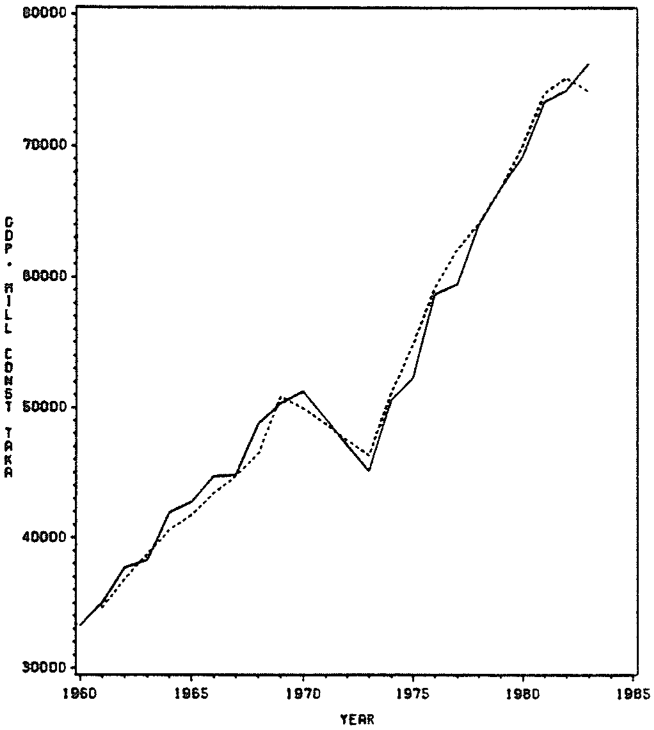


SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

In the non-agricultural sectors, the predictive performance is also quite satisfactory(see Table 5.2). Except for two variables--investment in manufacturing(Imf) and value-added in construction(Ycn)--all the other variables(Ymf, Lmf, Kmf, Yin, Ytb, Yho, and Yos) performed fairly well. The simulation graphs(see Fig. 5.2 for Ymf) show that the model tracks the actual series with a reasonable degree of accuracy: Theil's U1 statistics is also relatively low--8 percent or less. It may be noted here that the partial equilibrium results for the manufacturing investment equation in the previous chapter show comparatively less than satisfactory performance. In addition, now the endogenously determined non-agricultural bank credits(CRna) variable in the equation adds significant volatility since this variable itself has a very large RMSPE margin(more on this later). Finally, on the production side, the model simulates the gross domestic product(Ygd) very closely(see Fig. 5.5): both the RMSPE and U1 are less than 2.5 percent.

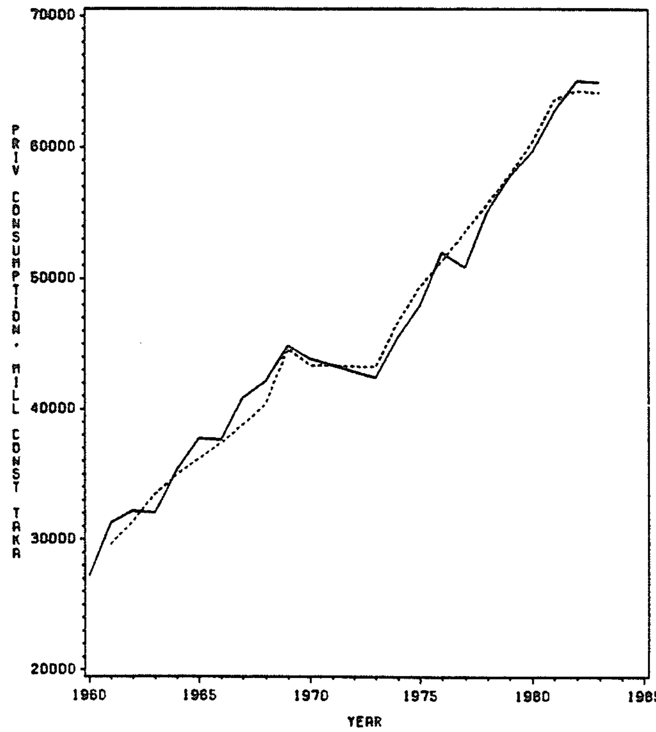
The simulation performance of both private and public consumption variables are quite good: the RMSPE and U1 for private consumption are both less than 3 percent(see Table 5.3). The simulation graphs show a strong tracking record of historical data(see Fig. 5.6-5.7 for private and total consumption). In contrast, both private and public investment variables (Ip and Igf) show less than satisfactory performance: the RMSPE show an error margin of 38 percent

FIG. 5.5: DYNAMIC MACRO SIMULTION 1961–83
GDP, MILL CONST TAKA(YGD)
ACTUAL AND CONTROL SIMULATION



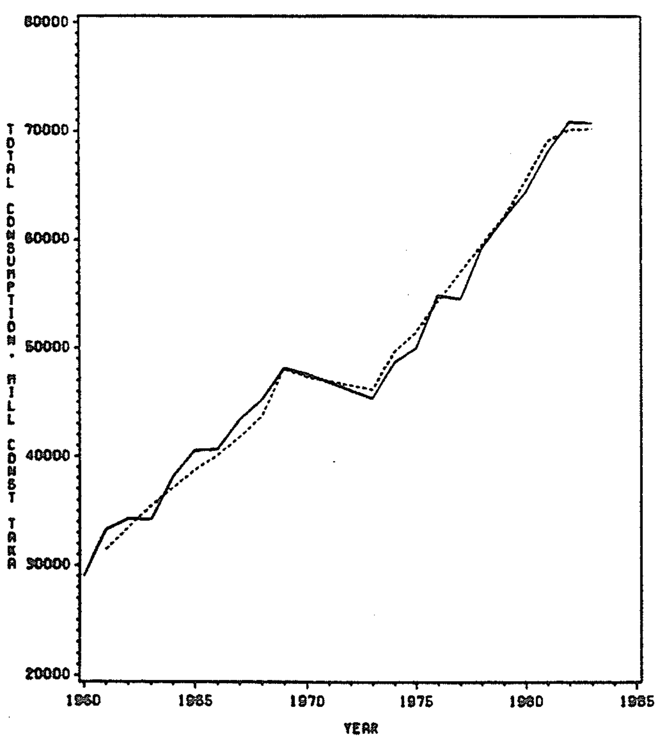
SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.6: DYNAMIC MACRO SIMULTION 1961–83
PRIVATE CONSUMPTION, MILL CONST TAKA(CP)
ACTUAL AND CONTROL SIMULATION



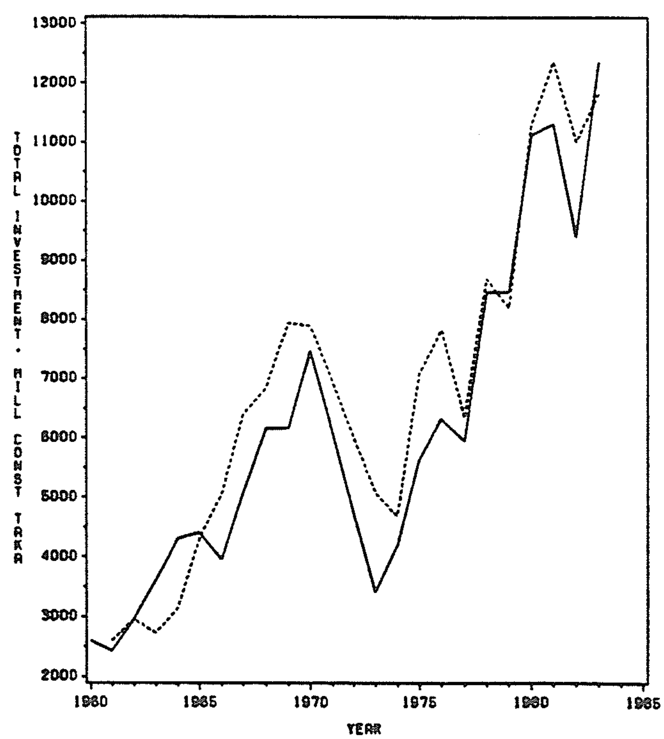
SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.7: DYNAMIC MACRO SIMULTION 1961–83
TOTAL CONSUMPTION, MILL CONST TAKA(C)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.8: DYNAMIC MACRO SIMULTION 1961–83
TOTAL INVESTMENT, MILL CONST TAKA(I)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = CONTROL SOLUTION
DOTTED LINE = CONTROL SIMULATION

and 22 percent, respectively. The simulation graph of the private investment variable shows that the model continuously over-predicts during three separate periods: 1966-70, 1973-77, and 1981-82. An important explanation of such behavior is the performance of the bank credit(CR) variable, which also shows a similar patterns of over-predictions. The simulation records for the total investment variables is quite satisfactory(see Fig. 5.8).

Table 5.3
Predictive Performance of the Demand Sector

Endogenous Variables	RMSPE	U1
Private consumption(Cp)	0.0272	0.024
Public Consumption(Cg)	0.0813	0.068
Total Consumption(C)	0.0256	0.022
Private Fixed Investment(Ip)	0.3793	0.215
Public Fixed Investment(Ig)	0.2167	0.142
Total Investment(I)	0.1993	0.215
Food-grains Imports(Mfor)	0.3260	0.331
Other Consumer Goods Imports(Mocr)	0.1793	0.162
Capital Goods Imports(Mkr)	0.4018	0.338
Raw Material Imports(Mrr)	0.1398	0.111
Total Imports(Mgr)	0.1210	0.114
Raw Jute Exports(Xjr)	0.0804	0.065
Jute Manufacturing Exports(Xjmr)	0.0696	0.064
Other Exports(Xor)	0.1065	0.138
Total Exports(Xgr)	0.0297	0.029
Exports Price Index(Px)	0.0921	0.055
Raw Jute Exports Price Index(Pxj)	0.3126	0.262
Current Account Balance(CA)	0.2823	0.118

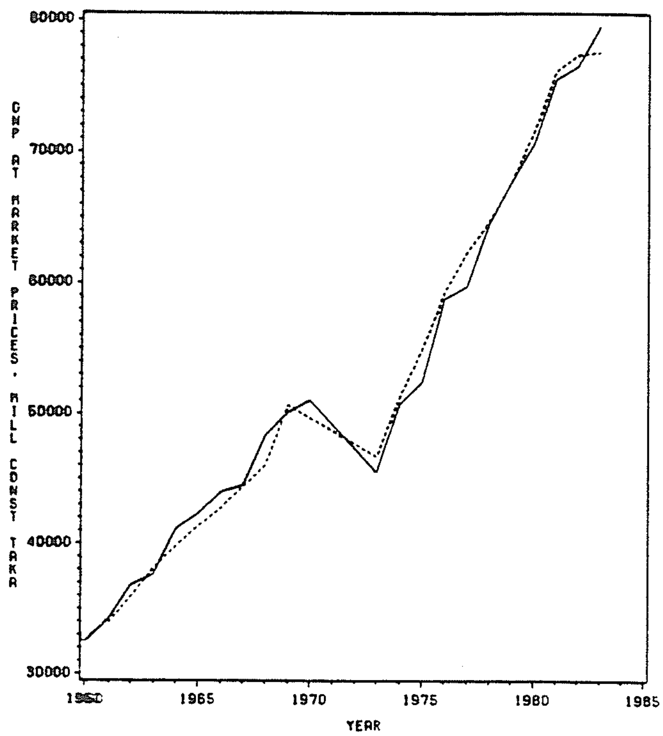
Source: Present Study.

In the international trade block the exports sector performs quite well capturing all the turning points admirably. Both the RMSPE and U1 statistics are relatively low(see

Table 5.3 and Fig. 5.10-12). The imports sector performance is, however, less than satisfactory. Although total imports variable tracks the historical data quite well, the individual imports equations' performances are quite varied. Surprisingly, the food imports equation tracks the historical data quite faithfully despite the very high RMSPE value. The imports of capital goods variable shows consistent over predictions during 1967-70, 1975-77, and 1981-82 partly due to the presence of volatile manufacturing investment variable(Imf) in that equation. Recall that the latter variable showed similar pattern in its own historical simulation. Imports of raw materials variable fails to track three major turning points: 1963 and 1977 troughs, and the 1982 peak. Finally, the model tracks the country's current account balance with resonable accuracy having a U1 value of 11.8 percent(see also Fig. 5.12). On balance, the model's ability to simulate the movements in the country's aggregate variable--GNP--appears to be quite good(see Fig. 5.9).

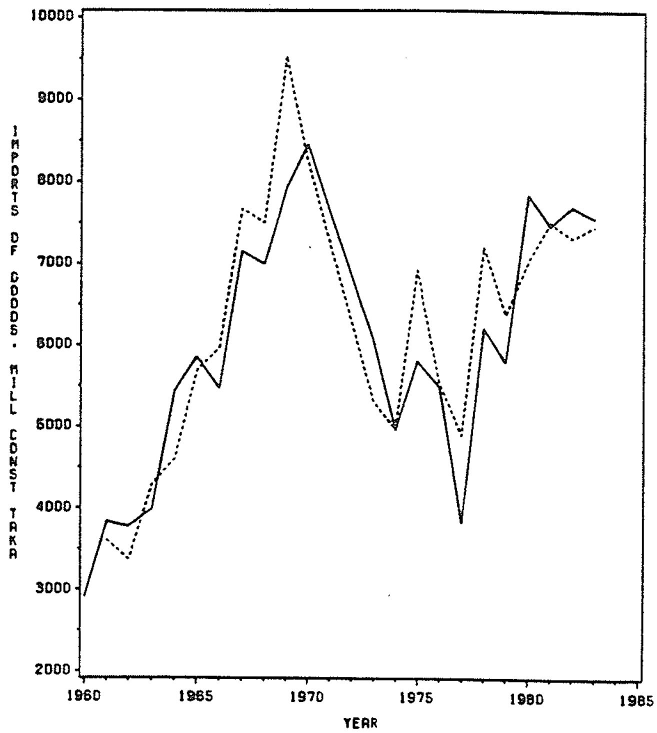
The summary statistics for the fiscal and the monetary sectors are presented in Table 5.4. All the government sector variables performed reasonably well: although the RMSPE values for some are relatively high the Theil inequality coefficient--U1 for all the variables are less than 10 percent except for the sales taxes(Tsl) and budget deficit(BD) variables both of which show an error margin of 12 percent. The simulation graphs for total government revenue(TR) variable

FIG. 5.9 : DYNAMIC MACRO SIMULTION 1961–83
GROSS NATIONAL PRODUCT, MILL CONST TAKA(Y)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.10: DYNAMIC MACRO SIMULTION 1961–83
TOTAL IMPORTS OF GOODS, MILL CONST TAKA(MGR)
ACTUAL AND CONTROL SIMULATION

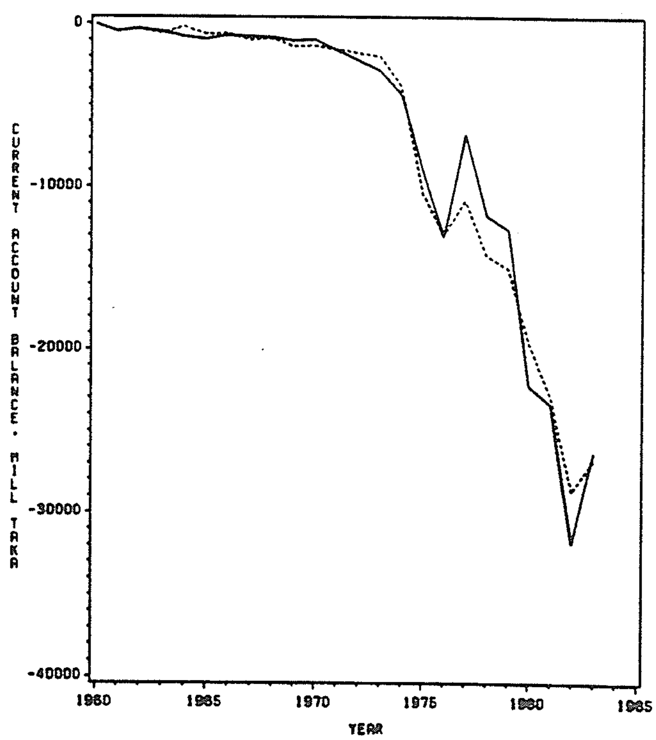


SOLID LINE = CONTROL SOLUTION
DOTTED LINE = CONTROL SIMULATION

FIG. 5.11: DYNAMIC MACRO SIMULTION 1961–83
TOTAL EXPORTS OF GOOODS, MILL MAUNDS(XGR)
ACTUAL AND CONTROL SIMULATION

SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.12: DYNAMIC MACRO SIMULTION 1961–83
CURRENT ACCOUNT BALANCE, MILL TAKA(CA)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

as well as all the other fiscal sector variables show good tracking performance of the model(see Fig. 5.13-14).

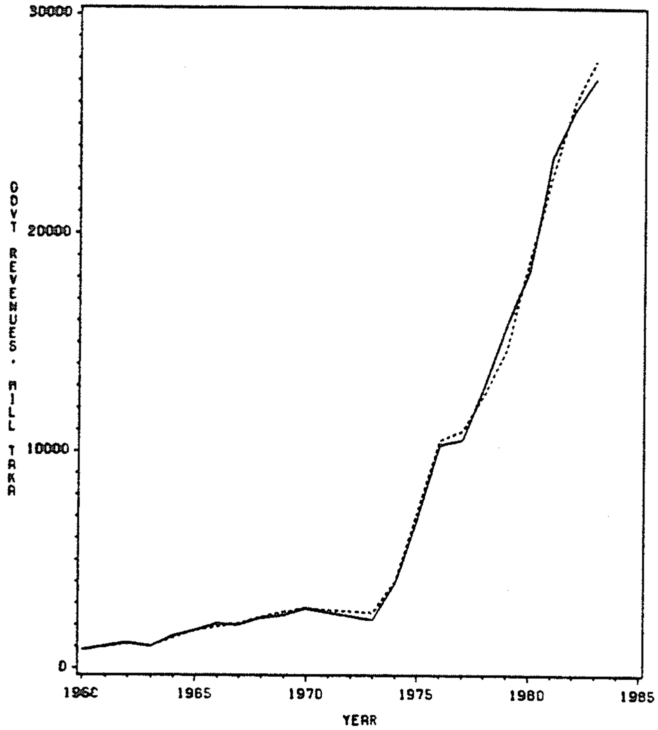
Of all the sectors, the simulation performance of the monetary sector is a bit disappointing despite all our efforts to make the sectoral modelling consistent and close to reality. While no cumulative divergence is exhibited, the overall performance of the sector is marked by high values for both the RMSPE and U1 coefficients(see Table 5.4, also see Fig. 5.15 and 5.20 for money supply and aggregate bank credits multipliers).

Table 5.4
Predictive Performance of Fiscal and Monetary Sectors

Endogenous Variables	RMSPE	U1
Income Taxes(Tin)	0.2260	0.093
Excise Taxes(Tex)	0.1693	0.082
Customs Duties(Tcs)	0.1554	0.088
Sales Taxes(Tsl)	0.2874	0.119
Total Government Revenues(TR)	0.0527	0.035
Total Government Expenditures(NG)	0.0959	0.045
Government Budget Deficit(BD)	0.2648	0.121
Currency in Circulation(CC)	0.3275	0.339
Demand Deposits(DD)	0.5157	0.355
Time Deposits(TD)	0.5057	0.335
Total Bank Deposits(D)	0.5057	0.341
Money Supply(M1)	0.3502	0.338
High Powered Money(H)	0.3502	0.330
Change in Govt Borrowings from the Central Bank(DGBbb)	9.9196	0.400
Govt Borrowings from the Scheduled Banks(GBsb)	0.1754	0.085
Total Bank Credits(CR)	0.4517	0.315
Net Foreign Assets(NFA)	0.5240	0.476
Non-Agri Bank Credits(CRna)	0.4999	0.394
Real Money Demand(M1r)	0.0716	0.070

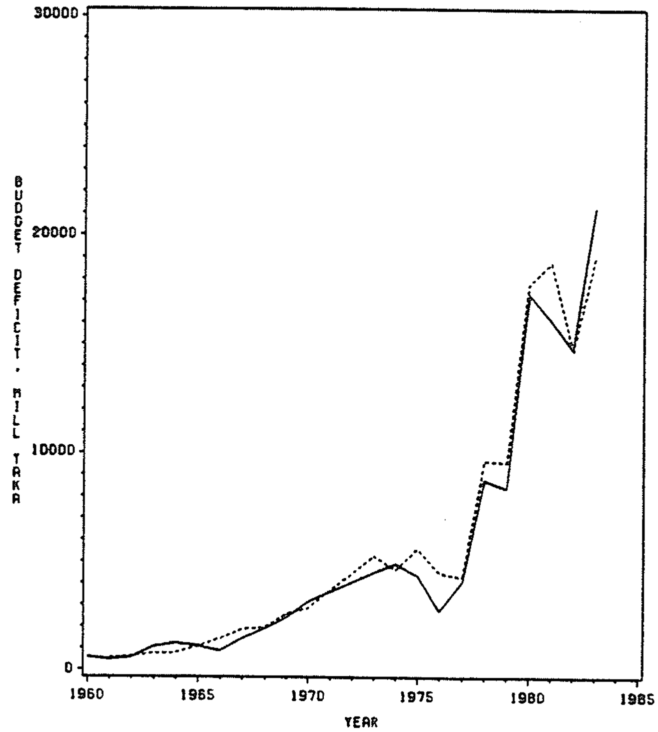
Sources: Present Study

FIG. 5.13 DYNAMIC MACRO SIMULTION 1961–83
TOTAL GOVT REVENUES, MILL TAKA(TR)
ACTUAL AND CONTROL SIMULATION



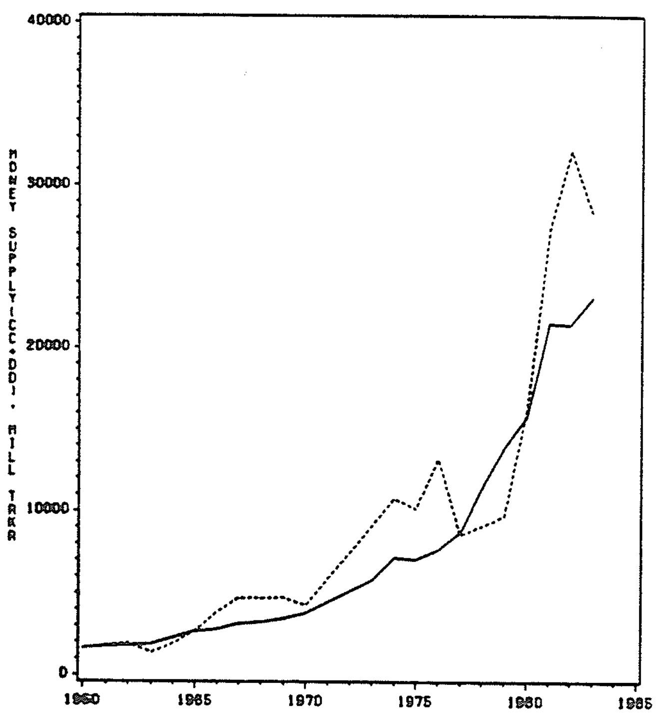
SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.14 DYNAMIC MACRO SIMULTION 1961–83
GOVERNMENT BUDGET DEFICIT, MILL TAKA(BD)
ACTUAL AND CONTROL SIMULATION



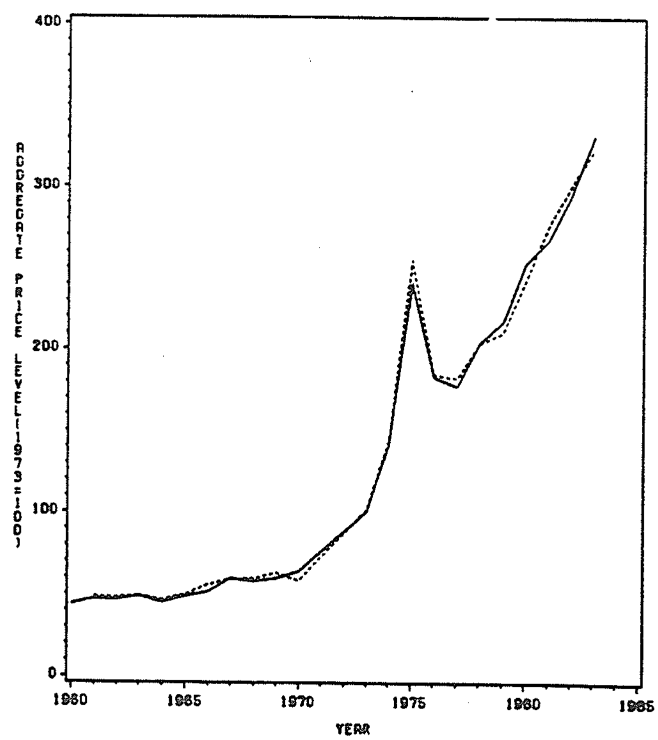
SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.15 DYNAMIC MACRO SIMULTION 1961–83
MONEY SUPPLY, MILL TAKA(M1)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.16 DYNAMIC MACRO SIMULTION 1961–83
AGGREGATE PRICE LEVEL, 1973=100(PGD)
ACTUAL AND CONTROL SIMULATION



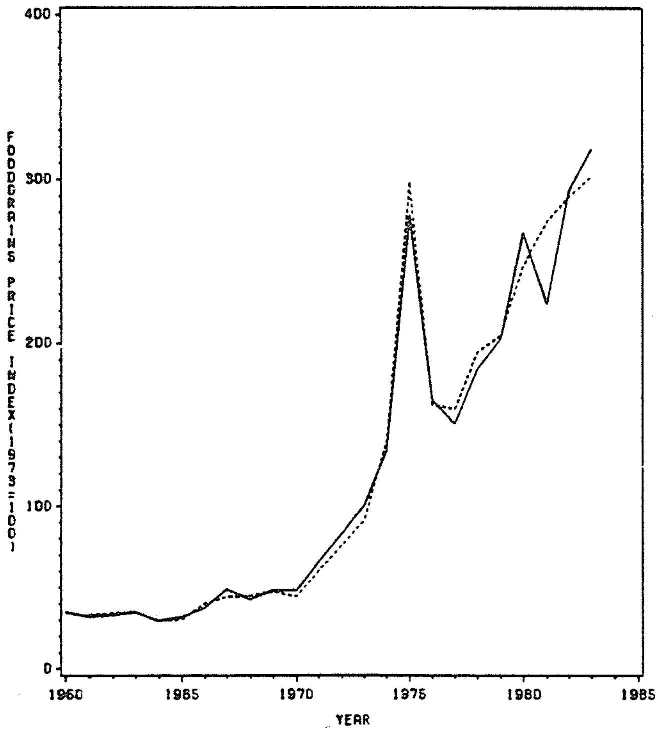
SOLID LINE = CONTROL SOLUTION
DOTTED LINE = CONTROL SIMULATION

It is worth noting here that despite high error margins, two variables, namely, government borrowings from the central bank(DGBbb) and from the scheduled banks(GBsb), performed remarkably well in tracking the historical time path of the corresponding variables catching all the turning points in the series. This supports the assertion that the summary statistics such as RMSPE and U1 are not the only criterion one should use in model validation. It may be mentioned here that the poor performance of the monetary sector is in part due to our modelling strategy of this sector. The money supply is an endogenous variable in the model. Also, rather than using ad-hoc stochastic specifications or assuming exogenously given, we have incorporated various banking and monetary authorities' balance sheet identities directly in the model which, unfortunately, permits rapid error build-up. Our close scrutiny of the various feedback loops in the model suggest that the major source of error build-up is with the net foreign assets(NFA) variable, which, incidentally has a RMSPE of 52 percent. The NFA variable is given by the accounting identity

NFA = LAG(NFA) + CA + CAP;

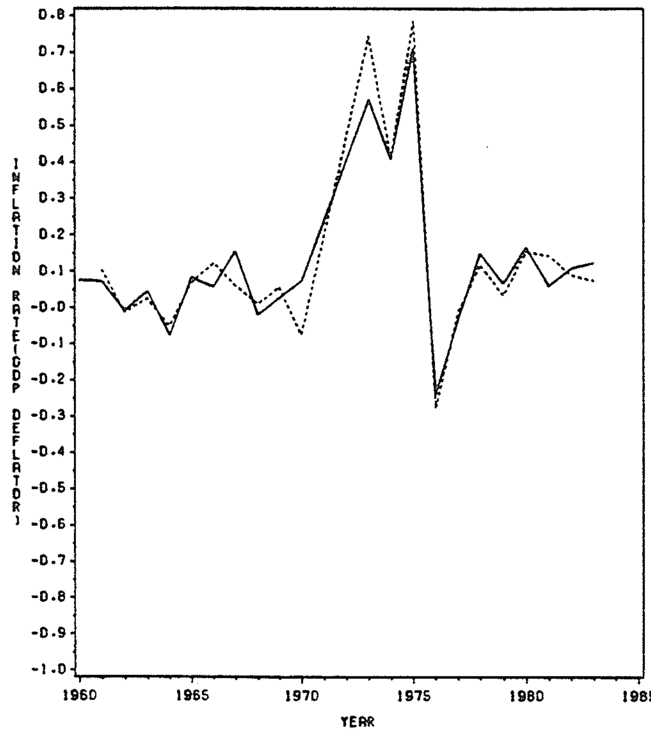
where, CA is current account balance and is endogenously determined, and CAP is foreign capital inflow--an exogenous variable in the model. Although CA has relatively low(28%) RMSPE, because of large fluctuations in the country's external reserve position(NFA), the resulting error margin for the NFA variable jumps to 52 percent.

FIG. 5.17 DYNAMIC MACRO SIMULTION 1961–83
PRICE OF FOODGRAINS, 1973=100(PF)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.18 DYNAMIC MACRO SIMULTION 1961–83
INFLATION RATE: GNP DEFLATOR(INFP)
ACTUAL AND CONTROL SIMULATION

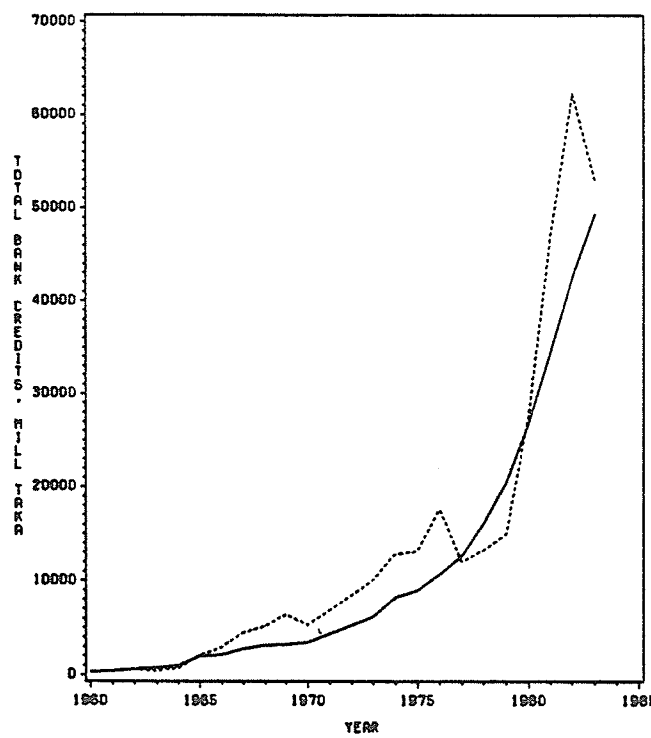


SOLID LINE = CONTROL SOLUTION
DOTTED LINE = CONTROL SIMULATION

FIG. 5.19 DYNAMIC MACRO SIMULTION 1961–83
AGGREGATE REAL WAGES, 1973=100(RW)
ACTUAL AND CONTROL SIMULATION

SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

FIG. 5.20 DYNAMIC MACRO SIMULTION 1961–83
TOTAL BANK CREDITS, MILL TAKA(CR)
ACTUAL AND CONTROL SIMULATION



SOLID LINE = ACTUAL DATA
DOTTED LINE = CONTROL SIMULATION

This large error in NFA has a clear ripple effect all over the monetary sector down to the bank credit variables(CR, CRna, and CRag). As we have seen earlier, the real sector also carries its share of this ripple effect through these bank credits variables.[274]

Finally, the simulation performance of the prices and wages sector is more than satisfactory. Except for the price of jute(Pj), all other prices show relatively low error margin: both RMSPE and U1 are less than 10 percent(see Table 5.5). The high error margin for the inflation variable is not unexpected since the variable is measured in percentage change form. Despite high error margin, the simulation graph of this variable shows a remarkably close tracking of historical data(see Fig 5.18), as does the tracking record for the general price level(see Fig. 5.16). The food-grains price(Pf) variable tracks very closely the historical values and all the turning points except the one in 1981(see Fig. 5.17). On the other hand, the jute price(Pj) variable tracks the historical series quite well during the pre-independence period only, while fails to simulate closely the post-independence time path missing at least one turning point--the 1978 peak.

---

[274] One solution to this problem is to make the NFA variable stochastic with CA and CAP as independent variables(see Pani, 1983). We refrain from doing so since it is felt that the accounting identities are integral parts of a consistent macroeconomic model.

Table 5.5
Predictive Performance of The Prices and Wages Sector

Endogenous Variables	RMSPE	U1
Aggregate Price Level(Pgd)	0.0377	0.029
Rate of Inflation(p)	0.8286	0.255
Price of Food-grains(Pf)	0.0702	0.081
Price of Raw Jute(Pj)	0.2420	0.217
Agricultural Price Deflator(Pag)	0.0685	0.057
Manufacturing Price Deflator(Pmf)	0.0757	0.085
WPI, manufacturing(WPImf)	0.0936	0.102
WPI	0.0810	0.063
CPI, urban(CPIu)	0.0817	0.049
CPI, rural(CPIr)	0.0874	0.090
CPI	0.0686	0.066
Nominal Wages, Agriculture(Wag)	0.0724	0.082
Nominal Wages, Manufacturing(Wmf)	0.0907	0.087
Real Wages, Aggregate(RW)	0.0724	0.066

Source: Present Study.

The two sectoral wages variables performed well, despite the fact that they are modelled based on traditional marginal productivity principle. Finally, the simulation graph for the aggregate real wages variable(Fig. 5.19) shows a good tracking ability of the model to simulate the historical time path of the variable.

In summary, the model performed reasonably well considering the nature, size, and complexity, as well as the time bounds of the dynamic simulation. We have seen that the model is able to track the historical time path reasonably well for almost all of the major endogenous variables, especially in the real sectors of the economy, exhibiting no divergent behavior in any significant way. The major weakness in tracking some of the dynamic responses in the model results from the relatively poor showing of the monetary sector. The relatively unsatisfactory performance of the monetary sector is in part due to our use of sectoral accounting identities which permit rapid error build up and our inability to closely track the net foreign assets(NFA) variable.

5.4 THE DYNAMIC STABILITY OF THE MODEL

In the previous section we have tested the predictive accuracy of the model and arrived at the conclusion that the model has reasonably good ex-post predictive accuracy, at least in tracking the historical data. However, a good predictive performance is not sufficient for a model to be usefully applied for policy analysis. Further tests are needed to ascertain the dynamic stability of the model. A model is not stable, if a small change in parameters, time path of exogenous variables, or in the initial conditions or base year produce large cyclical changes in the model. Naturally, policy simulations based on such models will be highly suspect. Therefore, in this section, several sensitivity tests are undertaken to check the dynamic stability of the model. The idea is to see how the model reacts to various small doses of 'shocks'. Results from three such tests are presented here. First, we allow a small change in the time path of an exogenous variable: a 5 percent sustained increase in foreign capital inflow(CAP) is assumed. Secondly, we make a small change in one of the estimated parameters in the model: the marginal propensity to consume is decrease by 5 percent in this case. And, finally, the base year is changed, first from 1959-60 to 1963-64 and than to 1972-73. Incidentally, all of these tests results may be given plausible economic interpretations. However, we refrain from this since our objective is to test the dynamic stability of the model.

Change in Exogenous Variable:

The model is first simulated with a 5 percent sustained increase in the exogenous variable--foreign capital inflow(CAP). The results(RMSPE, U1, and the simulation graphs) are compared with the corresponding results obtained earlier with the historical simulation, henceforth, referred to as the 'control solution'(which is the standard terminology for historical simulation in the literature). Our comparison shows that the values of both the RMSPE and U1 are very close in the two cases, and the simulation graphs do not indicate any divergent behavior of the model. The model does not exhibit 'explosive' tendencies in response to the shock applied to it. This can be interpreted as an indication of inherent stability of the model. To save space, we have reported the RMSPE and U1 statistics for this simulation and the differences in RMSPE and U1 between the present simulation and the control solution for selected important endogenous variables in Table 5.6. In almost all case we find the differences in error margins negligible.

Table 5.6
Sensitivity Test: Change in Exogenous Variable#

Endogenous variables	RMSPE Test*	RMSPE Difference+	U1 Test*	U1 Difference+
Food-grains Acreage(ACf)	0.0520	0.0008	0.0521	0.0009
Agricultural Output(Yag)	0.0332	0.0015	0.0332	0.0000
Manufacturing Output(Ymf)	0.0624	0.0002	0.0537	-0.0003
Gross Domestic Product(Ygd)	0.0288	0.0005	0.0269	0.0008
Private Consumption(Cp)	0.0330	0.0001	0.0287	0.0026
Total Consumption(C)	0.0308	0.0002	0.0265	0.0007
Total Investment(I)	0.2311	0.0383	0.1373	-0.0007
Imports of Goods(Mgr)	0.1363	0.0227	0.1190	0.0110
Exports of Goods(Xgr)	0.0301	0.0001	0.0305	0.0000
Budget Deficit(BD)	0.2622	0.0046	0.1225	0.0039
Money Supply(M1)	0.5927	0.1837	0.5954	0.2502
Aggregate Price level(Pgd)	0.0378	0.0014	0.0349	0.0020
Price of Food-grains(Pf)	0.0815	0.0059	0.0937	0.0074
Real Wages(RW)	0.0676	-0.0006	0.0622	-0.0004

A 5 percent increase in foreign capital inflow is assumed;
* For a 5 percent increase in foreign capital inflow variable;
+ Difference between present simulation and control solution.
Source: Present Study.

Change in Model Parameter:

To test the model's dynamic stability further we now allow the estimated marginal propensity to consume to drop by five percent through out the sample period. The results once again indicate that the model does not exhibit instability in response to small shock. A comparison of the RMSPE, U1 and the simulation graphs show no wild divergences between the present simulation and the control simulation. Table 5.7 presents comparative data for the two statistics between the two simulations for selected endogenous variables. Once again the differences in error margins between the two simulations are found to be negligible.

Table 5.7
Sensitivity Test: Change in Model Parameter#

Endogenous variables	RMSPE		U1	
	Test*	Difference+	Test*	Difference+
Food-grains Acreage(ACf)	0.0547	0.0030	0.0541	0.0029
Agricultural Output(Yag)	0.0401	0.0084	0.0399	0.0067
Manufacturing Output(Ymf)	0.0612	-0.0010	0.0533	-0.0007
Gross Domestic Product(Ygd)	0.0352	0.0069	0.0310	0.0049
Private Consumption(Cp)	0.0791	0.0462	0.0708	0.0447
Total Consumption(C)	0.0745	0.0439	0.0657	0.0399
Total Investment(I)	0.1932	0.0004	0.1409	0.0029
Imports of Goods(Mgr)	0.1133	-0.0003	0.0997	-0.0083
Exports of Goods(Xgr)	0.0314	0.0014	0.0334	0.0029
Budget Deficit(BD)	0.2575	-0.0001	0.1193	0.0007
Money Supply(M1)	0.4648	0.0558	0.3953	0.0501
Aggregate Price level(Pgd)	0.0354	-0.0010	0.0319	-0.0010
Price of Food-grains(Pf)	0.0794	0.0036	0.0838	-0.0025
Real Wages(RW)	0.0679	0.0003	0.0628	0.0006

A 5 percent drop in marginal propensity to consume(from 0.9739 to 0.9252 during the pre-independence period, and from 0.8096 to 0.7691 during the post-independence period) is assumed; * Error margin for a 5 percent drop in marginal propensity to consume; + Difference between present simulation and the control solution.
Source: Present Study.

