THE ROLE OF AGRICULTURAL PRODUCTION, EXPORT PERFORMANCE, AND FOOD AVAILABILITY IN ACHIEVING ECONOMIC STABILITY FOR BANGLADESH

by

© Hafizur Rahman

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HAFIZUR RAHMAN

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

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ABSTRACT

Bangladesh is an agriculture-based low-income country. Although rice is the major crop, inadequate domestic production has made food the single-most important import item. The concern over the food deficit situation and its effects on the balance of payments has made food self-sufficiency an important priority. For balance of payments improvements, an alternative is the promotion of jute exports -- the commodity in which Bangladesh has historically had comparative advantage. This study seeks to examine the effects of the alternative solutions of food self-sufficiency and export promotion on real gross domestic product and the current account balance.

In the sphere of production, rice competes with jute for agricultural land. A shift from jute to rice affects the current account in two ways. It reduces food imports, but at the same time, it also reduces the volume of jute exports. A macro-econometric model has been constructed to evaluate the alternative solutions. The model incorporates a disaggregated agriculture sector to examine the trade-off between rice and jute, and links the changes in the composition of agricultural output to real gross domestic product and the current account balance. The behavioral equations

are first estimated by the methods of ordinary least squares, maximum likelihood and seemingly unrelated regressions. The entire model, along with the restrictions and identities, is then simulated.

We perform seven policy simulations using two instruments -- changes in relative prices and increases in productivities of rice and jute, using each insturment in isolation as well as in combination with the other. We obtained generally better results for food self-sufficiency policies with price and productivity increases for rice. This policy unambiguously increases real gross domestic product and produces generally better results for current account balance than expansion of traditional exports. We propose that to improve the current account balance the policies of food self-sufficiency should be combined with policies of export diversification and import substitution. The main contribution of this thesis is that it explicitly examines the external sector stabilization effects of the performance of the agricultural sector and changes in agricultural output composition.

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Chapter I

INTRODUCTION

The balance of payments deficit problems of the less developed countries (LDCs), otherwise also known as the Third World countries, are now well known and have been well documented.[1] Especially difficult has been the position of those countries which can be classified as non-oil agriculture-based LDCs. Bangladesh is one such country.

There are many reasons behind rising external deficits. One issue of concern has been the high proportion of expenditure on food in the import bill of the country. Over the post-liberation period (i.e., since 1972-73) food imports as a percentage of total merchandise imports has been between a low value of 10 percent to as high a 45 percent. In the recent years it has been in the range of 15 to 20 percent. Food imports as a percentage of current account deficit has been even higher; fluctuating between a low of 14 percent to a high of 83 percent over the post-liberation period. In the recent years it has been in the range of 20 to 30 percent. This despite the fact that rice is the major crop in Bangladesh agriculture.

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[1] See, for example, World Bank (1985a), Cline and Weintraub (1981) and Loxley (1986).

The concern over the food deficit situation and its effects on balance of payments and external debt has prompted calls for the attainment of food self-sufficiency. Bangladesh government has assigned this issue the highest priority in agriculture. However, systematic and impartial examination of the issue of food self-sufficiency has not been done in Bangladesh.

An alternative to food self-sufficiency is export promotion. Under this alternative a country produces more of those goods in which it has comparative advantage. The deficiency in food is then financed by increased exports of the exportables.

Seen from the above perspective the commodity in which Bangladesh has historically had comparative advantage is jute. As a percentage of merchandise exports jute has accounted for between a low of 57 percent to a high of 89 percent of export earnings over the post-liberation period. It has been in the neighbourhood of 60 percent in the recent years.

The principal purpose of this study is to examine the effects of the alternative solutions of food self-sufficiency and export promotion on real gross domestic product (GDP) and the current account balance of Bangladesh. Our intent is therefore to investigate whether appropriate policy to promote either of the two solutions register gains

in real GDP and/or help stabilize the current account balance by reducing the deficit.

The two alternative solutions are however closely interconnected in terms of the response of the economy to either of them. In the sphere of production, jute competes with rice for agricultural land. Any shift from jute to rice or vice versa due to policy changes will alter the composition of agricultural output. If the relative response of the two crops are different, real GDP will change.

Policies which alter the composition of agricultural output will affect the current account in two different ways. Any shift from jute (rice) to rice (jute) will reduce (increase) import payments due to decreased (increased) food imports. At the same time it will decrease (increase) export earnings due to reduced (increased) jute exports. The net effect on the current account balance is a priori unknown. It depends on relative changes in acreages, the relative productivities of the two crops and the relative prices of the two commodities in the international market for the individual years.

The study is undertaken by constructing a macroeconomic model for the Bangladesh economy. The model outlines the basic structure of the economy and has a disaggregated agriculture sector. The disaggregation of agriculture allows us to examine the effects of alternative policies on the compo-

sition of agricultural output, and the effect of that on real GDP and the current account balance.

The policy instruments used in examining the alternative policies are basically of two types: i) policies which alter relative prices of rice and jute to the producers, and ii) policies which lead to increases in the productivities of the two crops.

The plan of the thesis is as follows: Chapter 2 outlines some issues in economic stabilization and puts our thesis in the perspective of literature surveyed. A brief elaboration of the structure of the Bangladesh economy is presented in chapter 3. The literature survey and the structure of the Bangladesh economy forms the basis of the macroeconomic model of the Bangladesh economy in chapter 4. The behavioral equations of the model are first introduced, and then the complete model with all definitions and identities is presented. In chapter 5 the behavioral equations are estimated and then the complete model is simulated. The relevant statistics of fit for the endogenous variables of the historical simulation as well as plots of predicted vis a vis actual values are presented in that chapter. Chapter 6 is devoted to policy simulations of the model. In all we perform seven policy simulations of price and productivity policies. The policy analysis presents and analyses the effects of different alternative policies on real GDP and the current account balance. The policy experiments include

increases in rice prices, jute prices (increasing one while holding the other constant, i.e., changing the relative price), and increases in productivities of the two crops. The price and productivity increases of the respective crops are undertaken in isolation as well as in combination with each other for each crop. Finally, the concluding chapter summarizes the nature of the study and its findings. Some comments on the scope of further work is also made.

We hypothesize (and later demonstrate) that Bangladesh producers are responsive to changes in relative prices of rice and jute. An increase in the relative price of rice produces a reallocation of acreages in favour of rice and away from jute. The reverse happens when relative price of jute is increased. Changes in relative prices can be directly instituted by the government which currently provides floor for the two commodities.

Increases in productivities can be attained by introduction of better seed-fertilizer technology and/or better organization in production leading to increased motivation in the part of the producers.

It is important to note that policies that promote productivity increases will require the establishment or expansion of institutions which encourage and market the productivity augmenting technologies. This may require considerable time and expenditure and will normally be a slow and gradual process.

The price policy is, on the other hand, successful in producing quicker results. It can be undertaken under the existing institutional structure and does not require establishment of new institutions. If a given price policy can help stabilize the current account balance, it can be undertaken as a medium-run strategy --- a strategy that may be integrated to a longer-run development plan. It can in that case ease, at least in the medium-run, the constraints imposed on the development efforts due to scarcity of foreign exchange.

Apart from examining the two sets of policy instruments in isolation, we will also examine the effects of simultaneous use of more than one policy instrument in various combinations. Those experiments will combine the use of price and productivity policies. Needless to say, these policies are matters of somewhat longer-run dynamics.

Chapter II

ISSUES IN ECONOMIC STABILIZATION

Economic stabilization in general means correcting imbalances between demand and supply in order to reduce economic fluctuations. In the context of development economics, it relates to correction of balance of payments deficits and/or controlling domestic inflation of the less developed countries (LDCs).

While in principle stabilization policies may be necessary to correct both surpluses and deficits in the balance of payments, in practice the LDCs are typically faced with deficits rather than surpluses. Again, in terms of price stabilization, problems typically faced by the LDCs are those of inflation rather than deflation. Therefore, analysis and policies of economic stabilization have been made with respect to balance of payments deficits and inflation.

2.1 THE BACKGROUND

The issue of stabilization policies have gained increased focus and attention with the recessions of 1970s and consequent inflation and debt crises of the LDCs.

In the 1950s and 1960s stabilization issues were generally integrated into broader contexts of economic growth and

development. The choice of an appropriate development strategy implicitly took into account the question of economic stabilization. This can be seen in the classic debates of balanced versus unbalanced growth, export-led versus import-substitution strategy of development, and so on.[2] These models or strategies of development however treat stabilization as basically a long-run issue rather than short-run.

The perception of stabilization policies has since then changed to a great extent to focus more on short-run imbalances of the balance of payments, and on inflation. The International Monetary Fund (IMF) has been a leader in taking this approach. IMF conditional financing arrangements put pressure on the borrowing countries to take policies and measures for reducing short-term fluctuations. The financing facilities are basically short-term lendings.

While in principle the World Bank's approach is to take a longer-run view of the problems of economic stabilization, it has, as Dell and Lawrence (1980) point out, played a more passive role in the development of policies and lending in this matter.

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[2] These issues are well documented in the development literature. Meier (1984) is a good source book. See pp. 373-380 for balanced versus unbalanced growth debate and pp. 388-405 for export-led versus import-substitution debate. In the context of trade strategy, see also pp. 516-552 for discussions on inward-versus outward-oriented development strategies.

The emergence of large scale private lending in the 1970s is another reason for a change towards short-term adjustment policies. Since these lendings are short-term and are made at market rates of interest, the borrowing countries, when forced to borrow from this market, make all attempts to correct their imbalances in the short-run.

It is useful to make an observation before we analyse the literature. Most of the current literature we review is aggregate economics whether they are supply determined (e.g. Harrod-Domar type) or demand determined (e.g. neoclassical or Keynesian type) in terms of their intellectual basis. This is true in most cases even when traditional/modern sector (e.g. dual economy type) analysis is used. Some questions of stabilization, as we will see later, can be addressed by making use of sub-sectoral disaggregation under certain conditions.

2.2 THE DEBATE

While there is no disagreement in the literature about the desirability of correcting instabilities, there is considerable disagreement about their origins and causes, and widespread disagreements in terms of appropriateness of different policies to correct them.

Following Black (1981), we can distinguish between internal and external sources of instability for a country, recognizing however, that there are linkages between them.

An important external factor is fall in export volume or price and/or increase in import prices. Closely related with this are other external factors like changes in capital flow, international reserves and external borrowing. Failure to sterilize these changes by offseting domestic operations can lead to cyclical fluctuations via changes in domestic money supply under the fixed exchange rate system prevalent in most LDCs.

Among the internal factors, one possible cause can be fluctuation in the production of crops, which may sometimes be due to factors beyond the control of the country. An overly expansionary domestic monetary policy or an overly expansionary fiscal deficit supported by deficit financing can create instabilities. Again, politically induced excessive wage increases, investment projects or consumption spending may act as additional factors. In fact, political instability itself may be an important cause of economic instability. Political instability may be of course of either domestic or foreign origin. Another largely internal factor, which has external influence as well, is the failure to maintain real exchange rate.

Although the resulting instabilities appear to be clear from the evidence, the literature on stabilization is divided on the issue of its causes and remedies into two broad groups. On the one hand, we have the orthodox-monetarist explanation, emphasizing the importance of monetary vari-

ables and focusing on domestic policies to analyze the causes and prescribe cures for instabilities. On the other hand, we have the structuralists, who maintain that deeply rooted structural characteristics of the LDCs, in combination with global disorders, create domestic and external imbalances; the structuralist prescriptions are therefore to cure the structural problems.[3]

Monetarists believe that balance of payments problems and problems of inflation have their causation in monetary factors. Inflation and balance of payments deficits, according to them, are caused by too rapid a growth of credit and money supply relative to the demand for it. Increase in money supply leads to increase in imports via its effect on aggregate demand, which generate current account deficit. The policy action also drives the capital account into deficit as capital flows out due to fall in interest rates. Inflation, which according to the monetarists is also a product of the same policy action, aggravates the situation even further. Exports become less competitive, and capital outflow increases as real rates of interest are depressed, sometimes even to negative levels (Black, 1981). Under fixed exchange rates all these lead to balance of payments deficits.

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[3] The monetarist approach may be traced to the writings of Friedman (1968) and his later writings, and others in the Chicago School. It can also be found in the writings of the IMF staff (see IMF 1977). Discussions of structuralism can be traced to the writings of Prebisch (1959, 1963). Formal structuralist models are presented in Taylor (1979, 1983)

A considerable volume of theoretical and empirical work on the balance of payments using the "monetary approach" exists in the literature. A significant proportion of the work has been done at the University of Chicago under the guidance of Robert Mundell and late Harry G. Johnson[4] and at the International Monetary Fund (IMF).[5]

A difficulty of using the monetary approach is that the precise composition of the balance of payments remains unexplained in this approach. Balance of payments is explained with reference to reserve-flow or capital-flow equation. Models of monetary approach are highly aggregative, focusing on the key monetary factors of the economy. Therefore, we do not think that such models are appropriate for the analysis of balance of payments effects of policies affecting sectoral and sub-sectoral composition of output in the LDCs.

Structuralists use a broader brush to paint their explanation of the problem. They assert that the roots of instabilities lie deep in the structure of the economy. Structural problems like resource immobility, market segmentation, and disequilibrium between sectoral demands and supplies are characteristic of all LDCs. Given these

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[4] See, for example, Mundell (1962, 1963, 1968 and 1971) and Johnson (1973a, 1973b, 1975, 1976a, 1976b, 1977a, and 1977b).

[5] See IMF (1977). Fund economists have also written extensively in various issues of the Staff Papers and other journals. See, for example, Aghevli (1975), Guitian (1976), Khan and Knight (1981, 1982) and references therein.

traits, Foxley (1981) argues, the economy is prone to develop extended bottlenecks as growth proceeds, caused by a lack of supply response. Some of these bottlenecks include supply of food, availability of foreign exchange, the rigidity in the tax and expenditure structure of the government, the inability to raise enough internal saving, and the supply of various intermediate inputs like fuels, fertilizers and transport facilities. Structuralists do not, however, disagree that inappropriate domestic policies can create instabilities. It is but one of the factors in their list of explanations, and not one of the more important ones. They would maintain that even if policies considered to be "appropriate" by monetarists were implemented, instabilities would remain, because the existence of structural bottlenecks render the policies ineffective. Structuralists also maintain that global disorders, by creating external shocks, work as another important source of instabilities.

To what extent the instabilities in LDCs are caused by mainly external factors as opposed to domestic factors is a matter of debate. Black (1981) argues on the basis of his results of a discriminant analysis, that success or failure of stabilization policies depended largely on country characteristics (e.g. size, development, openness, trade concentration and direction of trade) along with internal responses to external disturbances and other internally generated disturbances. Dell (1981), commenting on Black's

(1981) paper, however asserts that the difficulties in the 1970s have been "largely, though not exclusively, of external origin". While Black's (1981) argument may be more appropriate for middle income countries and the newly industrialized countries, for the low income LDCs the effect of external shocks have been more devastating.

Khan and Knight (1982) find close association between worsening of current account and deterioration of terms of trade for 28 out of 37 non-oil exporting LDCs during 1973-80. In another study for a group of 32 countries for the period 1973-81 Khan and Knight (1983) estimated relative contribution of various external and domestic factors to the behaviour of current account. Here again they find terms of trade to be the most important explanatory variable. They however conclude that external as well as domestic factors are relevant in explaining the deterioration of current account.

Experience of the 1970s and early 1980s show that externally generated events and forces have been important factors behind instabilities in the LDCs. The supply shocks and the recessions, along with increased difficulties in penetrating the markets of the DCs, have created huge trade and balance of payments deficits for the LDCs. Prices of the exportables of the low income LDCs (mainly primary goods) have increased at slower rates than the prices of imports (manufactured and intermediate goods, capital goods,

food and oil). As a result, the combined debt of the LDCs has increased to an extremely high level compared to historical standards. External debt has increased from 14 percent of GNP in 1970 to 34 percent in 1984, which has increased the debt to 135 percent of exports in 1984 compared to 109 percent in 1970. Consequently, debt service has increased from 15 percent of exports in 1970 to 20 percent in 1984 (WDR 1985a:23).

When we enter the policy area of economic stabilization for the LDCs, we step into a minefield of disagreements. In general, there is a wide variety of policies available to governments to deal with instabilities. Loxley (1986) categorizes them under four broad headings: (a) demand restraint policies using monetary or fiscal instruments; (b) exchange rate adjustments; (c) direct controls; and (d) liberalization measures.

The monetarist approach is usually focused on the use of a few policy instruments: Control of money supply, control of price level, exchange rate devaluation and the restoration of 'appropriate' interest rates. These come under the broad categories (a) and (b) noted above. However, in the long run, LDCs being small open economies, can influence only one of the policy instruments. When one is chosen, the other three adjust automatically through the forces of demand and supply (domestic and foreign). Under this principle, a complete integration of an economy with the world

economy will bring prices, interest rates and exchange rates in line with the levels prevailing internationally. This leads us to the monetarist conclusion that in the long run, balance of payments deficits are self-correcting. Monetarists caution that if governments attempt to regulate more than one variable, the economy will move into a state of disequilibrium in real or financial market.

The monetarist policy package outlined above was one which was applied in 1950s and 1960s. Foxley (1981) argues that monetarist stabilization policies implemented during the 1970s have two new components: (i) the policies are being applied by authoritarian military governments; and (ii) the policies have some long-term components. He uses the example of Latin American countries to support his first point. The policies constituting the second component fall under the fourth broad category of policies outlined above (i.e. liberalization measures). These involved structural changes like reducing size of the public sector, creating private capital markets, redefining the participation of private enterprise vis a vis labour organizations, and opening up the economy to free trade. These measures are implemented with the objective of allowing the market forces and the price system to work freely i.e., for "getting the prices right". Foxley (1981) calls this "a form of structuralism using orthodox instruments". However, its flavour is monetarist and its main aim is to integrate the domestic economy into the world economy.

For several reasons (to be discussed below) the immediate impact of monetarist stabilization policies are mostly contractionary (deflationary). Krueger (1981) suggests that these are short-term costs as a necessary price for achieving longer term benefits. The benefits, according to her, are long-run GNP growth of two to three percent, at the probable cost of a loss in GNP by one to two percent for one year or eighteen months.