As one would expect the shock resulted in decreased consumption, investment, imports demand and national income and output. What is noticeable is that the responses to the shock is much more pronounced during the pre-independence period compared to the post-independence period. This has also been observed with the previous sensitivity test. In general, as one would expect, the response pattern in the present case is similar to that for the previous test but reversed in direction.

Change in Base Year:

Finally, we change the initial conditions or the base year to test the model's sensitivity to small perturbation. First, we change the base year from 1959-60, which is the base year for control solution, to 1963-64. The resulting simulation values and associated statistics show very little divergences between this and the control solution. The model generated a stable solution. Next, the base year is changed to 1972-73, which is the first year of our post-independence data set. All the simulated series closely follow the control solution path, and a comparison of associated statistics(see Table 5.8) show small divergences, although the differences in the error margins are now relatively large compared to the previous two tests. In general the model is quite stable to change in the base year. As one would expect, the model with a recent base year simulates the data much better compared with the performance of control solution with a distant past base-year.

Table 5.8
Sensitivity Test: Change in Initial Conditions/Base Year#

Endogenous variables	RMSPE Test*	RMSPE Difference+	U1 Test*	U1 Difference+
Food-grains Acreage(ACf)	0.0138	-0.0379	0.0141	-0.0371
Agricultural Output(Yag)	0.0234	-0.0083	0.0238	-0.0094
Manufacturing Output(Ymf)	0.0562	-0.0060	0.0480	-0.0060
Gross Domestic Product(Ygd)	0.0186	-0.0097	0.0183	-0.0078
Private Consumption(Cp)	0.0169	-0.0160	0.0141	-0.0120
Total Consumption(C)	0.0161	-0.0145	0.0154	-0.0104
Total Investment(I)	0.1000	-0.0928	0.0832	-0.0548
Imports of Goods(Mgr)	0.0952	-0.0184	0.0866	-0.0214
Exports of Goods(Xgr)	0.0242	-0.0058	0.0236	-0.0069
Budget Deficit(BD)	0.1434	-0.1142	0.1019	-0.0167
Money Supply(M1)	0.0295	-0.1140	0.2862	-0.0590
Aggregate Price level(Pgd)	0.0293	-0.0071	0.0311	-0.0018
Price of Food-grains(Pf)	0.0791	-0.0036	0.0814	-0.0049
Real Wages(RW)	0.0646	-0.0036	0.0582	-0.0044

The base year is changed from 1959-60 to 1973-73 and the model is simulated for the period 1973-83, ceteris paribus; * Error margins after changing the base year; + Difference between the present simulation and the control solution.
Source: Present Study.

Indeed, for all the endogenous variables the error margins now decreases--as indicated by the negative signs for the 'difference' statistics in Table 5.8--, and in many cases the differences are quite significant. The models tracking performance of the recent past years seems relatively better.

5.5 MACRO POLICY SIMULATIONS AND MULTIPLIER ANALYSIS

The complete model for the Bangladesh economy is now utilized to explore the consequences of various macroeconomic policy alternatives and exogenous 'shocks' to the economy. Policy or shock simulation involves changing the values of policy/shock variables or parameters in the model and solving the model for the time path of the endogenous variables. The resulting simulations, henceforth, referred to as 'policy/shock simulation' or simply 'simulated values', are than compared with the 'control solution' obtained earlier. The dynamic multipliers can be calculated by taking the differences between the policy/shock simulation values and the control solution values for endogenous variables and dividing it by the change in policy/shock variables or parameters. A percentage deviation in policy/shock simulation over control simulation values is calculated in case of a percentage change in policy/shock variable or parameter.

A large number of simulation experiments were conducted with the model. The time period for all the simulations was 1961-83. In general, three alternative sets of policy/shock simulations have been considered: (a) 10, 5 or 1 percent change in the policy/shock variable over the entire sample period(sustained change); (b) 10, 5 or 1 million constant taka changes in policy/shock variable over the entire sample period(sustained change); and (c) 1 million taka change in the policy/shock variable in the first-year only(one-shot change). However, we have limited our discussion here to the first type of simulations only both to save space and to avoid the problem of unit and other difficulties associated with comparing changes measured in levels.

Although over fifty policy/shock simulation experiments have been conducted with the model, only a selected number of them--the most interesting ones--are discussed here. Again, to save space and to preclude an inundation of numbers we have limited our presentation to estimated multiplier values and to graphs of selected variables only. All the simulations can be classified into four broad categories: (1) fiscal policy simulations, (2) monetary policy simulations, (3) foreign sector policy/shock simulations, and (4) exogenous shock simulations. In each category, the results of at least two simulation experiments are presented here.

Fiscal Policy Simulations:

Four sets of simulations relating to the impact of fiscal policy in Bangladesh are presented here:

(1) Tax reform policy: 1 percent sustained increase in all taxes and government revenues: all the endogenous tax functions as well as exogenous revenue variables are multiplied by 1.01;

(2) Expansionary fiscal policy: 1 percent sustained increase in both public investment and consumption expenditures;

(3) 'Balanced budget' fiscal policy: 1 percent sustained increase in both taxes and public consumption and investment expenditures; and

(4) Reduction of subsidy and/or relaxation of price control: 1 percent sustained increase in food-grains prices.

In general, the simulation results show substantial endogenous responses in fiscal and monetary agents' behavior. In particular, the feedbacks, both simultaneous and lagged, are often quite significant. The important mechanism of these feedbacks and endogenous responses seem to have been operating through the government budgetary constraints, financing rules, and the accounting identities that transmit monetary impulses through out the rest of the economy. Because of the disequilibrium adjustments and induced compositional changes and also due to non-linearity in feedback mechanisms and longer than a year adjustment lags, our results are much different than those suggested by the standard short-run equilibrium IS-LM text book models.

The policy multipliers for selected endogenous variables for the uniform 1 percent increase in all taxes and revenues are presented in Table 5.9. It is well known that the tax system in Bangladesh is far from efficient, and that there is considerable scope for improvements in tax collection as well as widening the tax base, particularly income taxes, without hindering growth and development of the national

Table 5.9

MULTIPLIERS: 1% SUSTAINED INCREASE IN ALL GOVERNMENT REVENUES *
(Percentage Change in Predicted Values over Control Solution)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	0.0025059	-0.0023635	0.0096126	0.0068882	0.0093625	0.0088990	-0.00014336	0.0020494	0.0091472
1962	0.0040843	0.0019733	0.0074260	0.0094008	0.0075263	0.0094179	0.00003571	0.0033433	0.0073025
1963	0.0071449	-0.0010723	0.0178166	0.0158329	0.0176687	0.0179816	-0.00022292	0.0059401	0.0172873
1964	0.0078096	0.0011982	0.0134311	0.0177323	0.0136920	0.0162363	0.00020934	0.0063740	0.0134109
1965	0.0090585	-0.0005346	0.0178754	0.0189620	0.0179607	0.0164210	0.00034645	0.0074159	0.0176943
1966	0.0107393	0.0060167	0.0158299	0.0198345	0.0160260	0.0178255	0.00073414	0.0080982	0.0157471
1967	0.0118853	0.0006852	0.0228078	0.0250359	0.0230353	0.0218337	0.00118326	0.0091135	0.0228738
1968	0.0132371	0.0065835	0.0212851	0.0240455	0.0214577	0.0286268	0.00189292	0.0095652	0.0211742
1969	0.0163901	0.0021521	0.0313541	0.0305948	0.0312879	0.0468111	0.00446809	0.0114137	0.0314625
1970	0.0182644	0.0092797	0.0285034	0.0309453	0.0286537	0.0508241	0.00365480	0.0114030	0.0286496
1973	0.0131882	0.0111551	0.0074428	0.0325034	0.0088868	0.0292369	0.00078944	0.0095453	0.0099209
1974	0.0121694	0.0097461	0.0090698	0.0284423	0.0102256	0.0372740	0.00079124	0.0093604	0.0114812
1975	0.0117046	0.0069525	0.0115382	0.0457744	0.0130683	0.0225636	0.00098906	0.0082625	0.0143504
1976	0.0096239	0.0073438	0.0045062	0.0358615	0.0061431	0.0200683	0.00080841	0.0068873	0.0071043
1977	0.0089755	0.0047536	0.0062821	0.0322173	0.0078848	0.0282646	0.00081065	0.0064888	0.0092024
1978	0.0088659	0.0031890	0.0079231	0.0312776	0.0094524	0.0229475	0.00093163	0.0064003	0.0110275
1979	0.0088446	0.0026445	0.0084476	0.0316585	0.0100418	0.0275815	0.00099365	0.0063080	0.0118057
1980	0.0088746	0.0030032	0.0080853	0.0281276	0.0095575	0.0219100	0.00098015	0.0062602	0.0110482
1981	0.0088433	0.0028715	0.0080115	0.0271748	0.0094724	0.0221310	0.00099898	0.0062349	0.0108275
1982	0.0092899	0.0016064	0.0094967	0.0283821	0.0110721	0.0275517	0.00094771	0.0065332	0.0128060
1983	0.0099092	0.0011599	0.0103244	0.0306117	0.0120355	0.0275907	0.00104206	0.0069389	0.0138513

YEAR	MGR	KGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.0029289	0.00007172	0.0192032	0.0158163	0.0091246	-0.0030270	-0.0007510	-0.003691	-0.007219
1962	0.0067828	0.00181522	0.0207621	0.0162012	0.0132469	0.0085071	0.0008212	-0.005522	-0.006742
1963	0.0063028	0.00218176	0.0279512	0.0269169	0.0211441	0.0125956	0.0006527	-0.011265	-0.018126
1964	0.0089440	0.00278440	0.0590314	0.0225185	0.0218249	0.0206709	0.0035547	-0.006513	-0.008713
1965	0.0096483	0.00317486	0.0283174	0.0235512	0.0221500	0.0199597	0.0043844	-0.002918	-0.003056
1966	0.0151139	0.00919821	0.0318362	0.0263103	0.0242766	0.0216826	0.0054897	-0.003910	0.004902
1967	0.0146211	0.00378508	0.0309254	0.0346295	0.0272783	0.0182412	0.0059484	-0.003164	0.011108
1968	0.0233313	0.00671783	0.0474788	0.0315601	0.0293304	0.0267824	0.0080658	-0.004571	0.034343
1969	0.0354495	0.00573344	0.0677662	0.0426992	0.0335994	0.0233599	0.0100881	-0.032602	0.070270
1970	0.0391182	0.00894327	0.0661643	0.0427492	0.0357380	0.0290785	0.0130636	-0.090032	0.104588
1973	0.0115375	0.00293902	0.0267946	0.0378597	0.0354711	0.0342415	0.0095289	0.000264	0.008796
1974	0.0137946	0.00312347	0.0212268	0.0324810	0.0356618	0.0385504	0.0088233	0.019890	0.023242
1975	0.0092454	0.00386546	0.0101910	0.0316015	0.0330355	0.0349552	0.0092755	0.047653	0.053546
1976	0.0125595	0.00325689	0.0162394	0.0316746	0.0316706	0.0316610	0.0070026	0.015867	0.017938
1977	0.0134050	0.00305591	0.0192996	0.0311209	0.0353652	0.0464819	0.0062828	0.022798	0.024662
1978	0.0088907	0.00321134	0.0150001	0.0306524	0.0278971	0.0243048	0.0057902	0.025651	0.026791
1979	0.0109810	0.00353520	0.0175737	0.0309654	0.0313768	0.0320133	0.0055326	0.029719	0.029872
1980	0.0105120	0.00404196	0.0173663	0.0289579	0.0265007	0.0237746	0.0050417	0.024674	0.023072
1981	0.0122900	0.00425814	0.0193998	0.0293767	0.0284708	0.0273507	0.0047185	0.019550	0.020166
1982	0.0122718	0.00431966	0.0186024	0.0315272	0.0341433	0.0387751	0.0044253	0.019151	0.018103
1983	0.0117236	0.00453168	0.0225751	0.0333994	0.0338797	0.0346011	0.0046908	0.022811	0.022335

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	0.0128101	-0.000658	-0.0044	0.005951	0.0085881	-0.003691	0.0024651	0.00070174	-0.0026393
1962	0.0100336	-0.006173	-0.0172	0.002969	0.0070265	-0.005522	0.0043356	0.00097454	-0.0020569
1963	0.0238447	-0.009008	-0.0175	0.005593	0.0163736	-0.011265	0.0082550	0.00191635	-0.0026461
1964	0.0173697	-0.014432	-0.0115	0.001155	0.0126071	-0.006513	0.0091178	0.00181249	0.0000500
1965	0.0229821	-0.014351	-0.0219	0.001572	0.0166678	-0.002918	0.0106173	0.00224120	-0.0005906
1966	0.0207201	-0.015240	-0.1407	0.007540	0.0151911	-0.003910	0.0128606	0.00257359	-0.0010380
1967	0.0291435	-0.014512	-0.0650	0.010058	0.0211247	-0.003164	0.0152262	0.00283661	0.0008530
1968	0.0278806	-0.016036	-0.9157	0.025662	0.0203987	-0.004571	0.0179082	0.00308259	-0.0005555
1969	0.0405232	-0.015095	-4.9925	0.058940	0.0296518	-0.032602	0.0221987	0.00320239	0.0008543
1970	0.0364173	-0.016388	0.4022	0.073507	0.0274901	-0.090032	0.0258346	0.00491537	0.0002973
1973	0.0173076	-0.020286	-0.0255	-0.013551	0.0085490	0.000264	0.0216652	0.00436566	0.0087144
1974	0.0183079	-0.015179	-0.0556	0.017761	0.0104379	0.019890	0.0196479	0.00303410	0.0065089
1975	0.0185532	-0.010565	-0.1351	0.016469	0.0135028	0.047653	0.0185824	0.00286038	0.0052317
1976	0.0121147	-0.010490	-0.0472	0.006330	0.0051219	0.015867	0.0154908	0.00245378	0.0079871
1977	0.0133163	-0.008155	-0.1249	0.008686	0.0071787	0.022798	0.0138792	0.00224073	0.0065698
1978	0.0130293	-0.007233	-0.0866	0.010662	0.0089871	0.025651	0.0129108	0.00217651	0.0050616
1979	0.0137225	-0.006840	-0.0586	0.012252	0.0095337	0.029719	0.0125892	0.00218980	0.0045405
1980	0.0127589	-0.007347	-0.0487	0.011587	0.0089523	0.024674	0.0122435	0.00222214	0.0041220
1981	0.0127370	-0.007384	-0.1062	0.011801	0.0088244	0.019550	0.0120045	0.00220299	0.0045224
1982	0.0139380	-0.007386	-0.0969	0.012065	0.0105006	0.019151	0.0122275	0.00234181	0.0041626
1983	0.0145099	-0.007684	-0.0797	0.012885	0.0113872	0.022811	0.0126065	0.00244954	0.0040517

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	-0.01409	0.00000000	0.000000	-0.0007510	-0.0006582	0.00016778	-0.0005666	0.0065701	0.0063379
1962	-0.03907	0.00158741	-0.005506	-0.0007650	-0.0006704	0.00036473	-0.0028537	0.0091018	0.0079412
1963	-0.06021	0.00244382	-0.007453	-0.0017867	-0.0015660	0.00055155	-0.0024484	0.0158492	0.0160422
1964	-0.02674	0.00458550	-0.013545	-0.0010261	-0.0008993	0.00075737	-0.0034021	0.0143245	0.0173332
1965	-0.01937	0.00523671	-0.013618	-0.0008478	-0.0007431	0.00098034	-0.0008780	0.0169599	0.0212169
1966	0.07641	0.00609070	-0.014724	-0.0005974	-0.0005236	0.00131106	-0.0007601	0.0215985	0.0212408
1967	-0.05307	0.00634378	-0.014172	-0.0003929	-0.0003443	0.00164916	0.0007064	0.0233383	0.0270986
1968	-0.17506	0.00737555	-0.016627	0.0006852	0.0006005	0.00212491	0.0007303	0.0276818	0.0281320
1969	-0.05755	0.00787302	-0.016988	0.0021977	0.0019258	0.00358627	0.0059611	0.0335120	0.0364588
1970	-0.07265	0.00922569	-0.019654	0.0038029	0.0033319	0.00371643	0.0035904	0.0380299	0.0380786
1973	0.00457	0.00980356	-0.020053	-0.0002719	-0.0002383	0.00198945	-0.0024587	0.0213363	0.0265093
1974	-0.00418	0.00839579	-0.015545	0.0004239	0.0003715	0.00154853	0.0018611	0.0213887	0.0219059
1975	-0.00579	0.00726457	-0.012293	0.0019964	0.0017494	0.00160822	0.0024323	0.0214452	0.0216673
1976	-0.00073	0.00655093	-0.010879	0.0004487	0.0003932	0.00135288	0.0002491	0.0145193	0.0162070
1977	-0.12637	0.00551660	-0.008817	0.0007620	0.0006678	0.00128039	0.0014349	0.0140586	0.0149677
1978	-0.01714	0.00491594	-0.007989	0.0008699	0.0007623	0.00133171	0.0011305	0.0143915	0.0154661
1979	-0.02092	0.00453541	-0.007704	0.0009927	0.0008699	0.00137338	0.0010484	0.0146804	0.0161611
1980	0.00499	0.00438997	-0.007911	0.0006489	0.0005686	0.00137600	0.0006005	0.0143666	0.0159447
1981	-0.00095	0.00422093	-0.007814	0.0004955	0.0004342	0.00138090	0.0008222	0.0141081	0.0157247
1982	-0.01100	0.00409268	-0.007674	0.0003312	0.0002903	0.00139823	0.0007549	0.0148440	0.0170400
1983	-0.00820	0.00416186	-0.008142	0.0005268	0.0004616	0.00149439	0.0007511	0.0156899	0.0183641

*Definition of variables(YGD, PGD, CP, etc.) are given at the end of this chapter(Table 5.20).

economy.[275]

The negative impact effects of increased taxes on budget deficits, money supply, and the price level are consistent with *a priori* expections--although the effects are relatively small in our case. Notice that total government revenues rise by more than 1.5 percent in the first year due to feedback effects. However, budget deficit does not improve much because of large endogenous responses in government expenditures--both consumption and investment. Consequently national income and output responds positively but moderately through the traditional multiplier effects. Disposable income also rises with the rise in income. It should be noted here that because of the endogenous response of government expenditures, the tax policy is not a pure tax policy in our model, it is at the same time an expansionary fiscal policy![276]

The effects of the tax policy change beyond the first year, however, are quite different. The budget deficit continuously rises as increased government revenues and national income triggers greater endogenous responses in government expenditures. The induced effect on private expenditures is also positive. As a result, national income

---

[275] Indeed, our simulation exercise(not reported here) with a 10 percent increase in average income tax rates suggest no adverse effects on all the major endogenous variables in the model. The gains in taxes and revenues are, however, very small given the country's small income tax base.

[276] See section 3.4 above for details on this issue.

and output continuously rises and reaches the peak multiplier value of 3 in the ninth year.[277] As one would expect, increased income boosts the imports demand thereby worsening the country's balance of payment situation, which leads to contraction of the domestic money supply. However, during the later half of the period the situation reverses due to gradual dampening effects of the policy on the overall economy.

One puzzling issue is the relatively small response in aggregate price level and the inflation rate throughout the sample period. In general, compared to many developing countries, the price level in Bangladesh shows remarkable stability throughout the sample period except for the high inflation period in the first half of the seventies. However, the food-grains prices do respond vigorously to the policy change in the model but the effect is not felt quite the same way in the general price level. This may be, in part, due to the nature of the aggregate price relation in our model, which is a weighted average of all the sectoral prices, and the weights are being endogenously determined by the forces of both demand and supply. All the services sector prices are assumed exogenously given while only the agricultural and manufacturing prices are endogenously

[277] In general, the leveling off period for the multipliers in our model is found to be quite long compared to that found in other developing country studies. For example, Vernardakis(1979) found a period of seven year for the Greek economy. For the developed countries the period is considerably shorter(3 to 4 years).

determined.

The impact effects of expansionary fiscal policy--1 percent increase in public consumption and investment--show an increase in income and output but with an worsening budget deficit situation(see Table 5.10), which are in line with the text book predictions. What is worth noting is the relatively small response: an impact multiplier of 0.25 for national output with a long-run peak of only 0.27 in the third year. Furthermore, in the long run the multiplier turns negative, and remains so for the full part of the post-independence period. The endogenous nature of government financing requirements leads to substantial 'crowding out' of both private and public investment expenditures, and in the long run generates contraction in income, output, and expenditures through the traditional multiplier effects.[278]

When the above two experiments are combined, which we might call a 'balanced budget' strategy, although not quite the same as balanced budget fiscal policy strictly means, the results are revealing. The estimated multipliers for selected endogenous variables are given in Table 5.11.

[278] Our simulation experiment(not reported here) with a 10 percent increase in public consumption expenditures only show even greater contraction in all the real variables and a larger balance of payment deficits. In fact, the results show no expansionary effects on income and output even in the short run.

Table 5.10

MULTIPLIERS: 1% INCREASE IN GOVERNMENT INVESTMENT AND CONSUMPTION

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	0.0025165	-0.0024904	0.012161	0.0100452	0.011967	0.002375	0.00011959	0.0017489	0.010546
1962	0.0018943	0.0006248	0.003641	0.0156883	0.004253	-0.003780	0.00014360	0.0007464	0.003447
1963	0.0027497	0.0002281	0.007120	0.0196433	0.008053	-0.007501	0.00010329	0.0012888	0.006444
1964	0.0017187	0.0010271	0.001523	0.0207011	0.002686	-0.009916	0.00010129	0.0002575	0.001518
1965	0.0020814	0.0008119	0.003560	0.0198005	0.004835	-0.007674	0.00011310	0.0005867	0.003278
1966	0.0002110	-0.0001315	-0.001242	0.0207234	-0.000167	-0.010414	0.00005541	-0.0013406	-0.001070
1967	0.0016296	0.0009211	0.002865	0.0195887	0.004572	-0.007475	0.00012760	0.0000784	0.002494
1968	0.0003377	0.0002113	-0.001123	0.0202704	0.000214	-0.008835	0.00007976	-0.0011781	-0.000966
1969	0.0015900	0.0009791	0.002084	0.0204069	0.003682	-0.004739	0.00037100	-0.0002375	0.001924
1970	0.0010619	0.0006010	0.000484	0.0207418	0.001731	-0.007582	0.00012607	-0.0007554	0.000525
1973	-0.0010165	0.0015470	-0.003808	0.0245837	-0.002172	-0.030049	-0.00010132	-0.0026826	-0.004325
1974	-0.0034623	0.0005385	-0.006818	0.0214123	-0.005133	-0.044554	-0.00030971	-0.0048099	-0.007792
1975	-0.0053769	0.0013834	-0.011909	0.0200307	-0.010482	-0.032986	-0.00074441	-0.0057917	-0.013826
1976	-0.0048734	-0.0012863	-0.006317	0.0129476	-0.005312	-0.027137	-0.00075293	-0.0049266	-0.007311
1977	-0.0047594	-0.0009930	-0.006866	0.0125026	-0.005669	-0.034588	-0.00075617	-0.0048504	-0.007851
1978	-0.0044669	-0.0013664	-0.006342	0.0128424	-0.005086	-0.023512	-0.00078278	-0.0045509	-0.007200
1979	-0.0037853	-0.0017749	-0.005105	0.0138758	-0.003801	-0.022794	-0.00066005	-0.0040371	-0.005726
1980	-0.0030884	-0.0022878	-0.003356	0.0143714	-0.002054	-0.014727	-0.00047101	-0.0035164	-0.003584
1981	-0.0027965	-0.0017984	-0.003237	0.0158554	-0.001782	-0.014478	-0.00036235	-0.0034927	-0.003364
1982	-0.0026069	-0.0009741	-0.003690	0.0168228	-0.001979	-0.017944	-0.00032214	-0.0034885	-0.003890
1983	-0.0026128	-0.0004277	-0.004101	0.0173224	-0.002294	-0.018374	-0.00035519	-0.0035981	-0.004356

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.004703	0.0000488	0.029391	0.0010438	0.005695	0.014140	-0.0004536	0.000765	0.000009
1962	0.003741	0.0007590	0.015812	0.0024019	0.006236	0.012388	0.0018415	0.001638	0.001322
1963	0.003150	0.0010489	0.012679	0.0031711	0.004494	0.006454	0.0016485	0.000747	-0.000758
1964	0.001591	0.0008309	0.008187	0.0024204	0.002522	0.002692	0.0023119	0.000620	-0.000039
1965	0.002303	0.0010478	0.004102	0.0017442	0.001702	0.001637	0.0015263	0.000056	0.000172
1966	-0.000443	0.0000508	-0.001240	0.0012557	0.001161	0.001041	0.0016254	0.001244	0.001107
1967	0.001765	0.0007477	0.002130	0.0008838	-0.000128	-0.001372	0.0005447	-0.000605	0.001118
1968	0.000008	0.0001842	0.000065	0.0010829	0.000169	-0.000876	0.0009110	-0.001270	0.001703
1969	0.002809	0.0007747	0.004421	0.0014057	-0.000068	-0.001726	0.0004398	-0.006858	0.005323
1970	0.001232	0.0005346	0.001806	0.0014591	0.000456	-0.000496	0.0005868	-0.015017	0.003824
1973	-0.001704	-0.0002268	-0.003851	-0.0002108	-0.002620	-0.003860	0.0000462	-0.008233	-0.007889
1974	-0.005011	-0.0008844	-0.007719	-0.0023178	-0.010713	-0.018336	-0.0009781	-0.019675	-0.020436
1975	-0.004479	-0.0017651	-0.003737	-0.0051157	-0.015188	-0.028671	-0.0040342	-0.058421	-0.063993
1976	-0.010552	-0.0016395	-0.013739	-0.0065829	-0.014240	-0.032638	-0.0033520	-0.027560	-0.028547
1977	-0.011793	-0.0016105	-0.017617	-0.0056570	-0.014600	-0.038022	-0.0041842	-0.035269	-0.036218
1978	-0.007011	-0.0016067	-0.012549	-0.0049338	-0.010532	-0.017830	-0.0043116	-0.030866	-0.031320
1979	-0.007198	-0.0015017	-0.011938	-0.0037578	-0.009654	-0.018776	-0.0041090	-0.026331	-0.026035
1980	-0.005374	-0.0013954	-0.008804	-0.0024351	-0.006083	-0.010131	-0.0034537	-0.015262	-0.014233
1981	-0.004894	-0.0013365	-0.007751	-0.0016266	-0.004661	-0.008414	-0.0028470	-0.008067	-0.008477
1982	-0.004377	-0.0012035	-0.006673	-0.0016305	-0.005867	-0.013368	-0.0024770	-0.007430	-0.007123
1983	-0.004147	-0.0011866	-0.008078	-0.0019796	-0.006348	-0.012910	-0.0024091	-0.009408	-0.009156

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	0.016048	-0.0003975	-0.00675	0.007607	0.010865	0.000765	0.0031404	0.0006081	-0.0029678
1962	0.004440	-0.0066237	-0.01309	-0.000370	0.003445	0.001638	0.0030728	0.0004661	0.0002331
1963	0.009108	-0.0059300	-0.00794	0.002017	0.006543	0.000747	0.0040762	0.0007152	-0.0000596
1964	0.001374	-0.0059087	-0.00159	-0.002306	0.001430	0.000620	0.0028395	0.0004283	0.0018680
1965	0.004354	-0.0030546	-0.00317	0.000442	0.003319	0.000056	0.0028256	0.0005241	0.0006130
1966	-0.002239	-0.0022505	0.00548	-0.002314	-0.001192	0.001244	0.0010860	0.0000625	0.0023797
1967	0.003716	0.0000632	-0.00448	0.002593	0.002653	-0.000605	0.0016567	0.0003946	-0.0002052
1968	-0.001835	-0.0007891	-0.00125	-0.000475	-0.001076	-0.001270	0.0004489	0.0000949	0.0014953
1969	0.002757	0.0004277	-0.32571	0.005118	0.001970	-0.006858	0.0010566	0.0003034	-0.0004645
1970	0.000506	-0.0003392	0.01098	0.001542	0.000467	-0.015017	0.0007855	0.0003563	0.0003078
1973	-0.003439	-0.0007002	0.00366	-0.019624	-0.004374	-0.008233	-0.0006761	-0.0001901	0.0014159
1974	-0.007485	0.0003675	0.02022	-0.022521	-0.007846	-0.019675	-0.0029077	-0.0008199	0.0021030
1975	-0.013173	0.0008086	0.04954	-0.023805	-0.013937	-0.058421	-0.0062369	-0.0012211	0.0026912
1976	-0.009834	0.0051879	0.03995	-0.012162	-0.007181	-0.027560	-0.0069216	-0.0012147	-0.0015753
1977	-0.011555	0.0055068	0.11400	-0.013537	-0.007846	-0.035269	-0.0078742	-0.0011894	-0.0023112
1978	-0.010191	0.0058960	0.07242	-0.011771	-0.007194	-0.030866	-0.0081862	-0.0011060	-0.0026074
1979	-0.009210	0.0056454	0.03982	-0.009330	-0.005761	-0.026331	-0.0081326	-0.0009810	-0.0031901
1980	-0.006845	0.0055216	0.02470	-0.006024	-0.003716	-0.015262	-0.0074337	-0.0008288	-0.0033759
1981	-0.006202	0.0047378	0.04244	-0.004796	-0.003566	-0.008067	-0.0067849	-0.0007336	-0.0034082
1982	-0.006265	0.0040826	0.03476	-0.004575	-0.004080	-0.007430	-0.0063876	-0.0006651	-0.0030519
1983	-0.006407	0.0037774	0.02853	-0.005274	-0.004523	-0.009408	-0.0062038	-0.0006438	-0.0027472

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	-0.014844	0.0000000	0.0000000	-0.0004536	-0.0003975	0.00028045	-0.0000145	0.007801	0.007283
1962	-0.028069	0.0019282	-0.0065484	-0.0000865	-0.0000758	0.00024303	-0.0030233	0.003991	0.005945
1963	-0.007854	0.0020012	-0.0056233	-0.0003520	-0.0003085	0.00030812	-0.0001490	0.006530	0.007501
1964	-0.009398	0.0023552	-0.0058711	-0.0000432	-0.0000378	0.00020648	-0.0004298	0.002494	0.004929
1965	-0.002406	0.0016684	-0.0029306	-0.0001419	-0.0001244	0.00024660	0.0010563	0.004047	0.004826
1966	-0.010988	0.0014709	-0.0023854	0.0001543	0.0001352	0.00005203	0.0001934	-0.001187	0.001918
1967	0.010542	0.0006272	0.0001354	-0.0000824	-0.0000723	0.00020921	0.0011677	0.003383	0.002594
1968	0.021061	0.0007369	-0.0009415	0.0001740	0.0001525	0.00007670	-0.0003056	-0.000749	0.000780
1969	0.010034	0.0002637	0.0002734	0.0001760	0.0001542	0.00031165	0.0011368	0.002890	0.001635
1970	0.003858	0.0003993	-0.0005033	0.0001874	0.0001642	0.00019220	-0.0001510	0.001122	0.001245
1973	0.002326	0.0003241	-0.0004568	-0.0002778	-0.0002435	-0.00012995	-0.0003812	-0.002805	-0.002364
1974	-0.003019	-0.0001840	0.0010643	-0.0007942	-0.0006961	-0.00047778	-0.0000137	-0.007274	-0.006351
1975	0.001768	-0.0010278	0.0034556	-0.0030095	-0.0026379	-0.00088387	-0.0009193	-0.012486	-0.012739
1976	0.005024	-0.0021823	0.0062217	-0.0011722	-0.0010274	-0.00088370	0.0011324	-0.008600	-0.011502
1977	0.014432	-0.0026590	0.0068562	-0.0015292	-0.0013403	-0.00087661	-0.0005155	-0.008874	-0.011364
1978	-0.004115	-0.0030241	0.0070359	-0.0012914	-0.0011319	-0.00086346	-0.0004898	-0.008641	-0.010802
1979	-0.015769	-0.0030854	0.0065512	-0.0010268	-0.0008999	-0.00074405	-0.0005828	-0.007593	-0.009520
1980	-0.007161	-0.0029940	0.0059282	-0.0004610	-0.0004040	-0.00057564	-0.0002425	-0.005981	-0.007401
1981	0.003562	-0.0026754	0.0048894	-0.0001721	-0.0001509	-0.00047698	-0.0004203	-0.005298	-0.006217
1982	0.007201	-0.0023815	0.0041669	-0.0000957	-0.0000839	-0.00042905	-0.0003695	-0.004999	-0.005969
1983	0.010068	-0.0022102	0.0039528	-0.0001993	-0.0001747	-0.00044206	-0.0003089	-0.004993	-0.006121

* Definition of variables(YGD, PGD, etc.) are given at the end of this chapter(Table 5.20)

The time path of some of the important multipliers are also graphically presented in Fig. 5.21-28. Our results show that the balanced budget multiplier for output and income is positive. The impact multiplier for GDP is relatively small(0.4) but it shows gradual increment over time leveling off at 1.3 in the 10th year. Regarding the direction of effects on the endogenous variables it appears that the tax financed endogenous expansionary effects dominates the government expenditure initiated effects. This expansionary effects, however, generates inflationary trend, although with a long lag(3 years), despite the fact that money supply shrinks continuously. The contraction in money supply is triggered by the continuous deterioration of the balance of payment as a result of increasing imports demand. Note that the budget deficit in the first year rises by 1.23 percent despite increases in both expenditures and revenues by the same percentage point. This is expected because of low tax base and more than proportionate endogenous responses in government expenditures. Like the income multiplier the budget deficit multiplier also levels off around the 10th year but with a higher value(1.76).

To analyze the impact of agricultural price support and subsidies in Bangladesh, the model is simulated for a sustained 1 percent increase in food-grains prices under the assumption that a relaxation of these subsidies and support programs will increase the market price of food-grains. The result is mixed(see Table 5.12). The impact effect on both food production as well as aggregate output is negative. For the food sector this may be due to supply lags, and for the other sectors increased food price may be contractionary

Table 5.11

MULTIPLIERS: 1% INCREASE IN BOTH GOVERNMENT EXPENDITURES AND TAXES

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960	.	.	.	.	.	.	.	.	.
1961	0.0044941	-0.0044399	0.0206303	0.0145133	0.0200686	0.008294	0.00000442	0.0033655	0.0182580
1962	0.0050901	0.0021677	0.0096093	0.0226193	0.0102697	0.002891	0.00013518	0.0033554	0.0092324
1963	0.0079236	-0.0005821	0.0210677	0.0292638	0.0216784	0.002690	-0.00011353	0.0056075	0.0194677
1964	0.0072746	0.0018952	0.0112202	0.0322420	0.0124949	-0.000273	0.00013794	0.0048284	0.0110165
1965	0.0085569	0.0004406	0.0167795	0.0323227	0.0179998	0.002406	0.00028952	0.0059346	0.0160783
1966	0.0077694	0.0041527	0.0099360	0.0341487	0.0111217	0.000742	0.00050819	0.0043826	0.0099380
1967	0.0096672	0.0016049	0.0188772	0.0348274	0.0205059	0.005274	0.00088620	0.0063144	0.0179583
1968	0.0091125	0.0046586	0.0127203	0.0357516	0.0141599	0.008973	0.00128682	0.0052027	0.0127220
1969	0.0123948	0.0025150	0.0231700	0.0395131	0.0245954	0.025067	0.00332748	0.0073627	0.0227109
1970	0.0129354	0.0067559	0.0191040	0.0401135	0.0203968	0.023740	0.00242027	0.0067195	0.0190403
1973	0.0074313	0.0091237	0.0004871	0.0452943	0.0030689	-0.013577	0.00038437	0.0034881	0.0014513
1974	0.0042801	0.0069640	-0.0012109	0.0394070	0.0012124	-0.023146	0.00017553	0.0012130	-0.0007746
1975	0.0018883	0.0059280	-0.0048464	0.0483784	-0.0024677	-0.020474	-0.00014927	-0.0006201	-0.0051679
1976	0.0009137	0.0033898	-0.0033894	0.0336661	-0.0014549	-0.017099	-0.00028247	-0.0007822	-0.0031269
1977	0.0004037	0.0021642	-0.0033700	0.0305138	-0.0012762	-0.021247	-0.00032062	-0.0011153	-0.0029558
1978	0.0004966	0.0008549	-0.0022476	0.0304153	-0.0001088	-0.012461	-0.00032075	-0.0009367	-0.0015354
1979	0.0011762	-0.0001086	-0.0005101	0.0319744	0.0017210	-0.008914	-0.00016758	-0.0004471	0.0006413
1980	0.0019629	-0.0005351	0.0010982	0.0311882	0.0033084	-0.002966	0.00002961	0.0000906	0.0025694
1981	0.0023511	-0.0002475	0.0015541	0.0324302	0.0039080	-0.002205	0.00017345	0.0001684	0.0030444
1982	0.0028805	-0.0001682	0.0021215	0.0342071	0.0047981	-0.002425	0.00020405	0.0003845	0.0038137
1983	0.0033097	0.0001344	0.0022248	0.0361829	0.0050890	-0.002548	0.00023555	0.0005646	0.0040249

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960	.	.	.	.	.	.	.	.	.
1961	0.0072416	0.00008679	0.0460945	0.0113812	0.0117216	0.012340	-0.0010805	-0.002161	-0.005739
1962	0.0090287	0.00218052	0.0322935	0.0149463	0.0159538	0.017570	0.0025572	-0.003444	-0.005083
1963	0.0077627	0.00261862	0.0336503	0.0180726	0.0174128	0.016436	0.0022487	-0.008612	-0.015834
1964	0.0074630	0.00281829	0.0471652	0.0176647	0.0165233	0.014624	0.0050616	-0.006106	-0.009624
1965	0.0088313	0.00332371	0.0228523	0.0174328	0.0161791	0.014219	0.0048213	-0.003947	-0.003936
1966	0.0098447	0.00654055	0.0201975	0.0191792	0.0173404	0.014995	0.0056699	-0.003536	0.002290
1967	0.0114280	0.00337121	0.0222114	0.0208913	0.0164857	0.011070	0.0048580	-0.004318	0.007504
1968	0.0150062	0.00465660	0.0303733	0.0220407	0.0188066	0.015111	0.0066179	-0.006788	0.022988
1969	0.0262335	0.00458921	0.0489889	0.0275203	0.0208243	0.013290	0.0073095	-0.031608	0.051353
1970	0.0261794	0.00637513	0.0439045	0.0280148	0.0226488	0.017552	0.0092554	-0.079987	0.069081
1973	0.0053118	0.00164859	0.0124166	0.0240999	0.0195014	0.017134	0.0062927	-0.011302	-0.005417
1974	0.0033752	0.00109047	0.0051194	0.0174272	0.0111979	0.005541	0.0046827	-0.010019	-0.008706
1975	0.0009827	0.00061433	0.0022871	0.0133390	0.0044644	-0.007416	0.0018461	-0.032122	-0.034336
1976	-0.0031217	0.00030431	-0.0041126	0.0100349	0.0030331	-0.013792	0.0010528	-0.019194	-0.018932
1977	-0.0044280	0.00013429	-0.0070262	0.0106777	0.0039009	-0.013849	-0.0003276	-0.024637	-0.024526
1978	-0.0022924	0.00017813	-0.0047899	0.0120071	0.0041871	-0.006009	-0.0009110	-0.020163	-0.019930
1979	-0.0015210	0.00046888	-0.0029691	0.0138651	0.0073224	-0.002799	-0.0009969	-0.013731	-0.013199
1980	0.0001599	0.00089278	0.0003058	0.0152190	0.0090155	0.002133	-0.0006410	-0.004343	-0.003864
1981	0.0018339	0.00112997	0.0028656	0.0162948	0.0120453	0.006791	-0.0002279	0.001357	0.001334
1982	0.0025525	0.00133595	0.0038663	0.0173475	0.0143289	0.008984	0.0000075	0.002320	0.002109
1983	0.0025572	0.00150864	0.0049073	0.0182779	0.0138703	0.007250	0.0002725	0.002672	0.002671

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960	.	.	.	.	.	.	.	.	.
1961	0.0273785	-0.000947	-0.0106	0.012234	0.0184315	-0.002161	0.0053074	0.00116183	-0.0052199
1962	0.0124896	-0.011953	-0.0267	0.001679	0.0090922	-0.003444	0.0066532	0.00123987	-0.0013098
1963	0.0277755	-0.013372	-0.0211	0.004592	0.0193614	-0.008612	0.0106352	0.00210720	-0.0019392
1964	0.0138490	-0.017382	-0.0092	-0.002672	0.0105317	-0.006106	0.0097482	0.00173616	0.0022288
1965	0.0213351	-0.013997	-0.0177	0.000518	0.0156460	-0.003947	0.0107797	0.00210959	0.0003180
1966	0.0123183	-0.013667	-0.0893	0.001798	0.0095350	-0.003536	0.0104301	0.00187389	0.0019150
1967	0.0241290	-0.010525	-0.0467	0.007920	0.0174841	-0.004318	0.0125251	0.00231049	0.0006450
1968	0.0161367	-0.012246	-0.5858	0.015415	0.0121906	-0.006788	0.0126584	0.00214856	0.0017286
1969	0.0299601	-0.009807	-3.6091	0.042662	0.0219121	-0.031608	0.0160893	0.00239745	0.0002778
1970	0.0242256	-0.011494	0.2669	0.047309	0.0184249	-0.079987	0.0179674	0.00360476	0.0008256
1973	0.0073335	-0.014375	-0.0118	-0.032963	0.0005595	-0.011302	0.0134924	0.00259929	0.0074789
1974	0.0039975	-0.009657	-0.0134	-0.013600	-0.0013936	-0.010019	0.0097831	0.00111938	0.0065427
1975	-0.0016987	-0.006040	-0.0303	-0.015026	-0.0056716	-0.032122	0.0055908	0.00056833	0.0062698
1976	-0.0021635	-0.001545	0.0120	-0.009174	-0.0038524	-0.019194	0.0029128	0.00027205	0.0036065
1977	-0.0037975	0.000123	0.0455	-0.009912	-0.0038509	-0.024637	0.0007033	0.00011665	0.0020457
1978	-0.0030497	0.001197	0.0276	-0.007371	-0.0025495	-0.020163	-0.0005052	0.00013200	0.0007654
1979	-0.0016803	0.001432	0.0099	-0.003895	-0.0005757	-0.013731	-0.0008491	0.00025537	-0.0003263
1980	0.0001831	0.001204	-0.0009	-0.000515	0.0012159	-0.004343	-0.0004666	0.00043713	-0.0008897
1981	0.0011575	0.000483	-0.0157	0.001193	0.0017118	0.001357	0.0000837	0.00054706	-0.0008461
1982	0.0019825	-0.000270	-0.0201	0.001758	0.0023458	0.002320	0.0006946	0.00071734	-0.0007154
1983	0.0022324	-0.000892	-0.0173	0.001718	0.0024539	0.002672	0.0011724	0.00082382	-0.0004451

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960	.	.	.	.	.	.	.	.	.
1961	-0.026464	0.00000000	0.000000	-0.0010805	-0.0009470	0.00041163	-0.0004805	0.0133470	0.0126085
1962	-0.059653	0.00331145	-0.011302	-0.0007517	-0.0006588	0.00051222	-0.0055673	0.0111884	0.0123965
1963	-0.054349	0.00405157	-0.011817	-0.0017956	-0.0015738	0.00067857	-0.0021348	0.0184696	0.0198550
1964	-0.029160	0.00602654	-0.016555	-0.0009591	-0.0008406	0.00069008	-0.0032338	0.0126667	0.0177266
1965	-0.016245	0.00569681	-0.013245	-0.0008706	-0.0007630	0.00090306	0.0004555	0.0163427	0.0203157
1966	0.043254	0.00606323	-0.013329	-0.0003910	-0.0003427	0.00094009	-0.0004463	0.0139639	0.0171012
1967	-0.025409	0.00529366	-0.010149	-0.0004334	-0.0003798	0.00130103	0.0016537	0.0193956	0.0213446
1968	-0.090549	0.00604261	-0.012741	0.0005719	0.0005012	0.00146278	0.0000778	0.0173053	0.0196103
1969	-0.027892	0.00569944	-0.011194	0.0016010	0.0014029	0.00267637	0.0053176	0.0251553	0.0258311
1970	-0.043210	0.00667898	-0.013706	0.0025593	0.0022425	0.00258129	0.0019696	0.0258126	0.0261714
1973	0.005786	0.00690815	-0.013847	-0.0006113	-0.0005357	0.00113056	-0.0020593	0.0106630	0.0144520
1974	-0.006418	0.00535833	-0.009073	-0.0006720	-0.0005890	0.00049993	0.0012727	0.0061983	0.0073644
1975	-0.002154	0.00369881	-0.004429	-0.0018459	-0.0016179	0.00010815	0.0006571	0.0007309	0.0005754
1976	0.004755	0.00202345	-0.000697	-0.0009687	-0.0008490	-0.00007553	0.0012608	0.0002526	-0.0016602
1977	-0.060032	0.00087907	0.001181	-0.0012057	-0.0010567	-0.00015273	0.0001932	-0.0008013	-0.0027598
1978	-0.014384	0.00006112	0.002051	-0.0009721	-0.0008519	-0.00014718	0.0000548	-0.0006885	-0.0023769
1979	-0.037110	-0.00034292	0.002006	-0.0006542	-0.0005733	-0.00000997	-0.0000247	0.0005399	-0.0007539
1980	-0.005945	-0.00041903	0.001398	-0.0002221	-0.0001946	0.00017362	0.0000745	0.0020736	0.0013549
1981	0.002089	-0.00024650	0.000467	0.0000186	0.0000163	0.00029893	0.0000270	0.0028730	0.0027294
1982	0.000692	-0.00001551	-0.000291	0.0000230	0.0000202	0.00037656	-0.0000146	0.0037488	0.0039929
1983	0.005569	0.00023164	-0.000927	0.0000409	0.0000358	0.00043319	0.0000272	0.0043432	0.0047863

* Definition of variables are given at the end of this chapter(Table 5.20)

Table 5.12

MULTIPLIERS: 1% SUSTAINED INCREASE IN FOODGRAINS PRICES

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	-0.0003148	0.0040369	-0.002663	-0.0000084	-0.002419	-0.000378	0.0000721	-0.0003944	-0.002455
1962	0.0006241	0.0054357	0.001196	0.0001665	0.001143	0.000071	0.0001882	0.0002338	0.000960
1963	-0.0000793	0.0049690	-0.005113	0.0009727	-0.004659	-0.000555	0.0003232	-0.0001655	-0.004574
1964	0.0002522	0.0047572	-0.002155	0.0012153	-0.001951	0.002440	0.0007003	0.0000661	-0.001997
1965	0.0004333	0.0043895	-0.001901	0.0017632	-0.001613	0.005076	0.0010003	0.0001656	-0.001652
1966	0.0012288	0.0054283	0.002429	0.0022014	0.002418	0.008992	0.0011965	0.0002845	0.002272
1967	0.0013286	0.0058466	-0.003908	0.0060235	-0.002894	0.024375	0.0036230	0.0004090	-0.002808
1968	0.0047694	0.0058455	0.015077	0.0057812	0.014496	0.038085	0.0036122	0.0023702	0.014319
1969	0.0124055	0.0028112	0.031173	0.0186718	0.030083	0.107187	0.0136410	0.0068761	0.030879
1970	0.0134084	0.0105670	0.030460	0.0122892	0.029342	0.054481	0.0038753	0.0069318	0.028846
1973	0.0059812	0.0184745	-0.008732	0.0081739	-0.007758	-0.047163	-0.0004314	0.0044331	-0.010332
1974	0.0028480	0.0156218	-0.008454	0.0026947	-0.007789	-0.045569	-0.0005657	0.0026238	-0.010156
1975	0.0004452	0.0151832	-0.011729	-0.0018575	-0.011288	-0.029301	-0.0011723	0.0015488	-0.014124
1976	-0.0001290	0.0082555	-0.003808	-0.0046628	-0.003852	-0.022267	-0.0011037	0.0005008	-0.005265
1977	-0.0007239	0.0069002	-0.004781	-0.0051659	-0.004805	-0.027114	-0.0010664	0.0000797	-0.006213
1978	-0.0018441	0.0102915	-0.008465	-0.0059272	-0.008299	-0.020499	-0.0012273	-0.0009632	-0.010376
1979	-0.0018028	0.0086970	-0.007084	-0.0056518	-0.006986	-0.020781	-0.0010948	-0.0008314	-0.008682
1980	-0.0015467	0.0084445	-0.005803	-0.0042095	-0.005686	-0.014648	-0.0008525	-0.0008042	-0.007074
1981	-0.0012679	0.0078580	-0.005171	-0.0028879	-0.004997	-0.014712	-0.0007432	-0.0006953	-0.006244
1982	-0.0014483	0.0084531	-0.006414	-0.0025792	-0.006094	-0.018429	-0.0006829	-0.0008433	-0.007627
1983	-0.0017686	0.0087531	-0.007089	-0.0028782	-0.006734	-0.018314	-0.0008151	-0.0010799	-0.008409

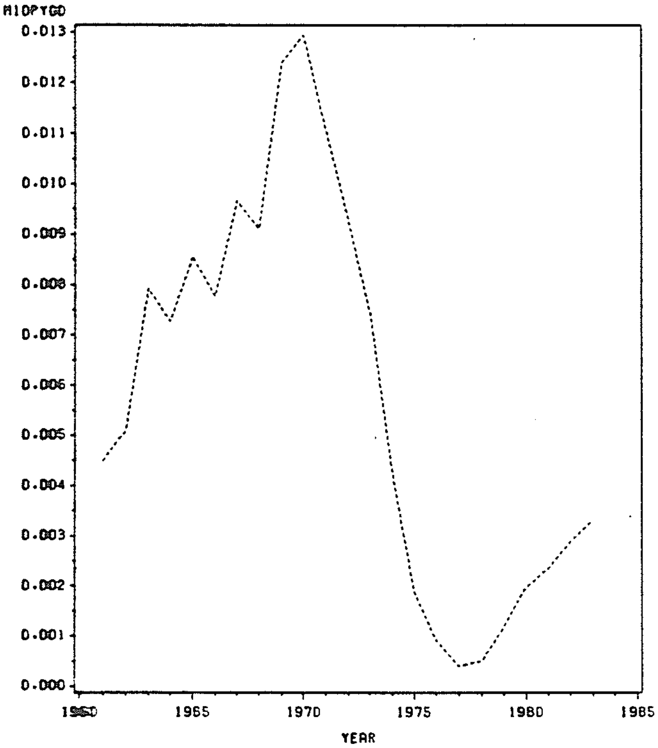
YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.002069	0.00073237	0.002783	0.0000464	0.000072	0.000120	-0.0000477	-0.00034	0.00240
1962	0.002718	0.00172644	0.005274	0.0005817	0.000416	0.000150	0.0005846	-0.00171	0.00542
1963	0.003211	0.00158755	0.002765	0.0019046	-0.000024	-0.002879	0.0024593	-0.00531	0.01069
1964	0.004184	0.00144108	0.019853	0.0017449	0.000662	-0.001139	0.0024168	-0.00756	0.02061
1965	0.006019	0.00165350	0.015772	0.0026084	0.001302	-0.000741	0.0024157	-0.01066	0.02100
1966	0.009175	0.00349944	0.019631	0.0036707	0.002368	0.000705	0.0031456	-0.01776	0.03915
1967	0.022703	0.00202380	0.053099	0.0091006	0.004428	-0.001317	0.0058258	-0.03694	0.06968
1968	0.031292	0.00352191	0.067460	0.0100198	0.007323	0.004242	0.0057619	-0.06468	0.11080
1969	0.085835	0.00467838	0.175177	0.0351655	0.018126	-0.001048	0.0141376	-0.21421	0.25487
1970	0.044815	0.00771124	0.078698	0.0166894	0.015526	0.014420	0.0135012	-0.44066	0.18589
1973	-0.008103	0.00131649	-0.015751	-0.0026703	0.005345	0.009472	0.0024809	-0.12910	-0.11776
1974	-0.007046	0.00071444	-0.009069	-0.0057082	-0.001347	0.002613	0.0014095	-0.10765	-0.10657
1975	-0.003783	0.00012767	-0.000048	-0.0069265	-0.006449	-0.005811	-0.0040975	-0.14928	-0.15988
1976	-0.011119	-0.00005407	-0.013747	-0.0078230	-0.009115	-0.012221	-0.0004242	-0.06403	-0.06317
1977	-0.012085	-0.00025451	-0.018403	-0.0069405	-0.011609	-0.023836	-0.0014700	-0.07390	-0.07306
1978	-0.001415	-0.00067897	-0.008870	-0.0077979	-0.010150	-0.013217	-0.0013511	-0.06706	-0.06420
1979	-0.004174	-0.00073030	-0.010349	-0.0062486	-0.011051	-0.018481	-0.0010689	-0.06080	-0.05599
1980	-0.002646	-0.00071584	-0.007149	-0.0048173	-0.008610	-0.012819	-0.0000913	-0.04290	-0.03490
1981	-0.005055	-0.00062215	-0.008921	-0.0037937	-0.008333	-0.013945	0.0005057	-0.03025	-0.02578
1982	-0.004752	-0.00068473	-0.008296	-0.0040082	-0.009812	-0.020088	0.0008107	-0.02956	-0.02340
1983	-0.003236	-0.00081904	-0.008997	-0.0047654	-0.009799	-0.017358	0.0003763	-0.03595	-0.03028

YEAR	PF	QJ	NFA	INVP	M10PYD	H	NWAG	NWMF	RW
1960									
1961	0.0062650	-0.000042	-0.001	-0.00031	-0.002379	-0.00034	0.0011988	-0.00010803	-0.0008266
1962	0.0112958	-0.002667	-0.004	0.00285	0.001131	-0.00171	0.0038814	0.00012176	-0.0025990
1963	0.0018069	-0.005556	-0.002	0.00050	-0.004699	-0.00531	0.0027336	-0.00007325	0.0021409
1964	0.0059310	-0.002744	-0.004	0.00642	-0.002023	-0.00756	0.0032873	-0.00007068	0.0008936
1965	0.0063995	-0.001976	-0.012	0.01174	-0.001772	-0.01066	0.0035904	0.00000404	0.0011989
1966	0.0121198	-0.001447	-0.087	0.01912	0.002331	-0.01776	0.0058576	0.00024785	-0.0013738
1967	0.0025037	-0.001933	-0.112	0.05685	-0.003619	-0.03694	0.0047813	-0.00054542	0.0044734
1968	0.0293210	0.003623	-1.301	0.07452	0.014449	-0.06468	0.0119417	0.00124695	-0.0057363
1969	0.0488923	0.001172	-12.906	0.20636	0.029481	-0.21421	0.0216525	-0.00046224	-0.0003139
1970	0.0491763	-0.006462	0.478	0.12420	0.029377	-0.44066	0.0292183	0.00700721	-0.0042349
1973	0.0064478	-0.028911	0.015	-0.17725	-0.010030	-0.12910	0.0196746	0.00301922	0.0140031
1974	0.0049248	-0.022793	0.024	-0.08371	-0.009729	-0.10765	0.0138756	0.00074391	0.0102044
1975	0.0002186	-0.017203	0.001	-0.05254	-0.013727	-0.14928	0.0087342	0.00031373	0.0082548
1976	0.0069389	-0.007685	0.040	-0.02639	-0.004328	-0.06403	0.0076355	-0.00003911	0.0042827
1977	0.0041697	-0.007649	0.119	-0.02680	-0.005464	-0.07390	0.0057969	-0.00017914	0.0040392
1978	0.0043732	-0.007735	0.051	-0.02528	-0.009602	-0.06706	0.0047253	-0.00039923	0.0027789
1979	0.0044532	-0.007732	0.035	-0.02071	-0.007995	-0.06080	0.0041460	-0.00047841	0.0022412
1980	0.0064205	-0.006826	0.020	-0.01501	-0.006425	-0.04290	0.0045500	-0.00045157	0.0013693
1981	0.0067731	-0.006779	0.049	-0.01352	-0.005695	-0.03025	0.0048928	-0.00033985	0.0018527
1982	0.0057033	-0.006969	0.043	-0.01447	-0.007092	-0.02956	0.0047495	-0.00037406	0.0022726
1983	0.0055253	-0.007002	0.032	-0.01621	-0.007819	-0.03595	0.0046096	-0.00039170	0.0021663

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	0.024063	0.00000000	0.000000	-0.0000477	-0.0000418	0.00000184	0.000093	0.0015274	-0.002025
1962	-0.012522	0.00074815	-0.002524	-0.0001634	-0.0001432	0.00014637	-0.001058	0.0062713	-0.000530
1963	-0.009195	0.00191888	-0.006026	0.0005394	0.0004727	0.00015151	-0.001249	0.0003643	-0.003305
1964	0.002479	0.00152521	-0.003521	0.0008902	0.0007801	0.00035980	0.002004	0.0026939	-0.003073
1965	-0.004095	0.00149592	-0.002779	0.0009184	0.0008048	0.00054883	0.001709	0.0026996	-0.002702
1966	0.012057	0.00156022	-0.002830	0.0015829	0.0013871	0.00074068	0.001976	0.0076206	-0.000004
1967	0.004166	0.00226891	-0.005027	0.0035488	0.0031093	0.00180116	0.005366	0.0029914	-0.001919
1968	0.000032	0.00126828	-0.000308	0.0044879	0.0039320	0.00240569	0.008429	0.0200918	0.008534
1969	-0.039435	0.00358933	-0.007960	0.0105106	0.0092051	0.00733389	0.020861	0.0336066	0.025433
1970	-0.079000	0.00629076	-0.012659	0.0071654	0.0062767	0.00449038	0.002331	0.0395463	0.032298
1973	0.019248	0.00960323	-0.022868	-0.0070546	-0.0061851	0.00076595	-0.013020	0.0080073	0.008895
1974	-0.008399	0.00785535	-0.017283	-0.0063957	-0.0056071	-0.00007965	-0.000635	0.0053197	-0.001807
1975	-0.000904	0.00549158	-0.008915	-0.0095367	-0.0083626	-0.00060210	-0.001261	0.0008463	-0.010360
1976	0.012860	0.00348763	-0.004283	-0.0038982	-0.0034171	-0.00067992	0.001450	0.0029510	-0.008663
1977	-0.066063	0.00285517	-0.003883	-0.0043129	-0.0037806	-0.00070702	-0.002455	0.0006468	-0.008637
1978	0.037082	0.00246760	-0.004411	-0.0038093	-0.0033391	-0.00088341	-0.002770	-0.0001935	-0.011799
1979	-0.060842	0.00228212	-0.004816	-0.0033434	-0.0029307	-0.00082913	-0.002523	-0.0000613	-0.011926
1980	-0.003488	0.00215772	-0.004868	-0.0022442	-0.0019670	-0.00067239	-0.001670	0.0013368	-0.011027
1981	-0.004223	0.00225007	-0.005261	-0.0017404	-0.0015254	-0.00056803	-0.001849	0.0016078	-0.009965
1982	0.005149	0.00236905	-0.005614	-0.0015547	-0.0013626	-0.00054404	-0.001872	0.0007838	-0.010429
1983	0.005474	0.00231723	-0.005314	-0.0019364	-0.0016972	-0.00063165	-0.002019	0.0002829	-0.011169

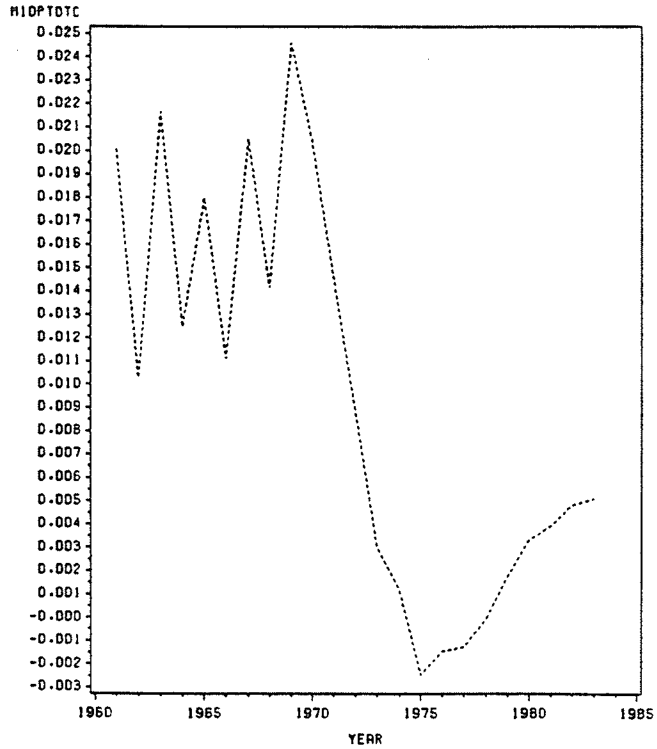
* Definition of variables are given at the end of this chapter(5.20)

FIGURE 5.21 DYNAMIC MACRO SIMULTION 1961–83 B
GDP, MILL CONST TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



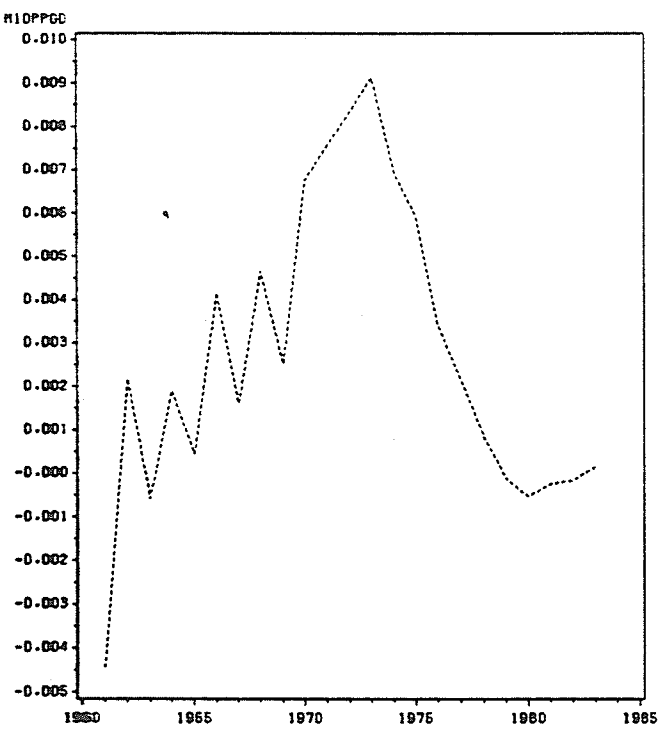
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.22 DYNAMIC MACRO SIMULTION 1961–83 B
TOTAL CONSUMPTION , MILL CONST TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



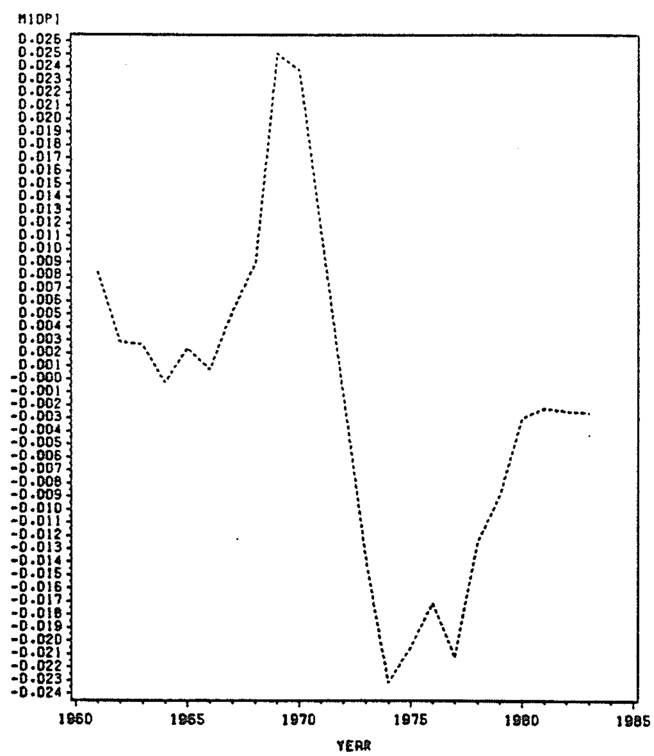
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.23 DYNAMIC MACRO SIMULTION 1961–83 B
AGGREGATE PRICE LEVEL:1973=100
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



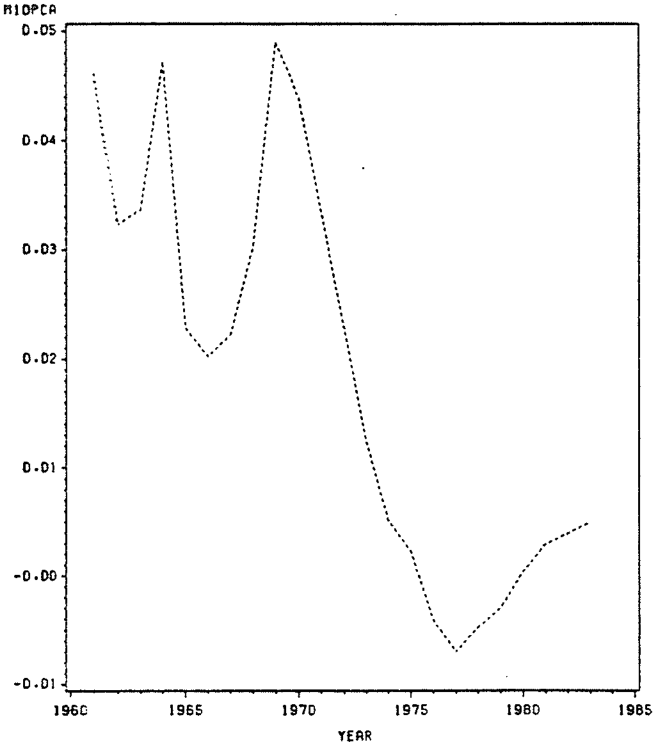
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.24 DYNAMIC MACRO SIMULTION 1961–83 B
TOTAL INVESTMENT, MILL CONST TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



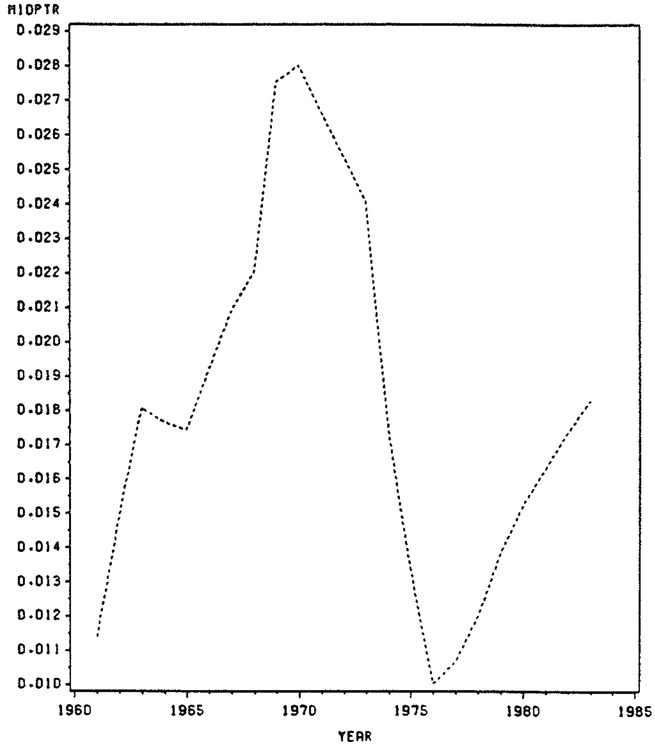
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.25 DYNAMIC MACRO SIMULTION 1961–83 B
CURRENT ACCOUNT BALANCE, MILL TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



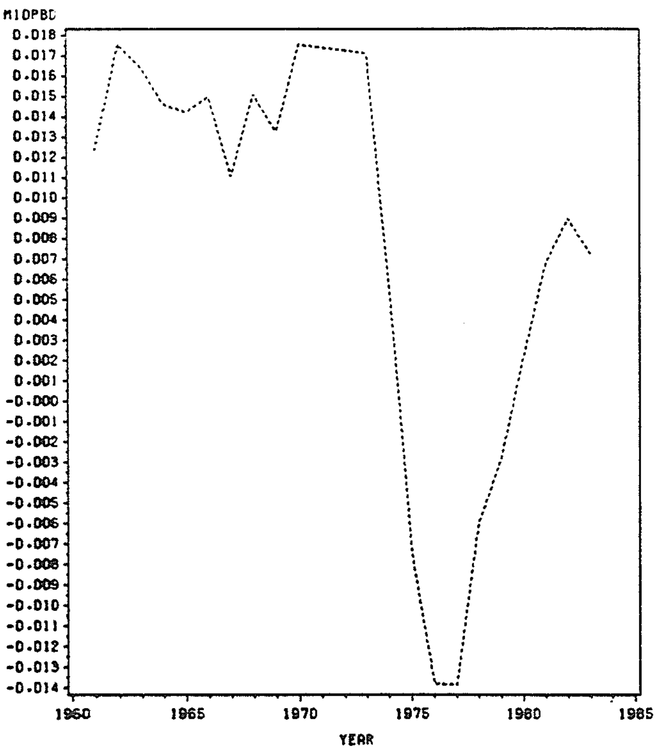
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.26 DYNAMIC MACRO SIMULTION 1961–83 B
GOVERNMENT REVENUES, MILL TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



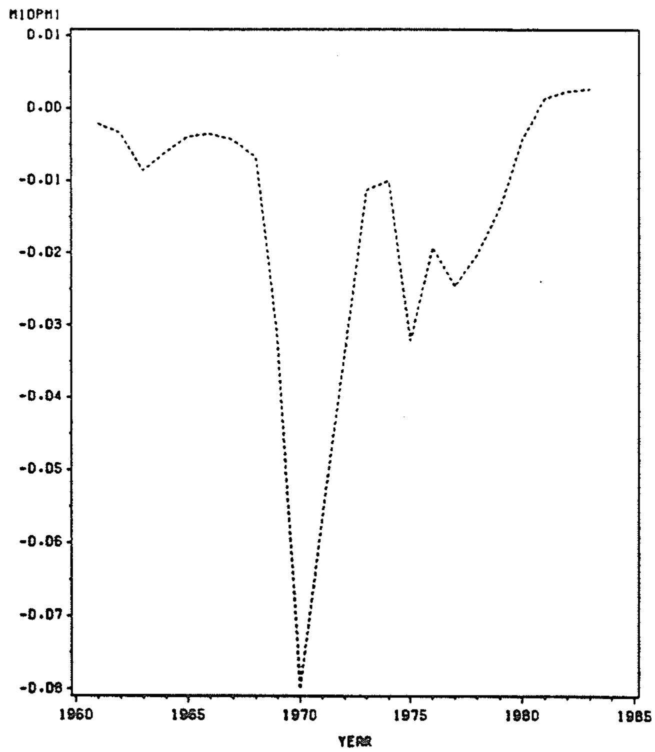
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.27 DYNAMIC MACRO SIMULTION 1961–83 B
BUDGET DEFICITS, MILL TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIGURE 5.28 DYNAMIC MACRO SIMULTION 1961–83 B
MONEY SUPPLY, MILL TAKA
MULTIPLIERS: 10% INCREASE IN BOTH GOVT EXPENDITURES AND TAXES



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

because of the critical role it plays particularly in setting the nominal wages. However, in the long run food production picks up but very slowly--indicating substantial supply inelasticity as well as long adjustment lags--reaching the peak multiplier value of 1.4 around the 9th year. Rising food prices also have, as one would expect, substantial inflationary effect in the economy and worsens the country's balance of payments. The rising inflation occurs despite contraction in money supply. It seems that the negative price effect on aggregate demand in the end outweighs the positive but slow food-grains supply response effects in the Bangladesh economy. The result is a general contraction of income and output in the long run.

To summarize the fiscal policy simulations, in general, we have seen that the government expenditure policies in isolation have contractionary effects on the economy; crowding out of both private and public investments occurs due to the ripple effect of endogenous government budget constraints and the nature of government financing in Bangladesh. On the other hand, quite contrary to conventional expectations, increased tax policies have, in general, expansionary effects on income and output and generate very little inflationary impulses. Ironically, here it is the endogenous government sector that triggers such expansion! When the two policies are combined the result is in general expansionary. The 'balanced budget' multiplier is positive.

One aspect we have not discussed is the differential impact all the above policies show at the various sectoral levels in the economy. Indeed, all the above policies seem to have noticeable impact on sectoral output, income, expenditures and prices. This should not be overlooked because of the critical role some of the sectors play in the development path of a country like Bangladesh.

Monetary Policy Simulations:

In chapter 3 we have presented the case for an endogenous money supply in Bangladesh economy where it is determined by policy decisions(e.g. various reserve ratios) together with behavioral relations for the portfolio composition of the private sector and the banking sector and by the government deficit financing obligations and international reserve movements(see, section 3.4.3). Despite this endogeneity, the central bank, can influence the domestic money supply by changing the reserve ratios--hence changing the money multiplier(mm)--or by bringing about changes in the residual items in the condensed balance sheets of both itself(the OAbb variable in our model) and of the scheduled banks(the OAsb variable). In either case the monetary base(H) will be affected, altering the domestic money supply. Another explicit monetary policy in the model is the distribution of total bank credits(CR), which is determined endogenously from the banking sectors consolidated balance sheet, between the agricultural sector(CRag) and the non-agricultural sector(CRna). To examine the responses to these policies two monetary policy simulation results are presented here:

(1) 10 percent sustained increase in money supply; and

(2) 10 percent sustained increase in bank credits to the agricultural sector with an equal reduction in non-agricultural bank credits.

The simulation results of a 10 percent increase in money supply are presented in Table 5.13. In general, the response in the real sector is either negligible or mildly contractionary.[279] This result is not altogether out of line with our a priori expectation, given the subsistance nature of the economy and that the monetized sector is relatively small and formal capital market is almost absent. Nevertheless, a closer examination of the multiplier values reveals substantial endogenous responses and feed back effects in both monetary and real sectors of the economy. First, we notice that a 10 percent sustained growth in money supply does not translate into proportional changes in the ultimate money supply figures. The impact effect on money supply is only 8.7 percent and in the long run it continually declines and ultimately turns into a negative 10 percent around the 10th year! This endogenous contraction in money supply is triggered by the ever worsening balance of payment situation as a result of increased imports demand, particularly

---

[279] One is tempted to draw the traditional real-monetary sector dichotomy conclusion here.