Structuralists believe that under the conditions of structural rigidities and bottlenecks, monetarist stabilization measures cannot produce any fruitful results in the long-run. Global disorders, which lie outside the control of LDCs, cannot be corrected by domestic monetary and fiscal policies. A typical monetarist stabilization package, according to them, will be deflationary. Restrictive monetary and fiscal policies create deflations which may be as severe as to decrease real wages by 20 to 40 percent (Dell, 1981). This view finds support from Foxley's (1981) findings on some Latin American countries.

The typical policy package containing liberalization measures, devaluation, credit restrictions and establishment of positive real interest rate, often turns out to be inflationary, which is precisely what the policy attempts to control. Most LDCs are characterized by the existence of monopolistic firms. Prices are therefore set monopolistically. Foxley (1981) suggests that inflation may increase

due to inflationary expectations overshooting actual inflation as price controls are removed and oligopolistic firms are free to set higher prices. He argues that declining wages and rising prices worsens the distribution of income, and the cost of stabilization is paid largely by the lower income groups. The cost is further increased as unemployment also increases as a result of deflation.

Inflation may also increase if nominal interest rates are allowed to increase sharply, and if interest costs are significant elements of total cost. Therefore, while there may be decreases in real wages, cost push inflation via increases in interest rates remain a possibility.

Another possible source of cost push inflation, pointed out by Ahluwalia and Lysy (1981), is through increased cost of imported intermediate inputs after devaluation. If the domestic industrial and manufacturing sectors are heavily dependent on such imports which cannot be produced at home, the inflationary impact can be significantly high.

The monetarist position of considering inflation to be the consequence of inappropriate domestic policies is also contradicted by the Scandinavian model of inflation. The Scandinavian model shows that a small open economy can experience inflation if its powerful trading partners develop inflation; the economy is susceptible to what is going on in the rest of the world. In that case, inflation is largely

imported from abroad.[6]

Benefits of devaluation on balance of payments depend on the demand elasticities of exports and imports. Structuralists are generally pessimistic about the benefits of devaluation, especially for the low income LDCs. Some demand and supply side factors are responsible for this pessimism. On the demand side, since LDCs are price takers in the world market, devaluation is unlikely to alter the foreign currency price of their exports. Consequently, there is no change in export demand and the country has to export more in order to finance the pre-devaluation level of imports. On the supply side, the problem may arise due to low substitutability between traded and non-traded goods --- a structural problem. That means, even if export demand increased, many or most low income LDCs may not be able to expand their exports to meet the increased export demand. This is especially true for products which have specific factor inputs that cannot be altered readily. Coffee, tea, cocoa and rubber are the best examples.

Import demand also may not be responsive due to both demand and supply factors. Some imports, like essential raw materials and intermediate inputs, for both export and import competing industries or other sectors, may be essential or need to be used in fixed proportions with other inputs in production. In that case, these imports are likely to

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[6] For discussions of the Scandinavian model see Santomero and Seater (1978) and Frisch (1977).

change very little. Again, it is generally hoped that as prices increase with devaluation, some domestic import substituting industries will develop which will reduce imports. These hopes may not materialize due to the existence of structural rigidities in the LDCs. Therefore, with devaluation, there may be large price increases with very little import reduction. If exports do not increase sufficiently, the balance of payments will deteriorate even further. This is ironic because the objective of devaluation in the first place was to reverse the deterioration.

Loxley (1986) points out an important inconsistency of universal application of devaluation. He argues that due to global origin of the problem, exchange rate adjustments as general prescriptions for all LDCs may lead to competitive devaluation and not expansion of total market for the products of LDCs. He calls it "a fallacy of composition". It simply means that what may be good for one country may not be good for all the countries if they try to implement it at the same time.

The alternative policy prescriptions of the structuralists are not as simple, clearcut and universal common package as that of the monetarists. It is important for the structuralists to first distinguish between those elements of a balance of payments deficits for which a LDC is itself responsible, and those elements that are due to factors beyond its control. The external problems are to be dealt

with differently and in a different forum; only the internal factors are within the control of individual countries.

Due to diversity of the LDCs in terms of their size, development, production structures, nature of exports and imports and so forth, the structuralists believe in formulating a different set of policy proposal for each country. Hence, the possible and desirable way of stabilization will vary from country to country.

Chenery (1981) points out that it is misleading to consider stabilization as a primary objective in itself rather than a means to a broader developmental goal. Structuralist policies, by taking a more gradualist approach, and by selecting policy instruments for specific sectors, demonstrate importance for longer-term policies and more direct commitment to economic development. They have a greater commitment to meeting basic needs, promoting more equitable distribution of income and accomplishing national economic integration. National economic planning is sometimes seen by many as an important way of implementing structuralist policy package.

It can be seen that the structuralist policies are more complex and involved, which make them more difficult to administer. A government has to have a great deal of administrative skill to administer them. To be successful, ac-

cording to Foxley (1981), a government must advance consistently on three fronts: price stability, structural reforms, and income redistribution. The balance is very precarious. It can be disrupted easily by dissatisfied pressure groups.

Critics of structuralism attack it on the grounds that it lacks elegance and sound theoretical foundation. Harberger (1981), for example, argues that structuralism is not a theory in the sense that monetary theory is. If it is to be considered as a serious scientific theory or approach, he says, its scientific content should be set forth as some counterpart of demand for money for real cash balances. But as we have seen, the nature of the problem is such that it is extremely difficult, perhaps not even desirable, to formulate a universal theory or model from the structuralist perspective. However, Fishlow (1981), while being sympathetic to the structuralists, maintains that a large part of the appeal of orthodoxy is the failure of alternative strategies. According to him, a more persuasive option remains to be fully defined.

It is important to note that most stabilization packages put uneven responsibility on the shoulders of the balance of payments deficit countries for correcting the imbalances, irrespective of the source of the instability. If viable long-run solutions are to be found, the international community would have to shoulder some burdens of adjustments for externally generated instabilities. In this context Dell

and Lawrence (1980) recommend that more cooperation should be established between the World Bank and the IMF in order to coordinate lending for particular circumstances and to bridge the gap between short-run and long-run lending.

2.3 A POINT LARGELY OVERLOOKED

The literature on economic stabilization has largely overlooked the significance of the composition of agricultural products in reducing instabilities of the external sector. This thesis focuses on this issue in the context of the Bangladesh economy. The problem, however, has broader applications to all LDCs that have agriculture sectors similar to Bangladesh.

Many food deficit LDCs depend on cash crops as the major source of foreign exchange earnings. While there are domestic and international political reasons for the advocacy of food self-sufficiency for the LDCs,[7] the economics of the matter has to be carefully examined.

A move toward self-sufficiency in food for these countries will alter the "composition" of agricultural products produced. Other things remaining the same, less will now be produced for exports. While the country will save foreign exchange due to lower food imports, it will also earn smaller amounts of foreign exchange due to reduced exports. The net effect on the current account depends on the do-

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[7] See, for instance, McHenry and Bird (1977) in the context of Bangladesh.

mestic marginal rate of transformation of food and export crops and their relative prices in the international market.

In the interest of improving the current account balance, the LDCs must choose an appropriate composition of agricultural output. The optimum mix may or may not move the individual economy toward self-sufficiency in food, but will increase its capacity to consume more.

The literature on economic development and LDC debt and balance of payments issues do not explicitly deal with the "composition" question in the manner in which we wish to focus in this work. The importance of agriculture, specially for the low-income agriculture based LDCs is, however, recognized now by many more development economists and policy makers than a decade or two ago.

Rashid (1981) constructed a short-term macro model for the Bangladesh economy which contains elements of both supply determined models as well as Keynesian aggregate demand models. Rashid (1984) also constructed a similar five-block model for the Philippines economy. His estimation results for both the economies show that these economies demonstrate import dependence of production. It is therefore important to take into account the constraints imposed by the availability of imports in assessing investment behaviour. In general, we may expect the marginal propensity to import to be fairly high for these economies.

These models are however highly aggregative and cannot be used to analyse the changes in the composition of output. Hence, the analysis of the balance of payments effects of changes in agricultural product composition necessitates the construction of a somewhat different model.

A macroeconomic model for the Malaysian economy outlined by Semudram (1982) contains a fairly detailed description of the structure of the economy. However, his focus was into breaking down the domestic sector in terms of tax revenues coming from different sources, and disaggregating the external sector into various categories of exports and imports. He also estimates export supply rather than demand functions on the basis of the argument that Malaysia is a small country and it supplies its exports at given world prices. While this may be a sound argument for many products, for some of the exportables of some LDCs one would have to estimate demand functions because a significant proportion of marketed output may come from one country. For example, this would obviously be the case for raw jute exported by Bangladesh. The Semudram (1982) model, like the models by Rashid (1981, 1984), also cannot be used to examine the composition question.

Taylor (1979) is a useful source book outlining models which focus on various aspects of LDCs. The techniques used are mainly those of social accounting matrix and input-output analysis. Although these methods are useful and

provide valuable insight about various features of the economies of the LDCs, policy analysis using simulation techniques are done by specifying a model structure and econometrically estimating the parameters. Nevertheless, the Taylor (1979) models can provide instructive guidance in model building for LDCs.

Taylor (1983) constructs a number of structuralist models. According to him, "an economy has structure if its institutions and the behaviour of its members make some patterns of resource allocation and evolution substantially more likely than others. Economic analysis is structuralist when it takes these factors as the foundation stones for its theories" (Taylor 1983:3).

The level of disaggregation presented in some of Taylor's (1983) models are higher than most other current literature. For example, two of his models are for economies with important food sector and mineral export sector, respectively. What is missing in them is that they do not address the question of composition, and the possible effects of changes in the composition of output in an important agriculture sector on the balance of payments. However, there is clear recognition in his writing about the importance that sectoral analysis can play in policy making. "Once any model of the economy is extended from one to several sectors, changes in relative prices of the different outputs can play a key role in the short-run adjustment process" (Taylor 1983:37).

It is now accepted by most, if not all, students of economic development that a development strategy of the Western style is not well suited for the needs of the LDCs. Following the experience of the developed countries, the Western approach called for growth through industrialization. The Lewis (1954) model provided the theoretical background for the adoption of such strategies in many LDCs in the 1950s and 1960s. The dual economy model and industrialization strategies came under attack in the 1970s. In a more recent article, Lewis (1979) admitted that the development of the "modern" sector in some cases may not benefit the "traditional" sector, and the modern sector may grow at the expense of the traditional sector.

The lack of success with development programs in many LDCs have now been attributed to their relative neglect of the agriculture sector. Consequently, a body of literature has evolved on the importances of agriculture-industry interaction and their complementarity, as well as the need for overcoming the weaknesses in agriculture.[8]

Our contribution to the growing literature is to examine how a change in the composition of agricultural output can produce improvements in the current account balance. For many LDCs both food and export crops are seasonal crops that compete for the same land as they are grown during the same season side by side under identical climatic conditions. An

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[8] See Meier (1984) pp. 406-422 for some of the representative works on these issues.

"appropriate" policy action can change the incentive structure for the growers and create desirable substitution between the crops to benefit the current account. The model we construct in chapter 4 takes into account this subsectoral disaggregation so that important policy questions can be examined for the Bangladesh economy.

The novelty of this approach is it does not require any major structural changes in the economy, and it therefore can be applied without much difficulty or long lags. The benefit in the current account is of great importance to the LDCs. We propose it as a medium-run strategy for LDCs like Bangladesh --- a strategy that can be integrated into a longer-run program of national development. It would provide the policy makers and planners some additional and very crucial medium-run "breathing-room" by easing the foreign exchange constraints.

2.4 CONCLUDING REMARKS

Most of the current literature on economic stabilization of LDCs is aggregate economics. Even when the dual economy traditional/modern sector analysis is used the disaggregation in terms of composition of output of different important products is not generally made.

For many agriculture-based LDCs product composition in agriculture can be a very important matter. The same land may have alternative uses in terms of production of food for

domestic consumption as opposed to production of export crops. Many LDCs exporting agricultural products are also food deficit countries. Balance of payments consequences of changes in product composition is therefore a crucial policy question for these countries, most of which also face balance of payments difficulties.

In this study we propose to investigate the importance of the composition of agricultural output in influencing the current account balance of the Bangladesh economy. For Bangladesh, the most important export and import items are jute and food respectively. In the sphere of agricultural production, rice is the basic subsistence crop while jute is the major cash crop for the farmers. The two crops are seasonal and compete with each other for land during the wet season.

A change in the composition of production of these crops affects current account directly. Increases in jute production will increase export earnings, but at the same time will increase the food import bill as less food can now be produced domestically. We will examine how changes in the composition of the crops produced affects the current account of Bangladesh under these circumstances with the help of an open-economy macroeconometric model.

Chapter III

BANGLADESH ECONOMY

This chapter presents an overview of the basic structure of the Bangladesh economy and serves as the building blocks of the macro model to be constructed in the next chapter.

Although the estimation of the model to be developed will use data from both pre-and post-liberation periods in order to gain advantages of a larger data set, the descriptions in this chapter mainly concentrates on the Bangladesh period.[9] This is because the analysis and policy simulations to be done later is in the light of the present conditions of the economy. However, a brief account of the nature and consequences of economic exploitation of Bangladesh during the Pakistan period is given in the section below.

3.1 THE PAKISTAN PERIOD

When the 200 year old British rule of the Indian subcontinent ended, two countries, India and Pakistan, were created in 1947. Pakistan was created as the homeland of the Muslims of the subcontinent. It had two wings--- East and West Pakistan---separated by 1000 miles of Indian territory in between.

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[9] Bangladesh was liberated from Pakistani rule on December 16, 1971 following a nine-month long bloody war of liberation.

The union of the two wings turned out to be an unhappy one. Pakistan period (1947-1971) turned out to be an era of economic exploitation and political suppression for the people of Bangladesh.

Table 3.1 shows the growth of disparity in per capita income between East Pakistan (now Bangladesh) and West Pakistan during the pre-liberation period. The disparities were mainly the results of uneven and unequal distribution of development expenditures, foreign aid and other public allocations. This was further exacerbated by the diversions of the trade surpluses of East Pakistan (mainly from jute) to West Pakistan along with the flight of capital from the eastern wing to the western wing through Pakistani merchants and industrialists.[10]

The emergence of Bangladesh as an independent country is the outcome of the long struggle for autonomy---political and economic---which to the last day the Pakistani regime refused to give.[11]

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[10] For some of the statistics on the disparities between East and West Pakistan see Ahmed (1978).

[11] An account of the struggle for autonomy is elaborately given by Ahmed (1978).

TABLE 3.1

Disparity in the Growth of Income During the Pre-Liberation Period

Year	GNP (Millions of Rupees)		Per capita Income		Disparity(%)
	East Pakistan	West Pakistan	East Pakistan	West Pakistan	
1949-50	123600	121060	287	338	18
1959-60	144890	172530	278	366	31
1967-68	202350	286520	302	530	75

Source: Ahmed (1978)

3.2 THE POST-LIBERATION PERIOD

Bangladesh is a small, densely populated agriculture based country. Within an area of 55,598 square miles, the country had an estimated population of 89.9 million in 1981, giving rise to a population density of 1617 persons per square mile (Population Census 1981). With an average annual rate of growth of 2.2 percent, the projected population in 1985 was 98.6 million (Statistical Pocket Book 1983). About 85 percent of the population lives in the rural areas where they are predominantly engaged in agricultural activities; estimates show that nearly 71 percent of the rural labour force is engaged in agriculture (Population Census 1981).

3.2.1 The Real Sector

During the post-liberation period (i.e. since 1972), GDP growth rate has been positive in real terms. Real growth rate has, however, fluctuated between a low of 1.1 percent and a high of 11.6 percent during 1972-73 to 1983-84 period. (World Bank, 1984). Per capita real growth rate has not been always positive. Per capita income in 1980-81 at current prices was Taka 2,180 which translates to about U.S. $100.

In terms of employment as well as output, agriculture is the most important sector. However, the share of agriculture sector in GDP has been going down over the years, while those of industry and services have been increasing. In

1972-73 agriculture accounted for 58 percent of GDP, whereas in 1982-83 its share went down to 48 percent. Within the agriculture sector, crops account for nearly 80 percent of the sectoral output. Agriculture is also the most important sector in terms of export earnings, because jute and jute goods are the major export items of Bangladesh, amounting to more than 50 percent of the value of merchandise exports (World Bank, 1984). Table 3.2 shows the growth of GDP and its sectoral distribution during the post-liberation period.

Being the most important sector, success or lack of success in agriculture has profound influence on economic stability and overall economic development of Bangladesh. This sector, however, has been, and still remains, relatively neglected, despite a lot of lip service since the pre-liberation, Pakistan period.

During the Pakistan period, in the 1950s and 1960s, import substitution industrialization policy was vigorously pursued, and the government consistently discriminated against agriculture, and against East Pakistan.[12] Although the Bangladesh government has softened the tone somewhat, discrimination against agriculture still persists. The share of public expenditures designed for the rural sector remained between 20 and 30 percent in late 1970s (Vylder and Asplund, 1980:27).

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[12] For a detailed discussion see, for example, Griffin and Khan (eds.), (1972).

TABLE 3.2

Gross Domestic Product and its Sectoral Distribution 1972/73 - 1984/85
(At market prices of 1972/73; millions of Taka)

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
GDP (at market prices)	45112	50569	52282	58686	59469	63340	66227	67095	71644	72227	74609	73800	76610
Agriculture	26100	28827	28537	31865	30903	33572	33082	33136	34908	35225	36859	37440	37940
Industry	4555	5212	7401	7755	8338	8504	10450	9948	10698	11024	10856	12010	12900
Services	14457	16530	16344	19066	20228	21264	22695	24011	26038	25978	26894	28550	30160

Sources: World Bank (1985b) and World Bank (1986)

An analysis of food production and food policies also demonstrates the bias against agriculture. Increase in foodgrains production has not kept pace with the increase in population for the last three decades. In the 1950s, rice production increased at only 0.7 percent per annum compared with a nearly 3 percent rate of growth of population. Despite improvements in the 1960s, rate of growth of food production remained below population growth rate. As a result, foodgrain imports grew from 0.5 million tons a year in the early 1960s to 1.5 million in 1969-70 (Bose, 1974:148).

Despite its rhetoric of a broad base, food policy in Bangladesh appears to have been formulated to benefit mainly the urban consumers. The government intervention extends to the three spheres of production, pricing and distribution. Input subsidies are the principal components of government involvement in production. With respect to pricing, government has attempted to maintain price by announcing a minimum price for government procurement. It has also recently engaged itself in open market operations, in a limited scale, in order to stabilize food prices. In the sphere of distribution, government is involved in supplying subsidized food through the ration system. However, the rationing system is geared to serving mainly the relatively small urban population. Under the current ration system, 2/3 of the supply goes to the urban population, even though the

rural poor are about three times the number of the total urban population (Ahmed, 1984).

It has been extensively discussed in the literature that food problem is essentially a problem of poverty.[13] The failure of food policy in Bangladesh is mainly due to the inability to integrate successful anti-poverty policy with food policy. Policies aimed at merely increasing the supply of foodgrains cannot be successful if there is insufficient effective demand. In fact, the extent of poverty has increased over the years. Estimates show that while 5 percent of the population in 1963-64 could be categorized as "extremely poor", who were unable to cover 80 percent of recommended daily average calorie intake, this proportion increased to 41 percent by 1975 (Vylder and Asplund, 1980:5). The proportion is expected to have increased further over the last ten years.

Bangladesh agriculture is characterized by a highly unequal distribution of land holdings, and an increasing trend in landlessness. The modest incidence of large estates is mainly due to the general shortage of land, rather than an egalitarian land ownership structure. Table 3.3 shows the distribution of land holdings in Bangladesh. It can be seen that less than 8 percent of the households owned nearly 46 percent of agricultural land in 1979. On the other extreme, over 60 percent of rural households owned less than one acre

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[13] See, for example, Sen (1981).

of land each in the same year. This implies that any modernization policy aimed at reaching the smallholders owning as little as one acre of land still excludes over 60 percent of rural households.

With this background, the performance of the agriculture sector has not been encouraging. Production of foodcrops have increased from the five-year average of 10.8 million tons during 1965-70 to 12.8 million tons during 1975-80, but it has not been able to achieve the food policy aim of self-sufficiency. Moreover, at the same time, acreage and production of jute and other crops like pulses, oilseeds, spices and vegetables have declined. For example, jute production has dropped from 7.1 million bales in 1969-70 to 4.9 million bales in 1982-83 (World Bank, 1984:59). The trade-off between food production and jute is clearly evident from this.

Despite the modest increase in the production of food, Bangladesh continues to experience a food deficit of about 10 percent. Food import bill, therefore, competes with other importables like capital goods, energy, industrial raw materials and intermediate goods. Consequently, the balance of payments difficulties of 1970s were not only due to increases in oil prices, but to a great extent due to increases in food and other prices. Sobhan (1979) shows, by comparing 1972-73 with 1974-75, that the increase in oil

TABLE 3.3

Size Distribution of Total Owned Land in Rural Bangladesh - 1979

Acres	Percent of Households	Percent of Population	Percent of Total Land
Zero	15.37	12.32	0.00
0.01-0.50	33.31	29.09	3.50
0.50-1.00	11.78	11.02	5.27
1.00-1.50	9.43	9.47	7.15
1.50-2.50	11.24	12.23	13.73
2.50-5.00	11.76	13.86	24.47
5.00-7.50	3.88	5.57	14.68
7.50-10.00	1.59	2.45	8.55
10.00-12.50	0.88	1.45	6.16
12.50-15.00	0.42	0.75	3.65
15.00-25.00	0.65	1.27	7.51
25.00 +	0.23	0.47	5.28

Source: Statistical Pocket Book of Bangladesh 1983

price bill accounted for only 20 percent of the increase in import bill.

Shortage of food and dependence on food aid also makes a country vulnerable to international food politics. In the case of Bangladesh, it became clearly evident during the famine of 1974.[14] It can easily upset the stability of an economy.

3.2.2 Some Structural Biases

Vylder and Asplund (1980) argue that the failure of the rapid growth of the agriculture sector is due to the existence of some biases and contradictions in agricultural policies. First, the urban bias, is a legacy of the British rule, followed by the Pakistani rule. It is reflected by high urban-rural income inequality, unequal access to food and social services, low share of public and private development expenditures on agriculture, and capital drain from rural to urban sector. Since through subsidized rationing food policy tends to depress food prices, agriculture policy and food policy become contradictory to one another.

Second, the foreign bias, is reflected by the high level of dependence on foreign aid for development budget--- upto as much as 75 to 80 percent in the forms of grant and aid (Vylder and Asplund, 1980:35). Food aid constitutes a significant proportion of the total aid package, and as Rahman

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[14] See, for example, McHenry and Bird (1977) and Sobhan (1979).

(1984) points out, the food budget is highly dependent on food aid. Not only that the foreign bias creates dependence on food and development budgets, it also creates, as shown by McHenry and Bird (1977), a dependence on food aid to finance the revenue budget as well. Sales of food from aid accounts for an estimated 14 to 18 percent of the revenue. This budgetary dependence on aid prompts requests for aid even in good harvest years.

The foreign bias may also relax voluntary savings effort by the government. Food aid may depress food prices and, therefore, have disincentive effect on production. It can also have a policy effect, in the sense that policy makers may not feel the pressure of drawing and implementing appropriate agricultural policies in order to stimulate output. All these lead to long-term economic dependency and increasing debt burden, which make the economy more vulnerable to shocks and instabilities.

Increasing dependence of Bangladesh on foreign assistance is reflected by the trade and foreign assistance figures over the years. Whereas exports as a percentage of GDP increased from 2.4 percent in 1974-75 to 6.5 percent in 1983-84, over the same time period imports as a percentage of GDP increased from 9.9 percentage to 20.2 percent. Although debt service payments as a percentage of GDP does not yet show an upward trend, over the same period of time external debt as a percentage of GDP has increased from 3.5

percent to 36.5 percent (Metropolitan Chamber of Commerce, 1985). This demonstrates a clear trend of increasing dependence. This pattern has strengthened the tendency towards donor-oriented rather than self-reliant development policy.

Third, the bureaucratic bias, is also an offshoot of the old, colonial style of bureaucracy. There is a great distance of the bureaucrats from the general rural population. In a country where most of the investment for development is allocated by the public sector, this distance translates into failure of recognition of actual needs (or lack of interest), which leads to inappropriate and inefficient allocation of investable funds. Consequently, rural people have developed a lack of confidence in the representatives of the state. Paradoxically, however, in the absence of any other kind of institutional support, the rural poor are forced to depend upon the government for support.

Soon after the liberation of Bangladesh, the government announced that the country would attempt to achieve economic development within a socialist framework.[15] The policy makers never clearly defined what that meant for the rural sector. The only notable policy action was to announce a ceiling of 33 acres for agricultural land holdings, which was way above the average size of the holdings. However, the importance of decentralization was recognized and admitted, but institutional framework for meaningful decen-

[15] For a discussion, see articles in Robinson and Griffin (eds.) (1974).

tralization was, and still is, lacking. The subsequent governments have, over the years, gradually moved away from the ideals of establishing a socialist economy.

In reality, however, the scope for solving rural problems by administrative reforms is very limited. This is because political and economic structure in the villages by and large determines how state funds are used; it is difficult for the civil servants to operate without the cooperation of the local elite.

Fourth, the capital bias, is caused by inappropriate fiscal and monetary policies. During the Pakistan period it was the result of deliberate policy actions to favour industrialization. The mechanism to do so was by having overvalued exchange rates, artificially low domestic rate of interest, and tax incentives and large depreciation allowances, which create distortions in relative prices of capital and labour. As a result, capital intensity in manufacturing became very high; in the late 1960s even higher than Japan in many industries (Vylder and Asplund, 1980:70). Another mechanism which leads to higher capital intensity is tied aid and technical cooperations.

Even in agriculture, there are evidences of capital bias. For example, capital intensive irrigation projects receive higher levels of allocation and rates of subsidy than less capital intensive types of irrigation, although it has been

observed that in terms of percentage of land irrigated, the labour intensive methods have a much higher level of contribution (Vylder and Asplund, 1980:74). Again, capital intensive rice mills have been replacing employment of rural women.

Mechanization is a mixed blessing. Unless there exist mechanisms that guarantee that the benefits are shared, it is likely to do more harm than good. It is in this context that the concept of appropriate technology becomes relevant.

It has been suggested from many quarters that an appropriate industrial strategy for Bangladesh would be to develop labour-intensive small-scale, cottage and rural industries.[16] It is argued that a countrywide spread of industries in small units would bring industry closer to agriculture, provide employment where living is cheaper, cater to local needs more speedily and surely than urban-based large factories can, and contribute to even overall development of all localities in the country.

Bangladesh Small Scale and Cottage Industries Corporation (BSCIC) became the successor of the East Pakistan Small Industries Corporation (EPSIC) after liberation, with cottage industries brought within its scope as well. But like EPSIC, it has continued to remain largely concerned with small-scale industries, mainly in 20 industrial estates.

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[16] See, for example, Rural Industries Study Project: Final Report (1981).

Cottage industries have remained essentially outside BSCIC's operational reach. The potential of these for output and employment expansion remain virtually unexplored.

There is also a structural dualism in the capital market in Bangladesh. On the one hand, there is the organized capital market, with a fairly competitive banking system, and on the other hand, there is the unorganized market dominated by private money lenders and other financial intermediaries. The larger borrowers (mostly urban) manage to get credit on relatively easier terms from the organized sector, whereas the majority (in rural areas) have virtually no access to the organized sector, and are left at the mercy of the unorganized sector where interest rates are much higher and terms of credit much more stringent.

Fifth, the production bias, is reflected by the domination of production oriented objectives in agriculture policy. This is not to imply that agricultural production is excessively favoured compared with other sectors of the economy---it is to the contrary in fact. What this implies is that there is a relative neglect of other important goals like employment and income distribution, institution building, organizing labour at local levels, or integrating the poor and landless in the development process.

The production bias is evident from the earliest attempts of the government during Pakistan period to initiate agri-

cultural development. In 1961, the Comilla cooperative program was initiated. The basic idea was to form agricultural cooperative societies at the "thana" levels, and was intended primarily as a vehicle for small farmers to accumulate savings, and receive financial support through loans to finance agricultural input and investments that would free them from the grips of local money-lenders.

In 1970, the Integrated Rural Development Program (IRDP) was established to replicate the Comilla-type rural development program throughout Bangladesh. By 1977-78, the program had expanded to cover 250 of the 415 "thanas" of Bangladesh (Khan, 1979).

The experience of the original Comilla project and its extension through IRDP has not been very impressive, and it has failed to achieve its egalitarian objectives. The landless have been virtually excluded, and membership in the societies is typically skewed towards those with relatively larger holdings. The leadership of each society has also been dominated by the most powerful members of the village community. In certain IRDP "thanas", however, rice production did increase substantially as a result of making irrigation, fertilizers, credit and extension education available to members (Khan, 1979). Nevertheless, this gain has not been generally shared by the landless and the marginal or small farmers, who constitute the greater proportion of the rural population. We also notice from the activities of

the IRDP that all kinds of off-farm activities remained largely out of its operational reach.

The other rural development program initiated during the Pakistan period was the Rural works Program (RWP) in 1962. The objective of this program was to construct infrastructures like roads, drainage channels and embankments by utilizing landless labourers during the dry idle months. However, from the very beginning the program was run on political motives; an attempt of the then military government in Pakistan to build up political support in the rural areas. For that reason, the large RWP funds, channelled down to the "union" levels, were well suited.

The largest beneficiaries of the RWP were the big landowners and associated interests among the rural elite. The landless and the marginal farmers gained little, if any. The works program, therefore, was not an answer to the massive problem of poverty and unemployment.

As a response to the famine and flood situation in 1974, the traditional RWP was complemented by a similar program, the Food For Works (FFW) program. This is basically a similar approach which pays out in-kind wages in the form of wheat obtained as grants from abroad. The program was initiated as a relief oriented activity. The in-kind wages paid are below the market wages of labour. This program suffers the same limitations as that of RWP.

The most-recent rural development project initiated is that of the swanirvar (self-reliance) movement, started in 1975. The major activity of the movement is the creation of irrigation facilities by digging canals and the introduction of high-yielding varieties (HYV) of rice and wheat in order to attain self-sufficiency in foodgrains at the village level.

The swanirvar movement also shares the shortcomings and deficiencies of the earlier cooperative movements. It is basically a bureaucracy-led reforming attempt at improving the human condition without altering the basic structure of society. "The leader (is) the government officer at the district and sub-district levels who contrary to the stereotype of an arrogant and corrupt bully was to convert himself into a friend, philosopher and guide of the villagers" (Khan, 1979).

The seed-fertilizer-irrigation technology of high-yielding varieties of rice and wheat being promoted in Bangladesh now, is also an agricultural policy which promotes the production bias. It has been shown by numerous studies, in Bangladesh and elsewhere, that although the cultivation method is claimed to be technically scale-neutral, in the real world of unequal distribution of income and resources it loses its property of scale-neutrality; the larger and more resourceful farmers are able to derive more benefits from this technology than the resource-poor small

farmers and sharecroppers.[17]

Sixth, the landlord bias, follows from the above argument about HYVs that the production bias favours relatively wealthier farmers, and that green revolution is not scale-neutral, because institutions that provide credit and inputs are not neutral. It may also be argued that since the rate of growth of output under HYV is greater than the rate of growth of labour input, and that the wage rate of labour is unlikely to increase under the existing conditions in Bangladesh, the successful introduction of HYVs will lead to a decline in the wage share of labour in total output.

Seventh, the rice bias, reflects the excessive reliance on one crop, rice, as the main foodgrain production. The production of rice takes about 80 percent of cropped acreage, 83 percent of the irrigated acreage and 88 percent of fertilizer use. It also accounts for 87 percent of cereal consumption (Rahman, 1984). It is argued that production can be diversified, specially in the winter, into crops that have higher yields, higher food and calorie value per acre of output, and need less water and also have lower maturation period. However, another possibility is to attain what is called "calorie bargain" through trade. It constitutes selling rice, which is more expensive, to buy more of less expensive food like wheat, sorghum etc. in the international market, in order to get more in terms of quan-

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[17] See, for example, Hossain (1984), Khan (1984), Rahman (1984a) and Vylder and Asplund (1980).

tity and calorie. The success of this, however, depends on how willing the consumers will be to change tastes and food habits. But this might be possible to some extent, because the consumption of wheat, which was negligible, has increased by a great extent in the recent years.

Finally, the private bias, gives rise to unequal distribution of land ownership, fragmentation of land holdings and increased landlessness. The bias also breeds contradiction between the need for collective effort and the private control of land and capital. Irrigation and other projects of infrastructure development are undertakings of a collective character, and require cooperation of many people. Unless people see themselves as relatively equal beneficiaries of collective efforts, the cooperative spirit is unlikely to develop.

Bangladesh, Clay (1981a) argues, like many other less developed countries, basically faces two types of problems: (1) short-run adjustments to external crises and supply shocks like energy crisis and world recession, and (2) long-term question of agricultural and rural development affecting poverty, malnutrition and food insecurity.

In the context of economic stability, food plays a crucial role, both with respect to short-run as well as long-run.

Clay (1981b) points out that Bangladesh experienced three main food crises during the 1970s: (1) the famine of 1974, (2) the Sylhet flood disaster and public food system crisis of 1977, and (3) the drought of 1979. These type of problems can create pressure on the balance of payments, and subsequently lead to instabilities. For example, during 1973-74, decline in domestic food production coupled with tight international market created severe short-term balance of payments problems (Clay, 1981a). An examination of balance of payments accounts also shows that value of foodgrain imports increased significantly during the crises periods (World Bank, 1984:19). The crisis periods put additional pressure on balance of payments over the trend which shows that trade balance has moved from a surplus position in pre-liberation period to increasingly deficit situation during the post-liberation years.

3.2.3 The External Sector

However, there are also other elements which are important in the context of economic stability, viz., commercial policy, exchange rate policy and export performance. Due to the existence of several biases discussed above, commercial policy has tended to favour imports of goods demanded by the urban population. The exchange rate policy since the first major devaluation in 1975 has been to prevent major overvaluation. It has been devalued from time to time, often under pressure from the IMF.

The performance of export sector has not been very bright over the years. As table 3.4 shows it has failed to keep pace with the growth of imports bills. The production of the main export crop, jute, has declined over years. It has also faced stiff competition in the world market from synthetic fibres and other competitors.

Terms of trade also have fluctuated significantly over the last 15 years. Given the base period of 1972-73, the lowest has been 56.8 in 1981-82 and the highest 85.7 in 1984-85. It is evident from the statistics that terms of trade for Bangladesh has deteriorated over the years.

An examination of the trade flows in table 3.5 that Bangladesh needs to diversify the exports. In the recent years, exports of some non-traditional items like shrimps, fish and froglegs, and readymade garments have increased to a great extent. Bangladesh has much greater potential in fish exports which remains to be exploited.

Food also plays an important role in the context of stability in the long-run. Long-term problem of agricultural and rural development requires that the food problem be satisfactorily solved. Although proponents of trade argue that self-sufficiency in food is not an important factor in development, it is very difficult to find a stable

TABLE 3.4

Balance of Payments Items 1972/73 - 1984/85
(millions of U.S. dollars)

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Merchandise exports, fob	354	370	344	372	405	490	610	722	711	626	686	822	943
Merchandise imports, c&f	-780	-925	-1403	-1275	-875	-1349	-1556	-2372	-2533	-2572	-2309	-2353	-2633
Trade Balance	-426	-555	-1059	-903	-470	-859	-946	-1650	-1822	-1946	-1623	-1531	-1690
Current account balance	-371	-547	-1003	-882	-439	-778	-831	-1436	-1428	-1592	-1107	-1012	-1256
Food Aid	183	229	382	314	122	178	179	375	194	231	255	277	244
Other Aid	369	232	519	495	411	651	851	887	953	1005	1090	991	1023
Terms of trade index	100	72.1	63.4	57.4	61.1	75.0	77.0	84.7	66.6	56.8	65.1	80.6	85.7

Sources: World Bank (1985b) and World Bank (1986)

TABLE 3.5

Real Trade Flows and Food Gap
(In 1972-73 taka and 000 long tons)

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Jute Exports (millions, taka)	2481	2511	2168	4582	4848	4776	4678	4596	5292	6714	8063	8103	6955
Other Exports (millions, taka)	275	308	398	761	899	1077	1087	1025	1319	1795	2489	3026	4220
Food Imports (millions, taka)	2747	1579	2510	2953	1609	3254	2055	5675	2088	3101	5254	6207	9098
Other Imports (millions, taka)	3322	3505	4120	7554	5986	8839	9283	9951	13601	16730	17850	19814	22001
Food Requirements (000 long tons)	11723	12006	12294	12623	12888	13191	13499	13850	14130	14452	14781	15162	15468
Food Gap (000 long tons)	2528	1616	1714	1310	1268	1214	1507	1938	513	1602	1715	2185	1135

Sources: World Bank (1985b) and World Bank (1986)

agriculture-based less-developed country which is not self-sufficient in food. After many years of successful exports of high quality agricultural goods, the countries of Sub-Saharan Africa still remain underdeveloped. Moreover, in the case of Bangladesh, the country has a comparative advantage in cereal production. The competing export crop, jute, at the same time, has lost a great deal of demand in the world market.