Table 5.13

MULTIPLIERS: 1 % SUSTAINED INCREASE IN MONEY SUPPLY(M1)*

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	-0.00030067	0.00522186	-0.010615	0.00544577	-0.0091401	0.0189435	0.00462534	-0.0004597	-0.0084394
1962	-0.00022036	-0.00017231	0.001017	0.00495590	0.0012166	0.0157926	0.00243351	-0.0007799	0.0012620
1963	0.00002920	0.00059826	-0.001414	0.00589599	-0.0008691	0.0174517	0.00265452	-0.0006364	-0.0007677
1964	-0.00061711	0.00077018	-0.003575	0.00604387	-0.0029921	0.0173402	0.00277115	-0.0013093	-0.0028139
1965	-0.00011459	0.00077592	-0.001125	0.00549878	-0.0006049	0.0191173	0.00244990	-0.0008190	-0.0005643
1966	0.00087752	-0.00026374	0.005117	0.00423622	0.0050742	0.0184529	0.00177492	-0.0001724	0.0049665
1967	0.00104261	0.00035873	0.001158	0.00527669	0.0015790	0.0231488	0.00290521	0.0000643	0.0016085
1968	0.00293011	0.00045434	0.011006	0.00319555	0.0105178	0.0209858	0.00168888	0.0015042	0.0103370
1969	0.00331132	0.00007580	0.007177	0.00493991	0.0069822	0.0244626	0.00300380	0.0017626	0.0070777
1970	0.00290843	0.00179440	0.005631	0.00124427	0.0053607	0.0027768	-0.00015930	0.0017979	0.0050733
1973	0.00155675	0.00308255	0.000404	0.00159447	0.0004729	0.0084093	0.00029848	0.0007588	0.0004714
1974	0.00139242	0.00250048	0.000954	0.00126846	0.0009730	0.0074216	0.00024172	0.0008561	0.0010227
1975	0.00037140	0.00271917	-0.002115	0.00033559	-0.0020050	-0.0030892	-0.00003864	0.0002721	-0.0025301
1976	0.00068588	0.00135443	0.000762	0.00112150	0.0007808	0.0046252	0.00051970	0.0003626	0.0008439
1977	0.00015830	0.00093919	-0.000681	-0.00035303	-0.0006607	-0.0040389	-0.00012964	0.0001767	-0.0009413
1978	-0.00017364	0.00098738	-0.000972	-0.00092520	-0.0009689	-0.0022124	-0.00001114	-0.0001180	-0.0012370
1979	-0.00024273	0.00069440	-0.000685	-0.00085961	-0.0006970	-0.0011049	0.00009363	-0.0002108	-0.0008589
1980	0.00008208	0.00054068	0.000346	0.00045203	0.0003536	0.0033173	0.00062260	-0.0001870	0.0004499
1981	0.00071120	0.00029643	0.001531	0.00197667	0.0015646	0.0076984	0.00091777	0.0001958	0.0018768
1982	0.00107514	0.00004161	0.002100	0.00248550	0.0021324	0.0077378	0.00061401	0.0005202	0.0024417
1983	0.00077733	0.00071888	0.000719	0.00175750	0.0008067	0.0020985	0.00029638	0.0003612	0.0007587

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.0167376	0.00097038	0.0789157	0.0104179	0.0057503	-0.0027232	0.00703991	0.08697	0.130574
1962	0.0111209	-0.00011631	0.0379625	0.0061376	0.0070851	0.0086051	0.00266718	0.07989	0.107277
1963	0.0113636	0.00020485	0.0478769	0.0069057	0.0078469	0.0092408	0.00247636	0.05711	0.094382
1964	0.0124993	0.00002780	0.0993386	0.0057002	0.0073652	0.0101353	0.00282831	0.05693	0.093355
1965	0.0155452	0.00022124	0.0507748	0.0048432	0.0065411	0.0091951	0.00074465	0.05691	0.060218
1966	0.0125640	0.00035754	0.0334111	0.0037184	0.0057352	0.0083077	0.00106308	0.05145	0.065465
1967	0.0198421	0.00041429	0.0505171	0.0059661	0.0054000	0.0047041	0.00245777	0.03786	0.060805
1968	0.0167193	0.00116015	0.0385995	0.0033987	0.0049921	0.0068130	0.00182144	0.02417	0.057488
1969	0.0199447	0.00105212	0.0422428	0.0073804	0.0050858	0.0025038	0.00392397	-0.02369	0.057641
1970	0.0034144	0.00151069	0.0056402	-0.0006522	0.0022786	0.0050624	0.00169412	-0.10212	0.007895
1973	0.0067542	0.00034328	0.0168002	0.0015999	0.0014706	0.0014041	0.00341508	0.02414	0.029071
1974	0.0050943	0.00035398	0.0083414	0.0001973	0.0006127	0.0009899	0.00297293	0.02421	0.025472
1975	0.0014030	0.00011880	0.0022367	-0.0009172	-0.0009865	-0.0010794	0.00112691	-0.00802	-0.008334
1976	0.0049894	0.00022993	0.0062851	0.0011182	-0.0000318	-0.0027950	0.00221919	0.02508	0.025637
1977	-0.0009009	0.00005254	-0.0013002	-0.0015922	-0.0016647	-0.0018545	0.00043058	-0.00779	-0.007632
1978	0.0002668	-0.00006402	-0.0000196	-0.0014667	-0.0017616	-0.0021461	0.00050537	-0.00127	-0.001076
1979	0.0007301	-0.00009770	0.0010703	-0.0008598	-0.0017815	-0.0032074	0.00060357	0.00568	0.005551
1980	0.0039736	0.00003633	0.0063786	0.0011759	-0.0004415	-0.0022359	0.00141777	0.02860	0.025032
1981	0.0074993	0.00034083	0.0121045	0.0030927	0.0009887	-0.0016129	0.00179288	0.03412	0.032519
1982	0.0061022	0.00049797	0.0093265	0.0026422	0.0015162	-0.0004775	0.00151162	0.02616	0.023434
1983	0.0030436	0.00035265	0.0056763	0.0007546	0.0004500	-0.0000074	0.00124427	0.01286	0.012393

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	-0.016057	0.0061668	-0.0181	0.0353416	-0.0094834	-0.01185	-0.0018088	-0.0017659	0.0055689
1962	0.000535	0.0166740	-0.0314	0.0215172	0.0009619	-0.01828	-0.0004363	0.0007697	-0.0004925
1963	-0.002617	0.0132703	-0.0300	0.0272826	-0.0012993	-0.03899	-0.0005369	-0.0000680	0.0010860
1964	-0.005788	0.0108822	-0.0193	0.0244791	-0.0033560	-0.03916	-0.0012897	-0.0001934	0.0019049
1965	-0.001778	0.0098380	-0.0393	0.0338271	-0.0010489	-0.03918	-0.0006624	0.0001012	0.0005827
1966	0.006885	0.0082753	-0.1477	0.0313873	0.0049109	-0.04414	0.0017369	0.0004825	-0.0022804
1967	0.000787	0.0034739	-0.1062	C.0498442	0.0010730	-0.05649	0.0015611	-0.0001438	0.0017431
1968	0.015034	0.0035311	-0.7445	0.0388758	0.0105476	-0.06894	0.0055063	C.0012089	-0.0037582
1969	0.008728	-0.0017338	-3.1121	0.0454198	0.0067877	-0.11245	0.0058933	0.0003609	0.0017859
1970	0.007462	-0.0038018	0.0343	0.0049683	0.0054304	-0.18374	0.0060341	0.0019023	0.0005844
1973	0.004263	-0.0039569	-0.0160	0.0292568	0.0004644	-0.06897	0.0051038	0.0002174	0.0024735
1974	0.004239	-0.0025663	-0.0219	0.0181282	0.0010982	-0.06890	0.0045683	0.0003654	0.0018203
1975	-0.000309	-0.0030903	-0.0297	-0.0043277	-0.0024746	-0.09820	0.0027422	0.0001780	0.0028302
1976	0.003252	-0.0000804	-0.0183	0.0107292	0.0008661	-0.06811	0.0028302	-0.0000143	0.0013517
1977	-0.000216	-0.0011256	0.0084	-0.0036146	-0.0007781	-0.09799	0.0016607	0.0002489	0.0016073
1978	-0.000217	-0.0005999	0.0001	-0.0010271	-0.0011024	-0.09206	0.0009795	-0.0000851	0.0011169
1979	0.000088	0.0002063	-0.0036	0.0017888	-0.0007731	-0.08574	0.0006615	-0.0000970	0.0006904
1980	0.001950	0.0012876	-0.0179	0.0109801	0.0003829	-0.06491	0.0011021	-0.0001586	0.0002147
1981	0.003477	0.0014189	-0.0663	0.0176197	0.0016860	-0.05989	0.0018831	0.0000729	0.0003130
1982	0.003704	0.0003582	-0.0486	0.0143229	0.0023223	-0.06713	0.0024016	0.0003609	0.0005733
1983	0.002054	-0.0009324	-0.0200	0.0059141	0.0007931	-0.07922	0.0021686	0.0002906	0.0010708

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	0.031125	0.0000000	0.0000000	0.00703991	0.00616685	0.00193432	0.0105556	-0.0031690	-0.0061472
1962	0.048230	-0.0028294	0.0117880	0.00551217	0.00482902	0.00157597	0.0098815	0.0010674	-0.0020412
1963	0.015266	-0.0025194	0.0088437	0.00500837	0.00438780	0.00142292	0.0041705	-0.0001663	-0.0016593
1964	-0.002021	-0.0022158	0.0064248	0.00505535	0.00442895	0.00144107	0.0045290	-0.0020038	-0.0027746
1965	0.000064	-0.0024425	0.0070189	0.00319500	0.00279943	C.00136622	0.0044632	0.0002088	-0.0018489
1966	-0.012110	-0.0021036	0.0054796	0.00317338	0.00278049	0.00113027	0.0030173	0.0046455	0.0024276
1967	0.006235	-0.0007219	0.0006839	0.00318200	0.00278804	0.00154088	0.0029933	0.0019481	0.0023087
1968	-0.002839	-0.0005947	0.0014097	0.00241760	0.00211838	C.00133469	0.0030675	0.0107127	0.0081306
1969	-0.004946	0.0011853	-0.0041208	0.00273538	0.00239678	C.00177464	0.0024202	0.0071178	0.0090847
1970	-0.017553	0.0015968	-0.0038866	0.00009712	0.00008511	0.00055478	-0.0014951	0.0068471	0.0080886
1973	0.003163	C.0020266	-0.0051649	0.00138572	0.00121429	0.00026131	0.0000088	0.0035805	0.0044236
1974	-0.001740	0.0017844	-0.0036021	0.00118637	0.00103962	0.00027452	0.0007013	0.0035339	0.0030963
1975	0.000457	0.0015689	-0.0027046	-0.00044132	-0.00038676	C.00003738	-0.0005918	0.0001826	-0.0000902
1976	0.002565	0.0009873	-0.0011577	0.00123072	0.00107847	C.00031329	0.0020665	0.0022024	0.0005870
1977	-0.020380	0.0008347	-0.0007720	-0.00040381	-0.00035389	0.00000433	-0.0007522	-0.0000030	-0.0002860
1978	0.000530	0.0005563	-0.0005553	-0.00005094	-0.00004464	-0.00003574	0.0001391	-0.0002533	-0.0009837
1979	-0.011283	0.0003073	-0.0000533	0.00029622	0.00025959	C.00002316	0.0005033	-0.0001674	-0.0010724
1980	-0.002141	0.0001597	0.0001852	0.00125782	0.00110222	0.00032425	0.0015677	0.0010106	-0.0002545
1981	-0.001773	C.0002064	0.0000290	0.00158610	0.00138987	C.00058226	0.0016574	0.0022337	0.0011431
1982	-0.002221	0.0004142	-0.0006025	0.00109693	0.00096125	C.00049571	0.0005740	0.0025541	0.0022628
1983	0.012465	0.0006625	-0.0014412	0.00058143	0.00050952	0.00027908	-0.0001571	0.0015433	0.0016503

*Definition of variables given at the end of this chapter.

capital goods imports. Increased money supply initially made possible substantial expansion in bank credits to the private sector therefore boosting investment expenditures which in most developing countries are heavily imports dependent. The interesting point to note here is that despite the substantial influx of investment expenditures aggregate income and output does not show any significant expansions at least in the initial years.[280]

Contrary to general expectations, the impact effect on the price level is minimal in our case, except for the brief inflationary period in the first half of the seventies, given the amount of shock applied to the model.

However, if we look at a more disaggregated level we find substantial impact of monetary policy on the real sector particularly on investment and the growth of manufacturing sector(impact effect of 4.6 percent). This inter-sectoral substitution and resource allocation cannot be observed in an aggregate analysis. Monetary policy in Bangladesh seems to have important role in affecting the compostion of sectoral output and income despite its insignificant overall effects on the aggregate variables.

The other monetary policy simulation, i.e. shifting 10 percent more bank credits to agriculture away from the non-agricultural sector, also suggest very little

[280] Rao(1952) and other have argued long time ago that the traditional Keynesian multipliers do not work in a subsistance underdeveloped economy.

Table 5.14

MULTIPLIERS: 10% SUSTAINED INCREASE IN AGRICULTURAL CREDITS

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	[illegible]
1960									
1961	0.0011868	-0.0023763	0.0074731	-0.0009352	0.0067011	0.000300	-0.0008688	0.0011143	0.0063724
1962	-0.0008281	-0.0020502	-0.0002189	-0.0006873	-0.0002426	-0.002313	-0.0005266	-0.0011369	-0.0001808
1963	0.0004141	-0.0015122	0.0037952	-0.0008796	0.0034469	0.000528	-0.0003527	0.0002955	0.0033271
1964	-0.0001468	-0.0015630	0.0017895	-0.0008713	0.0016282	-0.001898	-0.0005678	-0.0003354	0.0016126
1965	-0.0003847	-0.0014931	0.0012651	-0.0008450	0.0010995	-0.002277	-0.0004293	-0.0005786	0.0011107
1966	-0.0023612	-0.0028884	-0.0024069	-0.0009603	-0.0023361	-0.004654	-0.0005861	-0.0026240	-0.0022314
1967	-0.0000520	-0.0025612	0.0054477	-0.0028932	0.0045960	-0.007786	-0.0014408	0.0001244	0.0044653
1968	-0.0025915	-0.0023216	-0.0053932	-0.0023556	-0.0052033	-0.014006	-0.0014253	-0.0022670	-0.0051044
1969	-0.0026673	-0.0016645	-0.0028800	-0.0068289	-0.0032244	-0.030651	-0.0044109	-0.0012622	-0.0035123
1970	-0.0043814	-0.0032637	-0.0085455	-0.0042574	-0.0082816	-0.017848	-0.0015345	-0.0030619	-0.0080860
1973	-0.0016540	0.0002835	0.0020855	-0.0022611	0.0018351	0.011576	-0.0000233	-0.0019852	0.0023345
1974	-0.0004599	0.0023643	0.0007476	0.0003613	0.0007246	0.006868	0.0000429	-0.0009890	0.0008811
1975	-0.0012220	0.0056037	-0.0040426	0.0023959	-0.0037549	-0.002669	-0.0000979	-0.0019566	-0.0047251
1976	-0.0001906	0.0031535	-0.0004338	0.0015716	-0.0003291	-0.002961	-0.0002347	-0.0006107	-0.0006572
1977	-0.0002600	0.0033450	-0.0009905	0.0012050	-0.0008549	-0.006214	-0.0002433	-0.0007959	-0.0012947
1978	-0.0006771	0.0048385	-0.0027827	0.0002138	-0.0025865	-0.006419	-0.0004805	-0.0010944	-0.0034095
1979	-0.0005617	0.0043487	-0.0021550	-0.0003316	-0.0020298	-0.007564	-0.0005490	-0.0008227	-0.0027188
1980	-0.0004208	0.0041742	-0.0014440	-0.0005150	-0.0013758	-0.005934	-0.0006787	-0.0007578	-0.0019455
1981	0.0000622	0.0040014	-0.0005913	-0.0001839	-0.0005603	-0.005898	-0.0006603	-0.0002184	-0.0010434
1982	0.0002604	0.0043908	-0.0008857	-0.0002192	-0.0008301	-0.007600	-0.0006946	0.0001074	-0.0014137
1983	-0.0000184	0.0045680	-0.0014247	-0.0005027	-0.0013469	-0.008216	-0.0008617	-0.0002421	-0.0020414

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	-0.001888	-0.0002153	-0.015799	-0.001195	-0.0005844	0.000525	0.00510487	0.002365	0.001754
1962	-0.002994	-0.0008321	-0.007799	-0.000821	-0.0012229	-0.001868	0.00636660	0.003644	0.001083
1963	-0.001135	-0.0003451	-0.003392	-0.000901	-0.0008934	-0.000882	0.00565755	0.005873	0.001072
1964	-0.002451	-0.0004931	-0.016868	-0.000811	-0.0010558	-0.001463	0.00575465	0.006211	-0.003347
1965	-0.002775	-0.0006497	-0.008417	-0.000873	-0.0010255	-0.001263	0.00556567	0.006426	-0.005756
1966	-0.005242	-0.0028154	-0.011250	-0.001806	-0.0015670	-0.001262	0.00521621	0.009952	-0.012315
1967	-0.007933	-0.0007250	-0.018914	-0.003774	-0.0021305	-0.000110	0.00343186	0.016145	-0.024032
1968	-0.011900	-0.0016329	-0.024531	-0.003449	-0.0031315	-0.002769	0.00431153	0.025268	-0.036919
1969	-0.025508	-0.0013030	-0.052264	-0.010925	-0.0060157	-0.000491	0.00106954	0.070193	-0.072876
1970	-0.015218	-0.0024366	-0.026348	-0.004726	-0.0052740	-0.005794	0.00256127	0.142904	-0.056028
1973	0.003294	-0.0003671	0.006634	-0.000097	-0.0023679	-0.003537	0.00537980	0.040522	0.035891
1974	0.003370	-0.0001199	0.007373	0.001883	-0.0011629	-0.003928	0.00616992	0.026747	0.027241
1975	0.005121	-0.0004086	0.007909	0.000598	-0.0013433	-0.003942	0.00631303	0.004769	0.005858
1976	-0.000061	-0.0000684	0.000540	-0.000153	-0.0017452	-0.005570	0.00620568	-0.002217	-0.001564
1977	-0.001545	-0.0000926	-0.002461	-0.000294	-0.0025962	-0.008627	0.00643451	-0.005738	-0.005030
1978	0.001025	-0.0002509	-0.001385	-0.001696	-0.0031404	-0.005024	0.00639796	-0.011085	-0.009814
1979	-0.001169	-0.0002302	-0.003728	-0.001702	-0.0041348	-0.007898	0.00632383	-0.012962	-0.011212
1980	-0.001950	-0.0001981	-0.004471	-0.001636	-0.0037332	-0.006060	0.00654076	-0.009259	-0.006785
1981	-0.003710	0.0000226	-0.006426	-0.001490	-0.0040520	-0.007220	0.00682172	-0.004995	-0.003202
1982	-0.004051	0.0001129	-0.006627	-0.001683	-0.0053894	-0.011951	0.00712348	-0.003670	-0.001671
1983	-0.003769	-0.0000162	-0.008479	-0.002161	-0.0058885	-0.011487	0.00731050	-0.003264	-0.001226

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	0.008106	0.0044723	0.00363	0.004019	0.0066766	0.002365	0.0017100	0.0006260	-0.0017140
1962	-0.002389	0.0020186	0.00646	-0.003562	-0.0002071	0.003644	0.0002557	-0.0003527	0.0017024
1963	0.003481	0.0039438	0.00212	0.004463	0.0034878	0.005873	0.0010353	0.0000481	-0.0004539
1964	0.000655	0.0032424	0.00327	-0.002199	0.0016797	0.006211	0.0007038	0.0000371	0.0003118
1965	-0.000108	0.0033932	0.00651	-0.003613	0.0011797	0.006426	0.0003628	-0.0001519	0.0004160
1966	-0.004977	0.0039293	0.04972	-0.008802	-0.0023098	0.009952	-0.0013231	-0.0005541	0.0019149
1967	0.006303	0.0052315	0.03977	-0.015848	0.0050457	0.016145	0.0005154	0.0003131	-0.0024315
1968	-0.008815	0.0008427	0.47312	-0.026375	-0.0051686	0.025268	-0.0025361	-0.0006847	0.0029486
1969	-0.004292	0.0022397	3.85038	-0.056984	-0.0027236	0.070193	-0.0032646	0.0004161	-0.0018262
1970	-0.012888	0.0017022	-0.16015	-0.039303	-0.0082417	0.142904	-0.0062807	-0.0021959	0.0026210
1973	0.008236	0.0100303	-0.00631	0.055667	0.0023955	0.040522	-0.0012994	-0.0009534	-0.0052636
1974	0.007748	0.0059701	-0.01931	0.022181	0.0008604	0.026747	0.0014654	-0.0001275	-0.0029574
1975	0.004453	0.0014229	-0.10484	0.000254	-0.0047310	0.004769	0.0021457	-0.0002668	-0.0004626
1976	0.006608	0.0005462	-0.00157	0.000550	-0.0004930	-0.002217	0.0032250	0.0000068	0.0002204
1977	0.006210	-0.0001059	0.01592	-0.002054	-0.0011319	-0.005738	0.0037216	-0.0000592	0.0012336
1978	0.005200	-0.0003317	0.00799	-0.004437	-0.0031564	-0.011085	0.0037886	-0.0000887	0.0013558
1979	0.005345	-0.0001179	0.01244	-0.004137	-0.0024320	-0.012962	0.0039316	-0.0001095	0.0014485
1980	0.006142	0.0001436	0.01254	-0.002961	-0.0015988	-0.009259	0.0043600	-0.0000513	0.0011220
1981	0.007123	-0.0000802	0.03518	-0.001334	-0.0006513	-0.004995	0.0049365	0.0000249	0.0014936
1982	0.007144	-0.0006214	0.03453	-0.001009	-0.0009793	-0.003670	0.0052936	0.0000910	0.0018258
1983	0.006994	-0.0009398	0.02994	-0.001263	-0.0015714	-0.003264	0.0054722	0.0000632	0.0020026

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	-0.014165	0.0000000	0.0000000	0.00510486	0.00447230	-0.0002607	0.0009155	0.003868	0.0044863
1962	-0.002939	0.0009311	-0.0027259	0.00543044	0.00475745	-0.0004077	-0.0016432	-0.002185	0.0022303
1963	0.010679	0.0004685	-0.0005974	0.00518662	0.00454391	-0.0001737	0.0006315	0.001771	0.0033646
1964	0.000600	0.0006908	-0.0011857	0.00506035	0.00443332	-0.0002981	-0.0008640	0.000046	0.0028661
1965	0.000784	0.0006176	-0.0009351	0.00494505	0.00433234	-0.0002861	-0.0002776	-0.000380	0.0022561
1966	-0.016290	0.0004274	-0.0002633	0.00478671	0.00419366	-0.0005159	-0.0003142	-0.005053	-0.0001807
1967	0.003286	-0.0002798	0.0019722	0.00371271	0.00325293	-0.0006829	-0.0012273	0.001874	0.0028616
1968	-0.007132	0.0007186	-0.0022958	0.00359036	0.00314577	-0.0010174	-0.0039835	-0.007357	-0.0019274
1969	0.008610	-0.0002527	0.0010795	0.00132259	0.00115898	-0.0022860	-0.0062050	-0.005145	-0.0034275
1970	0.016362	-0.0001248	-0.0006502	0.00268645	0.00235391	-0.0015837	-0.0024878	-0.011274	-0.0071130
1973	0.008755	-0.0014121	0.0040481	0.00680152	0.00595810	-0.0003371	0.0044064	0.002637	-0.0026903
1974	0.006238	-0.0002264	0.0003635	0.00639776	0.00560456	-0.0000188	-0.0009945	0.003255	-0.0010831
1975	0.006766	0.0009228	-0.0032795	0.00538525	0.00471787	-0.0001543	-0.0018834	0.000854	-0.0042222
1976	0.004592	0.0013127	-0.0037190	0.00488661	0.00428115	-0.0001407	-0.0006798	0.002497	-0.0025536
1977	0.009382	0.0017064	-0.0042237	0.00472008	0.00413530	-0.0001679	-0.0006669	0.002055	-0.0022348
1978	0.016388	0.0019012	-0.0042473	0.00448826	0.00393226	-0.0003234	-0.0008907	0.001426	-0.0035938
1979	-0.018791	0.0019186	-0.0039547	0.00439677	0.00385212	-0.0003708	-0.0007961	0.001640	-0.0036838
1980	-0.002422	0.0019381	-0.0038655	0.00459380	0.00402470	-0.0004291	-0.0009561	0.002265	-0.0032390
1981	-0.001249	0.0020617	-0.0042243	0.00475023	0.00416171	-0.0003900	-0.0011499	0.003035	-0.0023992
1982	0.003382	0.0022749	-0.0048391	0.00483755	0.00423818	-0.0003878	-0.0013905	0.003056	-0.0022517
1983	0.003247	0.0024318	-0.0051815	0.00486685	0.00426385	-0.0004996	-0.0015960	0.002628	-0.0025736

* Definition of variables are given at the end of this chapter(Table 5.20)

impact on the aggregate variables(see Table 5.14). As expected, the policy improves both food-grains and raw jute production, with impact multiplier values of 0.5 and 0.4, respectively. However, production in other agriculture(Yoa) declines because of 'inherent bias' in the country towards food-grains and jute crop sectors(ref: chapter 4 and 5). Manufacturing output declines for obvious reasons. Increased domestic food-grains production improves the balance of payment situation by cutting food-grains import bill. In general, once again we find that the monetary policy has its most important effects in changing the sectoral composition of output and income distribution with very little effects on the aggregate real variables as well as on the aggregate price level in a predominantly subsistance based non-monetized agrarian economy.

Foreign Sector Policy/shock Simulations:

Dynamic simulation results for three alternative foreign sector policies/shocks are presented here:

(1) All exports prices rise by 10 percent;

(2) All imports prices rise by 10 percent; and

(3) Devaluation of the country's exchange rate by 1 percent.

It should be noted here that some of the above variables are not truely policy variables. Therefore it is more appropriate to talk about the impact of external shocks rather than the impact of explicit policy changes. The country's exchange rate, however, has been substantially overvalued(according to one estimate(Islam 1970) over 40 percent) for the whole of pre-independence period and at least the first few years during the post-independence period. The extent of overvaluation was relatively small during the later part of the sample period. Nevertheless, a 1 percent or even a 10 percent devaluation of the exchange rate has been a viable policy option for the entire sample period. Exports and imports prices are affected by changes in the international market conditions--a truly exogenous factor for the country. However, domestically appropriate policies in the areas of exports promotion initiatives, trade controls, exports and imports licensing and quotas could have similar effects on the effective exchange rates for tradeables.

As expected, an increase in imports prices generate substantial deterioration of the country's balance of payments situation: current account balance shows an impact effect of 56 percent deterioration, however, with a fast reduction to 3 percent in the 5th year(see Table 5.15). After the 6th year when the economy adjusts to the shock the current account balance begins to show some improvements. In response to rise in imports prices, real imports decreases continuously throughout the sample period which has a clear negative impact on capital formation and the growth of the industrial sector of the economy.

Table 5.15

MULTIPLIERS: 10% SUSTAINED INCREASE IN ALL IMPORTS PRICES

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960	.	.	.	.	.	.	.	.	.
1961	0.0148647	-0.032135	0.103268	-0.001058	0.093689	-0.00185	-0.018959	0.0133072	0.090476
1962	0.0145117	0.002971	0.033827	-0.002594	0.031978	-0.03065	-0.018240	0.0133196	0.031409
1963	0.0386359	-0.019105	0.166951	-0.019408	0.153063	-0.06668	-0.029430	0.0376283	0.145955
1964	0.0333187	-0.004259	0.079247	-0.026263	0.072849	-0.10287	-0.028220	0.0340837	0.070755
1965	0.0316820	-0.012705	0.088161	-0.029740	0.078905	-0.09771	-0.023493	0.0329470	0.078023
1966	0.0317193	0.021805	0.045062	-0.022346	0.041761	-0.10110	-0.021403	0.0306126	0.041141
1967	0.0325891	-0.007715	0.106314	-0.035111	0.091873	-0.14396	-0.029753	0.0343428	0.090603
1968	0.0181004	0.016566	0.000826	-0.026869	-0.000905	-0.14425	-0.023325	0.0212158	-0.000403
1969	0.0200907	-0.003495	0.070480	-0.051186	0.059869	-0.19757	-0.037779	0.0269720	0.058541
1970	0.0197729	0.021376	0.008106	-0.040856	0.005093	-0.16345	-0.027885	0.0255028	0.005456
1973	0.0074008	0.009514	-0.004874	-0.031674	-0.006418	-0.11863	-0.014555	0.0118313	-0.005348
1974	0.0041044	-0.001335	0.000365	-0.021111	-0.000917	-0.10536	-0.014341	0.0084114	0.000636
1975	0.0154495	-0.055432	0.067115	-0.016996	0.063356	-0.02156	-0.013435	0.0185782	0.078598
1976	0.0052870	-0.007605	0.009143	-0.013846	0.007943	-0.03810	-0.015215	0.0065910	0.010604
1977	0.0025158	-0.009235	0.005946	-0.020435	0.004316	-0.05876	-0.016596	0.0063814	0.005935
1978	0.0069043	-0.037968	0.034678	-0.016606	0.031320	-0.02854	-0.016823	0.0110705	0.039861
1979	0.0041080	-0.024482	0.020178	-0.016628	0.017650	-0.03089	-0.016758	0.0075955	0.023094
1980	0.0039005	-0.021348	0.018192	-0.010286	0.016100	-0.01774	-0.017125	0.0068083	0.021406
1981	0.0032028	-0.016147	0.017825	-0.011922	0.015558	-0.02445	-0.017755	0.0055838	0.019425
1982	0.0019420	-0.012302	0.012529	-0.014348	0.010287	-0.03819	-0.017606	0.0046115	0.013446
1983	0.0022123	-0.017371	0.015220	-0.015605	0.012620	-0.03277	-0.018347	0.0057938	0.016803

YEAR	MGR	XGR	CA	TR	NG	BD	QF	N1	CR
1960	.	.	.	.	.	.	.	.	.
1961	-0.03526	-0.0032583	0.56044	0.012789	0.009011	0.002152	-0.011189	-0.07681	-0.13348
1962	-0.02921	0.0053199	0.31282	0.009122	0.004087	-0.003989	0.003707	-0.16338	-0.22857
1963	-0.06961	0.0072480	0.24535	-0.013387	-0.011097	-0.007707	-0.025496	-0.32844	-0.53753
1964	-0.08300	0.0091612	0.24329	-0.010721	-0.026640	-0.053124	0.006490	-0.31265	-0.50773
1965	-0.09294	0.0072931	0.03389	-0.006563	-0.024931	-0.053642	0.029454	-0.26701	-0.29290
1966	-0.06123	0.0296118	0.09184	0.003618	-0.018013	-0.045602	0.022019	-0.30023	-0.35649
1967	-0.13764	0.0076509	-0.11130	-0.013178	-0.023737	-0.036717	0.011962	-0.26068	-0.35882
1968	-0.11633	0.0116661	-0.03692	-0.007323	-0.025890	-0.047107	0.020856	-0.27860	-0.37237
1969	-0.17557	0.0052409	-0.18157	-0.043162	-0.036594	-0.029205	-0.001917	-0.22287	-0.44877
1970	-0.13368	0.0132193	-0.07603	-0.016062	-0.033753	-0.050557	-0.002543	-0.36687	-0.51812
1973	-0.09746	0.0016414	-0.01381	0.006554	-0.029069	-0.047407	0.019999	-0.17792	-0.19624
1974	-0.09259	0.0010534	-0.00044	0.003753	-0.022315	-0.045987	0.007327	-0.20608	-0.21249
1975	-0.13451	0.0051976	-0.06338	0.011781	-0.009570	-0.038152	0.002660	-0.13275	-0.15180
1976	-0.08518	0.0018001	0.01688	0.003932	-0.004598	-0.025094	0.002236	-0.12183	-0.12503
1977	-0.09204	0.0008673	0.02127	-0.010417	-0.011589	-0.014660	-0.006776	-0.23936	-0.24196
1978	-0.12034	0.0025554	-0.01667	0.005186	-0.003488	-0.014797	-0.005271	-0.19726	-0.20346
1979	-0.10145	0.0016774	0.00353	0.001754	-0.001673	-0.006974	-0.005421	-0.18619	-0.18424
1980	-0.09697	0.0018115	0.01953	0.010355	0.004338	-0.002339	-0.003432	-0.14751	-0.13479
1981	-0.09136	0.0015692	0.01862	0.000153	0.003147	0.006849	-0.002529	-0.11052	-0.11086
1982	-0.09292	0.0009218	0.01805	-0.002726	-0.000027	0.004752	-0.001250	-0.12105	-0.11260
1983	-0.10334	0.0010383	0.00601	-0.000469	-0.000744	-0.001156	-0.001620	-0.13790	-0.13601

YEAR	PF	QJ	NFA	INVP	YD	N	NWAG	NWMF	RW
1960	.	.	.	.	.	.	.	.	.
1961	0.144608	-0.00981	-0.1288	0.00805	0.092262	-0.07681	0.0235638	0.0155700	-0.039726
1962	0.048229	-0.08240	-0.2590	-0.04179	0.032007	-0.16338	0.0249750	0.0352023	-0.016797
1963	0.249550	-0.11476	-0.1537	-0.07155	0.153429	-0.32844	0.0673627	0.0460841	-0.052415
1964	0.112500	-0.17544	-0.0472	-0.14679	0.074385	-0.31265	0.0608607	0.0396165	-0.012183
1965	0.113926	-0.15241	-0.0262	-0.16285	0.082205	-0.26701	0.0577205	0.0378855	-0.012418
1966	0.062008	-0.13246	-0.4059	-0.15544	0.043243	-0.30023	0.0527598	0.0389622	-0.000746
1967	0.147257	-0.10648	0.2341	-0.29712	0.098469	-0.26068	0.0640247	0.0432727	-0.022079
1968	0.002175	-0.12495	0.7121	-0.24909	0.000791	-0.27860	0.0373470	0.0336403	0.021183
1969	0.104827	-0.09657	13.3764	-0.34781	0.066653	-0.22287	0.0451170	0.0424942	-0.026441
1970	0.016104	-0.12227	-0.4621	-0.33798	0.007818	-0.36687	0.0316231	0.0327488	0.007411
1973	-0.006248	-0.08178	0.0131	-0.29705	-0.005598	-0.17792	0.0175040	0.0279099	0.005340
1974	-0.010496	-0.04176	0.0011	-0.16086	0.000420	-0.20608	0.0074624	0.0329563	-0.000296
1975	0.005347	-0.02003	0.8402	-0.02557	0.078543	-0.13275	0.0063308	0.0357082	-0.009312
1976	-0.002601	-0.01947	-0.0491	-0.06267	0.010392	-0.12183	0.0017004	0.0338755	-0.012728
1977	-0.009774	-0.02842	-0.1376	-0.08879	0.006795	-0.23936	-0.0039725	0.0330926	-0.016353
1978	-0.012475	-0.02757	0.0962	-0.06492	0.039335	-0.19726	-0.0076738	0.0338971	-0.017240
1979	-0.012540	-0.02410	-0.0118	-0.07056	0.022772	-0.18619	-0.0099409	0.0330236	-0.018913
1980	-0.008762	-0.01986	-0.0548	-0.05665	0.020143	-0.14751	-0.0099978	0.0331415	-0.018596
1981	0.000674	-0.01968	-0.1019	-0.05797	0.019634	-0.11052	-0.0072644	0.0330570	-0.021263
1982	-0.001003	-0.02496	-0.0940	-0.06824	0.013854	-0.12105	-0.0062861	0.0324578	-0.019293
1983	-0.006939	-0.02841	-0.0212	-0.06894	0.016786	-0.13790	-0.0074783	0.0328557	-0.017675

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960	.	.	.	.	.	.	.	.	.
1961	-0.19155	0.0000000	0.00000	-0.011189	-0.009813	-0.037497	-0.034882	0.053859	0.062909
1962	-0.32601	0.0195787	-0.06970	-0.015567	-0.013656	-0.031054	-0.067093	0.033775	0.051754
1963	-0.43599	0.0240252	-0.07546	-0.048360	-0.042510	-0.033634	-0.071949	0.121401	0.127212
1964	-0.17806	0.0491282	-0.14490	-0.040642	-0.035708	-0.034974	-0.090070	0.064834	0.114173
1965	-0.09491	0.0520443	-0.13614	-0.021472	-0.018843	-0.032958	-0.042223	0.063613	0.114388
1966	0.40746	0.0494451	-0.11209	-0.026134	-0.022940	-0.031501	-0.038395	0.063083	0.084768
1967	-0.28931	0.0413966	-0.08375	-0.028264	-0.024814	-0.034697	-0.046112	0.081365	0.109257
1968	-0.72675	0.0468800	-0.10543	-0.024859	-0.021819	-0.034247	-0.057916	0.016032	0.054233
1969	-0.25798	0.0343992	-0.06783	-0.035109	-0.030836	-0.039365	-0.056636	0.054564	0.070092
1970	-0.25493	0.0387118	-0.09053	-0.039718	-0.034894	-0.036968	-0.067688	0.026832	0.038472
1973	-0.02857	0.0319311	-0.07238	-0.011563	-0.010141	-0.032200	-0.013212	0.004144	0.018117
1974	-0.03222	0.0200818	-0.03113	-0.012503	-0.010966	-0.030538	-0.009589	-0.000701	0.011272
1975	-0.11342	0.0119231	-0.01210	-0.009154	-0.008027	-0.029085	-0.014177	0.018847	0.066883
1976	-0.09542	0.0092514	-0.01346	-0.006951	-0.006094	-0.030768	-0.025792	0.002923	0.039524
1977	-0.08074	0.0076838	-0.01604	-0.014349	-0.012587	-0.031845	-0.032766	-0.003369	0.024939
1978	-0.31929	0.0064138	-0.01756	-0.011610	-0.010182	-0.031707	-0.029007	0.000383	0.042607
1979	0.54040	0.0049691	-0.01518	-0.010339	-0.009067	-0.031953	-0.027480	-0.001980	0.036924
1980	0.04477	0.0039337	-0.01351	-0.007337	-0.006433	-0.032136	-0.027314	-0.000407	0.033671
1981	0.03860	0.0037590	-0.01427	-0.006264	-0.005492	-0.032541	-0.029960	0.003046	0.030393
1982	0.03408	0.0050490	-0.01958	-0.006267	-0.005495	-0.032644	-0.032488	0.001006	0.024759
1983	-0.09446	0.0058778	-0.02202	-0.007454	-0.006535	-0.032961	-0.033255	-0.000898	0.024843

* Definition of variables are given at the end of this chapter(Table 5.20)

Real investment is also adversely affected due bank credit squeeze generated by contraction in money supply as a result of initial continuous worsening of balance of payment situation. Despite these negative effects the aggregate income and output is pulled up by the relatively better performance of the agricultural and the non-tradeable services sector.

Increased imports prices clearly fuels the country's food price inflation--a 14.5 percent impact effect. However, the general price level shows in general a deflationary trend with a deflation of 3.2 percent in the first year, which is difficult to explain. One explanation for such a contradictory result, which we have mentioned above, is the nature of the aggregate price equation in the model. Large changes in the endogenously determined sectoral weights and our treatment of all services sector prices exogenous may be responsible, at least in part, for the dampening of the impact of large food price inflation on the aggregate price level.

Instead of imports prices now we consider a 10 percent increase in all exports prices. The estimated multipliers for selected endogenous variables are given in Table 5.16. As one would expect, the effects of this external shock are in most cases in direct opposition to those of the imports price increase case. Higher exports prices reduce real exports demand for Bangladesh goods in the international market, however, with a less than proportionate impact effects: negative 5.9 percent in the first year rising to the peak of 9.2 percent in the 6th year.