Although Bangladesh has a limited and poorly diversified natural resource endowments, natural gas being the only known non-agricultural resource, the rich land and abundant water properly utilized with its manpower can generate great success in agricultural production. Quality of land is high, and the climate is suitable for multiple cropping. Although population density in Bangladesh is high, since virtually all the lands are cultivable, land/man ratio is not extremely low by international standards. The ratio is, in fact, higher than Taiwan and South Korea, and close to China, Japan, West Germany and the United Kingdom. However, current per acre yields are extremely low in international standards. Technically, therefore, production can be increased significantly.

The reason for the existing low level of agricultural development has been attributed to the structure and organization of agricultural production and overall economic structure of the country. Seen in that context, the problem

of agricultural development of Bangladesh is basically a problem of poverty, and the poverty problem translates into all the different sectors of the economy.

In the area of food policy, Tarrant (1982) argues, that the policy must aim at both production and consumption of food, in order for increased food supplies to reach those who need them most. The essential conflict is to increase the production of food at a price that the consumers can afford.

Vylder and Asplund (1980) paint with a much broader brush. They suggest that for the development of Bangladesh through agricultural growth, there is urgent need for organization. They argue that "the only viable long-term solution lies in an altogether different strategy based on collective mobilization of arms and savings 'from below', supported and directed 'from above'. The fact that such a strategy is difficult to implement, and would require a whole range of political and socio-economic changes, cannot conceal that it is necessary" (p. 130).

3.3 CONCLUDING REMARKS

Despite Bangladesh being a predominantly agriculture-based rural economy, the agriculture sector has suffered much over the years. Agriculture is important also because it exerts a major influence on the balance of payments. While food is the major item in imports, jute is the most important export

item. Agricultural success can help improve the balance of payments situation and that will enable the country to allocate greater amounts of foreign resources for development activities.

The potential for agricultural success exists in Bangladesh. An observation by the French agronomist Rene Dumont forcefully puts forward this optimism: "Technically speaking, the agricultural potentialities of Bangladesh, by square mile of arable land, are much higher than those of India, China and Japan. The quality of soils and the average amount of rainfall are much higher than in India. The climate does not know any real winter, like most of China and Japan. Floods are the bigger constraints, but if all potentialities from flood-free areas in summer, and irrigation in winter (with much higher reserves, by desilting rivers and tanks) would be used, the agricultural production of Bangladesh could be at least doubled, inside actual cropping patterns, even with overwhelming rice domination, only with well-known techniques. By multiple cropping, diversification of crops, full development of fisheries, productive trees on hills, vegetable gardening, fodder and animal production intensification, etc., the actual production could at least be trebled. Technically speaking, it is not true to say that the future of Bangladesh is without any hope, and not only in agriculture.[18]

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[18] Quoted in Vylder (1982:17).

That potential for increasing production in agriculture exists is also shared many others. Faaland and Parkinson (1976) observe that rice output can be increased substantially with appropriate use of inputs, irrigation and flood control.

Nevertheless, agricultural problems are closely integrated with the problems of poverty. Osmani (1982) using a welfare economics methodology has shown that compared with 1963-64, in 1973-74 Bangladesh not only had a lower standard of welfare as a whole, but the rural sector has suffered relatively more than the urban sector. The rural sector appears to have suffered even more since 1973-74.

It is our contention that any development effort and policy package for Bangladesh must give due importance to the agriculture sector and that the economic success of the country is intimately related to agricultural success.

Chapter IV

SPECIFICATION AND ESTIMATION OF THE MODEL"S BEHAVIORAL EQUATIONS

The objective of this chapter is to specify the behavioral equations of the model and to obtain their estimates. The specification deemed to be the best fit for each equation according to our criteria (discussed below), will then be used for simulation in the next chapter.

The methodology followed in specifying the model and its behavioral equations is based on the theoretical discussion of issues in economic stabilization (chapter 2) and a description of the basic structure of the Bangladesh economy (chapter 3).

4.1 BASIC THEORETICAL TRAITS

We have developed an essentially Keynesian type model with some disaggregation in agricultural sector. As we are interested in examining the effect of our policy experiments on the external sector, we have constructed an open-economy model incorporating the current account balance.

As described in chapter 3, Bangladesh is an economy with an important agriculture sector, producing a food crop (rice) and an export crop (jute), both valuable in terms of the current account balance. The agriculture sector is important because food is not only the crop with the highest acreage and value added, it is also the largest single import item. On the other hand, jute is the traditional as well as the most important item of export, which competes with rice in production. In the light of this, agricultural development and food self-sufficiency play important roles in the planning agenda of Bangladesh. It is, therefore, essential to outline a model which examines the trade-off between rice and jute production for changes in relative prices. Hence, we have a model with disaggregated agriculture sector explaining the output behaviors of rice and jute.

As outlined in chapter 2, balance of payments instabilities can be caused, besides internal factors, by external factors as well. The model incorporates the world prices of exports and imports and income of the major trading partners so that the effects of external shocks are reflected in the estimations and simulations.

We have constructed a real sector model which does not include a monetary sector. This is because the policy questions we are examining do not require us to incorporate the monetary sector. In general it may be argued that a general

equilibrium model will contain more information and, therefore, explain the structure of the economy better than a partial equilibrium model. However, for the analysis of a given problem, the marginal costs of building a larger model may outweigh the marginal benefits. It is our contention that we can analyse our problem without the monetary sector at least as well as with it. Hence, we apply Occum's Razor and exclude it from our model.

The model is somewhat larger than required to answer our basic policy question as it explains the determination of the gross domestic product. We have done so to observe the effects of our policy actions on the gross domestic product in the simulation exercises. However, there is also a broader implication beyond this narrow objective. It involves the issue of predictive vs. structural models. In constructing the model, although we have excluded the monetary sector, we have outlined a fairly detailed structure of the real sector. In doing so we have subscribed to Klein's (1971) position which argues, "... I have maintained the position that there is no point in trying to construct models that are purely of use in prediction and deny that such models have an existence of their own apart from structural models ... Best predictions will be made from best structural models."

The above discussion shows that the model is essentially a "structuralist" one. Based on our survey in chapter 2, we

can say that in broad theoretical sense it resembles Taylor (1983). More specifically, it shares theoretical traits similar to Semudram (1982) of the Malaysian economy and Rashid (1981, 1984) of Bangladesh and the Philippines economies respectively.

In examining the balance of payments we do not use the monetary approach because, as discussed in chapter 2, the precise composition of the balance of payments remains unexplained in this approach. Our intent in this exercise is to examine the effects of changes in the composition of agriculture sector on the current account balance. Hence, the structural disaggregation of the current account balance is important for our study.

The preferred form of each equation from its different alternative specifications are chosen on the basis of the following criteria:

1. the equation should include important relevant theoretical arguments;
2. the equation should have reasonably good explanatory power; the arguments included should have the correct a priori sign and be significant at the 5 percent level at the appropriate t-test;
3. an argument not significant at the 5 percent level may be retained only if it is important theoretically and forms an important linkage for simulation and

policy analysis, to which a further cut-off mark of 50 percent will be applied;

In order to evaluate the significance of regression coefficients we will use the one-tail test of t-statistic rather than two-tail test because the regression coefficients have theoretical a priori signs. The only exceptions will be those variables for which signs of coefficients are not known a priori. This includes the time trend variable and the dummy variables for intercept and slope. All specifications have been tested with the time trend, T, added.

4.2 DATA DESCRIPTION AND SOURCES

This study uses annual macro data collected mainly from the World Bank sources, complemented by Bangladesh and Pakistan government publications. The appendix contains data for all variables along with the description of their sources.

It is important to note that the data used come from two time periods --- pre-and post-liberation of Bangladesh. The pre-liberation data from 1959-60 fiscal year to 1969-70 fiscal year has been combined with the post-liberation data from 1972-73 fiscal year to 1984-85 fiscal year, which gives us twenty four observations in total. The liberation war years, 1970-71 and 1971-72, have been excluded from the study because normal economic activities were severly disrupted during those years due to the war.

We have basically assumed the data to be continuous. However, this assumption may not be valid for all variables and behavioral relationships. Therefore, in order to test for structural changes between the two time periods we have experimented with intercept as well as slope dummy variables. They have been retained when found significant.

There are often concerns about the accuracy of official data of LDCs. Pray (1980), for example, makes an extensive assessment of the accuracy of the official agricultural statistics of Bangladesh. To the extent possible, we have taken data from independent sources (World Bank). We have also compared data from different available sources to check for possible errors and inconsistencies.

Keeping the possibilities of data inaccuracies in mind, we have performed statistical tests of influence diagnostics in order to identify and single out the observations that may be outliers and/or influential. Appropriate steps have then been taken to deal with such observations in order to obtain best possible estimates so that we are able to produce good simulation and forecast results.

4.3 MODEL SPECIFICATION

The model contains eight behavioral equations and twelve definitions and identities. The behavioral equations define the structure of the economy and the nature of interrelationships among the variables of our interest. For the sake of exposition we will present them under the categories of domestic and external sectors.

4.3.1 Domestic Sector

This sector is comprised of five behavioral equations with an emphasis on a disaggregated agriculture sector. All variables are defined in real terms unless otherwise stated.

Consumption Function The following relationship has been postulated for aggregate domestic consumption:

$$RC = C_1 (RDI, RCL) \qquad (4.1)$$

$$C_{11}, C_{12} > 0$$

Where RC represents aggregate consumption expenditures, RDI is aggregate disposable income, and RCL stands for consumption lagged by one period.

C_{11} and C_{12} indicate the a priori or expected signs of the partial derivatives of the dependent variable, RC, with respect to the independent variables, RDI and RCL, respec-

tively. Alternatively stated, we expect the coefficients of RDI and RCL both to be positive. This convention of indicating the our expected signs is followed throughout the rest of model specification.

Some, like Rashid (1981) argue in favour of inclusion of money supply in the consumption function. They maintain that due to the underdeveloped state of markets for financial assets in these countries, disequilibrium in the money market spills over to the commodity market. When the public end up with more money than they want, they spend a part of it on consumption. We did not find empirical support for this proposition to justify the inclusion of money supply in our consumption function.

Investment Function The aggregate private investment is represented by the following relationship:

$$RIP = I_1 (RGDPL, MRIK) \qquad (4.2)$$

$$I_{11}, I_{12} > 0$$

Where RIP is aggregate private investment, RGDPL is gross domestic product lagged by one period and MRIK represents imports of raw materials, intermediate goods and capital.

In this formulation, MRIK represents capacity constraint on the supply side faced by LDCs. These are mainly non-competitive intermediate and capital goods.

Our specification does not include any interest rate variable. There are good a priori reasons for removing interest rates as an explanatory variable from the investment function. Interest rates are administered and fixed by the government; it does not reflect the opportunity cost of borrowing or the scarcity value of capital. However, we made a number of regression runs by including the interest rates. In every case the estimated value had the wrong sign and was insignificant.

Food Acreage Function Acreage under food production is postulated to have the following relationship:

$$ACA = F_1 (PFJL, ACAL) \qquad (4.3)$$

$$F_{11} , F_{12} > 0$$

where ACA is total acreage under Aus[19] rice production, PFJL is relative price of food and jute lagged by one period, and ACFL is acreage of food lagged by one period.

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[19] Aus is the variety of rice grown in the wet season which competes with jute for land. See, for example, Hossain and Quddus (1973), which studies "some economic aspects of jute production compared to its substitute crop, aus rice" (p. 269).

It is worth noting here that food acreage is represented by the Aus rice only. This is because Aus is the wet season variety of rice which competes with jute for land. The other varieties of rice are grown in non-jute seasons.

Theoretically the relative price of food and jute is the most important explanatory variable for acreage decisions. Lagged acreage is included to see the effect of past acreage on current acreage decisions.

Jute Acreage Function Jute acreage function, which is similar to that of food is postulated as:

$$ACJ = J_1 (PJFL, ACJL) \qquad (4.4)$$

$$J_{11}, J_{12} > 0$$

where ACJ is total acreage under jute production, PJFL is price ratio of jute and food lagged by one period, and ACJL is jute acreage lagged by one period.

Tax Function The function for nominal tax receipts is expressed as:

$$TAX = T_1 (GDP, M) \qquad (4.5)$$

$$T_{11}, T_{12} > 0$$

Where TAX is the aggregate nominal tax revenues, GDP is nominal gross domestic product and M is the nominal value of imports.

We found a better fit for nominal as opposed to real tax revenues and, therefore, retained this formulation so that we may obtain better simulation results. However, in order to obtain real disposable income when the complete model is simulated, we deflate nominal taxes by an appropriate deflator in an identity added later.

4.3.2 External Sector

The External sector is modelled by three equations --- an international raw jute price equation, a non-jute export equation and a non-food import equation.

The ultimate purpose of the model is to determine the effect of changes in the production of jute and rice on the current account balance. Changes in jute production will lead to changes in the amount of jute exported. In order to test our policy move we will consider the worst possible scenario and assume that any increase in jute production will mean an equal amount of increase in raw jute exports. Since there is an international spot market for raw jute, Bangladesh can always export more. But since the country is the largest exporter of raw jute, it will affect the market price. The price equation is introduced to capture this effect.

We do not need a food import function because any changes in food production will mean an equivalent amount of change in imports. This will be directly reflected as changes to the current account.

Raw Jute Export Price Function The export price of raw jute is represented by the following relationship:

$$PRJ = P_1 (QRJX) \qquad (4.6)$$

$$P_{11} < 0$$

Where PRJ represents the price of raw jute and QRJX is the quantity of raw jute exported by Bangladesh.

A price function may include income, and price of related commodities as additional explanatory variables. In the above function these would be the income of the OECD countries (the major consumers of Bangladesh jute), and the price of synthetic fibres --- the substitutes of jute. Our attempts to estimate the equation by including these explanatory variables produced poor results. The coefficient of the jute substitute price variable had the wrong sign and both variables were statistically insignificant.

The results are not surprising. Raw jute is a primary product whose price is determined in the world spot market.

Its price is not likely to be influenced by income or a jute substitute which is a manufactured product. Jute manufactured goods prices are more likely to be affected by the substitutes.

Non-Jute Exports Function Our non-jute export demand function is represented by the following relationship:

$$RXO = X_1 (WY, PXO, ER) \qquad (4.7)$$

$$X_{11}, X_{13} > 0 > X_{12}$$

Where RXO is the value of total non-jute exports, WY is world income, which, in our case is the income of the OECD countries --- the major trading partners of Bangladesh, PXO is non-jute export prices in U.S. dollar, and ER is the exchange rate representing the amount of Bangladesh taka for one U.S. dollar.

Unlike any of the previous equations, the dummy variable used for intercept for this equation proved to be statistically significant. It is negative indicating a downward shift in the intercept during the post-liberation period.

This finding is quite consistent with the a priori notion about the Bangladesh external sector. This sector has undergone major changes and disruptions due to the liberation

war. A simple plot of the data for non-jute exports over time shows a clear downward shift in the exports of non-jute commodities during the post-liberation period.

Non-Food Import Function The imports of non-food commodities include all consumer, capital, and intermediate goods. The relationship is postulated as follows:

$$MO = M_1 \text{ (RGDP, PMOT, RNFID)} \qquad (4.8)$$

$$M_{11}, M_{13} > 0 > M_{12}$$

Where MO is the value of total non-food imports, RGDP is gross domestic product, PMOT is non-food import prices in Bangladesh taka, and RNFID is constant dollar private unrequited transfers from abroad.

RNFID is introduced as an explanatory variable because the remittances sent by Bangladesh citizens working abroad, especially in the Middle East, qualify to be used for a whole range of imports. These are called imports under "wage-earners' scheme". These remittances have increased significantly during the last decade.

Like the non-jute export equation, the intercept dummy variable was found to be significant in this equation also, and has been retained.

4.4 MODEL ESTIMATION

System estimation of our macro model using simultaneous equation techniques like two-or three-stage least squares is not possible because the number of exogenous variables for the full system (including identities) are greater than the number of observations.[20]

In general ordinary least squares (OLS) estimation techniques have been used to estimate the individual behavioral equations outlined above using the computer package program SAS.

However, when the Durbin-Watson statistic indicated the presence of first-order autocorrelation, or was inconclusive, corrections were made by using the SAS Autoreg procedure. The method of estimation used in such cases was maximum likelihood (ML). Improvements were obtained as a result of using this procedure. Such statistical corrections are justified when we are interested in using the results for simulations and/or predictions.

For estimating the acreage functions of Aus rice and jute we have used the technique of seemingly unrelated regressions (SUR), also available in the SAS program. This technique estimates the equations jointly. This technique is appropriate for these two equations because the two acreages are related via the constraint on total land available for

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[20] See Klein (1974) chapter IV for a discussion on this point.

cultivation. The equations and their estimation techniques are listed in table 4.1 .

TABLE 4.1

Estimation Techniques used for the Equations of the Model

Equation No.	Dependent Variable	Estimation Technique
1	RC	OLS
2	RIP	Autoreg:ML
3	ACA	SUR
4	ACJ	SUR
5	TAX	Autoreg:ML
6	PRJ	Autoreg:ML
7	RXO	OLS
8	MO	OLS

We now bring together the estimated results of all the behavioral equations. The reported statistics include adjusted R^2 -- indicating the goodness of fit of each equation, the F statistic of joint significance of the explanatory variables, the t statistic to test for the significance of individual explanatory variables, and the Durbin-Watson (D-W) statistic to test for the presence of first-order autocorrelation. The t ratios are reported in parentheses below the estimated parameter values. A single asterisk (*) beside the t ratio indicates that the variable is significant at 10 percent level of significance. Two and three

asterisks indicate significance at 5 and 1 percent respectively. The dummy variables are represented by D.