Table 5.16

MULTIPLIERS: 10% SUSTAINED INCREASE IN ALL EXPORTS PRICES

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	-0.015622	0.035024	-0.10343	0.0073633	-0.09326	0.003931	0.0025268	-0.012748	-0.08895
1962	-0.017601	-0.002561	-0.05222	0.0059067	-0.04927	0.028346	0.0035350	-0.013762	-0.04768
1963	-0.028314	0.025973	-0.11755	0.0133189	-0.10780	0.063218	0.0104098	-0.025418	-0.10327
1964	-0.026226	0.008657	-0.07119	0.0173232	-0.06583	0.082612	0.0098760	-0.024358	-0.06356
1965	-0.022249	0.007539	-0.05687	0.0193699	-0.05089	0.085244	0.0085054	-0.021734	-0.04961
1966	-0.024764	-0.014809	-0.04543	0.0170449	-0.04238	0.089538	0.0067284	-0.022021	-0.04102
1967	-0.011373	-0.006496	-0.01326	0.0225806	-0.00960	0.142083	0.0146010	-0.013246	-0.00866
1968	0.001776	-0.006853	0.03844	0.0194242	0.03725	0.144127	0.0097784	-0.002756	0.03732
1969	0.019950	-0.009508	0.06947	0.0442191	0.06726	0.261763	0.0286919	0.008212	0.06949
1970	0.022466	0.005920	0.06086	0.0337039	0.05919	0.169707	0.0111444	0.009316	0.05889
1973	0.011703	0.017316	-0.00454	0.0267735	-0.00274	0.004710	0.0005566	0.007408	-0.00484
1974	0.008425	0.014879	-0.00147	0.0158240	-0.00044	0.023931	0.0006061	0.006386	-0.00174
1975	0.004094	0.015552	-0.00679	0.0172070	-0.00572	0.014427	0.0007593	0.002380	-0.00788
1976	0.003388	0.008767	-0.00331	0.0138785	-0.00241	0.022145	0.0014176	0.002295	-0.00291
1977	0.002759	0.007689	-0.00199	0.0147837	-0.00095	0.038132	0.0021148	0.001109	-0.00111
1978	0.002546	0.008331	-0.00269	0.0163393	-0.00144	0.031586	0.0027296	0.000701	-0.00175
1979	0.003424	0.006506	0.00036	0.0187132	0.00162	0.039141	0.0030010	0.001353	0.00199
1980	0.004291	0.005332	0.00175	0.0186971	0.00300	0.031892	0.0029503	0.002133	0.00363
1981	0.004872	0.005089	0.00247	0.0179537	0.00365	0.035047	0.0029487	0.002827	0.00410
1982	0.005675	0.003649	0.00517	0.0178736	0.00623	0.044145	0.0027857	0.003501	0.00698
1983	0.005985	0.004631	0.00448	0.0196457	0.00576	0.041501	0.0031861	0.003387	0.00644

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	-0.021856	-0.059021	-0.34111	0.0080850	0.0033322	-0.0052961	0.008665	0.04539	0.091653
1962	-0.027519	-0.071591	-0.20073	0.0024535	0.0067532	0.0136515	-0.007193	0.10592	0.162593
1963	0.001553	-0.070225	-0.12456	0.0107140	0.0168617	0.0259654	0.000716	0.21177	0.413478
1964	0.013672	-0.071458	-0.11612	0.0122985	0.0241946	0.0439867	-0.015536	0.20013	0.422859
1965	0.033792	-0.068575	0.04580	0.0113362	0.0237554	0.0431679	-0.024232	0.15519	0.254651
1966	0.005300	-0.092369	-0.01249	0.0078514	0.0201517	0.0358404	-0.016729	0.16130	0.313387
1967	0.091137	-0.062567	0.17432	0.0211862	0.0279181	0.0361939	-0.012972	0.10883	0.343469
1968	0.082300	-0.062386	0.15829	0.0242320	0.0314583	0.0397163	-0.006545	0.06516	0.381778
1969	0.184180	-0.053001	0.35542	0.0742978	0.0501165	0.0229063	0.014366	-0.17322	0.601241
1970	0.106877	-0.047279	0.16498	0.0417723	0.0445025	0.0470956	0.023914	-0.43070	0.550384
1973	0.002837	-0.033067	-0.07035	0.0125672	0.0305858	0.0398612	0.008274	-0.05912	-0.039692
1974	0.010235	-0.031752	-0.03696	0.0051150	0.0222233	0.0377593	0.009205	0.01424	0.019292
1975	0.015791	-0.023433	-0.00321	0.0055900	0.0140967	0.0254846	0.009626	0.06609	0.074533
1976	0.015753	-0.027855	-0.01026	0.0123248	0.0134855	0.0162745	0.007251	0.06667	0.069539
1977	0.025015	-0.027269	-0.00990	0.0155692	0.0171829	0.0214093	0.009482	0.14001	0.142877
1978	0.023474	-0.025421	-0.00046	0.0166367	0.0148323	0.0124798	0.009523	0.15134	0.152319
1979	0.025643	-0.022053	-0.00459	0.0188958	0.0183223	0.0174352	0.009802	0.16814	0.163265
1980	0.023497	-0.020616	-0.01135	0.0200539	0.0169646	0.0135371	0.008227	0.14116	0.125305
1981	0.026485	-0.020494	0.00058	0.0181199	0.0177649	0.0173259	0.007404	0.10782	0.104991
1982	0.026189	-0.019776	0.00295	0.0176592	0.0198790	0.0238091	0.007045	0.10854	0.098923
1983	0.026891	-0.019853	0.00200	0.0203422	0.0195836	0.0184443	0.008571	0.13072	0.125159

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	-0.13435	0.007590	0.078	-0.021500	-0.09241	0.04539	-0.025855	-0.0049943	0.026682
1962	-0.06926	0.075519	0.166	0.023956	-0.04941	0.10592	-0.033933	-0.0048435	0.009692
1963	-0.15390	0.097126	0.078	0.081953	-0.10803	0.21177	-0.055241	-0.0097689	0.014645
1964	-0.09172	0.139771	0.023	0.117442	-0.06683	0.20013	-0.052367	-0.0064394	-0.005567
1965	-0.06906	0.121281	-0.035	0.146430	-0.05303	0.15519	-0.045622	-0.0051179	-0.011353
1966	-0.05864	0.095481	0.055	0.134130	-0.04360	0.16130	-0.045591	-0.0056673	-0.005969
1967	-0.01402	0.075205	-0.367	0.304740	-0.01228	0.10883	-0.030318	-0.0056181	-0.017981
1968	0.05651	0.053009	-3.053	0.256456	0.03684	0.06516	-0.002871	0.0023467	-0.034566
1969	0.09259	0.017133	-26.185	0.487014	0.06570	-0.17322	0.023797	-0.0016593	-0.015815
1970	0.07930	-0.003717	1.003	0.365848	0.05869	-0.43070	0.040124	0.0121361	-0.012897
1973	0.00461	-0.036075	0.067	-0.096098	-0.00522	-0.05912	0.025794	0.0067637	0.019243
1974	0.00872	-0.021571	0.097	0.008461	-0.00169	0.01424	0.019313	0.0020528	0.012477
1975	0.00564	-0.006315	0.043	0.015352	-0.00795	0.06609	0.014301	0.0009420	0.010135
1976	0.00489	0.000507	0.030	0.027674	-0.00376	0.06667	0.010824	0.0006132	0.008141
1977	0.00857	0.005624	0.064	0.048928	-0.00227	0.14001	0.009735	0.0004305	0.006096
1978	0.00890	0.005792	0.003	0.054428	-0.00305	0.15134	0.009106	0.0003951	0.004882
1979	0.01160	0.005455	0.015	0.060946	0.00041	0.16814	0.009603	0.0007288	0.004038
1980	0.01089	0.002618	0.032	0.055110	0.00194	0.14116	0.009757	0.0010507	0.003754
1981	0.01065	0.000872	-0.003	0.055895	0.00272	0.10782	0.009804	0.0011789	0.004378
1982	0.01284	0.000384	-0.015	0.060063	0.00571	0.10854	0.010555	0.0014375	0.003989
1983	0.01378	0.000616	-0.007	0.064474	0.00494	0.13072	0.011394	0.0013237	0.004287

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	0.20879	0.000000	0.000000	0.0086652	0.0075899	-0.0003666	0.007935	-0.055418	-0.06355
1962	0.32638	-0.017944	0.065305	0.0109477	0.0095877	0.0002177	0.040764	-0.049098	-0.06285
1963	0.56664	-0.023110	0.074200	0.0243899	0.0213425	0.0022430	0.034655	-0.078264	-0.10392
1964	0.19855	-0.036909	0.118056	0.0221922	0.0194220	0.0030712	0.045641	-0.054315	-0.09595
1965	-0.01241	-0.038064	0.107339	0.0143794	0.0125904	0.0027922	0.018454	-0.041978	-0.08370
1966	-0.25857	-0.033733	0.078861	0.0175975	0.0154051	0.0016316	0.010317	-0.054569	-0.06989
1967	0.08450	-0.029021	0.059868	0.0165288	0.0144705	0.0059943	0.022915	-0.014951	-0.04396
1968	0.01066	-0.021669	0.038947	0.0154589	0.0135347	0.0060986	0.012144	0.029976	0.00073
1969	-0.03495	-0.007897	-0.002456	0.0224395	0.0196381	0.0151031	0.032884	0.059021	0.04663
1970	-0.15910	0.003110	-0.021479	0.0207402	0.0181529	0.0101836	0.008715	0.064875	0.06325
1973	0.02787	0.010603	-0.034124	-0.0023048	-0.0020201	0.0026228	-0.016352	0.012483	0.02814
1974	-0.00718	0.008582	-0.022100	0.0006172	0.0005409	0.0010919	0.004944	0.013145	0.01392
1975	0.00139	0.005958	-0.009479	0.0036459	0.0031944	0.0007930	0.006987	0.007562	0.00193
1976	0.01259	0.003798	-0.002499	0.0034396	0.0030137	0.0010780	0.005146	0.005842	-0.00058
1977	-0.05249	0.002525	-0.000453	0.0069399	0.0060793	0.0014347	0.006053	0.006596	-0.00097
1978	0.00701	0.002122	-0.000673	0.0073854	0.0064693	0.0017925	0.004999	0.006632	-0.00174
1979	-0.06976	0.002005	-0.001351	0.0077815	0.0068162	0.0020712	0.005189	0.008625	0.00055
1980	-0.01625	0.002242	-0.002600	0.0059718	0.0052315	0.0021518	0.003787	0.009165	0.00282
1981	-0.00176	0.002416	-0.003472	0.0049757	0.0043592	0.0021966	0.004056	0.009465	0.00426
1982	-0.01250	0.002465	-0.003605	0.0045689	0.0040029	0.0021882	0.004268	0.010955	0.00706
1983	0.01801	0.002737	-0.004458	0.0058185	0.0050973	0.0023943	0.005229	0.011587	0.00797

* Definition of variables are given at the end of this chapter(Table 5.20).

This fall in real exports demand generates contraction in the domestic economy through the traditional multiplier effects. The impact multiplier for GDP is negative 1.6 and that for national income is even worse--negative 8.9 percent.

In nominal terms, the country's exports earning rises continuously, but less than proportionately: an impact multiplier of 4.3 rising to the maximum of 9 percent at the close of the sample period. The initial contraction of imports demand due to fall in income, coupled with increased exports earning improves the country's balance of payments significantly at least for the first four years. This clearly show ripple effect through out the economy via the usual expansion in monetary base-credit-investment channel. In the long run, however, the imports demand rises, to meet fastly growing investment demands and later in response to rise in income and output thereby worsening the balance of payments situation. At the sectoral level, increased exports prices have differential effects on the agricultural and the industrial sector with a negative impact on the former.

To see the impact of devaluation on the economy, we have allowed all imports prices to rise by one percent while all exports prices to fall by one percent through out the sample period. The resulting multipliers for selected endogenous variables are given in Table 5.17. Also, for major endogenous variables, the multipliers are graphically presented(see Fig. 5.29-36).

Our results indicate devaluation is not contractionary neither overly expansionary, with an impact multiplier for GDP of only 0.3 and having a peak effect of 0.66 in the third year. In the long run(beyond 8th year) the effect becomes negligible. However, the effect of devaluation on aggregate demand is found to be quite expansionary: the impact multiplier is 1.9. Real exports rises but by less than proportionately while real imports fall and on balance help grow income, output and consumption.

Devaluation, however, generates substantial food price inflation(the impact effect is 3 percent) at least for the first half-a-dozen year, which is triggered mainly by the fall in food-grains imports as a result of higher imports costs, and low agricultural supply responses and due to now higher disposable income. Devaluation also has differential impacts on agriculture and industry. In general, the agricultural sector expands and the industrial sector shrinks, mainly due to the differential impact of rise in imports costs, specially the costs of the capital goods, on the two sectors. The country's current account balance worsens in response to devaluation: a 9.4 percent deterioration in the first year. However, in the long run, the current account balance shows some improvements providing some support for the 'J curve' hypothesis.

Table 5.17

MULTIPLIERS: 1% DEVALUATION OF THE EXCHANGE RATE

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	0.00345415	-0.0072724	0.0233252	-0.000823	0.0211079	-0.000362	-0.0022314	0.00293126	0.0202420
1962	0.00363145	0.0006898	0.0097491	-0.000710	0.0092182	-0.006153	-0.0022528	0.00300880	0.0089759
1963	0.00726504	-0.0051650	0.0311753	-0.003106	0.0286206	-0.013480	-0.0040818	0.00670803	0.0273833
1964	0.00658235	-0.0015095	0.0169239	-0.004186	0.0156438	-0.019172	-0.0038833	0.00633006	0.0151700
1965	0.00620521	-0.0025643	0.0170679	-0.004940	0.0153401	-0.019075	-0.0033907	0.00619909	0.0150884
1966	0.00650800	0.0040732	0.0108144	-0.003851	0.0100963	-0.020018	-0.0029017	0.00591129	0.0098659
1967	0.00531215	-0.0007786	0.0150015	-0.005972	0.0128598	-0.030512	-0.0047343	0.00559472	0.0126246
1968	0.00229091	0.0027231	-0.0028583	-0.004683	-0.0029723	-0.030327	-0.0034348	0.00294178	-0.0029312
1969	0.00118248	-0.0000447	0.0046832	-0.010182	0.0033867	-0.046972	-0.0070039	0.00290409	0.0030288
1970	0.00047258	0.0018887	-0.0043622	-0.007549	-0.0045583	-0.034222	-0.0039758	0.00209223	-0.0044608
1973	0.00011313	0.0000885	0.0000278	-0.005738	-0.0003045	-0.013866	-0.0015629	0.00090727	0.0000296
1974	0.00000616	-0.0010681	0.0004451	-0.003481	0.0002109	-0.014031	-0.0015501	0.00058036	0.0005386
1975	0.00190508	-0.0085599	0.0097381	-0.002432	0.0091942	-0.003074	-0.0014085	0.00219066	0.0113799
1976	0.00060239	-0.0012723	0.0014726	-0.002040	0.0012892	-0.006272	-0.0016912	0.00067683	0.0016325
1977	0.00027784	-0.0014500	0.0010623	-0.003010	0.0008106	-0.010202	-0.0019206	0.00070765	0.0010130
1978	0.00081740	-0.0051811	0.0046542	-0.002812	0.0041652	-0.006163	-0.0020022	0.00131593	0.0052124
1979	0.00036136	-0.0032771	0.0025086	-0.003129	0.0021215	-0.007260	-0.0020322	0.00082759	0.0027166
1980	0.00023267	-0.0028348	0.0021462	-0.002557	0.0018007	-0.005082	-0.0020769	0.00065552	0.0023429
1981	0.00008033	-0.0022395	0.0020186	-0.002714	0.0016579	-0.006109	-0.0021520	0.00044096	0.0020595
1982	-0.00014569	-0.0017063	0.0011949	-0.002984	0.0008462	-0.008509	-0.0021215	0.00026278	0.0011500
1983	-0.00014209	-0.0024418	0.0016237	-0.003277	0.0012104	-0.007630	-0.0022477	0.00040206	0.0016443

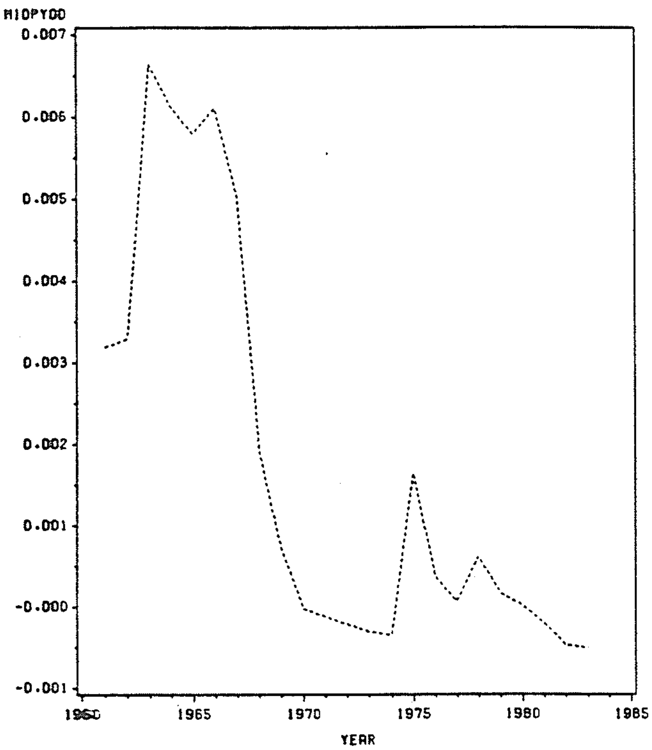
YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	-0.000932	0.0066179	0.093803	0.000683	0.0007237	0.000797	-0.0021238	-0.012707	-0.02365
1962	0.000443	0.0090522	0.053998	0.001081	-0.0000680	-0.001911	0.0013858	-0.028199	-0.04105
1963	-0.007272	0.0088646	0.039090	-0.001800	-0.0025398	-0.003636	-0.0019455	-0.056780	-0.10011
1964	-0.009607	0.0093812	0.041634	-0.001834	-0.0048717	-0.009926	0.0030425	-0.054330	-0.09825
1965	-0.013057	0.0089305	-0.000161	-0.001498	-0.0047377	-0.009802	0.0059138	-0.044824	-0.05832
1966	-0.006234	0.0143162	0.012002	0.000086	-0.0036063	-0.008315	0.0046071	-0.049228	-0.07099
1967	-0.024583	0.0083553	-0.030808	-0.003157	-0.0051370	-0.007571	0.0030267	-0.039157	-0.07548
1968	-0.020594	0.0089361	-0.019549	-0.002785	-0.0057204	-0.009075	0.0036461	-0.036861	-0.07938
1969	-0.037265	0.0071461	-0.054047	-0.011639	-0.0086941	-0.005380	-0.0013112	-0.007835	-0.10750
1970	-0.024580	0.0074901	-0.023535	-0.004949	-0.0077609	-0.010431	-0.0012047	-0.000714	-0.10916
1973	-0.010733	0.0046489	0.004829	0.000005	-0.0058768	-0.008904	0.0020667	-0.014070	-0.01870
1974	-0.010927	0.0044375	0.003230	0.000251	-0.0043941	-0.008612	0.0004913	-0.023901	-0.02505
1975	-0.017667	0.0041636	-0.008644	0.001268	-0.0021517	-0.006730	0.0000575	-0.014894	-0.01750
1976	-0.010247	0.0041219	0.003229	-0.000200	-0.0016352	-0.005083	0.0000403	-0.017761	-0.01830
1977	-0.012057	0.0039372	0.003460	-0.002231	-0.0028088	-0.004322	-0.0011451	-0.037779	-0.03828
1978	-0.015903	0.0039531	-0.002211	-0.000650	-0.0017634	-0.003215	-0.0010918	-0.034018	-0.03500
1979	-0.013644	0.0034996	0.000480	-0.001333	-0.0019660	-0.002945	-0.0012078	-0.034697	-0.03418
1980	-0.012962	0.0033431	0.002710	-0.000588	-0.0012149	-0.001910	-0.0009170	-0.028277	-0.02561
1981	-0.012540	0.0032827	0.001569	-0.001547	-0.0014398	-0.001307	-0.0007872	-0.021424	-0.02127
1982	-0.012687	0.0031475	0.001344	-0.001799	-0.0020197	-0.002410	-0.0006367	-0.022752	-0.02104
1983	-0.014091	0.0031731	-0.000138	-0.001783	-0.0020545	-0.002462	-0.0008174	-0.026361	-0.02580

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	0.0315610	-0.001861	-0.02155	0.003865	0.0208391	-0.012707	0.0055979	0.00219633	-0.0074117
1962	0.0133174	-0.017193	-0.04471	-0.006807	0.0092246	-0.028199	0.0066995	0.00419255	-0.0028440
1963	0.0434670	-0.022433	-0.02448	-0.016286	0.0286503	-0.056780	0.0135485	0.00578948	-0.0071960
1964	0.0227593	-0.033761	-0.00808	-0.027616	0.0158855	-0.054330	0.0126156	0.00483019	-0.0006437
1965	0.0215916	-0.029677	0.00012	-0.032504	0.0159149	-0.044824	0.0117704	0.00463356	-0.0003793
1966	0.0144007	-0.025570	-0.05305	-0.030517	0.0103780	-0.049228	0.0113953	0.00471803	0.0004978
1967	0.0198585	-0.020687	0.06479	-0.064516	0.0138944	-0.039157	0.0112278	0.00526523	-0.0006692
1968	-0.0042737	-0.021401	0.37704	-0.053241	-0.0027393	-0.036861	0.0054017	0.00332212	0.0062780
1969	0.0074337	-0.014136	3.98180	-0.084913	0.0044289	-0.007835	0.0044594	0.00486339	-0.0021119
1970	-0.0053836	-0.016016	-0.14305	-0.072366	-0.0042071	-0.000714	0.0008622	0.00222698	0.0031236
1973	-0.0003115	-0.006880	-0.00460	-0.024875	0.0000319	-0.014070	0.0005134	0.00235113	-0.0006594
1974	-0.0011664	-0.002991	-0.00846	-0.018459	0.0005123	-0.023901	-0.0000765	0.00329156	-0.0007512
1975	0.0015395	-0.001668	0.11459	-0.001951	0.0113962	-0.014894	0.0004237	0.00373626	-0.0018545
1976	-0.0001090	-0.002659	-0.00939	-0.008986	0.0016737	-0.017761	0.0000333	0.00352784	-0.0015813
1977	-0.0011372	-0.003996	-0.02239	-0.013894	0.0012138	-0.037779	-0.0005779	0.00343837	-0.0018711
1978	-0.0015358	-0.003880	0.01276	-0.011593	0.0052792	-0.034018	-0.0009971	0.00353462	-0.0019504
1979	-0.0019550	-0.003454	-0.00160	-0.013084	0.0028312	-0.034697	-0.0013866	0.00339652	-0.0020620
1980	-0.0015421	-0.002681	-0.00760	-0.011015	0.0023763	-0.028277	-0.0014829	0.00337181	-0.0020688
1981	-0.0004849	-0.002457	-0.00859	-0.011244	0.0022235	-0.021424	-0.0012362	0.00334420	-0.0024521
1982	-0.0008776	-0.002985	-0.00700	-0.012793	0.0013212	-0.022752	-0.0012331	0.00325159	-0.0022231
1983	-0.0016084	-0.003377	0.00049	-0.013184	0.0017908	-0.026361	-0.0014603	0.00330729	-0.0020963

YEAR	INFP	ACF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	-0.04335	0.00000000	0.000000	-0.0021238	-0.0018615	-0.0039081	-0.004590	0.0124583	0.0142002
1962	-0.07209	0.00415238	-0.014814	-0.0027552	-0.0024149	-0.0032687	-0.011672	0.0094757	0.0129679
1963	-0.11589	0.00520283	-0.016299	-0.0071114	-0.0062349	-0.0037228	-0.010948	0.0216035	0.0257188
1964	-0.04323	0.00934114	-0.028446	-0.0062403	-0.0054709	-0.0039305	-0.014376	0.0133572	0.0235394
1965	-0.01182	0.00978331	-0.026407	-0.0038320	-0.0033591	-0.0037285	-0.006682	0.0123469	0.0226972
1966	0.07757	0.00924769	-0.021626	-0.0045980	-0.0040307	-0.0034329	-0.005479	0.0138130	0.0180518
1967	-0.04839	0.00794016	-0.016484	-0.0048748	-0.0042734	-0.0042609	-0.007564	0.0117175	0.0184680
1968	-0.10408	0.00796550	-0.017711	-0.0042852	-0.0037564	-0.0042037	-0.007929	-0.0002144	0.0074933
1969	-0.03608	0.00509863	-0.008593	-0.0063773	-0.0055911	-0.0056547	-0.009510	0.0029689	0.0062346
1970	-0.01975	0.00486701	-0.010776	-0.0060423	-0.0052973	-0.0048659	-0.008718	-0.0025694	0.0001626
1973	-0.00442	0.00309826	-0.005984	-0.0010284	-0.0009013	-0.0036070	0.000637	0.0001189	0.0003443
1974	-0.00347	0.00182600	-0.001825	-0.0013323	-0.0011677	-0.0032937	-0.001152	-0.0005313	0.0006796
1975	-0.01570	0.00108638	-0.000768	-0.0010278	-0.0009008	-0.0030515	-0.001860	0.0027280	0.0091046
1976	-0.01385	0.00101846	-0.001804	-0.0009771	-0.0008564	-0.0032980	-0.003365	0.0003587	0.0055318
1977	-0.00875	0.00090908	-0.002201	-0.0020523	-0.0017988	-0.0034674	-0.004008	-0.0004404	0.0036217
1978	-0.04114	0.00076580	-0.002257	-0.0018562	-0.0016269	-0.0034819	-0.003525	0.0000044	0.0057351
1979	0.07378	0.00058718	-0.001884	-0.0017939	-0.0015723	-0.0035477	-0.003401	-0.0005772	0.0047025
1980	0.00618	0.00041474	-0.001516	-0.0013312	-0.0011667	-0.0035836	-0.003251	-0.0005085	0.0040227
1981	0.00434	0.00034737	-0.001465	-0.0011341	-0.0009940	-0.0036388	-0.003575	-0.0001896	0.0034559
1982	0.00466	0.00046341	-0.002023	-0.0010996	-0.0009637	-0.0036519	-0.003890	-0.0005742	0.0025531
1983	-0.01356	0.00051590	-0.002212	-0.0013326	-0.0011680	-0.0037099	-0.004074	-0.0008369	0.0025152

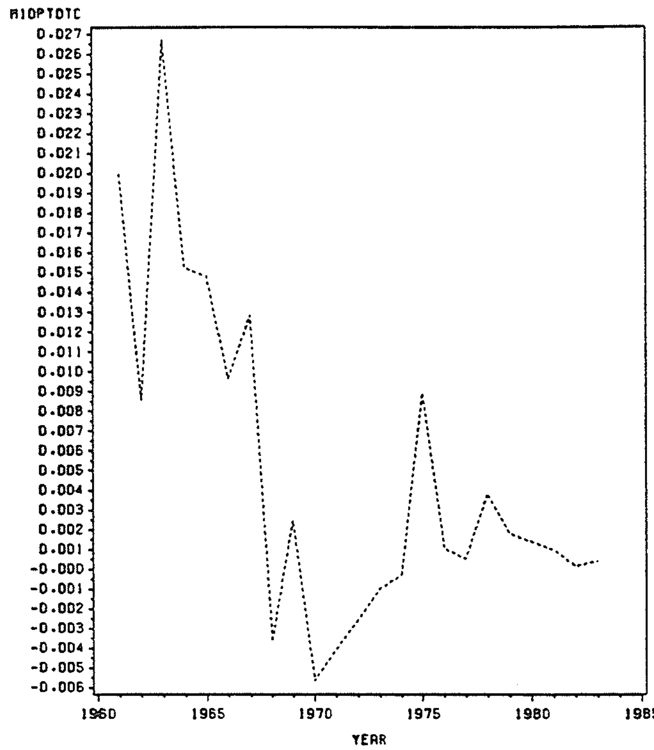
* Definition of variables are given at the end of this chapter(Table 5.20).

FIG. 5.29 DYNAMIC MACRO SIMULTION 1961–83 B
GDP, MILL CONST TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



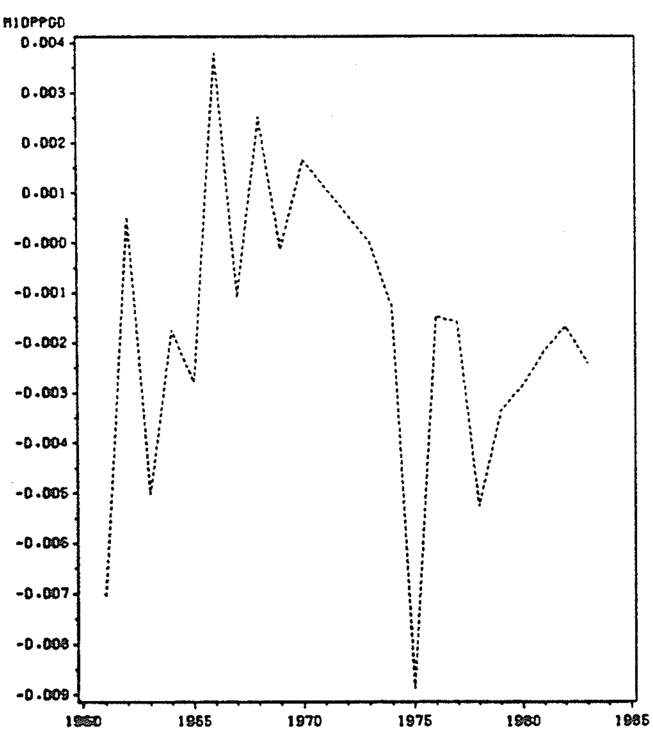
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.30 DYNAMIC MACRO SIMULTION 1961–83 B
TOTAL CONSUMPTION , MILL CONST TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



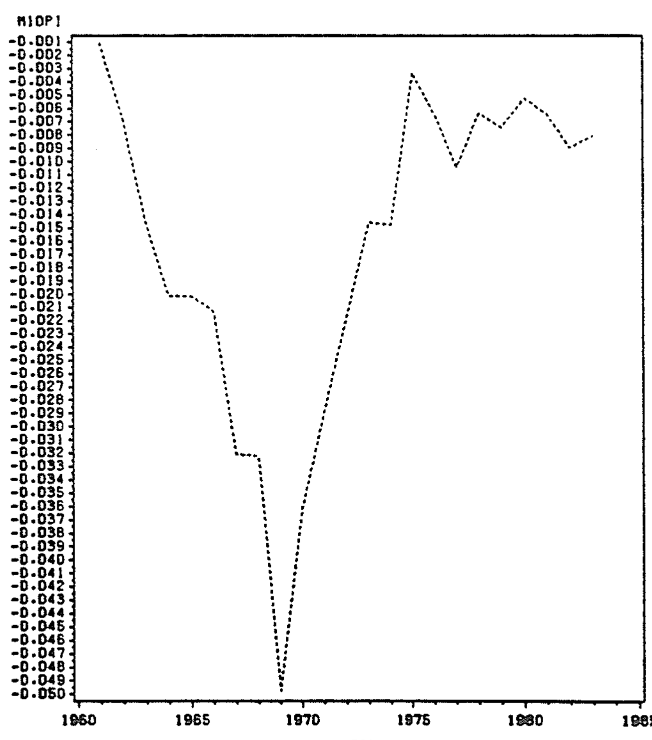
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.31 DYNAMIC MACRO SIMULTION 1961–83 B
AGGREGATE PRICE LEVEL:1973=100
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



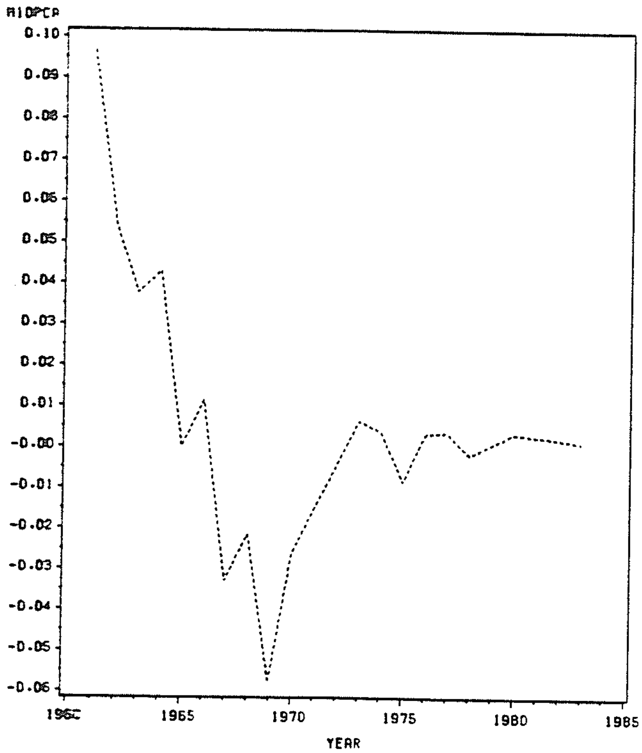
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.32 DYNAMIC MACRO SIMULTION 1961–83 B
TOTAL INVESTMENT, MILL CONST TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



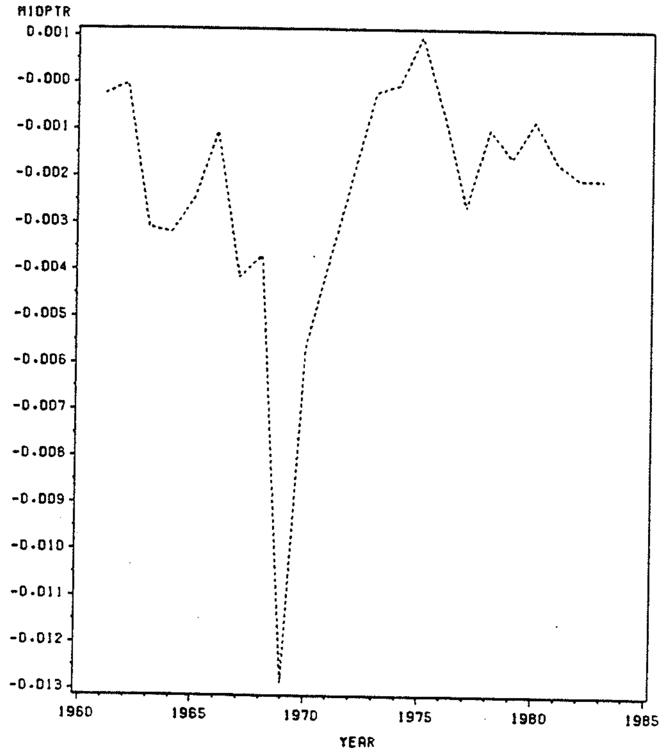
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.33 DYNAMIC MACRO SIMULTION 1961–83 B
CURRENT ACCOUNT BALANCE, MILL TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



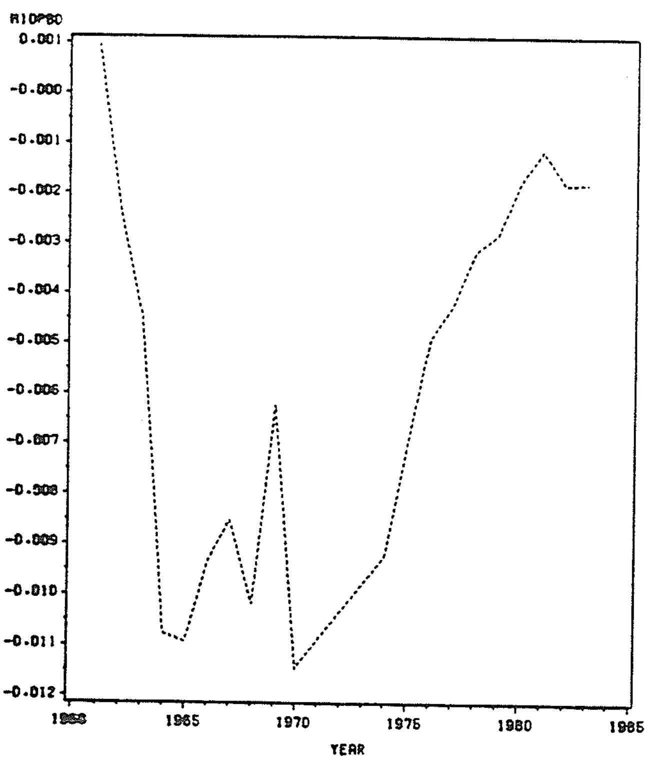
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.34 DYNAMIC MACRO SIMULTION 1961–83 B
GOVERNMENT REVENUES, MILL TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



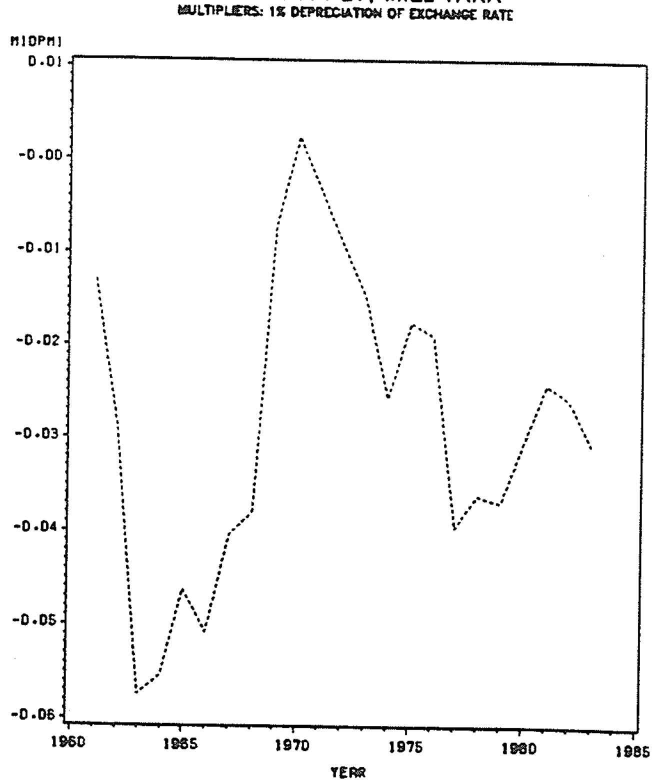
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.35 DYNAMIC MACRO SIMULTION 1961–83 B
BUDGET DEFICITS, MILL TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.36 DYNAMIC MACRO SIMULTION 1961–83 B
MONEY SUPPLY, MILL TAKA
MULTIPLIERS: 1% DEPRECIATION OF EXCHANGE RATE



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

The initial worsening of the balance of payment account, however, generates ripple effect throughout the economy via the usual 'credit crunch' channel. The effects of devaluation is strongly felt in the sectoral composition of output and on capacity creation, despite its positive impact on aggregate income and output.[281] Finally, in our case, devaluation also show a continuous negative impact on the real wages(impact effect negative 0.7 percent) of the working population, which is in line with the expectation in structuralist macroeconomic tradition(Taylor 1983).

Exogenous Shock Simulations:

Earlier in the section on sensitivity tests we have applied three minor shocks to the model to test the dynamic stability of the model. Here we apply two exogenous shocks to the model to evaluate and give plausible economic explanation to the responses in the time path of the endogenous variables:

(1) Technological change in agriculture(food-grains only): a 1 percent sustained increase in food-grains production.

(2) Increased inflow of foreign capital or foreign aid: a 10 percent sustained increase in non-food foreign aid and/ or capital inflow.

---

[281] Since devaluation in our model results in contraction of industry and industrial capacity creation, one can draw the inference that overvaluation of exchange rate, especially during the pre-independence period, does seem to have the effects desired by the governments in shifting resources from agriculture to industry.

The estimated multipliers for a 1 percent increase in food-grains production are presented for selected endogenous variables in Table 5.18. For important endogenous variables the multipliers are also graphically presented in Fig. 5.37-44. In general, the effects are expansionary on all the sectoral prices, wages, output and income with the exception of the contractionary effects in the post-independence period on consumption, investment, imports, aggregate demand and manufacturing outputs. The impact multiplier for GDP is 0.6 with a peak of 1.1 in the 10th year and thereafter the impact gradually tapers off to near zero at the end of the period.

The response in the general price level is as expected, but shows two clearly different phases: a positive but relatively low response in the sixties(multipliers generally less than one-half) while a greater(multiplier value more than 1.0) response is being observed during the post-independence period. It is worth noting here that this greater food production response phase also parallels with the contractionary phases for consumption, investment, imports, and manufacturing outputs mentioned earlier. At a more disaggregated level, expansion in the food sector results in contraction in the jute sector(see chapter 4). Furthermore, food prices rise immediately(impact effect 0.7) but what is to be noted is the fall in food prices in the second, fourth, fifth, and the seventh years.

Table 5.18

MULTIPLIERS: 1% SUSTAINED INCREASE IN FOODGRAINS PRODUCTION

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	0.0060659	0.0010852	0.0080303	0.0002073	0.0073120	0.006607	0.00018823	0.00729669	0.0069367
1962	0.0042902	0.0025156	-0.0006578	0.0008756	-0.0005800	0.000462	0.00020746	0.00536981	-0.0005396
1963	0.0059435	0.0024422	0.0062860	0.0012236	0.0059088	0.003712	0.00026051	0.00707279	0.0056124
1964	0.0049842	0.0034671	0.0004524	0.0019405	0.0005426	0.003033	0.00056384	0.00601450	0.0005448
1965	0.0046587	0.0035724	0.0004873	0.0023010	0.0006297	0.005053	0.00082165	0.00566000	0.0005856
1966	0.0048334	0.0028016	0.0042591	0.0024599	0.0041710	0.007682	0.00085786	0.00520120	0.0040798
1967	0.0052911	0.0039526	0.0004286	0.0046579	0.0008605	0.016167	0.00232295	0.00595970	0.0008456
1968	0.0067096	0.0032222	0.0105489	0.0044069	0.0101650	0.023295	0.00221050	0.00639186	0.0100626
1969	0.0109835	0.0024118	0.0183331	0.0112801	0.0177180	0.058136	0.00749907	0.00927856	0.0180841
1970	0.0111079	0.0051833	0.0179539	0.0081546	0.0173509	0.032200	0.00244922	0.00861892	0.0171186
1973	0.0070215	0.0148822	-0.0039167	0.0061731	-0.0033353	-0.019638	0.00002233	0.00747491	-0.0046729
1974	0.0059676	0.0147042	-0.0040101	0.0033297	-0.0035722	-0.019741	-0.00004758	0.00726024	-0.0048960
1975	0.0043080	0.0153478	-0.0073600	0.0021390	-0.0069354	-0.016121	-0.00046608	0.00639795	-0.0089095
1976	0.0042852	0.0111299	-0.0019234	-0.0015031	-0.0019015	-0.014004	-0.00051877	0.00632109	-0.0030991
1977	0.0035814	0.0104481	-0.0032183	-0.0030383	-0.0032072	-0.020816	-0.00060848	0.00589119	-0.0045773
1978	0.0024004	0.0130967	-0.0068939	-0.0047969	-0.0067566	-0.017400	-0.00084900	0.00499389	-0.0087373
1979	0.0022445	0.0120587	-0.0060578	-0.0054378	-0.0060152	-0.018943	-0.00082231	0.00512414	-0.0077547
1980	0.0023280	0.0118425	-0.0049271	-0.0046025	-0.0049033	-0.014059	-0.00066094	0.00511715	-0.0064033
1981	0.0025543	0.0116898	-0.0046761	-0.0037045	-0.0046020	-0.015062	-0.00060794	0.00538553	-0.0060682
1982	0.0022093	0.0124909	-0.0064817	-0.0038982	-0.0062662	-0.020214	-0.00060006	0.00529213	-0.0081103
1983	0.0015650	0.0122668	-0.0073723	-0.0047097	-0.0071477	-0.020699	-0.00079081	0.00483186	-0.0091271

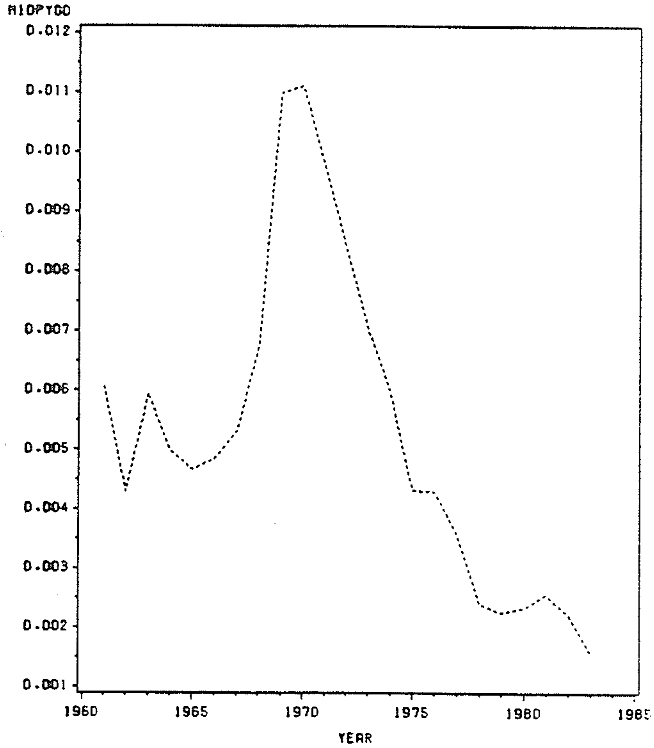
YEAR	IGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.0046123	0.00152870	0.0171571	0.0019971	0.001260	-0.000078	0.0096346	-0.00240	-0.002721
1962	0.0019330	0.00203251	0.0025879	0.0026750	0.001508	-0.000363	0.0110147	-0.00325	-0.001254
1963	0.0036530	0.00290688	0.0081307	0.0032464	0.002992	0.002616	0.0098063	-0.00609	-0.001184
1964	0.0037910	0.00255417	0.0130953	0.0035829	0.003087	0.002263	0.0111370	-0.00541	0.007890
1965	0.0058822	0.00294772	0.0110218	0.0034668	0.003350	0.003167	0.0106950	-0.00561	0.011705
1966	0.0074993	0.00417661	0.0142683	0.0040131	0.003878	0.003707	0.0104718	-0.00913	0.021299
1967	0.0151473	0.00270037	0.0318520	0.0071097	0.005145	0.002730	0.0119879	-0.01843	0.039474
1968	0.0192612	0.00335824	0.0394600	0.0071316	0.006505	0.005789	0.0119140	-0.03217	0.060968
1969	0.0470999	0.00411807	0.0935397	0.0203715	0.012215	0.003037	0.0164656	-0.10763	0.132592
1970	0.0263670	0.00527936	0.0455225	0.0108029	0.010788	0.010773	0.0161612	-0.22278	0.101236
1973	-0.0001209	0.00155204	0.0006960	0.0007737	0.006358	0.009233	0.0098991	-0.06388	-0.055532
1974	0.0009252	0.00151694	0.0032009	-0.0008888	0.002642	0.005849	0.0101194	-0.05539	-0.053480
1975	0.0014196	0.00140114	0.0050090	-0.0019015	-0.001132	-0.000102	0.0076505	-0.08785	-0.093065
1976	-0.0032242	0.00143597	-0.0035919	-0.0045163	-0.004360	-0.003984	0.0096887	-0.04423	-0.042400
1977	-0.0053025	0.00120481	-0.0085415	-0.0051596	-0.007567	-0.013873	0.0091033	-0.05829	-0.056355
1978	0.0010186	0.00084973	-0.0044505	-0.0067192	-0.007992	-0.009650	0.0092839	-0.05871	-0.055124
1979	-0.0015017	0.00087678	-0.0064985	-0.0060428	-0.009602	-0.015108	0.0092203	-0.05804	-0.052315
1980	-0.0006188	0.00103755	-0.0041970	-0.0049671	-0.007963	-0.011287	0.0099482	-0.04446	-0.035148
1981	-0.0030578	0.00120603	-0.0060315	-0.0044457	-0.008219	-0.012884	0.0104077	-0.03419	-0.028029
1982	-0.0032963	0.00100218	-0.0064083	-0.0051591	-0.010399	-0.019678	0.0106549	-0.03567	-0.027380
1983	-0.0026473	0.00069170	-0.0082722	-0.0062680	-0.010918	-0.017901	0.0100899	-0.04411	-0.036528

YEAR	PF	QJ	NFA	INVP	YD	W	WAG	NWMP	RW
1960									
1961	0.0073829	-0.000317	-0.0039	0.017639	0.0071744	-0.00240	0.0017109	0.00150043	-0.0023865
1962	-0.0044864	-0.002859	-0.0021	-0.001954	-0.0006224	-0.00325	-0.0000532	0.00106472	0.0017863
1963	0.0057027	0.000044	-0.0051	0.004834	0.0057769	-0.00609	0.0017019	0.00149103	-0.0018594
1964	-0.0028133	-0.001036	-0.0025	0.001129	0.0004246	-0.00541	0.0006737	0.00114088	0.0008758
1965	-0.0028197	0.001381	-0.0085	0.005906	0.0004544	-0.00561	0.0003546	0.00108141	0.0005504
1966	0.0028439	0.003492	-0.0631	0.011125	0.0040873	-0.00913	0.0013964	0.00121059	-0.0009151
1967	-0.0031201	0.002930	-0.0670	0.032311	0.0003970	-0.01843	0.0007396	0.00080450	0.0014364
1968	0.0115461	0.005858	-0.7611	0.041210	0.0101096	-0.03217	0.0043265	0.00175280	-0.0032866
1969	0.0203598	0.004309	-6.8913	0.107869	0.0173378	-0.10763	0.0091497	0.00086941	-0.0007156
1970	0.0203915	0.000756	0.2767	0.067601	0.0173156	-0.22278	0.0125091	0.00467908	-0.0021332
1973	0.0073876	-0.011078	-0.0007	-0.087476	-0.0044988	-0.06388	0.0100460	0.00263108	0.0040264
1974	0.0074227	-0.011768	-0.0084	-0.039811	-0.0046150	-0.05539	0.0087632	0.00151664	0.0031765
1975	0.0029589	-0.011899	-0.0664	-0.030814	-0.0086132	-0.08785	0.0065567	0.00121963	0.0039118
1976	0.0089464	-0.007365	0.0104	-0.016692	-0.0021862	-0.04423	0.0070117	0.00110705	0.0019279
1977	0.0068521	-0.00843C	0.0553	-0.020888	-0.0036776	-0.05829	0.0064141	0.00093940	0.0026919
1978	0.0048319	-0.008833	0.0257	-0.021869	-0.0078197	-0.05871	0.0054997	0.00069144	0.0025303
1979	0.0049525	-0.008145	0.0217	-0.019395	-0.0068366	-0.05804	0.0050501	0.00057196	0.0021267
1980	0.0067350	-0.006953	0.0118	-0.014914	-0.0054554	-0.04446	0.0054619	0.00054865	0.0014404
1981	0.0071926	-0.006885	0.0330	-0.014446	-0.0051506	-0.03419	0.0058402	0.00064088	0.0018980
1982	0.0056385	-0.007232	0.0334	-0.016978	-0.0071669	-0.03567	0.0055588	0.00056428	0.0024229
1983	0.0045877	-0.007262	0.0292	-0.019836	-0.0081312	-0.04411	0.0050427	0.00046715	0.0024189

YEAR	INFP	ACF	CJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	0.006470	0.00000000	0.0000000	-0.0003618	-0.0003171	0.00063265	0.0001360	0.0078014	0.004534
1962	-0.012842	0.00087692	-0.0029706	0.0001276	0.0001118	0.00048916	-0.0010123	0.0019346	0.001937
1963	-0.001450	0.00009022	0.0002913	-0.0002820	-0.0002471	0.00066818	0.0016220	0.0078954	0.004789
1964	-0.012028	0.00060129	-0.0014947	0.0005242	0.0004593	0.00071268	0.0003444	0.0039313	0.002826
1965	0.001174	0.00000605	0.0007833	0.0006820	0.0005977	0.00083157	0.0024478	0.0041139	0.001880
1966	-0.008953	-0.00054752	0.0026001	0.0010153	0.0008897	0.00089473	0.0025899	0.0068108	0.003794
1967	0.011495	-0.00021650	0.0010128	0.0021852	0.0019148	0.00156227	0.0037597	0.0047534	0.002475
1968	0.021606	-0.00082696	0.0034626	0.0027242	0.0023870	0.00182098	0.0053209	0.0132145	0.008099
1969	-0.010560	0.00042900	-0.0009164	0.0059700	0.0052300	0.00443377	0.0117430	0.0204358	0.016473
1970	-0.028241	0.00172631	-0.0030576	0.0043664	0.0038255	0.00293716	0.0025031	0.0222938	0.020018
1973	0.023736	0.00333270	-0.0081039	-0.0034212	-0.0029989	0.00091968	-0.0059930	0.0102114	0.006107
1974	-0.000526	0.00347086	-0.0088656	-0.0033411	-0.0029286	0.00050602	-0.0015610	0.0097588	-0.000038
1975	0.001328	0.00317100	-0.0071294	-0.0054798	-0.0048040	0.00014552	-0.0020053	0.0063140	-0.006087
1976	0.007828	0.00247030	-0.0049473	-0.0027717	-0.0024294	0.00007670	0.0003203	0.0080068	-0.005086
1977	-0.033139	0.00257070	-0.0054226	-0.0034496	-0.0030238	-0.00003683	-0.0022658	0.0058475	-0.005702
1978	0.028859	0.00260353	-0.0059538	-0.0033039	-0.0028961	-0.00027077	-0.0024131	0.0042867	-0.009089
1979	-0.039497	0.00239403	-0.0053909	-0.0031585	-0.0027685	-0.00029477	-0.0018467	0.0042684	-0.009917
1980	-0.002978	0.00222946	-0.0049680	-0.0022756	-0.0019946	-0.00020443	-0.0012597	0.0054708	-0.009517
1981	-0.001096	0.00229639	-0.0052389	-0.0018883	-0.0016551	-0.00014079	-0.0016365	0.0057034	-0.009086
1982	0.006905	0.00242882	-0.0056842	-0.0017761	-0.0015567	-0.00016331	-0.0018315	0.0044012	-0.010304
1983	-0.004074	0.00234162	-0.0053023	-0.0022474	-0.0019698	-0.00031439	-0.0020055	0.0031613	-0.011540

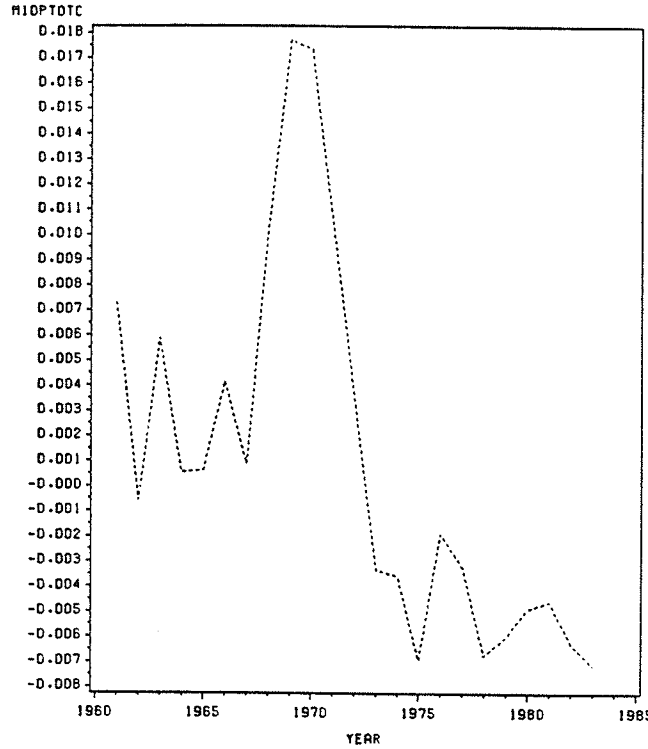
* Definition of variables are given at the end of this chapter(Table 5.20).

FIG. 5.37 DYNAMIC MACRO SIMULTION 1961−83 B
GDP, MILL CONST TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



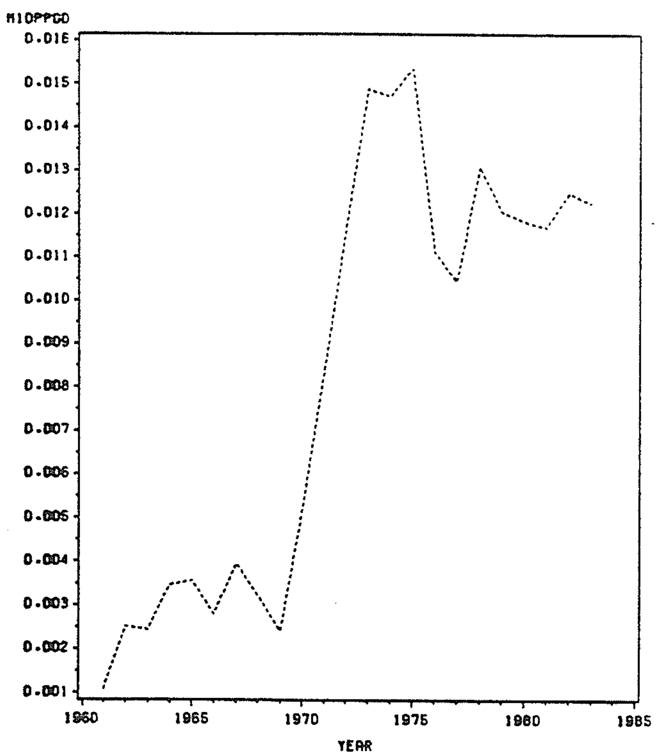
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.38 DYNAMIC MACRO SIMULTION 1961−83 B
TOTAL CONSUMPTION , MILL CONST TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



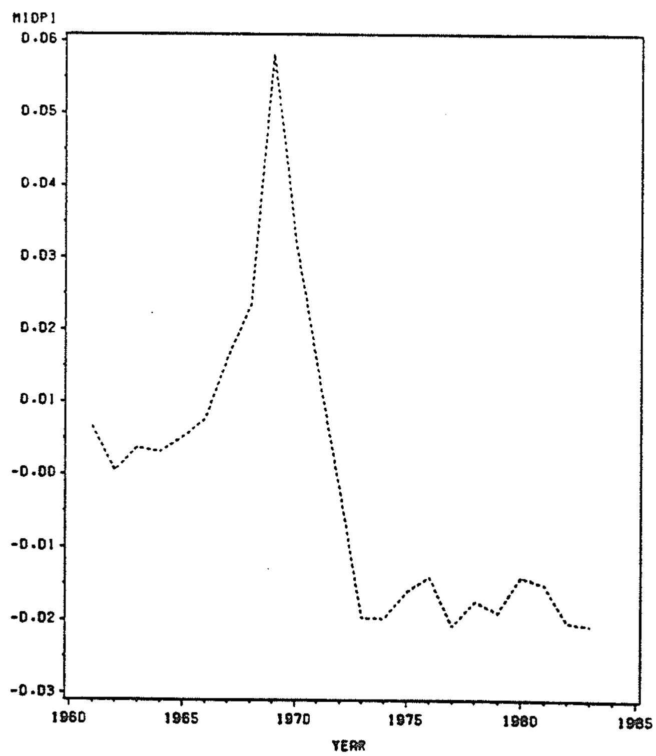
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.39 DYNAMIC MACRO SIMULTION 1961−83 B
AGGREGATE PRICE LEVEL:1973=100
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



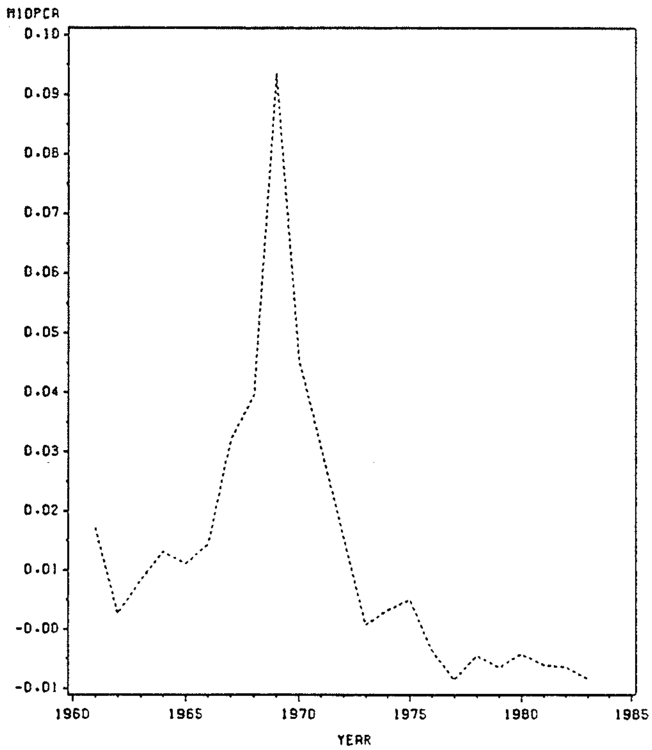
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.40 DYNAMIC MACRO SIMULTION 1961−83 B
TOTAL INVESTMENT, MILL CONST TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



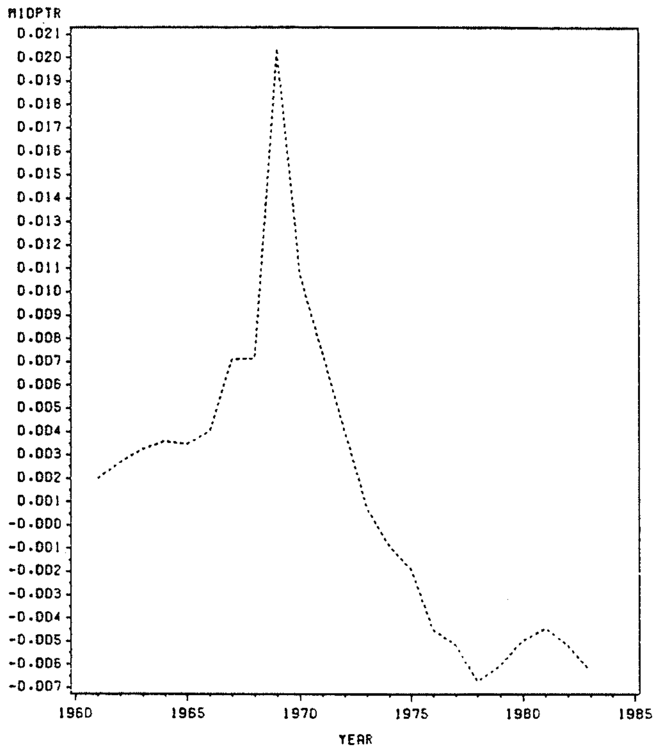
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.41 DYNAMIC MACRO SIMULTION 1961–83 B
CURRENT ACCOUNT BALANCE, MILL TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



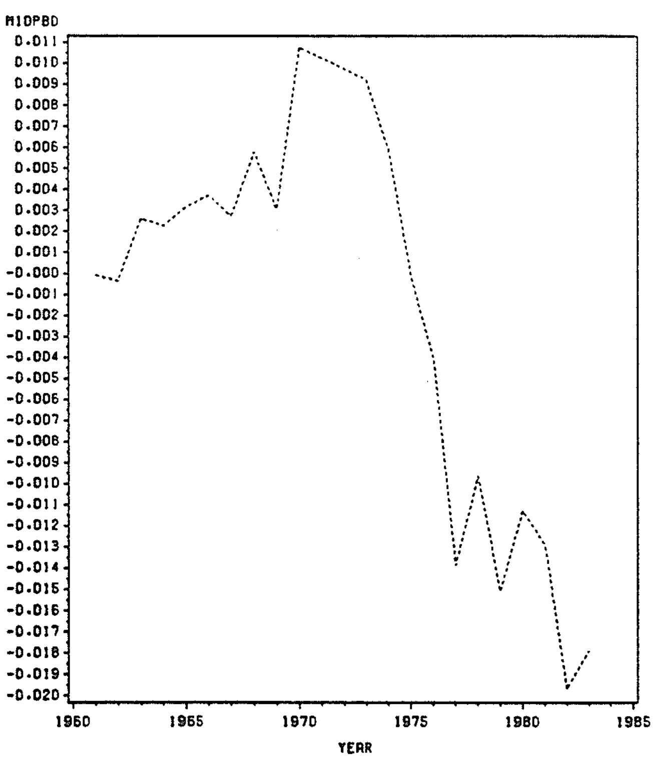
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.42 DYNAMIC MACRO SIMULTION 1961–83 B
GOVERNMENT REVENUES, MILL TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



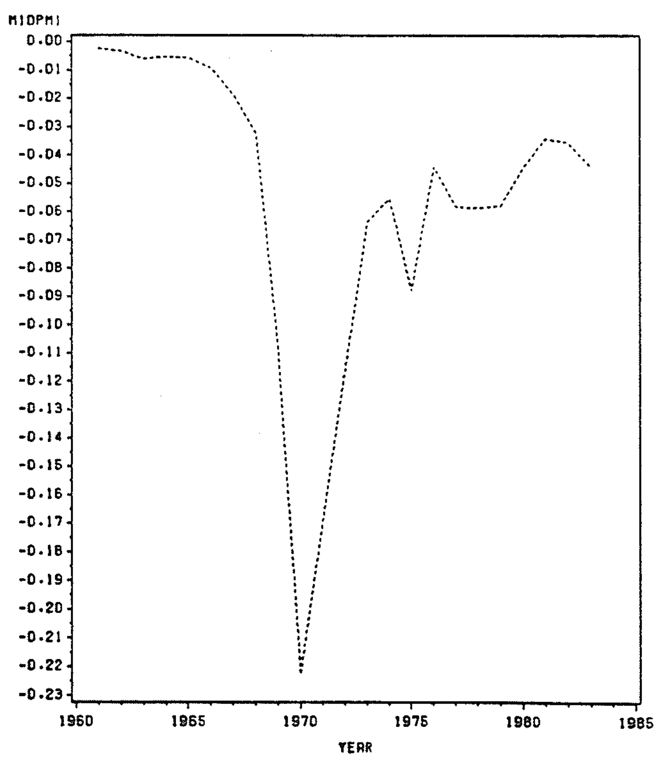
DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.43 DYNAMIC MACRO SIMULTION 1961–83 B
BUDGET DEFICITS, MILL TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

FIG. 5.44 DYNAMIC MACRO SIMULTION 1961–83 B
MONEY SUPPLY, MILL TAKA
MULTIPLIERS: 1% SUSTAINED INCREASE IN FOOD PRODUCTION



DOTTED LINE = % CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION

This cyclical behavior in food price response may be attributed to the supply lags and the foodgrain-jute crop difficulties in Bangladesh agriculture. The food price response peaks(0.2) in the 10th year, which is consistent with the movements in the endogenously determined food production in the model. It seems that an explanation for the negative impacts on some of the variables in the post-independence period can be traced in the behavior of the fiscal and monetary sector variables.

Finally, the simulation results for a 10 percent sustained increase in foreign aid and/or foreign capital inflows are presented in Table 5.19. In general, the effect of an increased flow of foreign capital would be similar to an increase in money supply or an increase in bank credits to the private sector. However, there are at least two differences that might influence the direction and magnitude of the ultimate effect. First, the impact of foreign capital inflow is felt in the monetary sector only indirectly, through the movements in the consolidated balance sheets of the monetary authorities and the banking sector. Secondly, as is typical of some other developing countries, foreign capital inflow is almost all foreign aid or grant to the government, giving rise to additional factor, namely, government budgetary feedbacks, in the determination of the size and magnitude of the ultimate effect of foreign capital inflow on domestic economy.

Table 5.19

MULTIPLIERS: 10% SUSTAINED INCREASE IN FOREIGN CAPITAL INFLOW*

(PERCENTAGE CHANGE IN PREDICTED VALUES OVER CONTROL SOLUTION)

YEAR	YGD	PGD	CP	CG	C	I	YMF	YAG	Y
1960									
1961	-0.008706	0.0138513	-0.050730	-0.007860	-0.046793	-0.005931	-0.0001709	-0.006758	-0.044043
1962	-0.003625	-0.0015641	-0.001390	-0.008877	-0.001770	0.007742	0.0002222	-0.002232	-0.001477
1963	-0.017495	0.0118812	-0.074999	-0.014143	-0.070464	0.000798	0.0010861	-0.014315	-0.066578
1964	-0.011531	-0.0018218	-0.017951	-0.019838	-0.018065	0.020698	0.0008606	-0.008861	-0.016742
1965	-0.008604	-0.0045731	-0.009744	-0.018608	-0.010440	0.016752	0.0005228	-0.006660	-0.008854
1966	-0.009186	-0.0077462	-0.015922	-0.019903	-0.016117	0.015800	0.0000417	-0.005875	-0.014806
1967	-0.006887	-0.0043588	-0.009432	-0.017615	-0.010268	0.019686	0.0005559	-0.004811	-0.008377
1968	-0.004833	-0.0059542	-0.005674	-0.014179	-0.006206	0.017053	-0.0000112	-0.002555	-0.005193
1969	-0.007176	-0.0011936	-0.019001	-0.014883	-0.018642	0.019615	0.0008924	-0.004813	-0.016926
1970	-0.005377	-0.0043979	-0.006475	-0.015547	-0.007033	0.014776	-0.0005458	-0.002426	-0.006179
1973	-0.004493	0.0105543	-0.011692	-0.028074	-0.012635	0.026832	-0.0004216	-0.001759	-0.013708
1974	-0.001532	0.0096148	-0.007485	-0.022312	-0.008369	0.035209	-0.0002300	0.001003	-0.008811
1975	-0.017135	0.0704776	-0.083710	-0.059400	-0.082623	-0.029354	-0.0033676	-0.008576	-0.097944
1976	-0.006364	-0.0014314	-0.002163	-0.054173	-0.004878	0.010159	-0.0016392	0.000697	-0.003703
1977	-0.002677	-0.0033330	0.001087	-0.044193	-0.001711	0.029145	-0.0009901	0.002688	0.000943
1978	-0.006501	0.0252817	-0.024775	-0.050117	-0.026434	0.010705	-0.0021815	-0.001272	-0.029412
1979	-0.003486	0.0115806	-0.009774	-0.051202	-0.012619	0.021813	-0.0017930	0.002041	-0.011975
1980	-0.001233	0.0124958	-0.005998	-0.036748	-0.008257	0.023600	-0.0003176	0.002714	-0.007308
1981	0.002237	0.0067221	0.002484	-0.029241	0.000066	0.031669	0.0004347	0.005134	0.002525
1982	0.004287	0.0061966	0.005252	-0.026128	0.002634	0.045062	0.0010129	0.006319	0.005801
1983	0.004170	0.0126084	0.000262	-0.029295	-0.002231	0.038506	0.0006035	0.006227	-0.000212

YEAR	MGR	XGR	CA	TR	NG	BD	QF	M1	CR
1960									
1961	0.0058605	0.0008404	0.000403	-0.003137	-0.0060306	-0.011284	0.002335	-0.00177	0.00674
1962	0.0024169	-0.0015530	-0.008389	-0.004719	-0.0030220	-0.000299	-0.007863	0.00457	0.01473
1963	0.0112647	-0.0024040	-0.037862	-0.005951	-0.0072307	-0.009126	0.000114	0.01987	0.06136
1964	0.0097988	-0.0041071	0.049258	-0.008277	-0.0035090	0.004424	-0.014203	0.01237	0.05324
1965	0.0049634	-0.0047221	0.035278	-0.004772	-0.0013904	0.003895	-0.013734	0.00389	0.02604
1966	0.0018334	-0.0091182	0.019606	-0.005868	-0.0019347	0.003083	-0.008611	-0.00245	0.02040
1967	0.0103608	-0.0032748	0.045298	-0.005340	0.0027016	0.012588	-0.007563	-0.00965	0.01922
1968	0.0083966	-0.0035538	0.033072	-0.003129	0.0041491	0.012467	-0.006164	-0.01248	0.01202
1969	0.0132497	-0.0025683	0.034951	-0.001486	0.0052012	0.012726	-0.003794	-0.02760	0.02246
1970	0.0076399	-0.0031070	0.013617	-0.005462	0.0052020	0.015331	-0.007009	-0.03181	0.00019
1973	0.0360626	-0.0010038	0.094760	-0.006784	0.0051193	0.011247	-0.007733	-0.02855	-0.02655
1974	0.0348866	-0.0004009	0.081874	-0.003411	0.0120755	0.026139	-0.004698	-0.02297	-0.02119
1975	0.0983325	-0.0056655	0.156835	-0.019393	-0.0024222	0.020297	-0.021072	-0.30961	-0.32814
1976	0.0040986	-0.0021396	0.012141	-0.015791	-0.0059226	0.017791	-0.008093	-0.07751	-0.07822
1977	0.0045302	-0.0009032	0.004400	-0.004421	0.0031495	0.022977	-0.006075	-0.05955	-0.06036
1978	0.0538407	-0.0023720	0.046655	-0.015983	0.0010312	0.023214	-0.007310	-0.10840	-0.10072
1979	0.0306540	-0.0014028	0.030315	-0.008860	0.0047590	0.025827	-0.005177	-0.09782	-0.08945
1980	0.0367363	-0.0005805	0.041586	-0.002693	0.0086701	0.021277	-0.000026	-0.02545	-0.01744
1981	0.0252004	0.0010623	0.035089	0.004230	0.0124059	0.022516	0.002550	0.00718	0.01006
1982	0.0305918	0.0019783	0.040146	0.007918	0.0184889	0.037205	0.004421	0.02847	0.02833
1983	0.0413080	0.0018802	0.059643	0.004504	0.0171584	0.036165	0.004774	0.01393	0.01898

YEAR	PF	QJ	NFA	INVP	YD	H	NWAG	NWMF	RW
1960									
1961	-0.06831	0.002046	0.04427	-0.02437	-0.045323	-0.00177	-0.013430	-0.0022024	0.012560
1962	-0.00132	0.030637	0.05468	0.01072	-0.001316	0.00457	-0.008011	-0.0010282	-0.006529
1963	-0.10405	0.024764	0.10472	-0.02832	-0.068925	0.01987	-0.029949	-0.0048559	0.015040
1964	-0.02341	0.057587	0.04764	0.02581	-0.016849	0.01237	-0.022608	-0.0027993	-0.009912
1965	-0.01063	0.041006	0.06749	0.01996	-0.009086	0.00389	-0.016831	-0.0020368	-0.010428
1966	-0.02389	0.020069	0.24641	0.00683	-0.015280	-0.00245	-0.018015	-0.0021568	-0.002336
1967	-0.01370	0.015168	0.06964	0.02103	-0.008736	-0.00965	-0.014613	-0.0019185	-0.007222
1968	-0.01226	0.012080	0.38021	0.00944	-0.005438	-0.01248	-0.012758	-0.0009999	-0.004678
1969	-0.02891	0.011172	2.93168	0.01547	-0.017969	-0.02760	-0.015118	-0.0021653	0.000238
1970	-0.01018	0.017059	-0.20422	0.00253	-0.006245	-0.03181	-0.012625	-0.0008189	-0.005505
1973	0.00259	0.010473	0.07203	-0.02459	-0.013429	-0.02855	-0.007334	-0.0011929	-0.007743
1974	0.00487	0.000979	0.05523	-0.00694	-0.008614	-0.02297	-0.003299	-0.0004251	-0.005835
1975	-0.03355	-0.020614	-0.76937	-0.12563	-0.097963	-0.30961	-0.013862	-0.0033919	0.009231
1976	0.00129	0.000587	0.29869	-0.01765	-0.002459	-0.07751	-0.007883	-0.0020723	-0.007221
1977	0.00154	0.000873	0.50998	-0.01340	0.001242	-0.05955	-0.004506	-0.0008409	-0.004613
1978	0.00480	-0.005170	0.21332	-0.04116	-0.028102	-0.10840	-0.001854	-0.0012475	-0.003244
1979	0.00794	-0.009874	0.23786	-0.02611	-0.011030	-0.09782	0.001005	-0.0009563	-0.002230
1980	0.01414	-0.009382	0.17789	-0.00328	-0.006641	-0.02545	0.005197	-0.0007655	-0.001821
1981	0.01715	-0.009530	0.35512	0.01042	0.002736	0.00718	0.008887	0.0003400	0.000641
1982	0.02040	-0.010045	0.33793	0.02029	0.005807	0.02847	0.012287	0.0008915	0.002299
1983	0.02294	-0.011984	0.21067	0.01081	0.000289	0.01393	0.015225	0.0011732	0.003647

YEAR	INFP	\CF	ACJ	YLF	YLJ	LMF	PJ	NYGD	M1R
1960									
1961	0.08257	0.000000	0.000000	0.002335	0.002046	-0.0008710	0.000781	-0.029928	-0.030967
1962	0.13666	-0.008585	0.029980	0.000728	0.000638	-0.0002393	0.015154	-0.002977	-0.016445
1963	0.26673	-0.006811	0.018542	0.006973	0.006108	-0.0011160	0.001840	-0.054298	-0.054476
1964	0.15931	-0.017517	0.054471	0.003373	0.002956	-0.0005240	0.020273	-0.018153	-0.039212
1965	-0.03084	-0.015476	0.039394	0.001770	0.001551	-0.0004385	-0.001635	-0.013238	-0.026552
1966	-0.03716	-0.010784	0.018109	0.002196	0.001925	-0.0007435	-0.006304	-0.022171	-0.023684
1967	0.03419	-0.009064	0.013823	0.001514	0.001327	-0.0003707	0.000416	-0.012572	-0.018458
1968	0.04759	-0.007334	0.011036	0.001179	0.001033	-0.0003648	-0.000062	-0.011030	-0.013148
1969	0.06261	-0.006042	0.009172	0.002261	0.001981	-0.0002704	0.002173	-0.018008	-0.018670
1970	0.03277	-0.007470	0.016645	0.000465	0.000407	-0.0006001	0.003249	-0.010504	-0.013809
1973	0.03694	-0.006166	0.011872	-0.001577	-0.001382	-0.0006742	-0.002299	-0.003321	-0.018426
1974	-0.00279	-0.003337	0.002178	-0.001365	-0.001196	-0.0002879	-0.004162	0.000721	-0.015546
1975	0.12622	-0.001134	-0.003155	-0.019961	-0.017515	-0.0032543	-0.016353	-0.034438	-0.082750
1976	0.12659	-0.003521	0.004627	-0.004588	-0.004022	-0.0017093	0.006327	-0.005135	-0.043811
1977	-0.09359	-0.002616	0.003925	-0.003468	-0.003040	-0.0008903	-0.001367	-0.002404	-0.022694
1978	0.31609	-0.001345	0.000066	-0.005972	-0.005236	-0.0017671	-0.006479	-0.004922	-0.034038
1979	-0.51514	0.000273	-0.005122	-0.005448	-0.004776	-0.0014179	-0.005800	-0.000540	-0.025016
1980	0.01261	0.001602	-0.007969	-0.001625	-0.001425	-0.0004505	-0.001253	0.005198	-0.018242
1981	-0.04141	0.002800	-0.009314	-0.000249	-0.000218	0.0003880	-0.000340	0.009519	-0.007519
1982	-0.00455	0.003834	-0.010552	0.000585	0.000513	0.0009308	0.000373	0.012377	-0.000081
1983	0.11729	0.004809	-0.011954	-0.000035	-0.000030	0.0007752	-0.001071	0.012940	-0.000715

*Definition of variables given at the end of this chapter (Table 5.20)

The simulation results indicate increased foreign capital inflow having almost negligible impact on the real sector of the economy in the initial years. Private investment responds vigorously but with some delay due to rapid expansion in bank credits possible due to improved international reserve positions. When the multiplier process is allowed to operate for a number of years, only then we see some positive impacts on aggregate income and output. Output response reaches close to a percentage point around the 10th year while for aggregate demand it takes about 7 years. Manufacturing sector show mild response despite large influx of bank credits, partly due to relatively high capital-output ratio, long gestation period,and relatively small size of the sector. On the other hand, agriculture shrinks, which is expected since foreign capital inflow in most developing countries discriminates against agriculture. Imports, as expected, rises sharply with two year delay, this rise was necessary to satisfy needs of fastly growing private investment demands. As a result the current account balance show continuous deterioration. Finally, money supply rises only by 2.3 percent in the first year because of the reasons we have mentioned earlier, but in the long run it catches up-- with a growth of over 35 percent in one later year.

5.6 SUMMARY

This chapter deals with the final objective of the present study, namely, the validation of the estimated macro model for the Bangladesh economy and the multiplier analysis using various policy/exogenous shock simulations with the model. We find that the model tracks the historical data well and that the hypothesised macroeconomic system for the economy is dynamically stable as demonstrated by various sensitivity tests with the model. In general, the policy/shock simulation results suggest that both the impact and the dynamic multiplier values are in keeping with macro-theoretic predictions with very few exceptions.

The multiplier analyses demonstrate substantial endogenous responses in fiscal and monetary sector agents' behavior. In general, the time pattern of the responses in endogenous variables vary considerably across variables. However, for many aggregate variables it is observed that the multipliers level off around the 10th year, which is relatively on the high side compared to findings for other developing countries(see Behrman,1977, and Vernardakis, 1979). Generally, the size of the multipliers are relatively small. Supply inelasticities, institutional rigidities, structural bottlenecks, etc. play their share quite prominently in cutting off or dwarfing the various channels of operation for the multipliers in the economy.

Fiscal, monetary, and foreign sector policies all have one common significant effect: ability to alter the sectoral composition of income, output and expenditures in the economy. This is particularly noticeable in the case of monetary policy, despite the fact that the policy has very little impact on the aggregate real variables. Appropriate fiscal policies financed by raising taxes in our model have desirable positive impact on the overall growth of the economy. We also find that expansionary government expenditure-- consumption or investment or both--policies alone have in general very little impact on the economy due to low value for investment and expenditure multipliers and due to government budgetary constraints and endogenous fiscal responses. This endogeneity coupled with the lags and direct and indirect feedback effects mean that successful fine-tuning of the economy is nearly impossible.