Equation (4.1)

$$RC = 1797.91 + 0.73\ RDI + 0.18\ RCL$$
$$(1.79)* \quad (6.78)*** \quad (1.46)$$

$R^2 = 0.99$ F = 1164.07 D-W = 1.913

Equation (4.2)

$$RIP = -68.67 + 0.052\ RGDPL + 0.27\ *\ MRIK$$
$$(-0.11) \quad (3.53)*** \quad (1.82)*$$

$R^2 = 0.66$ D-W = 2.01

Equation (4.3)

$$ACA = 2574.56 + 7.30\ PFJL + 0.57\ ACAL$$
$$(2.94)*** \quad (2.01)** \quad (4.55)***$$

D-W = 2.39

Equation (4.4)

$$ACJ = 276.86 + 4.03\ PJFL + 0.58\ ACJL$$
$$(1.19) \quad (4.38)*** \quad (5.11)***$$

D-W = 1.49

System weighted R^2 for equations (4.3) and (4.4) was reported to be 0.71

Equation (4.5)

$$TAX = -320.95 + 0.05\ GDP + 0.14\ M$$
$$(-1.41) \quad (5.40)*** \quad (2.86)***$$

$R^2 = 0.99$ D-W = 1.93

Equation (4.6)

$$PRJ = 168.12 - 0.02\ QRJX$$
$$(13.43)*** \quad (-5.23)***$$

$R^2 = 0.61$ D-W = 1.68

Equation (4.7)

$$RXO = 483.32 - 1738.03\ D + 14.75\ WY - 3.24\ PXO + 49.35\ ER$$
$$(4.25)*** \quad (-7.90)*** \quad (4.35)*** \quad (-3.61)*** \quad (5.32)***$$

$R^2 = 0.83$ F = 26.99 D-W = 1.93

Equation (4.8)

$$MO = -3038.03 - 3147.77\ D + 0.21\ RGDP - 6.52\ PMOT + 7.85\ RNFID$$
$$(-2.32)** \quad (-7.44)*** \quad (7.29)*** \quad (-3.85)*** \quad (1.91)*$$

$R^2 = 0.83$ F = 28.69 D-W = 1.96

4.5 CONCLUDING REMARKS

In this chapter we have outlined and estimated the stochastic equations of our model. Our objective was to obtain the best possible estimates for each equation. In order to achieve that objective we have used three different estimation techniques --- each to meet the particular need for each equation.

The estimation results are fairly good and they should produce reasonably good simulation results.

Chapter V

DYNAMIC EX-POST SIMULATION OF THE COMPLETE MACROMODEL

The principal purpose of building the Bangladesh model is to use it for policy analysis outlined in the introductory chapter. In order to do that we will perform policy simulations. However, before such exercises are undertaken in the next chapter, our interest in the present chapter is to evaluate the performance of the model in order to see how well it predicts the historical data. In other words, we would like to assess how well the model tracks the actual values of the endogenous variables over time in our data set.

Our present objective is fulfilled by performing historical or ex-post simulation. This simulation is important because it helps us determine how much confidence we can have on the model in terms of its ability to answer policy questions. If a model tracks historical values well we can say with a great deal of assertion that the policy analysis will be meaningful and that the model explains the structure of the economy well.

We will evaluate the simulation characteristics of our model on the basis of two criteria. First, the overall

performance will be judged on the basis of some measures of error for model validation. These measures calculate the overall fit of the predicted values of individual endogenous variables over the sample period. Some estimates of the decomposition of the deviation from actual values are also available.

Second, we will plot the actual and predicted values over time on the same graph to visually examine how well the model tracks the actual values. A good simulation should not only produce decent summary statistics and have predicted values tracking actual values closely, the predicted values should also be able to reproduce the turning points. Of special interest here will be the variables real gross domestic product and current account balance --- our target variables in policy analysis of the next chapter.

When we simulate the model, the entire model along with all definitions and identities, is simultaneously solved. In the last chapter we introduced and estimated the stochastic equations of the model. We now outline the entire model.

5.1 THE COMPLETE MODEL

The model below contains eight behavioral equations, all linear in both parameters and variables. Some of the twelve definitions and identities which follow the behavioral equations are, however, nonlinear in variables.

5.1.1 Behavioral Equations

$$RC = a0+a1*RDI+a2*RCL \qquad (5.1)$$

where RC = Real consumption
RDI = Real disposable income
RCL = Real consumption lagged

$$RIP = b0+b1*RGDPL+b2*MRIK \qquad (5.2)$$

where RIP = Real private investment
RGDPL = Real gross domestic product lagged
MRIK = Imports of raw materials, intermediate goods and capital

$$ACA = c0+c1*PFJL+c2*ACAL \qquad (5.3)$$

where ACA = Acreage of Aus rice
PFJL = Lagged price ratio of food and jute
ACAL = Acreage of Aus rice lagged

$$ACJ = d0+d1*PJFL+d2*ACJL \quad (5.4)$$

where ACJ = Acreage of jute

PJFL = Lagged price ratio of jute and food

ACJL = Acreage of jute lagged

$$TAX = f0+f1*GDP+f2*M \quad (5.5)$$

where TAX = Nominal tax revenue

GDP = Nominal gross domestic product

M = Nominal value of imports

$$PRJ = g0+g1*QRJX \quad (5.6)$$

where PRJ = Export price of raw jute

QRJX = Quantity of raw jute exports

$$RXO = h0+h1*D+h2*WY+h3*PXO+h4*ER \quad (5.7)$$

where RXO = Real non-jute exports

D = Dummy variable

WY = World income

PXO = Non-jute export prices

ER = Exchange rate as taka per U.S. dollar

$$MO = i0+i1*D+i2*RGDP+i3*PMOT+i4*RNFID \quad (5.8)$$

where MO = Real non-food imports

D = Dummy variable

RGDP = Real gross domestic product

PMOT = Price of non-food imports in taka

RNFID = Real unrequited private transfers from abroad

5.1.2 Definitions and Identities

$$RGDP = RC+RIP+RIG+RG+RXRJ+RXJM+RXJS +RXO-RMFNA-RMFA+RDQSFD-MO \quad (5.9)$$

where RGDP = Real gross domestic product

RC = Real consumption

RIP = Real private investment

RIG = Real government investment

RG = Real government expenditures

RXRJ = Real exports of raw jute

RXJM = Real exports of manufactured jute

RXJS = Real exports of jute specialty goods

RXO = Real non-jute exports

RMFNA = Real non-aid food imports

RMFA = Real aid-financed food imports

RDQSFD = Real change in food output due to the execution of any new policy

MO = Real non-food imports

$$GDP = (RGDP*PI)/100 \quad (5.10)$$

where GDP = Nominal gross domestic product

RGDP = Real gross domestic product

PI = GDP price deflater

$$RDI = RGDP-(TAX/PI)*100 \quad (5.11)$$

where RDI = Real disposable income

RGDP = Real gross domestic product

TAX = Nominal tax revenue

PI = GDP price deflater

$$TQF = (ACA*YLA)/2240+QFO \quad (5.12)$$

where TQF = Total rice production in long tons

ACA = Acreage of Aus rice

YLA = Yield of Aus rice in pounds

2240 pounds = 1 long ton

QFO = Total production of other varieties of rice

$$QSFD = (TQF-DELS+TSW)*0.9 \quad (5.13)$$

where QSFD = Total domestic supply of food

TQF = Total rice production

DELS = Change in the stock of rice

TSW = Total production of wheat

Total food supply is 90% of total production because 10% is subtracted as seed, feed and waste.

RDQSFD = ((QSFD-CQSFD)*2049.408)/1000 (5.14)

where RDQSFD = Real change in food output due to the execution of any new policy

QSFD = Total domestic supply of food

CQSFD = Predicted QSFD value in historical simulation

RDQSFD is equal to zero for historical simulation because both QSFD and CQSFD are one and the same. When the execution of any policy affects food output this variable measures the change due to the policy action and feeds it into the model. Of the two constants the first one is the price of food per ton in the base year and the second one scales the numbers so that the variable is expressed in millions of constant taka.

QJ = (ACJ*YLJ)/400 (5.15)

where QJ = Total production of jute in bales

ACJ = Acreage of jute

YLJ = Yield of jute in pounds

400 pounds = 1 bale

TJD = QJ+UJ-DELJ (5.16)

where TJD = Total disposition of jute

QJ = Total production of jute

UJ = Unaccounted market arrivals of jute

DELJ = Change in stock of jute

QRJX = TJD-QJMX-QJSX-DCJ (5.17)

where QRJX = Quantity of raw jute exports

TJD = Total disposition of jute

QJMX = Quantity of manufactured jute exports

QJSX = Quantity of jute specialty goods exports

DCJ = Domestic consumption of jute

RXRJ = QRJX*((47.36*7.7808)/1000) (5.18)

where RXRJ = Real exports of raw jute

QRJX = Quantity of raw jute exports

47.36 = Base period price of raw jute in U.S. dollar

7.7808 = Base period exchange rate

The expression is divided by 1000 to obtain the value in million taka.

PRJN = ((PRJ*47.36)/100)*ER (5.19)

where PRJN = Nominal export price of raw jute in taka

PRJ = Export price of raw jute (index)

47.36 = Base period price of raw jute in U.S. dollar

ER = Exchange rate as taka per U.S. dollar

$$CA = ((PRJN*QRJX)/1000)+((PJMN*QJMX)/1000) +((PJSN*QJSX)/1000)+((PXOT*RXO)/100) -((PFW/100)*(RMFNA+RMFA-RDQSFD)) -((PMOT/100)*MO)+NFS+NFI \quad (5.20)$$

where CA = Current account balance in nominal taka

PRJN = Nominal export price of raw jute in taka

QRJX = Quantity of raw jute exports

PJMN = Nominal export price of manufactured jute in taka

QJMX = Quantity of manufactured jute exports

PJSN = Nominal export price of jute specialty goods in taka

QJSX = Quantity of jute specialty goods exports

PXOT = Price of non-jute exports (taka value index)

RXO = Real non-jute exports

PFW = World price of food (index)

RMFNA = Real non-aid food imports

RMFA = Real aid-financed food imports

RDQSFD = Real change in food output due to execution of any new policy

PMOT = Price of non-food imports (taka value index)

MO = Real non-food imports

NFS = Net foreign service account

NFI = Net flow of unilateral transfers

5.2 MODEL SIMULATION

When we simulate our model, we basically find the solution of the model using actual values of the exogenous variables over time. The solution procedure typically starts with an initial set of values for the endogenous variables and iterates through the system until the difference on two successive iterations is no more than some preselected amount for all endogenous variables. This is called a solution point. The starting values for the endogenous variables are usually the values of the first observation. However, computer programs like SAS allow the user to specify his/her own starting values.

For ex-post or historical simulation, the procedure estimates predicted values of the endogenous variables for each observation, except the first one, taking parameter values of the estimated coefficients and values of the exogenous variables as given.[21]

Due to the presence of nonlinearities in some variables, the model is simulated by using the techniques of nonlinear simulation. We have, in fact, used the SIMNLIN procedure of the SAS program to simulate our model.

We also have a dynamic system as some lagged endogenous variables appear as explanatory variables. This requires us to perform dynamic simulation. When we execute a dynamic

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[21] See Klein and Young (1980) chapter 3 for a numerical example of a solution through the iterative procedure.

simulation, the predicted values of endogenous variables from the last period are used as lagged endogenous variables for the current period in the iteration process. On the other hand, a static simulation treats lagged endogenous variables as predetermined variables and uses the actual historical values from the data set.

It is important that we subject our model to the more stringent test of dynamic simulation because that helps us evaluate the dynamic characteristics of the model. A model which exhibits satisfactory system characteristics in static simulation may not exhibit satisfactory system dynamics. It is important to examine the dynamics of the model before we perform policy simulations. Cline and Young (1980:65) argue that dynamic simulation "is clearly the exercise most like forecasting. It is a test that a model must pass before we would be willing to use it for forecasting purposes".

The computer program used for simulation, the SAS SIMNLIN procedure, allows us to use three alternative solution methods ----- Newton, Jacobi and Gauss-Seidel. We have used the Newton method as it is fastest computationally and produces results identical to the other two methods. Moreover, unlike the Gauss-Seidel method, it is order invariant; the equations can be written in any order.[22]

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[22] For details on the algorithms and computational procedures of these solution methods see SAS (1984). Additional discussion on Newton's method can be found in chapter IV of Evans and Klein (1968). Fromm and Klein (1969) contains a discussion on the Gauss-Seidel method along with a brief account of Newton's method. Klein

There are several measures of model validation. We will use some of them to evaluate the performance of our model.

The most frequently used statistics are root-mean-square error (RMSE) and root-mean-square percent error (RMSPE). These statistics measure deviation of the simulated variable from its actual time paths. They are defined as:

$$RMSE = [\ 1/T\ \Sigma(Pt - At)^2\ ]^{1/2} \qquad (5.21)$$

$$RMSPE = [\ 1/T\ \Sigma\{(Pt - At)/At\}^2]^{1/2} \qquad (5.22)$$

where Pt = predicted (simulated) value of the variable over the sample period

At = actual value over the sample period

T = number of periods in simulation

We can see that RMSPE expresses deviation of predicted value from actual value in percentage terms which makes comparisons across variables possible and more meaningful.

Two other statistics often reported in computer printouts of simulations are mean error and mean percent error. As Pindyck and Rubinfeld (1981) point out, these errors may be close to zero if large positive errors cancel out large

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(1983) also has a detailed discussion on simulation procedures and algorithms including Newton's method. However, for an introductory discussion on simulation models see Pindyck and Rubinfeld (1981).

negative errors.[23] Consequently, we do not evaluate our variables by these measures.

Theil has defined two statistics to measure the accuracy of simulations. These are also known as Theil's inequality coefficients. The first one, called the U statistic is defined as:[24]

$$U = [1/T\ \Sigma(Pt-At)^2]^{1/2} / [1/T\ \Sigma(Pt)^2 + 1/T\ \Sigma(At)^2]^{1/2} \qquad (5.23)$$

This statistic lies between 0 and 1; it is equal to 0 if it is a perfect forecast.

For some problems[25] associated with the above statistic Theil (1966) suggested a slightly modified form of the above statistic, called the U1 statistic, defined as:

$$U1 = [1/T\ \Sigma(Pt-At)^2]^{1/2} / [1/T\ \Sigma(At)^2]^{1/2} \qquad (5.24)$$

This statistic is also equal to 0 in the case of perfect forecasts. Maddala (1977) notes that "of the two statistics U and U1 ... the statistic U is not a useful measure and U1

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[23] For definitions of these measures see Pindyck and Rubinfeld (1981).

[24] See Theil (1961) for the introduction of this statistic as a measure of forecast error.

[25] These are discussed in Maddala (1977).

should be preferred, as was also suggested by Theil." We, however, report below both U and U1 values of the variables in our model.

If we look at the two inequality coefficients we find that the numerators are the RMSE and the denominators are devices to obtain appropriate units of measurement. Theil has further decomposed the numerator to define two sets of components called inequality proportions. The first set of proportions consists of bias proportion (UM), variance proportion (US), and covariance proportion (UC), where UM+US+UC=1. The second set of inequality proportions include bias proportion (UM), regression proportion (UR), and disturbance proportion (UD),[26] where, once again, UM+UR+UD=1.

The bias proportion UM measures systematic error. If it is large, it means that on the average the predicted change deviates substantially from the average actual change. We would hope that UM would be close to zero.

The variance proportion US helps us assess the ability of the model to track the variability of the variable of our interest. A large US means that the simulated values have either failed to fluctuate while the actual values did or vice versa.

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[26] For the definitions of all the inequality proportions and their derivations from RMSE see Theil (1961, 1966).

The covariance proportion UC measures unsystematic error. This component will be high when we have a good prediction. When U>0, which means we do not have a perfect fit, the ideal distribution of the inequality proportions is UM=US=0, and UC=1.

Maddala (1977) argues that the decomposition into the second set of inequality coefficients, bias UM, regression UR, and disturbance UD components is perhaps more illuminating.[27]

Both bias UM, and regression UR proportions measure systematic errors. The UM is the same as defined above. In a perfect forecast UR will be equal to zero.

The disturbance component UD estimates the variance of the residuals obtained by regressing actual relative changes to predicted changes. Again with U > 0, the ideal distribution of this set of inequality proportions is UM=UR=0, and UD=1.

The two tables below present the simulation results of our model in terms of the measures of model validation discussed above. Table 5.1 reports the statistics of overall fit --- the RMSE, RMSPE, U, and U1 statistics --- for the individual endogenous variables of our model. In table 5.2 we present the decomposition of the mean square error --- the inequality proportions US, UC, UM, UR, and UD.

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[27] See Maddala (1977) chapter 15 for a discussion on the problems with variance US, and covariance UC proportions.