Contrary to the structuralist macroeconomic tradition, devaluation in our case is non-contractionary. However, substantial food price inflation is generated in the economy along with a continuous deterioration of real wages of the working population--both of which are in accord with the structuralist macroeconomic predictions. Devaluation also results in a compositional shift of resources from industry to agriculture thereby retarding the process of industrialization of the country. The exogenous shock simulations highlight the importance of supply side in an economy with very low multiplier values and supply elasticities and substantial structural rigidities and bottlenecks.

Finally, it may be noted here that the above simulation exercises demonstrate the importance of building consistent macroeconomic models and question the value of various highly aggregative macroeconomic models. As we have seen, endogenous fiscal, monetary, and private sector agents' responses, and various feedback effects and disequilibrium adjustment lags and induced changes in sectoral compositions, all produce results in many cases quite different, both in terms of signs and magnitudes, from what one usually encounters in the conventional IS-LM textbook macroeconomic models.

Table 5.20

DEFINITION OF VARIABLES IN TABLE 5.9 - 5.19

```
ACF = 'FOOD ACREAGE IN MILLIONS'
YLF = 'FOOD YIELD, MAUNDS PER ACRE'
ACJ = 'JUTE ACREAGE IN MILLIONS'
YLJ = 'JUTE YIELD, MAUNDS PER ACRE'
QF = 'FOOD PRODUCTION, MILL MAUNDS'
QJ = 'JUTE PRODUCTION, MILL MAUNDS'
YOA = ' OTHER AGRI OUTPUT, MILL CONST TAKA'
YAG = ' ALL AGRI OUTPUT, MILL CONST TAKA'
YGD = ' GDP, MILL CONST TAKA'
Y   = 'GNP AT MARKET PRICES, MILL CONST TAKA'
YMF = ' MANUFAC. OUTPUT, MILL CONST TAKA'
YIN = ' INFRASTRUCT OUTPUT, MILL CONST TAKA'
YTB = ' TRADE & BANK OUTPUT, MILL CONST TAKA'
YHO = ' HOUSING OUTPUT, MILL CONST TAKA'
YCN = ' CONSTRUCT. OUTPUT, MILL CONST TAKA'
YOS = ' OTHER OUTPUT, MILL CONST TAKA'
LMF = 'LABOUR EMPLOYED IN MANUFACTURING'
LAG = 'LABOUR EMPLOYED IN AGRICULTURE'
INVMF = 'MNF FIXED INVEST, MILL CONST TAKA'
INVGF = 'GOVT FIXED INVEST, MILL CONST TAKA'
INVP  = 'PRIV FIXED INVEST, MILL CONST TAKA'
I     = 'TOTAL INVESTMENT, MILL CONST TAKA'
NINV = 'TOTAL INVESTMENT, MILL TAKA'
CP    = 'PRIV CONSUMPTION, MILL CONST TAKA'
NCP    = 'PRIV CONSUMPTION, MILL TAKA'
CG    = 'GOVT CONSUMPTION, MILL CONST TAKA'
NCG    = 'GOVT CONSUMPTION, MILL TAKA'
C     = 'TOTAL CONSUMPTION, MILL CONST TAKA'
MFOR  = 'FOOD IMPORTS, MILL CONST TAKA'
MF    = 'FOOD IMPORTS, MILL TAKA'
MOCR  = 'OTH CONSUMER IMPRT, MILL CONST TAKA'
MOC   = 'OTH CONSUMER IMPRT, MILL TAKA'
MKR   = 'CAPITAL IMPORTS, MILL CONST TAKA'
MK    = 'CAPITAL IMPORTS, MILL TAKA'
MRR   = 'RAW & INTRMD IMRT, MILL CONST TAKA'
MR    = 'RAW & INTERD IMPT, MILL TAKA'
MG    = 'IMPORTS OF GOODS, MILL TAKA'
MSN   = 'IMPORTS OF SERVICES, MILL TAKA'
PGD   = 'AGGREGATE PRICE LEVEL(1973=100)'
CR  = 'TOTAL BANK CREDITS, MILL TAKA'
PF = 'FOODGRAINS PRICE INDEX(1973=100)'
YD = 'DISPOSABLE INCOME, MILL CONST TAKA'
BD = 'BUDGET DEFICIT, MILL TAKA'
CA = 'CURRENT ACCOUNT BALANCE, MILL TAKA'
MGR = 'IMPORTS OF GOODS, MILL CONST TAKA'
XGR = 'EXPORTS OF GOODS, MILL CONST TAKA'
XG = 'EXPORTS OF GOODS, MILL TAKA'
XJR = 'RAW JUTE EXPORTS, MILL CONST TAKA'
XJ = 'RAW JUTE EXPORTS, MILL TAKA'
XJMR = 'JUTE MNF EXPORTS, MILL CONST TAKA'
XJM = 'JUTE MNF EXPORTS, MILL TAKA'
XOR = 'OTHER EXPORTS, MILL CONST TAKA'
XO = 'OTHER EXPORTS, MILL TAKA'
PX = 'EXPORTS PRICE INDEX(1973=100)'
MM = 'MONEY MULTIPLIER'
H = 'HIGH POWERED MONEY, MILL TAKA'
CC = 'CURRENCY CIRCULATION, MILL TAKA'
DD = 'DEMAND DEPOSITS, MILL TAKA'
TD = 'TIME DEPOSITS, MILL TAKA'
D = 'TOTAL DEPOSITS(DD+TD), MILL TAKA'
M1 = 'MONEY SUPPLY(CC+DD), MILL TAKA'
M1R = 'MONEY DEMAND, MILL CONST TAKA'
TR = 'GOVT REVENUES, MILL TAKA'
TIN = 'INCOME TAX REVENUES, MILL TAKA'
TEX = 'EXCISE TAX REVENUES, MILL TAKA'
TSL = 'SALES TAX REVENUES, MILL TAKA'
TCS = 'CUSTOMS TAX REVENUES, MILL TAKA'
NT = 'NON TAX REVENUES, MILL TAKA'
NG = 'GOVT EXPENDITURES, MILL TAKA'
CRNA = 'NONAGRI BANK CRDT, MILL TAKA'
NFA = 'NET FOREIGN ASSETS, MILL TAKA'
GBSB = 'PUB BRRW FROM BNKS, MILL TAKA'
DGBBB1 = 'CHNGE CNTRL BNK BRRW, MILL TAKA'
CPI = 'CONSUMER PRICE INDEX(1973=100)'
NWAG = 'NOMINAL AGRI WAGE(1973=100)'
NWMF = 'NOMINAL MNF WAGE(1973=100)'
NW1 = 'NOMINAL WAGE(1973=100)'
RW = 'REAL WAGE(1973=100)'
INFP = 'INFLATION RATE(GDP DEFLATOR)'
PJ = 'RAW JUTE PRICE FRM GATE(1973=100)'
PXJ = 'RAW JUTE EXPRT PRICE(1973=100)'
```

Chapter VI

SUMMARY AND CONCLUSION

6.1 INTRODUCTION

The major objectives of this study have been to develop a macro-economic model for the Bangladesh economy which captures all the major linkages among various sectors of the economy, to collect, measure, and estimate all the necessary data required for the estimation of the structural model from both published and unpublished sources, to estimate the structural model using suitable econometric techniques, and finally to conduct multiplier analysis based on macroeconomic policy and exogenous shock simulations. In this chapter a brief summary of the study, its usefulness, strengths and weeknesses and some concluding comments regarding future research directions are presented.

Section 6.2 presents a summary of the study while the concluding section 6.3 provides some thoughts on the general direction for future research in this area.

6.2 A BRIEF SUMMARY OF THE STUDY

This is an empirical study of the economic structure and of the impact of various macroeconomic policies and exogenous shocks in the case of a particular developing country--Bangladesh. The time period for the study is 1959/60 to 1982/83. To the best of our knowledge, the present study is the first attempt to develop a comprehensive macroeconometric model for the economy and to undertake multiplier analysis to study the impact of macroeconomic policies and exogenous shocks on the economy based on such a model. Our major ingredients for building the present model have been economic theory, structural and institutional features of the country, econometric techniques, and the author's lifelong familiarity with the country's economic, social, and political path of evolution.

The present model is specifically designed to be an effective aid in understanding the observed developments of the economy, in particular, the growth of sectoral outputs, aggregate income, changes in balance of payments, international reserves, domestic credits, money supply, prices and wages. The model also provides guidelines for formulating consistent short-run policies for stabilizing macroeconomic target variables. Finally, the model could also be utilized as a useful tool in developing consistency between short-run macroeconomic policies and the long-run development strategy of the country.

Chapter one begins with the objectives, methodology, and motivation of the study, while chapter two first provides a detailed analysis of the structural and institutional features of the Bangladesh economy relevant for our study covering almost all the economic variables in production, expenditures, fiscal, monetary, international, and prices and wages sectors. The analysis brings forth and highlights both the obvious and subtle differences in structure and institutions between Bangladesh and other countries. In the second part of the chapter a survey of past attempts to construct econometric models for Bangladesh economy has been undertaken. It has been observed that these models are inadequate and are not suitable to serve our objectives. It is our firm belief that macroeconomic models for developing countries should address themselves to problems inherent in those countries, which many of these models fail. As such, a fully articulated model of the economy is needed to address the issues relating to problems of short-run to medium run macroeconomic adjustments. Key structural features, such as the role of agriculture, foreign trade, food deficit, balance of payments, bank credits, endogenous fiscal and monetary responses should be given adequate attention. The significance of the foreign sector as a source of non-competitive intermediate inputs and capital goods as well as a significant proportion of government revenues should be well integrated into the model. Similarly, the degree of endogeneity of fiscal and monetary variables should be appreciated such that the model consistency is not compromised and the policy options are not overstated. Finally, although the demand side should be well represented, more emphasis should be put on modelling the supply side.

Chapter three is an attempt to build a comprehensive macroeconomic model for the Bangladesh economy addressing all of these issues and concerns. Three major elements of the model are worth noting here: the emphasis on supply side; the endogenous fiscal operations affecting both monetary and real sectors; and the endogenous linkages of the monetary sector with the domestic and international factors.

The supply side is disaggregated into nine producing sectors--three in agriculture, one manufacturing, and the rest in construction and services sectors. Of these nine, three are key sectors: food-grains, jute, and manufacturing. Production functions for each of these are specified in the neoclassical tradition, while the output of the service sector is essentially demand determined. These production functions determine output which determines income, and the income generating mechanism in turn affects demand and transmits impulses throughout the economy.

Individual components of aggregate demand are modelled next. These include private consumption and investment, public consumption and investment, imports and exports.

Role of bank credits in private investment expenditures highlights an important linkage between the monetary and the real sectors. Public sector investment and consumption functions are linked to endogenously determined government revenues receipts, and foreign aid/capital inflows providing yet another linkage between the real and the monetary sector. It also emphasizes the endogenous nature of fiscal operation in the country.

Four imports demand functions are specified: for foodgrains, other consumer goods, capital goods, and industrial raw materials. The estimated income and price elasticities among these importables are quite different. Also, three separate exports functions are specified: for jute, jute manufacturing, and all other exportables. Once again, estimated income and price elasticities indicate significant differences across the various exportables.

Government policy module is modelled with several tax functions, endogenous budget constraint, monetary authorities' accounting identities, and several behavioral specifications for the agents involved in the monetary sector. Disaggergated tax functions show wide variations in responses across various types of taxes. Money supply is endogenously determined by policy decisions(e.g. various reserve ratios) together with behavioral relations for the portfolio composition of the private sector and the banking sector and by the government deficit financing obligations and international reserve movements. However, despite this endogeneity, the central bank can influence the domestic money supply by changing the reserve ratios--hence changing the money multiplier, or by bringing about changes in the residual items in the consolidated balance sheets of both itself and of the scheduled banks. In either case the monetary base will be affected altering domestic money supply. On the other hand, movement in the international reserve position brought about either by the performance of the endogenous foreign trade sector or by the exogenous foreign aids/capital inflows variable would have direct implications for the 'monetary base' again affecting the domestic money supply.

Sectoral prices, in general, are determined by the level of excess demand in the particular market, which in turn depends upon the positions and rates of movements of the demand and supply curves in that market. As such the price equations are quasi-reduced form equations. The competitive forces are dominant in the agricultural sector, while monopolistic and oligopolistic elements are pervasive in the manufacturing sector. Prices in the services sectors are assumed to follow the general pattern of the manufacturing and agricultural prices. In particular, food-grains prices is affected mainly by food-grains supply and per-capita disposable income, while jute price is determined by domestic production and the demand for jute. Manufacturing price is dominated by wages, productivity,. and imports price of raw materials. Once the sectoral prices are determined, the general price level is determined by the weighted average of these sectoral prices, where the weights are given by sectoral outputs relative to gross national product. Finally, both demand and supply factors in the respective markets determine the two nominal wages in the agricultural and manufacturing sectors. All the other wages are exogenously given and are assumed to follow the general pattern in the two key sectors.

Once the model is estimated using suitable econometric techniques in chapter four, the complete estimated model is than used for model validation and multiplier analysis in chapter five. The model used for macro simulations contains in total 93 endogenous variables of which 43 are stochastic behavioral and/or quasi-behavioral equations and the remaining 50 are definitions, equilibrium conditions, and various sectoral accounting identities and in total 70 are exogenous variables. A large number of simulations were conducted with the model to investigate model-response to macroeconomic policy and exogenous shocks. Results from only a selected number of these simulations are presented to save space. All the simulations can be classified into four broad categories: (i) fiscal policy; (ii) monetary policy; (iii) foreign sector; and (iv) exogenous shocks.

To analyze the impact of fiscal policy four policy simulations were run: (i) tax reform policy--a 1 percent sustained increase in all taxes and government revenues; (ii) expansionary fiscal policy--a 1 percent sustained increase in both public investment and consumption expenditures; (iii) 'balanced budget' fiscal policy--a 1 percent sustained increase in both taxes and government consumption and investment expenditures; and (iv) reduction of government subsidies--a 1 percent sustained increase in food-grains prices. In general, the fiscal policy simulation results show that government expenditure policies in isolation have contractionary effects on the economy; crowding out of both private and public investments occurs due to the ripple effect of endogenous government budget constraints and the nature of government financing in Bangladesh. On the other hand, quite contrary to conventional expectations, increased tax policies have, in general, non-contractionary effects on income and output and very little inflationary impulses. Interestingly, here it is the endogenous government sector that triggers such expansion! When the two policies are combined the result is in general expansionary. The 'balanced budget' multiplier is positive. All of these policies, however, have important effects at the sectoral level.

Two monetary policy simulations were conducted with the model: (i) a 10 percent sustained increase in money supply; and (ii) a 10 percent increase in bank credits to agriculture with an equal reduction in non-agricultural credits. The simulation results show, in general, either negligible or mildly contractionary impact on the real sector. This is not unrealistic given the subsistance nature of the economy, and that the monetized sector is relatively small and formal capital market is almost absent. The impact effect on the price level is also minimal, in general. However, at a more disaggregated level a substantial impact of monetary policy changes is observed on the real sector, particularly on investment and growth of manufacturing sector. This inter-sectoral substitution and resource allocation cannot be observed in aggregate analysis. Monetary policy in Bangladesh seems to have important role in affecting the composition of sectoral output and income despite its overall insignificant impact on the aggregate variables.

To assess the model-response to foreign sector policy changes/exogenous shocks, three simulations were conducted; (i) a 10 percent rise in all export prices; (ii) a 10 percent rise in all import prices; and (iii) a 1 percent devaluation of the exchange rate. Higher import prices generate substantial deterioration of the country's balance of payments situation. Since real imports decreases, a clear negative impact on capital formation and the growth of the industrial sector is observed. On the other hand, higher export prices, although reduce real demand for Bangladesh goods but less than proportionately, improve the country's balance of payments at least for the first few years. Finally, simulation results show that devaluation is not contractionary or overly expansionary. However, it generates substantial food price inflation, and a continuous deterioration of real wages of the working class. It also, worsens the country's balance of payments. At the sectoral level devaluation also has differential impact on agriculture and industry. In general, agriculture expands; industry shrinks.

Finally, two simulations were conducted to see the impact of exogenous shocks; (i) technological change in agriculture--a 1 percent sustained increase in food-grains production; and (ii) a 10 percent sustained increase in foreign aid/foreign capital inflows. The results from technological change simulation show, in general, expansionary effects on all fronts. On the other hand, impact of foreign aid is minimal on the real sector of the economy in the initial years. Investment responds significantly, but because of low investment multipliers and structural rigidities and bottlenecks income and output response with a long lag. The country's current account balance deteriorates due to heavy import demand, especially for capital goods and raw materials. At the sectoral level, in general, agriculture shrinks.

The multiplier analyses demonstrate substantial endogenous responses in fiscal and monetary sector agents' behavior. In general, the time pattern of the responses in endogenous variables vary considerably across variables.

For many, however, the multipliers seem to level off around the 10th year. Generally, the size of the multipliers are relatively small. Supply inelasticities, institutional rigidities, structural bottlenecks, etc. are quite powerful in cutting off or dwarfing the various channels of operation of multipliers in the country.

The simulation exercises also demonstrate the importance of building consistent macroeconomic models and question the value of various highly aggregative macroeconomic models. Endogenous fiscal, monetary, and private sector agents' responses, and various feedback effects and disequilibrium adjustment lags and induced changes in sectoral compositions, all produce results in many cases quite different from the predictions of the conventional IS-LM textbook macroeconomic models.

6.3 FUTURE DIRECTION OF RESEARCH

Despite our efforts to build a consistent macroeconomic model for the Bangladesh economy which can be used for structural and policy analysis, the present study is far from complete and free of unintended shortcomings. The most important shortcoming is the data limitations and 'impurity'. For effective policy analysis a concerted effort must be devoted to construct a consistent and more reliable macroeconomic data for the country.

The model presented here, itself, can be improved upon on several fronts: (i) by making economic-theoretic content of each behavioral equations more explicit and rigorous; (ii) by making sectoral linkages and structural-institutional content of the model more up-to-date to accommodate future changes in the economy; and (iii) by making econometric-specification and testing content of individual stochastic relations more rigorous.

In particular, the present model, for example, does not explicitly incorporate, due to lack of data, the role of inventories and stock formation in various sectors. Similarly, the ramification of the labour market and its operations are partially dealt with. Also missing are the effects of population growth, and explicit treatment of income distribution and the role of savings.

One future application of the model is in forecasting, given the availability of more reliable data. An important extension of the present study would be the application of 'control theory' techniques to improve system performance and derive optimal policy rules. In this regards, model 'dimension-reduction' may be undertaken from the viewpoint of determining robust optimal economic policies(Rao, 1987). A linearized version of the model may be developed and the Kalman filtering concepts invoked to identify 'loop-variables' and remove 'superfluous' identities and 'noisy' variables. The resulting compact subsystem may than be used for optimal policy making.

In closing, it is necessary to emphasize that the model developed in this study is a tentative one, although we have discussed the model performance as if it represents the 'true' structure of the economy. Despite our extreme care in modelling the economy 'faithfully', questions remain regarding the data base and model specification in which some assumptions are admittingly quite ad-hoc. Models are essentially approximation of reality and modelling is as much an art as it is a science. Notwithstanding these shortcomings, our objectives will be more than satisfied, if the present study succeed in providing insights on the process and issues in large-scale econometric modelling in developing countries and generates impetus in the future for macroeconomic policy analysis in developing countries in general and Bangladesh in particular based on formal and consistent macroeconomic model of the economy.

Appendix A

MACRO DATA FOR BANGLADESH: SOURCES

The data used to estimate the Bangladesh model developed in this study are constructed from the following sources:

1) Alamgir and Berlage(1974).

2) Alamgir and Rahman(1974).

3) World Bank(1974): Bangladesh, Development in a Rural Economy, vol. II, Statistical Appendix(Report No. 455a-BD), Washington, DC.

4) World Bank(1978, 1984): Banglasdesh, Economic Trends and Development Administration, Vol.ii, Statistical Appendix, Washington, DC.

5) Bangladesh Bank Bulletin, (variuos Issues), Dhaka, Bangladesh.

6) Monthly Statistical Bulletin of Bangladesh, (various issues), Bangladesh Bureau of Statistics, Dhaka.

7) Reports on Activities of the Financial Institutions in Bangladesh, (various issues), Ministry of Finance, Dhaka.

8) International Financial Statistics, (various issues), IMF, Washington, DC.

9) Bangladesh Economic Survey, various issues, Ministry of Finance, Dhaka.

10) Statistical Year Book of Bangladesh, 1975, 1982, 1984, Bangladesh Bureau of Statistics, Dhaka.

11) Economic Survey of East Pakistan, 1960/61 -1970/71, annual issues, Finance Department, Government of East Pakistan, Dacca.

12) 25 Years in Pakistan Statistics, Central Statistical Office, Government of Pakistan.

13) Statistical Digest of Bangladesh No. 7, 1970/71-71/72, Bangladesh Bureau of Statistics, Dhaka.

14) UN Year Book of National Accounts, various issues, United Nations.

15) Statistical Year Book, various issues, United Nations.

16) Commodity Bulletin, various issues, FAO.

17) Production Year Book, various issues, FAO.

18) Main Economic Indicators, various issues, OECD.

19) Agricultural Year Book, various issues, Bangladesh Bureau of Statistics, Dhaka.

20) Islam(1981)

21) Haque(1963)

22) Zaman and Asad(1972)

23) Rahman, et al(1984)

25) Chowdhury(1985)

26) Kabir(1981)

27) PIDE(1983)

28) Five Year Plans, 1973-78 and 1980-85, Planning Commission, Bangladesh Government, Dhaka.

29) Two-Year Plan, 1978-80, Planning Commission, Bangladesh Government, Dhaka.

30) World Bank Report, country reports on Bangladesh, various issues, World Bank, Washington, DC.

Appendix B

LIST OF ALL ENDOGENOUS AND PRE-DETERMINED VARIABLES

Variable	Definition and unit of measurement
ACf	Acreage of food-grains; millions of acres.
ACj	Acreage of jute; millions of acres.
AID	Total foreign aid; millions of taka.
AIDnf	Total non food-grain aid, millions of taka.
Asb	Scheduled banks total assets; millions of current taka.
BD	Government budget deficit; millions of current taka.
bc	Bonus expenditure rate on consumer goods imports.
bk	Bonus expenditure rate on capital goods imports.
br	Bonus expenditure rate on raw materials imports.
BRsb	Scheduled banks' borrowings from the Central bank; millions of current taka.
C	Aggregate real consumption expenditure; millions of constant taka(1972/73=100).
Cg	Real government current consumption; millions of constant taka(1972/73=100).
Cp	Real private consumption expenditure; millions of constant taka(1972/73=100).
CPI	Consumer price index; weighted average of CPIu and CPIr(1972/73=100).
CPIr	Consumer price index for rural households (1972/73=100).
CPIu	Consumer price index for urban households (1972/73=100).
CA	Current account balance; millions of current

taka.

CAP Capital account balance(net capital inflow); millions of current taka.

CC Currency in circulation; millions of taka.

CR Total bank credits to non-bank public; milions of current taka.

CRj Bank credits to raw jute traders; millions of current taka.

CRmf Bank credits to manufacturing sector; millions of current taka.

CRna Bank credits to all non-agricultural sectors; millions of current taka.

CRag Bank credits to agriculture; milions of taka.

CUmf Capacity utilization index for manufacturing.

D TD + DD

DD Demand deposits; millions of current taka.

DM Index of degree of monetization.

D_{65} Dummy variable for 1965 India-Pakistan war; D_{65}=1 for 1965/66, otherwise 0.

D_{71} Dummy variable for 1971 Independence war; D_{71}=1 for 1972/73 onward, otherwise 0.

D_{75} Dummy variable for 1974 famine year, D_{75}=1 for 1974/75, otherwise 0.

D_{76} Dummy variable for 1975 devaluation of taka; D_{76}=1 for 1975/76 , otherwise 0.

Dgp Dummy variable for agricultural credit policy; Dgp=1 for 1974/75 onwards, otherwise 0.

Ddn Dummy variable for privatization ; Ddn=1 for 1978/79 onwards, otherwise 0.

Dho Dummy variable for housing policy changes; Dho=1 if assistance given, otherwise 0.

Dn Dummy variable for nationalization of industries; Dn=1 for 1973/74 onwards, otherwise 0.

DCi Dummy variable for control of jute trading; DCi=1 if there is control, otherwise 0.

ΔDTi	Dummy variable for discretionary policy changes in ith taxable item.
ΔDSi	Dummy variable for discretionary policy changes in public subsidy programmes.
ΔDRi	Dummy variable for discretionary policy changes in public debt market.
ER	Official exchange rate for taka;taka per unit of US dollar.
EERmr	Effective exchange rate for imported raw materials and intermediate goods.
EERmk	Effective exchange rate for imported capital goods;taka per unit of US doller.
ERS	Excess reserves of scheduled banks; millions of current taka.
FT	Fertilizers used in agriculture; thousands of long tons.
GAPf	Expected food shortage; millions of tons.
GB	Total domestic public debt; millions of current taka.
GBp	Government borrowing from non-bank private sector; millions of current taka.
GBbb	Government borrowing from the Central Bank; millions of current taka.
GBsb	Government borrowing from scheduled banks; millions of current taka.
Iag	Total real investment in agriculture; millions of constant taka(1972/73=100).
Imf	Real investment in manufacturing; millions of constant taka(1972/73=100).
Ig	Total real public investment; millions of constant taka(1972/72=100).
Icn	Real investment in construction; millions of constant taka(1972/73=100).
Iin	Real investment in infrastructure; millions of constant taka(1972/73=100).
I	Aggregate real investment; millions of constant taka(1972/73=100).

Ipf	Private gross fixed investment; millions of constant taka(1972/73=100).
Igf	Public gross fixed investment; millions of constant taka(1972/73=100).
Igs	Public investment in inventories; millions of constant taka(1972/73=100).
Ipa	Private gross fixed investment in agriculture; millions of constant taka(1972/73=100).
Ipm	Private gross fixed investment in manufacturing; millions of constant taka(1972/73=100).
Ipo	Private gross fixed investment in other sectors; millions of constant taka(1972/73=100).
Kp	Nominal value of private capital stock; millions of current taka.
Kmf	Capital stock of manufacturing sector; millions of constant taka(1972/73=100).
Kcn	Capital stock in construction; millions of constant taka(1972/73=100).
Lag	labour supply in agriculture; millions of workers.
Lmf	Employment in manufacturing sector; millions of workers.
Lot	Employment in other sectors; millions.
mm	Money multiplier(M1/H).
M1	Narrow money(CC + DD); millions of taka.
M2	Broad money(CC+DD+TD); millions of taka.
M	Total imports of goods and non-factor services; millions of current taka.
Mr	Imports of intermediate goods and raw materials; millions of current taka.
Mk	Imports of capital goods; millions of taka.
Mg	Imports of goods; millions of current taka.
Ms	Imports of services; millions of taka.
Mf	Imports of food-grains; millions of taka.

Mc	Imports of other consumer goods; millions of current taka.
Msn	Import payments for non-factor services; millions of current taka.
Msy	Import payments for factor(investment) income; millions of current taka.
NR	Net factor income from abroad; millions of current taka.
NPR	Net private remittances of migrant workers; millions of current taka.
NFIp	Net factor income payments; millions of current taka.
NT	Non-tax revenues; millions of current taka.
NG	Total public expenditure on all items; millions of current taka.
NOB	Total number of bank branches; thousands.
NFA^{0}	Net foreign assets of the Central Bank; millions of US doller.
NFA	Net foreign assets of the Central Bank; Millions of taka.
NW	Aggregate nominal wage rate index; weighted average of sectoral indices(1972/73=100).
OAbb	Other net assets of the Central Bank; millions of current taka.
P	General price level(GDP deflator); 1972/73=100.
Pf	Wholesale price index of food-grains, 1972/73=100.
Pj	Farm-gate price index of raw jute, 1972/73=100.
PRf	Farmers price risk index for food-grains; 4 year moving average of SD of monthly prices.
Pfg	Government procurement price of food-grains; taka per maund.
Pjg	Government procurement price of jute; taka per maund.
PRj	Farmers price risk index for jute; 4 year moving average of SD of monthly prices.

Pag Price index for agriculture; 1972/73=100.

Pmf Price index for manufacturing; 1972/73=100.

Pcn Price index for construction, 1972/73=100.

Pm Import price index(weighted average of taka unit value indices); 1972/73=100.

Pmr Import price index for raw materials and intermediate goods; 1972/73=100.

Pmr^0 Pmr but foreign currency unit value index; 1972/73=100.

Pmk Import price index for capital goods; taka unit value index(1972/73=100).

Pmk^0 Pmk, but foreign currency(US doller) unit value index(1972/73=100).

Pmfo Import price index for food-grains; taka unit value index(1972/73=100).

$Pmfo^0$ Pmfo, but foreign currency(US doller) unit value index(1972/73=100).

Pmoc Import price index for other consumer goods; taka unit value index(1972/73=100).

$Pmoc^0$ Pmoc, but foreign currency(US doller) unit value index(1972/73=100).

Pms^0 Import price index for non-factor services; US dollar unit value index(1972/73=100).

Px Export price index(weighted average of taka unit value individual indices); 1972/73=100.

Pxj Export price index for raw jute; taka unit value index(1972/73=100).

Pxj^0 Pxj, but foreign currency(US doller) unit value index; 1972/73=100.

Pxjm Export price index for jute manufacturing; taka unit value index(1972/73=100).

$Pxjm^0$ Pxjm, but foreign currency(US dollar) unit value index(1972/73=100).

Pxo Export price index for all other goods; taka unit value index(1972/73=100).

Pxo^0 Pxo, but foreign currency(US doller) unit value index(1972/73=100).

Pxs^0	Export price index for non-factor services; US dollar unit value index(1972/73=100).
Pjm¤	World price index(major exporters) of jute manufacturing goods; 1972/73=100.
Pjs	World price index of jute substitutes; 1972/73=100.
Pinv	Price index for investment goods; 1972/73=100.
Pho	Price index for housing sector; 1972/73=100.
Prm	Price index for industrial raw materials and intermediate goods; 1972/73=100.
Pna	Price index for non-agricultural sector(weighted average of relevent GDP deflators); 1972/73=100.
Pft	Price index for fertilizer; 1972/73=100.
Pin	GDP deflator for infrastructure, 1972/73=100.
Ptb	GDP deflator for trade and banking, 1972/73=100.
Pos	GDP deflator for other services, 1972/73=100.
Pci	Price index for construction materials; 1972/73=100.
Psr	GDP deflator for all services, 1972/73=100.
p	Rate of inflation; annual percentage change of GDP deflator= $«P/(P_{-1})-1».100$.
Þ	Expected rate of inflation.
POP	Total population; millions.
POPu	Total urban population; millions.
Qf	Domestic production of food-grains; millions of maunds.
QMf	Foodgrains imports; millions of maunds.
QSf	Foodgrains year end stock held by private and public sectors; millions of maunds.
Qj	Domestic production of jute; millions of maunds.
QJmf	Raw jute demand by jute manufacturing sector; millions of maunds.

QXj	Raw jute exports; millions of maunds.
Qf^{+}	Expected domestic production of food-grains; millions of tons.
RN	Rainfall index; base index=25 years(1950-75) annual average rainfall in inches.
rTD	Interest rate on time and savings deposits.
rGB	Interest rate for government securities.
rBR	Bank rate or discount rate.
rCR	Interest rate(weighted average) on bank credits.
RES	Total Reserves(VC+ERS+RRS); millions of taka.
RRS	Required reserves of scheduled banks; millions of current taka.
RD	Total interest payments on public debts; millions of current taka.
RG	"Resource gap"; millions of constant taka 1972/73=100.
REEmc	Real Effective exchange rate for imported consumer goods; taka per unit of US dollar.
REEmk	Real effective exchange rate for imported capital goods; taka per unit of US dollar.
REEmr	Real effective exchange rate for imported raw materials; taka per unit of US doller.
REEj	Real effective exchange rate for raw jute exports; taka per unit of US dollar.
REEjm	Real effective exchange rate for jute manufacturing goods; taka per unit of US dollar.
REEot	Real effective exchange rate for all other exports; taka per unit of US dollar.
SDf	Standered deviation of current year monthly farm-gate prices of rice.
SDj	Standered deviation of current year monthly farm-gate price of jute.
STj	Stock of jute held by traders and jute-mills, year end; millions of maunds.
ΔST	Total inventory investments(private and public);

millions of constant taka(1972/73=100).

SUB	Government subsidies to non-bank public; millions of current taka.
sj	Subsidy rates for raw jute exports.
sjm	Subsidy rates for jute manufacturing exports.
so	Subsidy rates for other traditional exports.
sn	Subsidy rates for non-traditional exports.
sw	Exchange rate premium obtained in open market or Wage earners exchange rate premium.
TQf	Total quantities of food-grains available; millions of maunds.
t	Time trend; 1,2,...22.
TR	Government total revenues from all sources; millions of current taka.
T	Tax revenues; millions of current taka.
Tdi	Direct tax revenues(personal and corporation income taxes); milions of current taka.
Tid	Indirect taxes; millions of current taka.
Tln	Land revenue taxes; millions of current taka.
Tex	Excise taxes; millions of current taka.
Tsl	Sales taxes; millions of current taka.
Tcs	Customs duties; millions of current taka.
Tot	Other indirect taxes; millions of taka.
TP	Transfer payments other than subsidies; millions of current taka.
TD	Time and savings deposits of scheduled banks; millions of current taka.
tc	Tariff rates on consumer goods imports.
tk	Tariff rates on capital goods imports.
tr	Tariff rates on raw materials imports.
tj	Tariff rates on raw jute exports.

tjm	Tariff rates on jute manufacturing exports.
to	Tariff rates on other traditional exports.
TU	Index of trade union activities; Unionized industrial labour as a proportion of total.
u	Unemployment rate; national average.
VC	Vault cash of scheduled banks; millions of current taka.
NWag	Nominal wage index for agricultural worker, 1972/73=100.
NWmf	Nominal wage index for manufacturing workers; 1972/73=100.
NWcn	Nominal wage index for construction workers; 1972/73=100.
WLT	Aggregate wealth of the private sector; millions of current taka.
WYj	Real GDP index of jute importing countries; weighted average(1972/73=100).
WY	Real GNP index of major trading partners; trade weighted average(1972/73=100).
X	Exports of goods and non-factor services; millions of current taka.
Xg	Exports of goods; millions of taka.
Xs	Exports of services(non-factor and factor income receipts); millions of taka.
Xj	Raw jute exports; millions of taka.
Xjm	Jute manufacturing goods exports; millions of current taka.
Xot	All Other goods exports; millions of current taka.
Xsn	Non-factor services exports receipts; millions of current taka.
Xsy	Factor(foreign investment) income receipts; millions of current taka.
Y	Real gross national product(GNP); millions of constant taka(1972/73=100).

Ygd	Real GDP at factor costs; millions of constant taka(1972/73=100).
Ygn	Real GNP at factor costs; Millions of constant taka(1972/73=100).
Yag	Real value added in agriculture; millions of constant taka(1972/73=100).
Ymf	Real value added in manufacturing; millions of constant taka(1972/73=100).
Ycn	Real value added in construction; millions of constant taka(1972/73=100).
Ysr	Real value added in services; millions of constant taka(1972/73=100).
Yfd	Real value added in food-grains; millions of constant taka(1972/73=100).
Yjt	Real value added in raw jute; millions of constant taka(1972/73=100).
Yoa	Real value added in other agriculture; millions of constant taka(1972/73=100).
Yin	Real value added in infrastructure; millions of constant taka(1972/73=100).
Ytb	Real value added in Trade and Banking; millions of constant taka(1972/73=100).
Yho	Real value added in housing; millions of constant taka(1972/73=100).
Yos	Real value added in other services; millions of constant taka(1972/73=100).
Yna	Real value added in all non-agriculture; millions of constant taka(1972/73=100).
YLf	Foodgrains yield per acre; maunds.
YLj	Jute yield per acre; maunds.
Yf	Gross real value of food-grains production; millions of constant taka(1972/73=100).
Yj	Gross real value of jute production; millions of constant taka(1972/73=100).
Yd	Personal real disposable income; millions of constant taka(1972/73=100).
ymf	Real growth rate for manufacturing sector.

NOTE:
The following general rules have been followed in defining all variables:
(1) Superscript « ^{0} » indicates that the corresponding variable is expressed in foreign currency(US dollars).
(2) Superscript « * » indicates that the corresponding variable being expressed in per capita terms.
(3) Superscript « $^{+}$ » indicates expected value of the corresponding variable.
(4) The bullet sign « • » indicates that the corresponding variable being exogenously determined.
(5) All constant taka values and price indices are estimated assuming 1972/73 as the base year.
(6) All values and prices are expressed in current nominal taka unless otherwise explicitly mentioned.
(7) All foreign currency values and prices are measured in US dollar only.

BIBLIOGRAPHY

Aghevli, Bijan B. and Mohsin S. Khan(1977): "Inflationary Finance and the Dynamics of Inflation: Indonesia, 1951-72", American Economic Review, vol.67(3):pp.390-403.

Ahammed, C. Saleh(1981): "A Policy Multiplier Model of Bangladesh Jute in the World Market", Journal of Developing Economies.

Ahmed, Iftekhar(1974): "Employment in Bangladesh: Problems and Prospects", in E.A.G.Robinson and K.Griffin,eds.(1974): The Economic Development of Bangladesh within a Socialist Framework, (Dhaka: MacMillan).

Ahmed, Iqbal(1981): "Wage Determination in Bangladesh Agriculture", Oxford Economic Papers, vol.33(New Series):pp.298-322.

Ahmed, Q.K.,et al.(1979): World Trade in a Primary Commodity: The Case of Jute, (Dhaka: Bangladesh Institute of Development).

Ahmed, R.(1979) Food-grain Supply, Distribution and Consumption Policies Within a Dual Price Mechanism: A Case Study of Bangladesh, Research Report 8, International Food Policy Research Unit, Washington, D.C.

Ahmed, Sadiq(1977): "Demand for Money in Bangladesh: Some Preliminary Evidence", Bangladesh Development Studies, vol.5(2):pp.227-237.

Alam, Syed N.(1977): "The Rate of Adjustment of the Pakistan Currency 1959-64", Yale Economic Essays, vol.11(1&2): pp.53-96.

Alamgir, M.(1974): "Some Analysis of Distribution of Income, Consumption, Saving and Poverty in Bangladesh", Bangladesh Development Studies, vol.2.

----------- and Lodewijk J.J.B. Berlage(1974): Bangladesh: National Income and Expenditure 1949/50-1969/70, Research Monograph No.1(Dhaka: Bangladesh Institute of Development Studies).

--(1973): Cross-Section Analysis of Food-grain Demand in a Low-income Economy: The Case of Bangladesh, New Series No.11, Bangladesh Institute of Development Studies, Dhaka.

----------- and A. Rahman(1974): Savings in Bangladesh 1959/60 - 1969/70, Research Monograph No. 2, Bangladesh Institute of Development Studies, Dhaka.

----------- and Sultan H. Rahman,eds.(1977): The New International Economic Order and UNCTAD IV, Proceedings of the Bangladesh National Seminar (Dhaka: Bangladesh Institute of Development Studies).

Alauddin, M. and T.J. Mules(1980): "Structural Interdependence and Bangladesh Agriculture: 1972-73 and 1977-78", Australian Economic Papers, vol.19(34,June): pp.155-167.

Anderson, L.C. and K.M. Carlson(1970): "A Monetarists Model of Economic Stabilization", FRB of St. Louis Review, vol.52(November): pp.7-21.

Ando, Albert and Franco Modigliani(1963): "The 'Life Cycle' Hypothesis of Saving: Aggregate Implications and Tests", American Economic Review, vol.53(part 1,March).pp55-84.

Askari, N. and C. Cummings(1976): Agricultural Supply Response: A Survey of Econometric Evidence, (New York: Praeger Publishers).

Atta, Jacob K.(1981): A Macroeconometric Model of a Developing Economy: Ghana(Simulation and Policy Analysis), (Washington: University Press of America).

Bain, A.D.(1973): "Flow of Funds Analysis: A Survey", Economic Journal, (December).

Ball, R.J.,ed.(1973): The International Linkage of National Economic Models, (Amsterdam: North-Holland).

---------- and P.S.Drake(1964): "The Relationship Between Aggregate Consumption and Wealth", International Economic Review, vol.5(1,January):pp.63-81.

BAM(1983): Bangladesh Agriculture Model: A Linkable General Equilibrium Model for Bangladesh with Special Reference to Agricultural Sector, Research Reports, SOW, Centre for World Food Studies, Free University, Amsterdam. Research Team: Wim van Veen, W. Tims, W. Kennes and others.

Barro, Robert J. and H.I. Grossman(1971): "A General Disequilibrium Model of Income and Employment", American Economic Review, vol.61, p82-93.

Behrman, J.R.(1968): <u>Supply Response in Underdeveloped Agriculture</u>, (Amsterdam: North-Holland).

--------------(1972): "Sectoral Investment Determination in a Developing Economy", <u>American Economic Review</u>, vol.62(2,December): pp.825-841.

--------------(1977): <u>Macroeconomic Policy in a Developing Country: The Chilean Experience</u>, (Amsterdam: North-Holland).

-------------- and L.R. Klein(1970): "Econometric Growth Models for the Developing Economy", in M.F.G. Scott and J.N. Wolfe edited <u>Induction, Growth and Trade</u>, (Oxford: Oxford University Press), Ch.12, pp167-187.

Beltran del Rio, A. B. and L.R. Klein(1974): "Macroeconometric Model Building in Latin America: The Maxican Case", in N. Ruggels edited <u>The Role of the Computer in Economic and Social Research in Latin America</u> (New York: Columbia University Press),pp.161-190.

Benassy, Jean-Pascal(1986): <u>Macroeconomics: An Introduction to the Non-Walrasian Approach</u>, (Academic Press, Inc.; Orlando, FL), 250p.

Bhagwati, Jagdish N. and T.N. Srinivasan(1979): "Trade Policy and Development", chapter 1 of R. Dornbusch and J. Frenkel edited <u>International Economic Policy, Theory and Evidence</u>, (Baltimore: Johns Hopkins University Press),pp.1-38.

Bhuiyan, M. N. I.(1971): <u>An Econometric Model of Financial Behavior in Pakistan</u>, Unpublished Ph.D. Dissertation, University of Pennsylvania.

Biorn, Erik(1981): "Estimating Economic Relations from Incomplete Cross-Section/Time-Series Data", <u>Journal of Econometrics</u>, vol.16(2,June): pp.221-236.

Blaug, Mark(1977): " Educated Unemployment in Asia With Special Reference to Bangladesh, india and Sri Lanka", <u>Economic Bulletin for Asia and the Pacific</u>, vol.28(1/2,June/December):pp.120-137.

Bottomley, Anthony(1965): "Keynesian Monetary Theory and the Developing Countries", <u>Indian Economic Journal</u>, vol.12(April/June): pp.335-346.

Brainard, William C. and James Tobin(1968): "Pitfalls in Financial Model Building", <u>American Economic Review, Papers and Proceedings</u>, vol.58(2.May): pp.99-122.

Branson, W. H.(1979): Macroeconomic Theory and Policy, 2nd edition, (Harper and Row; New York).

Bridge, J.L.(1971): Applied Econometrics, (Amsterdam: North-Holland).

Brookings Model(1965): James S. Duesenberry, Gary Fromm, Lawrence R. Klein, and Edwin Kuh, eds.: The Brookings Quarterly Econometric Model of the United States, (Rand McNally: Chicago).

Brown, T.M.(1952): "Habit Persistence and Lags in Consumer Behavior", Econometrica, vol.20(3,July):pp.355-371.

-----------(1970): Specification and Uses of Econometric Models, (Toronto: MacMillan).

Brunner, Karl, et al, eds.(1972): Problems and Issues in Current Econometric Practice, College of Administrative Science Monograph No. AA-6 (Ohio State University Press; Ohio).

Burress, Glenn E.(1973): "Who First Proposed the Habit Persistence Hypothesis: Keynes or Duesenberry and Modigliani?", Indian Economic Journal vol.20(January/March).

Cameron, Norman E.(1984): Money, Financial Markets and Economic Activity, (Ontario: Addison-Wesley).

Chaipravat, O., K. Meesook, and S. Ganjarevmdee(1979): "An Econometric Model of Thailand", Southeast Asian Studies, vol.17, No.2(September).

Chakravarty, S.(1979): "Keynes , 'Classics', and the Developing Countries", in C. H. H. Rao and P. C. Joshi, eds., Reflections on Economic Development and Social Change: Essays in Honor of V. K. R. V. Rao, (Allied Publishing: New Dehli).

Challen, D.W. and A.J. Hagger(1983): Macroeconometric Systems Construction, Validation and Applications, (New York: St. Martin's Press).

Chenery, H.B. and Alan M. Strout(1966): "Foreign Assistance and Economic Development", American Economic Review, vol.56(September): pp.679-733.

Choudhry, Nurun N.(1976): "Integration of Fiscal and Monetary Sectors in Econometric Models: A Survey of Theoretical Issues and Empirical Findings", IMF Staff Papers, vol.23:pp.395-440.

Choudhury, N.K., Y.Kotowitz, et al(1972) The TRACE Econometric Model of the Canadian Economy, University of Toronto press, Toronto.

Chow, Gregory C. and Paolo Corsi,edited(1982): Evaluating the Reliability of Macro-Economic Models, a Wiley-Interscience publication(New York: John Wiley & Sons).

Chowdhury, O. H.(1985) "Agricultural underemployment, industrial growth, real wages, and labour absorption in Bangladesh economy, 1952-78", Research Report, new series No.39, Bangladesh Institute of Development Studies, Dhaka.

Christ, C.F.(1968): "A Simple Macroeconomic Model with a Government Budget Constraint", Journal of Political Economy, vol.76(1):pp.53-67.

Cline, William R. and S. Weintraub, eds.(1981): Economic Stabilization in Developing countries, (Washington: Brookings Institute).

------------------ and Associates(1981): World Inflation and the Developing Countries, (Washington: Brookings Institute).

Clower, R. W.(1965): "The Keynesian Counterrevolution: A Theoretical Appraisal", in F. H. Hahn and F. P. R. Breching, eds., The Theory of Interest, (Macmillan; London).

Coats, W.L. Jr. and D.R. Khatkhate(1978): "Money Supply Implications of Commercial Banks' Financing of Government Debt in Developing Countries", Oxford Bulletin of Economics and Statistics, vol.40(2,May), also reprinted in Coats and Khatkhate,eds.(1980): pp.371-385.

Conrad, Alfred H.(1968): "Econometric Models in Development Planning: Pakistan, Argentina, Liberia", in G. Papanek, ed.(1968): Development Policy: Theory and Practice, (Harvard University Press), Chapter 2: pp.31-54.

Cuddington, John T., Per-Olov Johansson, and Karl-Gustaf Lofgren(1984): Disequilibrium Macroeconomics in Open Economies, (Basil Blackwell; England), 246p.

Cummings, J. T.(1974): "The Supply Responsiveness of Bangladesh Rice and Cash-crop Cultivators", Bangladesh Development Studies, vol.2, No.4(October).

Darby, Michael R.(1984): "Some Pleasant Monetarist Arithmetic", Quarterly Review, FRB of Minneapolis, (spring):pp.15-20; also reprinted in Thomas M. Havrilesky ed.(1985): Modern Concepts in Macroeconomics, (Illinois: Harlan Davidson),pp.265-273.

Davis, Tom E.(1952): "The Consumption Function as a Tool for Prediction", Review of Economic and Statistics, vol.34(August).

DePrano, M.E. and J.B. Nugent(1966): A Global Financial Model of Ecuador, (Quito: Junta Nacional de Planification).

Dervis, Kemal, Jaime deMelo, and Sherman Robinson(1982): General Equilibrium Models for Development Policy, World Bank Research Publication, (Cambridge University Press; Cambridge), 526p.

Desai, Meghnad J.(1973): "Macro Econometric Models for India: A Survey", Sankhya: The Indian Journal of Statistics, Series B, vol.35, pp169-206.

Dhrymes, P.J., et al.(1972): "Criteria for Evaluation of Econometric Models", Annals of Economic & Social Measurements, vol.1, pp.291-324.

Drake, P.J.(1980): Money, Finance and Development, (Oxford: Martin Robertson).

DRI Model or Data Resource Institute Model(Otto Eckstein, Edward W. Green, and Associates)

Duesenberry, J.S.(1949): Income, Saving, and the Theory of Consumer Behavior, (Cambridge: Harvard University Press).

------------------, G. Fromm, L.R. Klein, and E. Kuh,eds.(1965): The Brookings Quarterly Econometric Model of the United States, (Chicago: Rand McNally).

--,eds.(1969): The Brookings Model, Some Further Results, (Rand McNally; Chicago), 519p.

Eshag, Eprime(1971): "The Relative Efficacy of Monetary Policy in Selected Industrial and Less-Developed Countries", Economic Journal, vol.81: pp.294-305.

-------------(1983): Fiscal and Monetary Policies and Problems in Developing Countries, (Cambridge,London: Cambridge University Press).

Evans, Michael K.(1967): "The Importance of Wealth in the Consumption Function", Journal of Political Economy, vol.75(4,August):pp.335-351.

------------------(1967a): "A Study of Industry Investment Decisions", Review of Economics and Statistics, vol.49(2;May):pp.151-164.

------------------(1969): Macroeconomic Activity: Theory Forecasting, and Control- An Econometric Approach, (New York: Harper & Row).

Fair, R.(1970): "The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First Order Serially Correlated Errors", Econometrica, vol.30(May): pp.507-516.

Fair, R.(1973): "A Comparison of Alternative Estimators of Macroeconometric Models", International Economic Review, vol.14(2,June):pp.261-277.

---------(1984): Specification, Estimation and Analysis of Macroeconometric Models, (Cambridge:Harvard University Press;479p).

Fand, David I.(1970): "Can the Central Bank Control the Money Stock?", FRB of St. Louis Review, January, p12-16; also reprinted in Thomas M. Havrilesky and John T. Boorman,eds.(1980): Current Issues in Monetary Theory and Policy, 2nd edition (Illinois:AHM Publishing Co.): pp.288-295.

Farashuddin, Mohammad, et al.(1979): "Shadow Prices for Bangladesh: A Country-Specific Second Best General Equilibrium Approach", Center for Asian Development Studies:Research Project, (Boston University).

Fei, J.C.H. and G. Ranis(1968): "Foreign Assistance and Economic Development: Comment", American Economic Review, vol.58(September):pp.897-917.

Ferber, Robert(1953): A Study of Aggregate Consumption Functions, Technical Paper 8(New York:National Bureau of Economic Research).

--------------(1973): "Consumer Economics: A Survey", Journal of Economic Literature, vol.11(December).

Fomby, Thomas B.,R. Carter Hill and Stanley R. Johnson(1984): Advanced Econometric Methods, (New York: Ds Springer-Verlag;624p).

Friedman, Milton(1957): A Theory of Consumption Function, (Princeton,NJ: Princeton University Press).

-----------------(1968): "The Role of Monetary Policy", American Economic Review, vol.38:pp.1-17.

-----------------(1972): "Monetary Policy in Developing Countries", in Friedman, Milton(1973): Money and Economic Development, The Horowitz Lectures of 1972(Praeger Publishers); also reprinted in Paul A. David and Melvin W. Reder,eds.(1974): Nations and Households in Economic Growth, Essays in Honor of Moses Abramovitz,(New York: Academic Press): pp.265-278.

Friedman, B. M.(1978): "Crowding Out or Crowding In? The Economic Consequences of Financing Government Deficits", Brookings Papers on Economic Activity, vol.3:pp.593-641.

----------------(1983): "The Roles of Money and Credit in Macroeconomic Analysis", in James Tobin,ed.(1983): Macroeconomics, Prices, and Quantities Essays in Memory of Arthur M. Okun(The Brookings Institute):pp.161-189.

Fromm, Garry and Lawrance R. Klein,eds.(1975): The Brookings Model: Perspective and Recent Developments, (Amsterdam: North-Holland).

------------ and Paul Taubman(1968): Policy Simulations with an Econometric Model, (The Brookings Institute; Washington, DC), 179p.

Fry, Maxwell J.(1978): "Monetary Policy and Domestic Saving in Developing ESCAP Countries", Economic Bulletin for Asia and the Pecific, vol.29(1,June):pp.79-99.

Fuchs, Victor R.(1965): The Growing Importance of the Service Industries, Occasional Paper 96(New York: National Bureau of Economic Research).

-----------------,ed.(1969): Production and Productivity in the Service Industries, National Bureau of Economic Research Studies in Income and Wealth, vol.34(New York: Columbia University Press).

Gapinski, James H.(1982): Macroeconomic Theory, Statics, Dynamics and Policy, (New York: McGraw-Hill).

Ghatak, Subrata(1981): Monetary Economics in Developing Countries, (London: Macmillan Press).

Gibson, W.E.(1972): "Demand and Supply Functions for Money in the United States: Theory and Measurement", Econometrica, vol.40,New Series(March):pp.361-370.

Gill, Gerard J.(1983), "Mechanized Land Preparation, Productivity and Employment in Bangladesh", Journal of Development Studies, vol.19(3), April, pp329-348.

Griliches, Z.(1971): "A Note on the Serial Correlation Bias in Estimates of Distributed Lags", Econometrica, vol.29, pp65-73.

Gujarati, D.(1968): "Demand for Money in India", Journal of Development Studies, vil.5(1):pp.59-64.

Gupta, K.L.(1970): "Personal Savings in Developing Nations: Further Evidence", Economic Record, vol.46(June): pp.243-249.

Gurley, John G. and E.S. Shaw(1960): Money in a Theory of Finance, (Washington,DC: The Brookings Institute).

------------------------------(1967): "Financial Structure and Economic Development", Economic Development and Cultural Change, vol.15: pp.257-268.

Hansen, B.(1973): "Simulation of Fiscal, Monetary and Exchange Policy in a Primitive Economy: Afghanistan", in H.C. Bos, H. Linneman and P. deWolf,eds.(1973): Economic Structure and Development, (Amsterdam: North-Holland):pp.215-237.

Haq, M.(1963) Strategy of Economic Planning: A Case Study of Pakistan, Oxford University Press.

Harris, Laurence(1981): Monetary Theory, (New York: McGraw-Hill).

Hasan, Parvez(1971): "The Investment Multiplier in an Underdeveloped Economy", in I. Livingstones, ed.(1971): Economic Policy for Development: Selected Readings, (England: Harmondsworth), Chapter 17: pp.333-344.

Healy, Derek T.(1972): "Development Policy: New Thinking About an Interpretation", Journal of Economic Literature, September:pp.757-797.

Heathfield, David,ed.(1976): Topics in Applied Macroeconomics, (London: MacMillan). bib Heller, Peter S.(1975): "A Model of Public Fiscal Behavior in Developing Countries: Aid, Investment, and Taxation", American Economic Review, June, pp368-379.

Hickman, Bert G.,ed.(1972): Econometric Models of Cyclical Behaviour, Studies in Income and Wealth,vol.1,No.36,NBER (New York: Columbia University Press).

Hicks, John R.(1937): "Mr. Keynes and the 'Classics': A Suggested Interpretation", Econometrica, vol.5:pp.147-159.

Houthakker, H.S. and Lester D. Taylor(1966,1970): Consumer Demand in the United States, 1929-1970: Analyses and Projections, (Cambridge,Mass: Harvard University Press), first edition:1966, second edition:1970.

Hussain, Sayed Mustaq(1964): "A Note on Farmer Response to Price in East Pakistan", Pakistan Development Review, (Spring):pp.251-265.

Ichimura, Shinichi and Mitsuo Ezaki,eds.(1985): Econometric Models of ASIAN Link, (New York: Springer-Verlag), 332p.

Imam, K.H.(1970): "A Structural Model of Pakistans Monetary Sector", Pakistan Development Review, vol.10(3):pp.359-380.

----------(1974): "Some Aspects of the Foreign Trade Policies of Bangladesh", in E.A.G. Robinson and K. Griffin,eds.(1974): The Economic Development of Bangladesh within a Socialist Framework, (New York: John Wiley & Sons):pp.289-308.

Intriligator, Michael D.(1978): Econometric Models, Techniques, and Applications, (New Jersey: Prentice-Hall).

Islam, A.I. Aminul(1970): "An Estimation of the Extent of Overvaluation of the Domestic Currency in Pakistan at the Official Rate of Exchange, 1948/49-1964/65", Pakistan Development Review, vol.10(1):pp.50-67.

Islam, Muhammad A.(1979): "Tax Efforts in Bangladesh: Some Empirical Observations", Bangladesh Development Studies, vol.7(1).

Islam, Nurul(1965): A Short-term Model for Pakistan Economy: An Econometric Analysis, (Dhaka: Oxford University Press).

------------,ed.(1970): Studies on Commercial Policy and Economic Growth, (Karachi: Pakistan Institute of Development Economics).

------------(1977): Development Planning in Bangladesh, A Study in Political Economy, (London: C. Hurst & Co.).

------------(1978): Development Strategy of Bangladesh, (Oxford: Pergamon Press).

------------(1981): Foreign Trade and Economic Controls in Development: The Case of United Pakistan, (New Haven: Yale University Press).

------------(1983):

Jahan, Selim(1983): Money, Income, the Balance of Payments of bangladesh: A Macroeconometric Model, Unpublished Ph.D. Dissertation(Montreal: McGill University).

Johnston, J.(1984): Econometric Methods: Third Edition, (New York: McGraw-Hill).

Just, R.E.(1975): "Risk Response Models and Their Use in Agricultural Policy Evaluation", American Journal of Agricultural Economics, vol.57(5,December).

Kabir, M.(1981): A Disaggregated Econometric Model of Price Behaviour in Bangladesh, Unpublished Ph.D. Dissertation(Hamilton: McMaster University).

Kapur, B.K.(1976): "Alternative Stabilization Policy for Less-Developed Countries", Journal of Political Economy.

Kenen, Peter B.(1985): The International Economy, (Englewood Cliffs,NJ: Prentice-Hall).

Keynes, John M.(1936): The General Theory of Employment, Interest and Money, (London: MacMillan).

JMK, vol.XIV, vol.XXVII, Collected Works of John Maynard Keynes, edited by ....

Khan, Azizur R.(1972): The Economy of Bangladesh, (London: MacMillan).

----------------(1976): Poverty and Inequality in Rural Bangladesh, (ILO; Geneva).

Khan, M.(1974): "Import and Export Demand in Developing countries", IMF Staff Papers, vol.21, pp678-693.

Khatkhate, Deena R.(1972): "Analytical Basis of the Working of Monetary policy in Less Developed Countries", IMF Staff Papers, vol.19:pp.533-557.

------------------ and W.L. Coats,Jr., eds.(1980): Money and Monetary Policy in Less Developed Countries: A Survey of Issues and Evidence, (Pergamon Press); 827p).

Klein, Lawrence R.(1963): "A Quarterly Model of the American Economy, 1948-1961", Mimeographed.

-----------------(1965): "What Kind of Macroeconometric Model for Developing Economies?", The Econometric Annual of the Indian Economic Journal, vol.13(3); pp.313-324; also reprinted in Coats and Khatkhate,eds.(1980).

-----------------(1974): "Supply Constraints in Demand Oriented Systems: An Interpretation of the Oil Crisis", Zeitschrift fur Nationalokomic, vol.13(3): pp.45-56.

------------------(1978): "The Supply Side", American Economic Review, vol.68(1):pp.1-7.

------------------(1981): Econometric Models as Guides for Decision-Making, The Charles C. Moskowitz Memorial Lectures(New York: Free Press, Macmillan Publishing Co; 75p).

------------------ and A.S. Goldberger(1955): An Econometric Model of the United States, 1929-52, (Amsterdam: North-Holland).

------------------ and Y. Shinkai(1963): "An Econometric Model of Japan, 1930-1959", International Economic Review, vol.4(1,January):pp.1-28.

------------------ and R.S. Preston(1967): "The Measurement of Capacity Utilization", American Economic Review, vol.57(1,March):pp.34-58.

------------------, L.R. Lau, et al.(1975): A Bibliography of Econometric Models of Developing Countries, Mimeograph, (Department of Economics: Stanford University).

------------------ and Richard M. Young(1980): An Introduction to Econometric Forecasting and Forecasting Models, (Lexington,Mass: Lexington Books,D.C. Heath & Co).

Kmenta, J.(1971): Elements of Econometrics, (MacMillan; London). ---------- (1972): "Summary of the Discussion", in K. Brunner edited Problems and Issues in Current Econometric Practice, College of Administrative Science Monograph No.AA-6, (Ohio State University Press: Ohio), pp262-284.

---------- and J.B. Ramsey,eds.(1981): Large-Scale Macro-Economic Models, (Amsterdam:North-Holland).

Koutsoyiannis, A.(1977): Theory of Econometrics, second edition, (MacMillan; London).

Kravis, Irving B., Alan W. Heston and Robert Summers(1983): "The Share of Services in Economic Growth", in F. Gerard Adams and Bert G. Hickman, edited Global Econometrics, Essays in Honor of Lawrence R. Klein, (MIT press; Cambridge, Mass.), Ch.10, pp188-218.

Krishna, Raj(1963): "Farm Supply Response in India-Pakistan: A Case Study of the Panjab Region", Economic Journal, vol.63(September):pp.477-487.

------------(1967): "Agricultural Price Policy and Economic Development", in H.M. Southworth and B.F. Johnston,eds.(1967): Agricultural Development and Economic Growth, (Ithaca: Cornell University Press).

Labys, Walter C. and Peter K. Pollak(1984): Commodity Models for Forecasting and Policy Analysis, (London: Croom Helm).

Lahiri, Ashok K. and P. Roy(1985): "Rainfall and Supply-response: A Study of Rice in India", Journal of Development Studies, vol.18, pp315-334.

Laidler, David E.W.(1985): The Demand for Money: Theories, Evidence, and Problems, Third Edition(New York: Harper & Row).

Leamer. E. E.(1978): Specification Searches. (Wiley: New York).

------------ and R.M. Stern(1970): Quantitative International Economics, (Boston: Allyn & Bacon).

Leff, Nathaniel H. and Kazo Sato(1975): "A Simultaneous-Equation Model of Savings in Developing Countries", Journal of Political Economy, vol.83(6):pp.1217-1228.

--------------------------------(1980): "Macroeconomic Adjustment in Developing Countries: Instability, Short-run Growth, and External Dependency", Review of Economics and Statistics, vol.62(2): pp.170-179.

Leibenstein, H.(1957): "The Theory of Underemployment in Backward Economies", Journal of Political Economy, vol.65(April).

Leijonhufvud, Axel(1968): On Keynesian Economics and the Economics of Keynes, (New York: Oxford University Press).

Levy, Michael E.(1963): Fiscal Policy, Cycles and Growth, Studies in Business Economics,No.81: A Research Report from the Conference Board.

Lewis, W.A.(1954): "Economic Development with Unlimited Supplies of Labour", Manchester School of Economic and Social Studies, vol.22; pp.139-191.

Maddala, G.S.(198x): Econometrics, (New York: McGraw-Hill).

Mahmud, W.(1979): "Food-grain Demand Elasticities in Rural Households in Bangladesh--An Analysis of Pooled Data", Bangladesh Development Studies, vol.7(1), Winter.

---------- and S.R. Osmani(1980): "Impact of Emigrant Workers' Remittances on the Bangladesh Economy", Bangladesh Development Studies, vol.8(3,Monsoon):pp.1-28.

Masih, Abul M.M.(1978): "Specification and Estimation of the Commercial Bank Equations in a Developing Economy: The Case of Pakistan", Nigerian Journal of Economic and Social Studies, vol.20(1,March):pp.71-88.

Masson, Paul R.,David E. Rose and Jack G. Selody(1980): Building a Small Macro-model for Simulation: Some Issues, Bank of Canada Technical Report 22(November 1980):115p.

Mathur, Ashok(1986): "On 'throwing the baby away with the bath-water", Indian Economic Journal, vol.12(4):pp.397-416.

Mckenzie, George(1976): "Imports and Exports", chapter 6 in Heathfield(1976),pp.144-163.

McKinnon, R.I.(1973): Money and Capital in Economic Development, (Washington: Brookings Institute).

Mikesell, Raymond F. and James E. Zinser(1973): "The Nature of the Savings Function in Developing Countries: A Survey of the Theoretical and Empirical Literature", Journal of Economic Literature, vol.11(1):pp.1-26.

Miller, Preston, J.(1983): "Higher Deficit Policies lead to Higher Inflation", Quarterly Review, FRB of Minneapolis, Winter:pp.8-19; also reprinted in Thomas H. Havrilesky, ed.(1985): Modern Concepts in Macroeconomics, (Illinois: harlan Davidson): pp.243-264.

Ministry of Finance(1976): Resume of the Activities of the Financial Institutions in Bangladesh(16th December 1971 to 31st December 1975), 2nd Issue(Dhaka: Government of Bangladesh).

MPS Model or the MIT-PENN-SSRC Model: (Albert Ando, Franco Modigliani, and Robert Rasche:

Mujeri, Mustafa K.(1979): "An Econometric Model Simulation of the World Jute Market", Bangladesh Development Studies, vol.7(4):pp.1-42.

Musgrove, Philip(1980): "Income Distribution and the Aggregate Consumption Function", Journal of Political Economy, vol.88(June):pp.506-523.

Myint, H.(1971): Economic Theory and the Underdeveloped Countries, (Oxford University Press).

Naqvi, Syed N.H., Ashfaque H. Khan, Nasir M. Khilji and Ather M. Ahmed(1983): The P.I.D.E. Macroeconometric Model of Pakistan Economy, vol.1(Islamabad: Pakistan Institute of Development Economics).

Nerlove, M.(1958): The Dynamics of Supply: Estimation of Farmer's Response to price, (John Hopkins Press).

-----------(1966): "A Tabular Survey of Macroeconometric Models", International Economic Review, vol.7(May): pp.127-175.

Okun, Arthur M.(1975): "Uses of Models for Policy Formulation", Ch.8 in Fromm and Klein, eds.(1975): The Brookings Model: Perspective and Recent Developments, (Amsterdam; North-Holland), pp361-373.

Osmani, Siddiqur R.(1982): Economic Inequality and Group Welfare: A Theory of Comparison with Application to Bangladesh, (Oxford: Clarendon Press).

Pani, P.K.(1977): A Macroeconometric Model of the Indian Economy, (Macmillan Co. of India Ltd.).

Papanek, Gustav(1980):

Park, Yung Chul(1972): "Some Current Issues on the Transmission Process of Monetary Policy", IMF Staff Papers, vol.19:pp.1-43.

---------------(1973): "The Role of Money in Stabilization Policy in Developing Countries", IMF Staff Papers, vol.20:pp.379-418.

Patinkin, Don(1956): Money, Interest, and Prices: An Integration of Monetary and Value Theory, (New York: Harper & Row).

-------------(1976): "Keynes and Econometrics: The Interaction Between the Macroeconomic Revolutions of the Inter-war Period", Econometrica, vol.xliv, no.6, pp1091-1123.

Phillips, A.(1963): "An Appraisal of Measures of Capacity", American Economic Review, Papers and Proceedings, vol.53(2.May):pp.275-292.

PIDE(1983): see Naqvi, et al.(1983).

Pitt, Mark M.(1983): "Food Preferences and Nutrition in Rural Bangladesh", The Review of Economics and Statistics, vol.65(1), February, pp105-114.

Pindyck, Robert S. and Daniel L. Rubinfeld(1981): Econometric Models and Economic Forecasts, Second Edition, (New York: McGraw-Hill; 630p).

Polak, J.J.(1957): "Monetary Analysis of Income Formation and Payments Problems", IMF Staff Papers, vol.4(November).

Porter, Richard C.(1965): "Narrow Security Markets and Monetary Policy: Lessons from Pakistan", Economic Development and Cultural Change, vol.14(1):pp.48-60.

Rahman, A.,M.S. Haque and M. Ahmad(1984): Production Procurement and Agricultural Price Policy in Bangladesh, Centre for Integrated Rural Development for Asia and the Pacific, (Dhaka: Institute of Business Administration).

Rahman, A. N. M. A.(1973) "Elasticities of Substitution in Manufacturing Industries of Bangladesh: An International Comparison", Bangladesh Economic Review, vol.1, pp173-185.

Rahman, Sultan H.(1981): "Simulation of an Econometric Model to Analyze the Impact of a Buffer Stock Scheme in the Bangladesh Jute Sector", Bangladesh Development Studies, vol.9(4):pp.1-33.

Rabbani, A. K. M. G. and R. C. Repetto(1968): "Food-grains Availability, Money Supply and the Price Level in East Pakistan", Pakistan Development Review, vol.8, pp281-287.

Raj, K. N.(1979): "Keynesian Economics and Agrarian Economics", in C.H.H. Rao and P.C. Joshi, edited Reflections on Economic Development and Social Change, Essays in Honor of Professor V.K.R.V. Rao, (Allied Publishers; New Dehli).

Rao, M.J.M.(1987) Filtering and Control of Macroeconomic Systems, A control System Incorporating the Kalman Filter for the Indian Economy, North Holland.

Rao, V.K.R.V.(1952): "Investment, Income and the Multiplier in an Underdeveloped Economy", Indian Economic Review, vol.1(February): pp.55-57; also reprinted in A.N. Agarwala and S.P. Singh,eds.(1958): The Economics of Underdevelopment, (Oxford university Press).

Raqibuzzaman, Mohammad(1966): "Marketed Surplus Function of Major Agricultural Commodities in Pakistan", in Sayed M. Hussain and Mohammad I. Khan,eds.: Empirical Studies on Pakistan Agriculture, (Karachi: Pakistan Institute of Development Studies):pp.297-315.

RDX2(Bank of Canada) Model(1969): John F. Helliwell, Fred Gorbert, and Associates(1969):

Reddaway, W.B.(1963): "The Economics of Underdeveloped Countries", Economic Journal, vol.73: pp.1-12.

Rohmberg, R. R.(1962): "Money, Income, and the Foreign Balance", in E.F. Jackson, ed.(1962): Economic Development in Africa, (Oxford: Basil Blackwell), pp.255-275.

Robinson, E.A.G. and Keith Griffin,eds.(1974): The Economic Development of Bangladesh Within a Socialist Framework, Proceedings of a Conference Held by the International Economic Association at Dhaka(New York: John Wiley & Sons).

Rushdi, Ali A.(1982): "Factor Substituteability in the Manufacturing Industries In Bangladesh: An Application of the Translog Cost Model", bangladesh Development Studies, vol.10(2), June, pp85-105.

Samualson, P.A.(1975): "The Art and Science of Macro Models Over 50 Years", in Fromm and Klein, eds.(1975): The Brookings Model: Perspectives and Recent Developments, (North-Holland; Amsterdam), pp3-10.

Sapir, Andre and Ernst Lutz(1980): Trade in Non-Factor Services: Past Trends and Current Issues, World Bank Staff Working Paper No.410(A Background Study for World Development Report 1980).

Sargent, Thomas J.(1979): Macroeconomic Theory, (Florida: Academic Press).

------------------ and N. Wallace(1973): "Rational Expectations and the Dynamics of Hyper-Inflation", International Economic Review, vol.2(June):pp.74-90.

---------------------------------(1981): "Some Unpleasant Monetarist Arithmetic", Quarterly Review, FRB of Minneapolis, vol.5(Fall):pp.1-17.

Sawyer, John A.,ed.(1979): Modelling the International Transmission Mechanism: Applications and Extensions of the Project LINK System, (Amsterdam: North-Holland).

Schultz, Theodore W.(1964): Transforming Traditional Agriculture, (Yale University Press).

Schydlowsky, Daniel M.(1970-71): "Short-run Policy in Semi-Industrialized Economies", Economic Development & Cultural Change, vol.19: pp.391-413.

Seeer, D.(1967): "The Limitations of the Special Case", in Kurt Martin and J. Napp edited: The teaching of Development Economics, (Frank Cass; London).

Sen, A. K.(1981): Poverty and Famines: An Essay on Entitlement and Deprivation, (Clarendon Press; Oxford).

Shapiro, Harrold T. and L. Halabuk(1976): "Macroeconometric Model Building in Socialist and Non-Socialist Countries: A Comparative Study", International Economic Review, vol.17(3): pp.529-565.

Shaw, E.S.(1973): Financial Deepening in Economic Development, (Oxford: Oxford University Press).

Shourie, Arun(1972): "The Use of Macro-Economic Regression Models of Developing Countries for Forecasts and Policy Prescription: Some Reflections on Current Practice", Oxford Economic Papers, vol.24(1), New Series: pp.1-35.

Singer, H.W.(1985): "Relevance of Keynes for Developing Counties", in Harrold L. Wattel, ed.(1985): The Policy Consequences of John Maynard Keynes, (New Yok: M.E. Sharpe,Inc.), section 10, pp.128-144.

Snyder, Wayne W.(1964): "Money in a Developing Economy: A Case Study of Pakistan, 1953-61", Review of Economics and Statistics, vol.46(November):pp.413-420.

-----------------(1970): "Money in a Developing Economy: A Reappraisal", Review of Economics and Statistics, vol.52(1):pp.54-61.

Sobhan, Rehman(1979): "Plotics of Food and Famine in Bangladesh", Economic and Political Weekly, vol.14.

---------------(1981): "The Impact of External Factors on the Development Pattern of Bangladesh: A Study in the Political Economy of Dependent Development", mimeographed(Dhaka), cited in Roger Ehrhardt(1983): Canadian Development Assistance to Bangladesh, (The North-South Institute: Ottawa), pp3.

Stone, Richard(1978): "Keynes, Political Arithmetic and Econometrics", Keynes Lecture in Economics, Proceedings of the British Academy, vol.lxiv, pp55-92.

STUPIDE(1984) or The Stockholm University Model: Lars Werin,ed. A Quarterly Macroeconometric Model of the Swedish Economy, (Department of Economics, 1984:2RE, University of Stockholm).

Taheruddin, Muhammed(1977) "The Demand for and Supply of Bank Credits in Bangladesh, An Empirical Analysis", Bangladesh Development Studies, vol 5(4), p442-450.

Tait, Alan A., et al.(1979): "International Comparisons of Taxation for Selected Developing Countries: 1972-76", IMF Staff Papers, March:pp.xx-xx.

Taylor, Lance(1974): "Short-term Policy in Open Semi-industrialized Economies: the Narrow Limits of the Possible", Journal of Development Economics, vol.1: pp.85-104.

--------------(1975): "Theoretical Foundations and Technical Implications", in Charles R. Blitzer, et al., eds.(1975): Economy-Wide Models and Development Planning, (Oxford University Press), pp.33-110.

--------------(1979a): Macro Models for Developing Countries, (New York: McGraw-Hill).

--------------(1979b): "IS/LM in the Tropics: Mechanics off the New Structuralist Macro-critiques", Mimeograph, (Boston: M.I.T.); a shorter version in Cline and Weintraub, eds.(1981),

--------------(1984): Structuralist Macroeconomics, (New York: Basic Books).

Teigen, R.L.(1964): "Demand and Supply Functions for Money in the United States: Some Structural Estimates", Econometrica, vol.32,New Series(4,October):pp.476-509.

Theil, H.(1966): Applied Economic Forecasting, (Amsterdam: North-Holland).

Theil, H.(1974): Econometrics, Willey.

Thirlwall, A.P.(1974): Inflation, Saving and Growth in Developing Economies, (London: Macmillan).

----------------(1980): Balance-of-Payments Theory and the United Kingdom Experience, (London: Macmillan).

Thomas, Vinod(1979): "Price Elasticities of Demand for Bangladesh's Jute", Bangladesh Development Studies, vol.7(2):pp.101-106.

Tinbergen, J.(1956): The Theory of Economic Policy ?????

-------------(1981): "The Use of Models: Experiences and Prospects", Nobel Lecture 1970, American Economic Review, vol.71(6), December, pp17-22.

Tobin, James(1969): "A General Equilibrium Approach to Monetary Theory", Journal of Money, Credit, and Banking, vol.1(1): pp.15-30.

------------(1985): "Monetarism: An Ebbing Tide?", The Economist, April 27:pp.23-25.

Tolley, George S., Vinod Thomas and Chung Ming Wong(1982): Agricultural Price Policies and the Developing Countries, (Baltimore: Johns Hopkins University Press for The World Bank).

Turnovsky, Stephen J.(1977): Macroeconomic Analysis and Stabilization Policy, (Cambridge University Press; Cambridge), 390p.

UNCTAD(1973): "Models for Developing Countries" by UNCTAD STAFF in Ball,ed.(1973),Chapter 6:pp.109-176.

Vane, Howard R. and John L. Thompson(1979): Monetarism: Theory, Evidence and Policy, (Oxford: Martin Robertson).

Vernardakis, Nikos(1979): Econometric Models for the Developing Economies: A Case Study of Greece, (New York: Praeger Publishers; 143p).

Vernon, Raymond(1966): "Comprehensive Model Building in the Planning Process: The Case of the Less-Developed Countries", Economic Journal, vol.76: pp.57-69.

von Furstenberg, George M. and Burton G. Malkiel(1977): "The Government and Capital Formation: A Survey of Recent Issues", Journal of Economic Literature, vol.15(3), September, pp835-878.

Waelbroeck, Jean(1973): "A Survey of Short-run Model Research Outside the United States", in Fromm and Klein, eds.(1975): The Brookings Model: Perspectives and Recent Developments, (North-Holland; Amsterdam).

Wai, U Tun and Chorng-huey Wong(1982): "Determinants of Private Investment in Developing Countries", Journal of Developing Studies, vol.19(1,October):pp.19-36.

Weisskopf, T.E.(1972): "An Econometric Test of Alternative Constraints on the Growth of Underdeveloped Countries", Review of Economics and Statistics, vol.54(February): pp.67-78.

Williamson, Jeffrey G.(1968): "Personal Saving in Developing Nations: An Inter-temporal Cross-Section From Asia", Economic Record, June:pp.194-210.

Winston, Gordon C.(1970): "Overinvoicing and Industrial Efficiency", Pakistan Development Review, Winter, also reprinted in K. Griffin and A.R. Khan, eds.(1972): Growth and Inequality in Pakistan, (London: Macmillan):Chapter 6,pp.169-187.

Worton, David A.(1969): "The Services Industries in Canada 1946-66", in Fuchs,ed.(1969):pp.237-286.

Yotopulos, Pan A. and L.J. Lau(1974): "On Modelling the Agricultural Sector in Developing Countries: An Integrated Approach of Micro and Macroeconomic", Journal of Development Economics, vol.1: pp.105-127.

Yotopoulos, Pan A. and Jeffrey B. Nugent(1976): Economics of Development: Empirical Investigations, (New York: Harper & Row).

Zaman and Asad(1972), "An analysis of rice prices in Bangladesh, 1951-68", Research Report, new series No.2, Bangladesh Institute of Development Studies, Dhaka.

Zarembka, Paul(1972): Toward a Theory of Economic Development, (San Francisco: Holden-Day;249p).

Zellner, A.(1962): "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias", Journal of the American Statistical Association, vol.57:pp.348-368.