TABLE 5.1

Statistics of Fit

Variable	RMSE	RMSPE	U	U1
RC	2655	5.166	0.026	0.053
RIP	427	17.119	0.055	0.110
ACA	486	6.526	0.032	0.065
ACJ	246	13.199	0.066	0.132
TAX	503	15.334	0.021	0.042
PRJ	21	21.418	0.096	0.192
RXO	119	20.432	0.073	0.147
MO	627	15.141	0.061	0.122
RGDP	2283	3.873	0.020	0.040
GDP	7015	3.873	0.021	0.042
RDI	2290	4.116	0.021	0.042
TQF	180	1.666	0.007	0.015
QSFD	162	1.661	0.007	0.015
QJ	774	13.199	0.066	0.134
TJD	774	12.870	0.065	0.132
QRJX	774	25.744	0.126	0.262
RXRJ	285	25.744	0.126	0.262
PRJN	232	22.340	0.137	0.255
CA	2638	48.464	0.087	0.178

A number of points should be noted before we examine and evaluate the results of the two tables presented. First, our sample size is small. In total we have only 24 observations. Second, our sample is stretched across two distinctly different time periods. We have 11 observations from the pre-liberation period and 13 observations from the post-liberation period. The model has produced simulated values of these two periods. Finally, as we have noted earlier, in any empirical work of the less developed coun-

TABLE 5.2

Mean-Square-Error Decomposition Proportions

Variable	US	UC	UM	UR	UD
RC	0.092	0.097	0.001	0.167	0.832
RIP	0.023	0.975	0.002	0.004	0.995
ACA	0.358	0.606	0.036	0.054	0.910
ACJ	0.130	0.866	0.004	0.004	0.992
TAX	0.021	0.964	0.016	0.030	0.955
PRJ	0.102	0.889	0.009	0.454	0.537
RXO	0.026	0.969	0.005	0.001	0.994
MO	0.014	0.986	0.000	0.113	0.887
RGDP	0.096	0.904	0.001	0.146	0.854
GDP	0.051	0.939	0.011	0.064	0.925
RDI	0.098	0.902	0.000	0.155	0.845
TQF	0.081	0.886	0.034	0.054	0.913
QSFD	0.050	0.917	0.034	0.032	0.934
QJ	0.004	0.983	0.013	0.206	0.781
TJD	0.141	0.846	0.013	0.507	0.480
QRJX	0.240	0.747	0.013	0.500	0.487
RXRJ	0.240	0.747	0.013	0.500	0.487
PRJN	0.344	0.617	0.040	0.188	0.773
CA	0.043	0.927	0.030	0.099	0.871

tries we encounter two types of data problems --- availability and reliability. We share these common problems with all other researchers.

In the light of the points made above, the simulation results reported in the tables here are fairly good. It is to be remembered that we have performed dynamic simultaneous simulation. The error statistics of static simulation (not reported here) are even smaller than our reported results. Our results also compare very well with some other macro model simulations of LDCs. For example, our RMSPE statis-

tics reported in table 5.1 are in general as good or better than studies done by Rashid (1981, 1984) and Semudram (1982). Unfortunately we cannot compare our other statistics with these studies as they do not report them.

We can see from table 5.1 that some of the RMSPE are higher than the others. It is instructive to evaluate them at this stage. However, a distinction must be made between the dependent variables of the behavioral equations with those of the identities. If the RMSPE of the dependent variable of a stochastic equation is high and the variable enters in an identity, it automatically causes the RMSPE of the identity to be high. This has happened in the case of the variables QRJX, RXRJ and PRJN in table 5.1.

Again, an identity of special interest to us, CA, is a residual of other variables. In such cases, even if absolute deviations are not high they may be high in percentage terms because the values may be close to zero. This is precisely why CA has high RMSPE. The plot of the variable showing actual and simulated values (below) reveals that the predicted values are fairly close to actual values over time.

For the behavioral equations it is useful to analyse the decomposition of the mean-square-error in order to understand the sources of error. The decompositions reported in table 5.2 --- the Theil inequality proportions --- can now be examined to analyse the errors.

It is essential to distinguish between systematic and unsystematic sources of variation in error of the prediction of a given variable. As noted above, UM, US and UR measure systematic error. Presence of systematic errors is a matter of concern in prediction. We observe from table 5.2 that the bias proportion UM is low for all variables. For variable ACA, although the variance proportion US is rather high, the alternative statistic, regression proportion UR, is low. Since we do not have clear evidence of systematic error, we conclude that the errors of forecast for ACA is caused by unsystematic errors. Again, for variable PRJ although we have a high UR, the US is not very high.

Of all the behavioral equations only PRJ and RXO have RMSPE of more than 20 percent. The next highest one is RIP (table 5.1). Of these three RIP and RXO do not show any signs of systematic error; their respective UM, US, and UR are very low (table 5.2). Only in the case of PRJ, as noted in the above paragraph, is there some inconclusive evidence of systematic error.

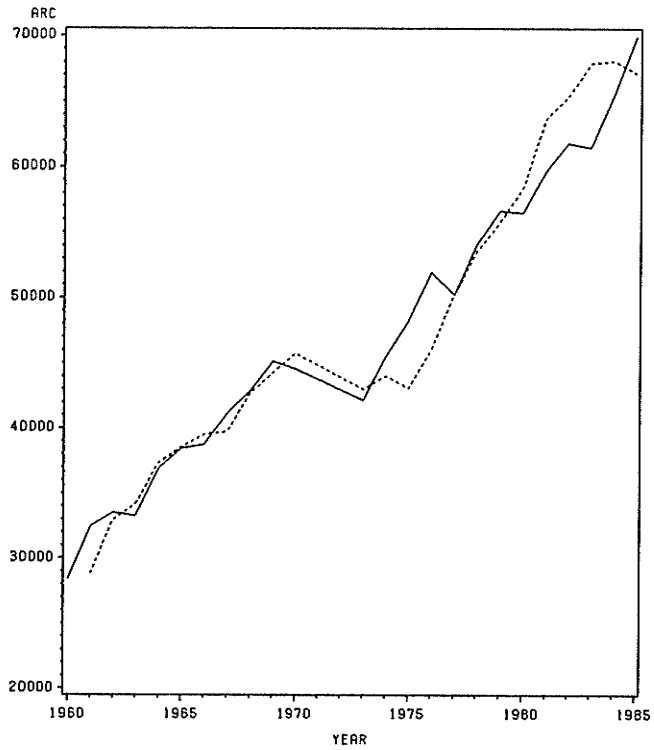
The relatively higher RMSPE for variable RIP --- private investment --- should not be surprising. Investment is in general a more volatile component of national expenditure. The other two variables with high RMSPE --- PRJ and RXO ---belong to the external sector of the model. More accurate predictions of these variables would require incorporation into the model more detailed information about the

countries who trade with Bangladesh. The scope of that expansion is so extensive that it can be a subject matter of an altogether different study. In our case the marginal costs of such expansion would be much greater than the marginal benefits. Moreover, the error statistics, as they stand now, are comparable to other studies cited above.

The statistics of model validation presented and analysed above are measures that calculate average prediction error over the sample period. They provide us with useful information about overall performance of the prediction, but fail to furnish us with an important feature of prediction which is of interest to us --- how well the model predicts the turning points in the actual data. For that matter a visual presentation of the actual and simulated values over time is most appropriate. The figures below plot actual and simulated values of respective variables over time on the same graph. This form of presentation allows us to see how the model tracks the historical values.

We have presented the plots of all behavioral equations. In the policy analysis of the next chapter we will, however, be most interested in examining the effects of our policies on the real gross domestic product and the current account balance. Therefore, in the last two we present plots of RGDP and CA.

FIGURE 5.1: HISTORICAL SIMULTION
REAL CONS, MILL CONST TAKA

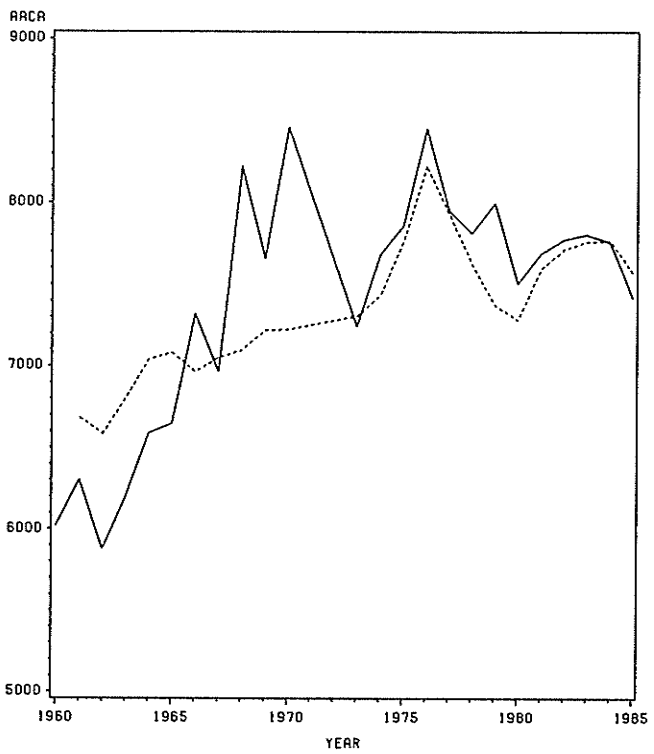


SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.2: HISTORICAL SIMULTION
REAL PVT INVESTMENT

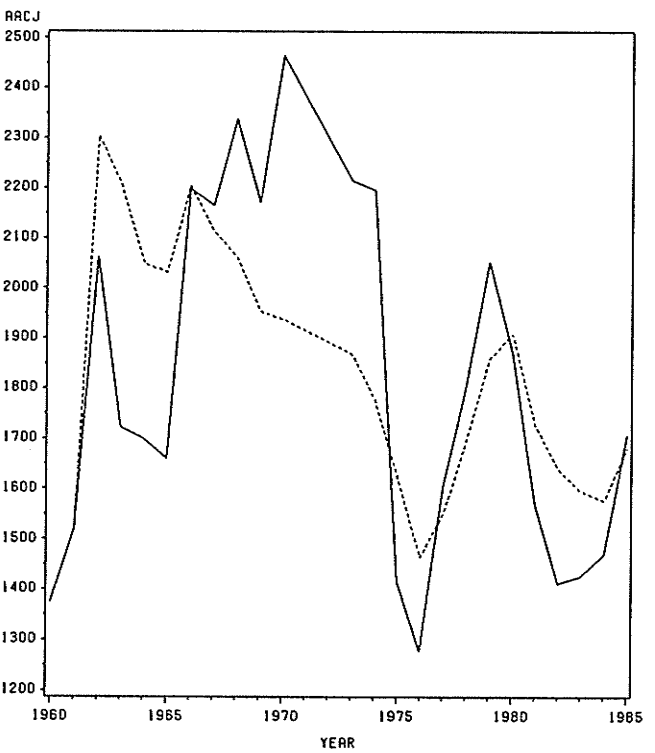
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.3: HISTORICAL SIMULTION
ACREAGE OF AUS RICE



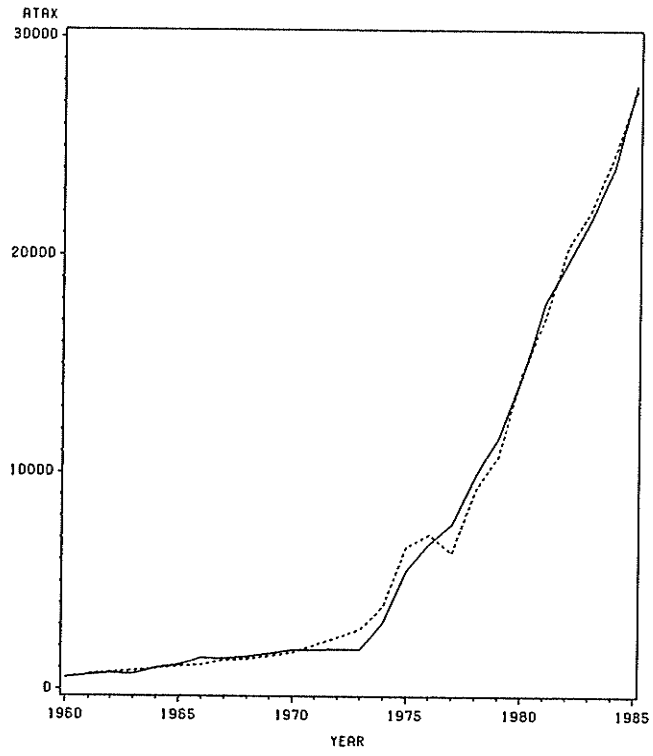
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.4: HISTORICAL SIMULTION
ACREAGE OF JUTE



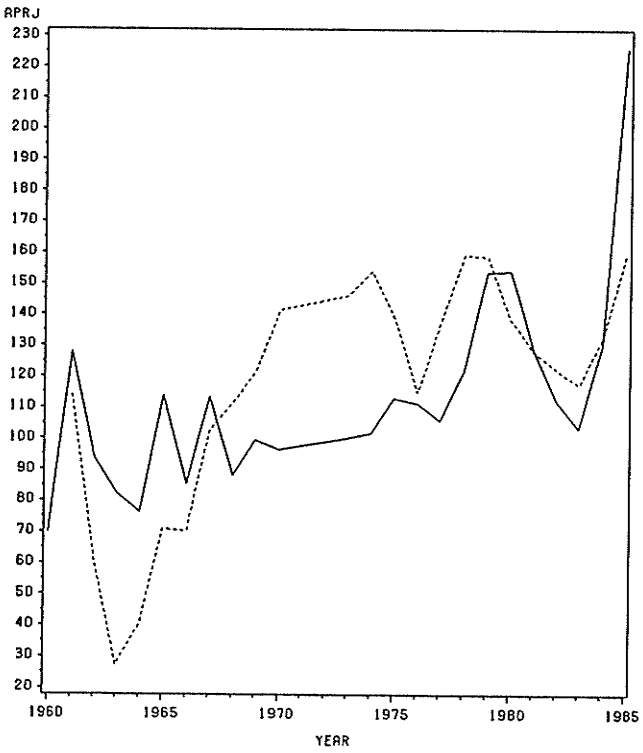
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.5: HISTORICAL SIMULTION
NOMINAL TAX, MILL TAKA



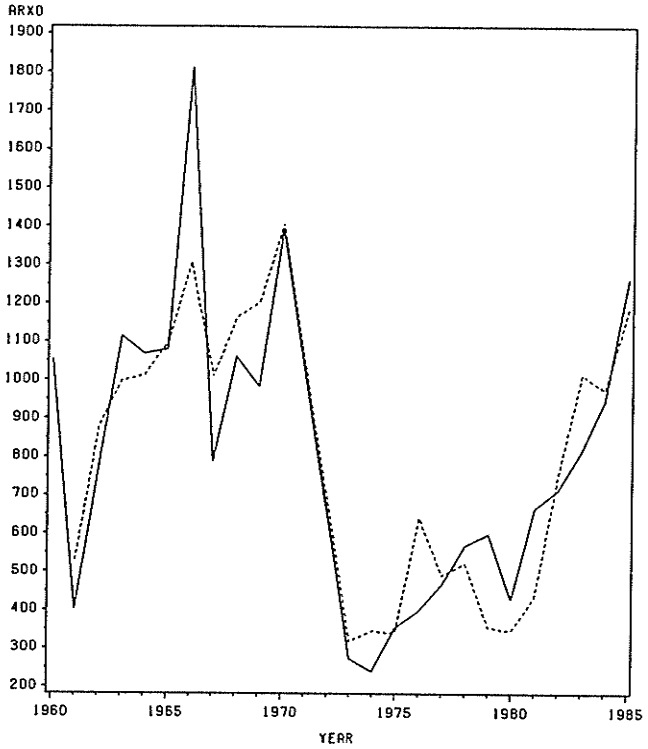
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.6: HISTORICAL SIMULTION
RAW JUTE EXPT PRICE



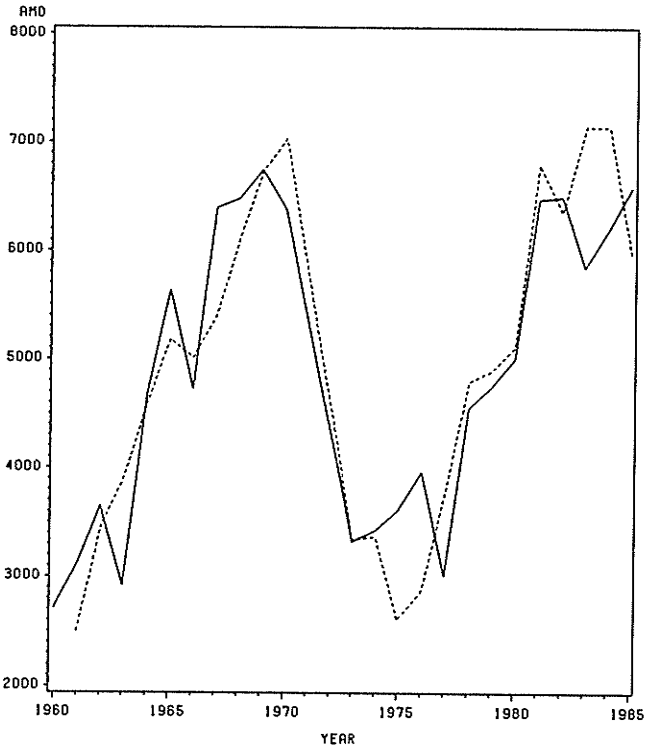
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.7: HISTORICAL SIMULTION
REAL NON-JUTE EXPTS



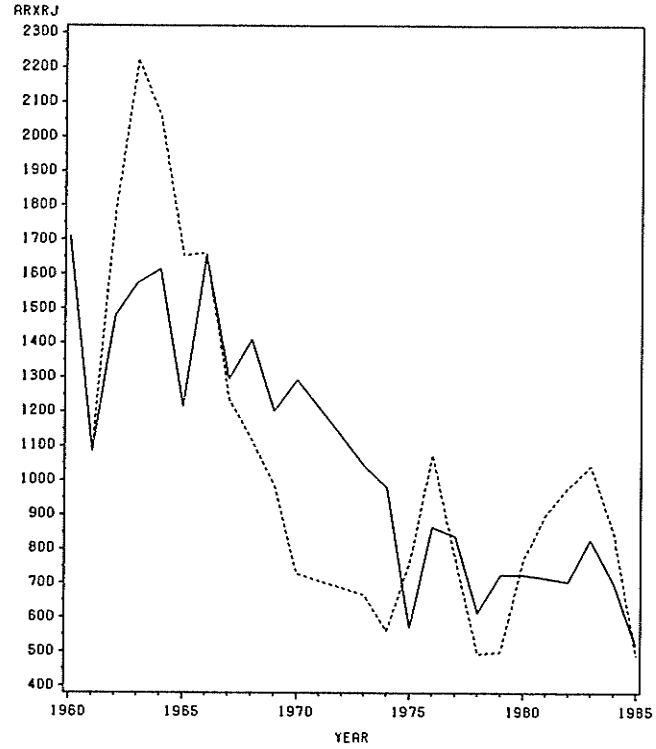
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.8: HISTORICAL SIMULTION
REAL NON-FOOD IMPTS



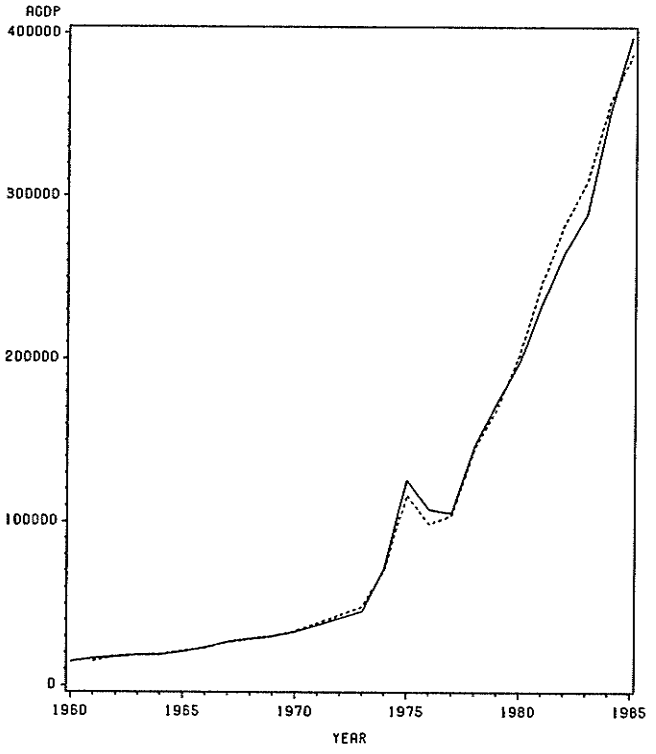
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.9: HISTORICAL SIMULTION
REAL EXPTS OF RAW JUTE



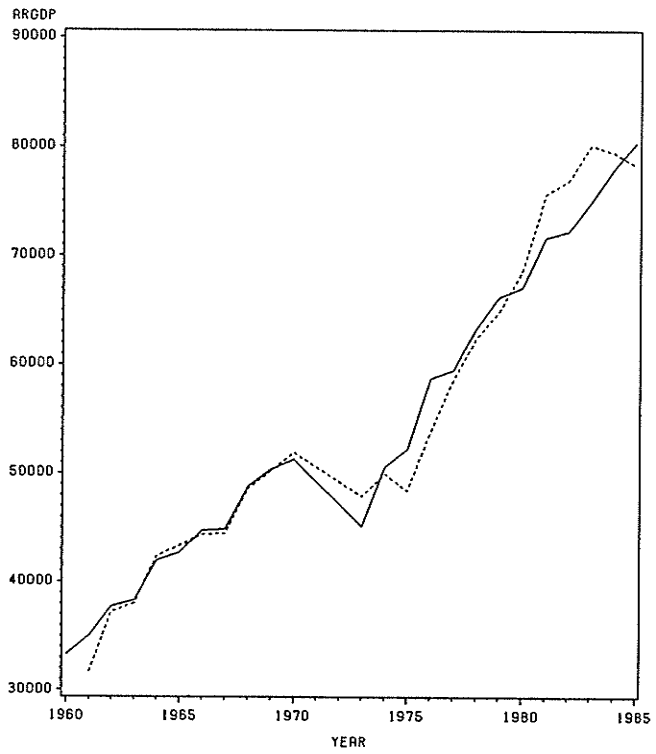
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.10: HISTORICAL SIMULTION
NOMINAL GDP, MILL TAKA



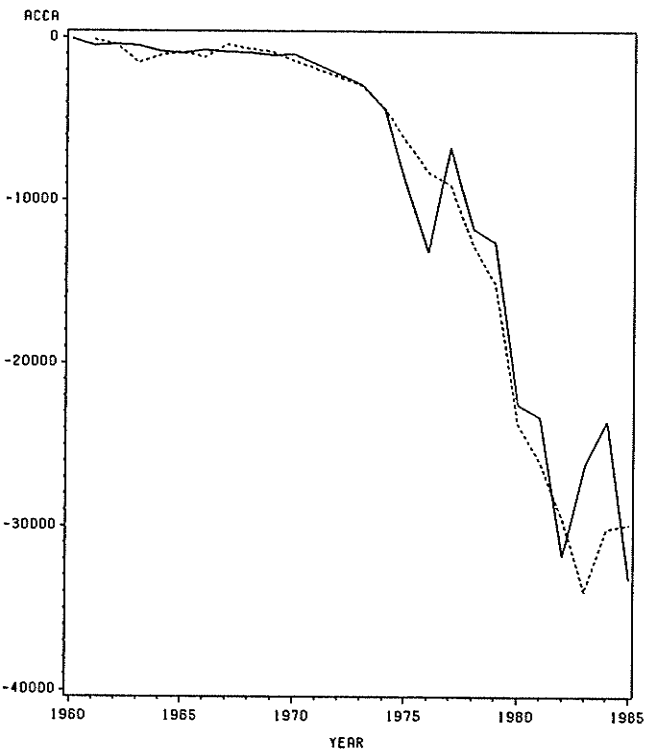
SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.11: HISTORICAL SIMULTION
REAL GDP, MILL CONST TAKA



SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

FIGURE 5.12: HISTORICAL SIMULTION
CURR ACC BALANCE



SOLID LINE: ACTUAL VALUES
DOTTED LINE: SIMULATED VALUES

Given the limitations of our predictions discussed earlier in this chapter our figures demonstrate reasonably good plots of the variables. The plots of static simulation (not presented here) are even better than dynamic simulation. We observe here that a lot of turning points appear with either a lag or are predicted a period or two ahead.

The plot of the two variables of keen interest for the next chapter --- RGDP and CA --- are very good. The predicted values are very close to historical values and they track the actual values very well.

5.3 CONCLUDING REMARKS

Ex-post or historical simulation is the most important test that a simulation model must undergo before it can be utilized for policy analysis. We have put our model to that test in this chapter.

Based on the results of the various statistics of fit used in this chapter to test the predictive capacity of our model, we can say that it has passed this crucial test. These tests were based on a dynamic simultaneous simulation of the model, which takes into account not only the interrelationships and feedbacks of the variables in the model, but also its dynamic structure as it feeds into the simulation the predicted values of lagged endogenous variable when the model is being solved. It is definitely the most stringent test.

We have compared the results of our dynamic simulation with that of static simulation. On the average, as expected, the error statistics are somewhat larger in dynamic simulation, but not seriously so. There are no significant changes or jumps in the estimates. The same comparison was also done for the plots of the endogenous variables. Once again, we found slightly better fit with static simulation. With dynamic simulation more turning points were either predicted in advance or with a lag. However, the results of dynamic simulation and the comparison with static simulation suggests that our model is dynamically stable.

Chapter VI

POLICY ANALYSIS: FOOD SELF-SUFFICIENCY VERSUS EXPORT PROMOTION

Having performed the tasks of estimation and then model validation with historical simulation in the last chapter, we now turn to policy analysis. The purpose of the policy analysis, as outlined in the introductory chapter, is to examine the effects of policies which alter the mix of agricultural output on the real GDP and the current account balance. It is in this sense that we are interested in examining the stability of the external sector in response to alternative policies affecting agricultural product composition.

6.1 THE NATURE OF THE POLICY EXPERIMENTS

In this chapter we perform some specific policy experiments which are listed later in this section. However, it is useful at the outset to briefly discuss the general nature of policy simulations.

Policy simulations are basically "what if" type of studies where effects of a change in a policy instrument on the dependent variable of interest are studied. Given the parameter values of the equations and unchanged values of all other exogenous variables, new policy variables for the

policy instruments are used to obtain the predicted values of the endogenous variables. These policy simulation values are then compared to the values predicted in historical simulation, sometimes also known as control solution. The changes between the predicted values of the two simulations are the consequence of policy actions.

Policy simulations are like controlled laboratory experiments where all but the policy variable(s) in question are held constant. The experiments are done within the sample period. This means that we are essentially examining what would have happened if one or more exogenous variables were different within the sample period, ceteris paribus.

Policy simulations need not be confined to experiments with changes in the exogenous variables only. Consequences of changes in the parameter values of explanatory variables may also be obtained by simulating a model. Policies which lead to changes in such factors as the marginal tax rates, marginal propensities to consume, save, or import may be evaluated by changing appropriate parameter values. However, our experiments do not involve any changes in the estimated parameters.

It is also important to distinguish between a policy simulation and a forecast. Unlike policy simulations forecasts involve predictions beyond the sample period. When we make forecasts we predict the values of endogenous variables

beyond the sample period on the basis of assumed values of exogenous variables. This means that values of exogenous variables beyond the sample period are to be provided for the forecast. It may be noted that our policy experiments do not involve forecasts beyond the sample period. More specifically, we will examine the effects of two distinct policies --- policies that promote food self-sufficiency and policies that promote export expansion via increased traditional exports, jute. The instruments used are price policies and productivity increases.

Our estimation results have shown that the relative price of rice and jute are important explanatory variables for the acreage decisions of the two crops. Changes in the relative price will therefore lead to a change in the composition of the agricultural output. The effects such changes on the real GDP is traced by the policy simulations.

However, as pointed out earlier in the study, changes in agricultural product composition also affect the current account as the volumes of imports and exports of food and jute respectively undergo changes due to the policy move. The net effect on the current account balance is a priori unknown.

The second policy instrument, productivity increases, does not itself affect the allocation of land between the two crops in our model. It does however affect real GDP and

the current account. The effects of pure productivity increases are rather obvious and predictable. We have, as a matter of realistic experiments, also combined productivity and price changes in order to examine the effects of simultaneous changes in relative prices and productivities.

The experiments concerning changes in more than one policy instrument simultaneously is not uncommon, and is sometimes believed to be more realistic. The realism, needless to say, depends on the viability of the experiments in question. It can be argued that increases in the relative price of a crop and its productivity can go hand in hand. Higher prices may make it possible for the producers to use productivity augmenting inputs and techniques of production which may otherwise be out their reach due to low return from the crops. It may also be possible for the policy makers to promote these inputs and techniques more easily when combined with price increases.

We have performed seven explicit policy simulations with our model combining different changes in the policy variables. They are as follows:

1. Increasing the price of rice to the growers by 10%
2. Increasing the productivity of rice by 10%
3. Increasing simultaneously the price and productivity of rice by 10% each.
4. Increasing the price of jute to the growers by 10%

5. Increasing the productivity of jute by 10%
6. Increasing simultaneously the price and productivity of jute by 10% each.
7. Increasing the price of jute to the growers by 10% while jute export price is held constant.

It can be observed that the first three experiments relate to food self-sufficiency and the last four relate to promotion of traditional exports.

In our model, when the price of rice is increased, jute prices remaining the same, it becomes relatively more attractive, a priori, for the producers to produce more rice. This leads to reallocation of land into rice and away form jute. The net effect on the real GDP depends on the relative changes in acreages and the productivities (exogenous) for the different years. The final change in real GDP is however a multiple of the initial change due to the multiplier effect of the change in an exogenous variable.

The effect on the current account for the same policy experiment has three principal sources. First, the food price increase leads to higher food output and consequently lower food imports. The outcome is unambiguous. Second, jute output goes down and jute export volume falls. This leads to a rise in the export price of raw jute. Since prices and quantities move in the opposite directions, the net result is a priori unknown. Third, changes in real GDP

due to the policy move cause changes in non-food imports. The direction of this change is also a priori unknown because the direction of movement in real GDP itself is unknown. The net change in current account balance is the sum of the above three forces.

The effects of changes in jute price on real GDP and current account will also be transmitted by the same channels discussed above, except that food imports will increase unambiguously due to decrease in domestic production.

6.2 POLICY SIMULATION RESULTS

Seven tables below present respectively the results of the seven policy simulations outlined above in terms of the variables of our interest --- the real GDP and the current account balance.

Each table presents predicted values of real GDP and current account balance for the years 1960 to 1985 produced by both control simulation and policy simulation. The control simulation values for real GDP is named CRGDP and the policy simulation values are named PRGDP. Likewise, the control and policy simulation values for current account balance are named CCA and PCA respectively. The differences between the control and policy simulation predicted values are represented by DRGDP and DCA respectively for real GDP and current account balance. It may be worth noting that real GDP is expressed in millions of 1973 taka and current account balance is expressed in millions of current taka.

6.3 ANALYSIS OF THE OUTCOMES OF POLICY SIMULATIONS

Our principal purpose in this chapter is to analyse the effects of alternative policies elaborated above on real GDP and the current account balance. Tables below report the results of our policy simulations. We now examine the results of those policy experiments to see how the individual policies affect real GDP and the current account balance.

6.3.1 Policy Simulation No.1

In this simulation we examine the effect of a 10% increase in rice prices. It is an experiment where price increase via acreage responses promotes a move toward food self-sufficiency.

Simulation results reported in table 6.1 shows that the policy effect on real GDP is ambiguous. However there is an appearance of a pattern. The policy real GDP is lower than control real GDP during the pre-liberation period up to 1974 and only in 1980 during the post-liberation period. All other years during the post-liberation period demonstrate increase in real GDP.

Two factors are responsible for the changes in real GDP in the model. First, as a result of increased rice acreage food production increases which increases the real GDP. Second, due to decreased jute acreage and consequent decline

TABLE 6.1

Policy Simulation for a 10% Increase in Rice Prices

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	31658.4	-15.0	-155	-147	8
1962	37214.2	36985.9	-228.3	-419	-312	107
1963	37992.0	37683.9	-308.1	-1553	-1362	191
1964	42360.9	42110.5	-250.4	-1086	-924	162
1965	43326.1	43103.6	-222.5	-891	-791	100
1966	44347.3	44105.7	-241.6	-1211	-1112	99
1967	44447.6	44231.6	-216.0	-413	-369	44
1968	48577.4	48389.8	-187.6	-683	-661	22
1969	50210.4	50076.4	-134.0	-879	-871	8
1970	51922.4	51788.8	-133.6	-1439	-1471	-32
1973	47869.6	47740.2	-129.4	-2927	-2943	-16
1974	49942.1	49892.4	-49.7	-4309	-4238	71
1975	48412.3	48479.9	67.6	-6344	-6171	173
1976	53836.4	54017.8	181.4	-8284	-7871	413
1977	58523.4	58694.5	171.1	-9061	-8928	133
1978	62441.5	62558.5	117.0	-12774	-12852	-78
1979	64829.0	64853.6	24.6	-15061	-15080	-19
1980	68698.3	68640.2	-58.1	-23660	-23499	161
1981	75630.8	75652.3	21.5	-26036	-25656	380
1982	76940.3	77007.6	67.3	-29502	-29077	425
1983	80168.1	80242.9	74.8	-33997	-33587	410
1984	79516.7	79602.7	86.0	-30175	-29854	321
1985	78315.8	78368.8	53.0	-29892	-29895	-3

in jute production the real GDP goes down. We computed the elasticities of rice and jute acreages with respect to the changes in relative prices of rice and jute from our simulation results of the acreages of the two crops. The results (not reported here), show that while the elasticity of jute acreages remained fairly constant, only varying somewhat randomly, the corresponding elasticity for rice acreages increased over the sample period. Since in absolute terms the total acreage of rice is much higher than that of jute,

this has led to increases in rice output which have gradually outweighed the loss of jute output over the years. This explains why the effect on real GDP has been positive in most post-liberation years.

Another factor that influences the outcome of policy effects on real GDP as well as the current account is the exogenously determined yields of the two crops. Yields of the two crops vary randomly over the sample period which means that an equal switch in the acreages between the two crops produces different outcomes in terms of changes in real GDP and the current account balance.

An examination of the current account balance figures shows that for all but five years --- 1970, 1971, 1978, 1979 and 1985 --- it registered improvement due to the policy action.

The change in current account balance is the net effect of three forces. First, higher food prices lead to increases in food acreage, and consequently, increases in food output. This causes food imports to decline, which in turn, produces an improvement in the current account balance. We examined the breakdown of the components of the current account which change due to this policy action (not reported here). From that investigation we find that food imports do decline unambiguously.

Second, changes in non-food imports take place due to changes in real GDP. Further examination shows that the non-food imports are higher for the years in which real GDP increased and lower for those years registering a decline in the real GDP.

Finally, changes in nominal jute exports take place due to the policy move. Higher food prices lead to a reduction in jute production, and consequently exports, due to substitution in production. However, lower exports raise export prices of jute. The net result --- changes in nominal exports --- depends on the relative changes in quantity and prices as the two move in the opposite directions. An examination of the percentage changes of the two variables shows that the changes in quantity have, for all but five years, been higher than that of price. Therefore, for all but five years this component has caused current account balance to deteriorate due to the policy experiment.

It can be seen from the above discussion that the net change in real GDP as well as the current account balance cannot be a priori determined for the given policy experiment. Our simulation results show that they can be positive for some years and negative for the others, and that explanations for such results can be found by decomposing them into their constituent parts.

For changes in real GDP, the results depend on the relative changes in the output of the two commodities. The output levels vary due to differences in the elasticities of acreage response to price changes as well as variation in yields. If yields were held constant we would have experienced definite increases in real GDP because acreage elasticity of rice was observed to increase over the sample period.

In the case of the current account balance the outcome is the product of a somewhat more complicated interaction of its different components. Improvements in terms of lower food imports is clear and unambiguous. The changes in export earnings due to decreases in jute acreage and output is not very clear. In most years export earnings go down, but its magnitude depends on the movement of the export price. Finally, increases in real GDP also lead to increases in non-food imports. This factor causes current account balance to deteriorate.

Our analysis therefore leads us to conclude that under the structure of the economy characterized by our model a drive to food self-sufficiency by increasing the relative price of rice does not produce clearcut gains in terms of real GDP and the current account balance.

6.3.2 Policy Simulation No.2

This simulation examines the effect of a 10% increase in food yield for all the years in our sample. It is also a food self-sufficiency experiment caused by changes in non-price factors in production. Productivity increases can be achieved by several factors like introduction of new seed-fertilizer technology or by increasing subsidies on inputs which increase productivity.

Table 6.2 shows that the effect of such a policy on real GDP is unambiguously positive. Rice output increases without any corresponding fall in jute output producing an increase in the policy real GDP.

The net change in the current account balance is, however, not unambiguous. In eight of the twenty three years for which we have predicted values of current account balance, the balance deteriorates due to the policy change.

Under this policy experiment there is no change in the export of jute. Changes in current account balance are caused by the net effect of decreased imports of food due to increased rice output, and increased non-food imports caused by higher levels of real GDP. Deterioration in the current account balance is caused in the eight years due to non-food imports rising faster than the decline in food imports.

TABLE 6.2

Policy Simulation for a 10% Increase in Rice Yields

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	35204.2	3530.8	-155	148	303
1962	37214.2	42012.6	4798.4	-419	-38	381
1963	37992.0	43108.7	5116.7	-1553	-1780	-227
1964	42360.9	48289.8	5928.9	-1086	-724	362
1965	43326.1	49516.5	6190.4	-891	-543	348
1966	44347.3	50561.9	6214.6	-1211	-1114	97
1967	44447.6	50430.5	5982.9	-413	-35	378
1968	48577.4	54894.3	6316.9	-683	-399	284
1969	50210.4	56802.8	6592.4	-879	-620	259
1970	51922.4	58763.4	6841.0	-1439	-1332	107
1973	47869.6	54257.1	6387.5	-2927	-2413	514
1974	49942.1	56792.8	6850.7	-4309	-2557	1752
1975	48412.3	55205.2	6792.9	-6344	-4827	1517
1976	53836.4	61137.7	7301.3	-8284	-5205	3079
1977	58523.4	65671.3	7147.9	-9061	-8421	640
1978	62441.5	69971.3	7529.8	-12774	-13527	-753
1979	64829.0	72379.2	7550.2	-15061	-15333	-272
1980	68698.3	76298.6	7600.3	-23660	-24307	-647
1981	75630.8	83675.0	8044.2	-26036	-25141	895
1982	76940.3	85061.9	8121.6	-29502	-29627	-125
1983	80168.1	88548.3	8380.2	-33997	-34839	-842
1984	79516.7	88089.5	8572.8	-30175	-30721	-546
1985	78315.8	86791.4	8475.6	-29892	-32695	-2803

The somewhat surprising result of the current account balance deteriorating in eight of the sample years does not imply that marginal propensity to nonfood imports with respect to real GDP was greater than unity. Our examination of the results in real terms (not reported here) revealed that the current account balance improved for all years when evaluated in 1973 taka values. However, for the purposes of current account balance we evaluate the changes in food and nonfood imports in terms of current taka values. Due to the

differences in the movements of import prices of food and nonfood items, the conversions into nominal taka produce net deterioration in the current account balance for eight years. In other words, for these years the food import saving in nominal taka due to increased food output were less than nominal taka increases of nonfood imports due to increased GDP.

It can be concluded from the discussion of the present policy simulation that although food self-sufficiency via increased productivity of rice will increase real GDP it will not necessarily improve the current account balance.

6.3.3 Policy Simulation No.3

Table 6.3 presents the results of the policy simulation where both rice prices and yields are simultaneously increased by 10%. It is an experiment where price and non-price policies may be utilized as complimentary instruments. However, as pointed out before, some productivity increases can be induced by higher prices. Needless to say, this is also an experiment in food-self sufficiency.

We can see from table 6.3 that increases in real GDP is registered for all the years in our sample. Productivity increase are the principal forces behind this uniform outcome. This can be understood by examining table 6.1, 6.2 and 6.3 together. DRGDP in table 6.3 is higher than table

TABLE 6.3

Simultaneous 10% Increase in Rice Prices and Yields

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	35199.0	3525.6	-155	156	311
1962	37214.2	41797.3	4583.1	-419	70	489
1963	37992.0	42817.6	4825.6	-1553	-1590	-37
1964	42360.9	48063.4	5702.5	-1086	-559	527
1965	43326.1	49320.4	5994.3	-891	-441	450
1966	44347.3	50347.3	6000.0	-1211	-1014	197
1967	44447.6	50242.5	5794.9	-413	11	424
1968	48577.4	54735.3	6157.9	-683	-376	307
1969	50210.4	56698.2	6487.8	-879	-611	268
1970	51922.4	58659.5	6737.1	-1439	-1364	75
1973	47869.6	54156.7	6287.1	-2927	-2427	500
1974	49942.1	56776.4	6834.3	-4309	-2476	1833
1975	48412.3	55311.8	6899.5	-6344	-4642	1702
1976	53836.4	61368.0	7531.6	-8284	-4766	3518
1977	58523.4	65890.7	7367.3	-9061	-8283	778
1978	62441.5	70134.0	7692.5	-12774	-13611	-837
1979	64829.0	72445.8	7616.8	-15061	-15357	-296
1980	68698.3	76277.7	7579.4	-23660	-24153	-493
1981	75630.8	83739.2	8108.4	-26036	-24755	1281
1982	76940.3	85174.9	8234.6	-29502	-29200	302
1983	80168.1	88668.8	8500.7	-33997	-34436	-439
1984	79516.7	88223.1	8706.4	-30175	-30403	-228
1985	78315.8	86887.2	8571.4	-29892	-32717	-2825

6.2 for those years for which the variable is positive in table 6.1 . In these years the productivity effects are reinforced by positive price effects to produce an even higher level of increase in real GDP. The converse holds for those years which register negative DRGDP in table 6.1 .

The most powerful policy experiment in favour of food-self sufficiency also produces mixed outcome with respect to changes in the current account balance. A breakdown of the

components reveals that the country saves by importing less food but spends more on non-food imports due to increases in real GDP. At the same time higher relative price of rice for most years leads to lower export revenue from jute.

With respect to this policy simulation we also make the same conclusion as in the preceding one, and maintain that a move toward self-sufficiency in food through a combination of price and non-price instruments increases real GDP but does not necessarily improve the current account balance.

6.3.4 Policy Simulation No.4

This simulation is the first of four experiments which examine the effect of the promotion of traditional exports for which the country has favourable resource endowments. In the case of the Bangladesh economy this commodity, as we have noted earlier, is jute. We focus our attention in this experiment to a 10% increase in the grower's price of jute.

We have presented the results of this simulation in table 6.4 . It can be seen that for five years in our sample period real GDP in fact declines due to this policy experiment. For those years the gains from increased jute output as a result of higher jute prices were outweighed by decreased food output due to decline in rice acreages. Once again, exogenously determined different levels of productivities of the two crops also play an important role in producing this outcome.

TABLE 6.4

Simulation for a 10% Increase in Jute Prices to Growers

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	31708.5	35.1	-155	-166	-11
1962	37214.2	37489.6	275.4	-419	-563	-144
1963	37992.0	38362.7	370.7	-1553	-1798	-245
1964	42360.9	42681.6	320.7	-1086	-1287	-201
1965	43326.1	43620.3	294.2	-891	-1022	-131
1966	44347.3	44663.7	316.4	-1211	-1346	-135
1967	44447.6	44737.9	290.3	-413	-481	-68
1968	48577.4	48837.6	260.2	-683	-726	-43
1969	50210.4	50413.2	202.8	-879	-901	-22
1970	51922.4	52125.5	203.1	-1439	-1420	19
1973	47869.6	48066.7	197.1	-2927	-2930	-3
1974	49942.1	50059.4	117.3	-4309	-4291	-82
1975	48412.3	48411.5	-0.8	-6344	-6526	-182
1976	53836.4	53729.6	-106.8	-8284	-8715	-431
1977	58523.4	58426.8	-96.6	-9061	-9229	-168
1978	62441.5	62399.1	-42.4	-12774	-12741	33
1979	64829.0	64881.2	52.2	-15061	-15107	-46
1980	68698.3	68832.5	134.2	-23660	-23917	-257
1981	75630.8	75687.6	56.8	-26036	-26491	-455
1982	76940.3	76952.6	12.3	-29502	-30023	-521
1983	80168.1	80172.2	4.1	-33997	-34525	-528
1984	79516.7	79512.0	-4.7	-30175	-30610	-435
1985	78315.8	78338.6	22.8	-29892	-29993	-101

With the exception of only two years, the current account balance due to this policy move deteriorates in comparison with control simulation. This apparently unexpected result is produced by a combination of different factors. The increases in food imports have been larger than the gains in terms of jute export earnings for most of the years. The gains in terms of export earnings have been small because increased production and exports put downward pressure on the export price of jute. Jute export earnings in fact fell

in five of our sample periods. That was caused by a proportionately higher decline in price in comparison to increase in export volume for those years.

Again, we find that for all but five years, real GDP increases due to this policy action. The increases in real GDP lead to increases in non-food imports. This factor makes the current account balance deteriorate even further.

The lesson that we learn from this policy simulation is that promotion of traditional exports may not necessarily be the answer to the difficulties with the current account. Our results show this to be the case with Bangladesh.

6.3.5 Policy Simulation No.5

This policy simulation is the counterpart of simulation no.2 for rice. Here we experiment with an uniform increase of 10% in the productivity of jute. The results are presented in table &poltabe .

In the present case we obtain unambiguous increase in real GDP very much like table 6.2 because with increases in jute yield and output there is no corresponding decrease in rice output.

For all but two years, however, the current account balance deteriorates. Although no change in food imports is involved in this case, the increases in non-food imports due

TABLE 6.5

Policy Simulation for a 10% Increase in Jute Yields

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	32082.7	409.3	-155	-179	-24
1962	37214.2	37924.1	709.9	-419	-658	-239
1963	37992.0	38846.7	854.7	-1553	-1959	-406
1964	42360.9	43211.2	850.3	-1086	-1381	-295
1965	43326.1	44143.8	817.7	-891	-1074	-183
1966	44347.3	45169.4	822.1	-1211	-1407	-196
1967	44447.6	45236.5	788.9	-413	-492	-79
1968	48577.4	49327.9	750.5	-683	-735	-52
1969	50210.4	50894.9	684.5	-879	-902	-23
1970	51922.4	52615.0	692.6	-1439	-1412	27
1973	47869.6	48551.2	681.6	-2927	-2906	21
1974	49942.1	50573.2	631.1	-4309	-4311	-2
1975	48412.3	48961.5	549.2	-6344	-6466	-122
1976	53836.4	54392.9	556.5	-8284	-8614	-330
1977	58523.4	59088.0	564.6	-9061	-9274	-213
1978	62441.5	63036.4	594.9	-12774	-12843	-69
1979	64829.0	65493.3	664.3	-15061	-15222	-161
1980	68698.3	69405.6	707.3	-23660	-24172	-512
1981	75630.8	76310.8	680.0	-26036	-26660	-624
1982	76940.3	77609.9	669.6	-29502	-30314	-812
1983	80168.1	80837.9	669.8	-33997	-34955	-958
1984	79516.7	80208.5	691.8	-30175	-30951	-776
1985	78315.8	78972.1	656.3	-29892	-30358	-466

to increases in real GDP outweigh the increases in jute export revenues.

The reasons for the deterioration of the current account balance is very much similar to those in simulation no. 2. Here also, our examination of the results in real terms (not reported here) revealed that the current account balance improved for all years when measured in constant 1973 taka. The deterioration of the current account balance in nominal

terms is again due to increased imports in nominal taka being higher than increases in the nominal value of jute exports. The gains from jute exports are further diminished due to fall in raw jute exports prices as a result of increases in quantities exported. Hence, the net effects for all but two years is detrioration in the current account balance.

Following the conclusion of the preceding simulation we may once again maintain that the promotion of traditional exports may not necessarily solve the problems with the current account. The present simulation however shows that an increase in real GDP is nevertheless attainable with productivity increases in the export crop.

6.3.6 Policy Simulation No.6

This policy simulation advances the move towards export promotion more powerfully than the last two policies. It is designed to capture the effects of a simultaneous increase in jute price to growers and jute productivity by 10%.

Simulation results presented in Table 6.6 show that real GDP increases unambiguously for this policy experiments. The consequences of this policy simulation on real GDP is similar to that of the third simulation above. For most years positive influence of productivity increase on real GDP is reinforced by positive effects of jute price increase.

TABLE 6.6

Simultaneous 10% Increase in Jute Prices and Yields

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	32130.2	456.8	-155	-203	-48
1962	37214.2	38238.9	1024.7	-419	-869	-450
1963	37992.0	39269.9	1277.9	-1553	-2289	-736
1964	42360.9	43585.8	1224.9	-1086	-1648	-562
1965	43326.1	44491.5	1165.4	-891	-1257	-366
1966	44347.3	45542.0	1194.7	-1211	-1601	-390
1967	44447.6	45581.3	1133.7	-413	-605	-192
1968	48577.4	49640.2	1062.8	-683	-815	-132
1969	50210.4	51144.8	934.4	-879	-951	-72
1970	51922.4	52865.5	943.1	-1439	-1423	16
1973	47869.6	48794.4	924.8	-2927	-2955	-28
1974	49942.1	50732.5	790.4	-4309	-4429	-120
1975	48412.3	48996.1	583.8	-6344	-6683	-339
1976	53836.4	54319.9	483.5	-8284	-9116	-832
1977	58523.4	59025.7	502.3	-9061	-9515	-454
1978	62441.5	63031.4	589.9	-12774	-12886	-112
1979	64829.0	65589.1	760.1	-15061	-15381	-320
1980	68698.3	69587.0	888.7	-23660	-24578	-918
1981	75630.8	76412.2	781.4	-26036	-27249	-1213
1982	76940.3	77664.9	724.6	-29502	-30996	-1494
1983	80168.1	80883.9	715.8	-33997	-35673	-1676
1984	79516.7	80246.6	729.9	-30175	-31584	-1409
1985	78315.8	79036.1	720.3	-29892	-30620	-728

The simulation results also show that except for only one year, all other years register a deterioration in the current account balance. When we compare our present results with those of the other two export promoting simulations in tables 6.4 and 6.5 we find that the present policy has the greatest deteriorating effect on the current account balance.

The situation is worse than policy simulation no.5 because unlike the present policy there is no increase in food imports when only jute productivity is increased. Moreover, in the present case increases in non-food imports are greater in most years due to greater level of increases in real GDP. The positive effects of slightly higher jute export revenue in this simulation fail to outweigh the negative effects mentioned above, producing a deterioration in the current account balance.

Again, when we compare the present simulation with simulation no.4 above, which captures the effects of increase in grower's price of jute, we also find that the current account balance deteriorates in the present case. Further examination reveals that increase in food imports are the same for the two simulations. However, the negative effects of increases in non-food imports caused by higher real GDP outweigh the positive effects of increases in jute export revenues. However, for some years jute export revenue itself deteriorates because for those years export prices of jute decrease relatively more than the increases in export volumes of jute.

This policy simulation once again leads us to conclude that policies to promote jute exports leads to a deterioration in the current account balance. However, it should be noted that we do experience improvements in real GDP.

6.3.7 Policy Simulation No.7

Our final simulation examines the effect of a 10% increase in grower's price of jute while jute export prices are held constant. This means we are now examining the consequences of the assumption that changes in raw jute exports by Bangladesh do not produce any changes in export prices. Bangladesh is therefore assumed to be a small participant in a world jute market where jute prices as determined exogenously; Bangladesh can export any amount at the going world price without affecting the price.

As can be seen from table 6.7 the effect on real GDP is the same as that of policy simulation no.4 presented in table 6.4 where jute export price was allowed to vary. The effect is the same in both simulations because variation in jute export prices affect jute export revenues in current taka but not real exports of jute measured in real taka. Increases in real GDP is smaller than policy simulations where jute productivities are increased, as can be seem from tables 6.5 and 6.6 .

The effect on the current account balance of this policy experiment is mixed. In eleven out of twenty three years the predicted current account deteriorates. It shows improvements on the rest. However, compared to a situation where export price of jute varies, policy simulation no.4,

TABLE 6.7

10% Increase in Jute Grower Price, Export Price Const.

Year	CRGDP	PRGDP	DRGDP	CCA	PCA	DCA
1961	31673.4	31708.5	35.1	-155	-132	23
1962	37214.2	37489.6	275.4	-419	-401	18
1963	37992.0	38362.7	370.7	-1553	-1580	-27
1964	42360.9	42681.6	320.7	-1086	-1110	-24
1965	43326.1	43620.3	294.2	-891	-885	6
1966	44347.3	44663.7	316.4	-1211	-1196	15
1967	44447.6	44737.9	290.3	-413	-376	37
1968	48577.4	48837.6	260.2	-683	-636	47
1969	50210.4	50413.2	202.8	-879	-833	46
1970	51922.4	52125.5	203.1	-1439	-1363	76
1973	47869.6	48066.7	197.1	-2927	-2847	80
1974	49942.1	50059.4	117.3	-4309	-4329	-20
1975	48412.3	48411.5	-0.8	-6344	-6458	-114
1976	53836.4	53729.6	-106.8	-8284	-8550	-266
1977	58523.4	58426.8	-96.6	-9061	-9090	-29
1978	62441.5	62399.1	-42.4	-12774	-12634	140
1979	64829.0	64881.2	52.2	-15061	-14968	93
1980	68698.3	68832.5	134.2	-23660	-23706	-46
1981	75630.8	75687.6	56.8	-26036	-26278	-242
1982	76940.3	76952.6	12.3	-29502	-29754	-252
1983	80168.1	80172.2	4.1	-33997	-34189	-192
1984	79516.7	79512.0	-4.7	-30175	-30300	-125
1985	78315.8	78338.6	22.8	-29892	-29805	87

we have improvements in the current account balance for the present simulation. Nevertheless, constancy of jute export prices does not guarantee an improvement in the current account balance.

If we examine the decomposition of the sources of change in the current account balance for the present simulation and compare it with policy simulation no.4 (jute export price variable) we find that for both simulations the magni-

tude of increase in food imports are the same. Again, the magnitude of change in non-food imports are also the same for both simulations. The reasons for these are quite obvious. For both simulations the increase in grower's price of jute by 10% produces the same reallocation of resources leading to the same increase in food imports and an equal change in real GDP. Equal changes in real GDP in turn produce uniform changes in non-food imports.

The gains from expanded jute exports are, needless to say, higher in our present simulation because more is now exported at unchanged prices. However, the gains from increased export revenue fall short of increased import payments in eleven years of our sample period.

The results of this simulation indicates that even under more favourable conditions policies to promote traditional exports do not necessarily produce improvements in current account balance.

6.4 CONCLUDING REMARKS

In this chapter we have examined the consequences of two very important and crucial policy questions for Bangladesh --- the issues of food self-sufficiency and export promotion. Both issues are also interrelated because, as our model of the economy shows, policies which affect food production also affect export revenues via its effect on jute, and vice versa.

We have examined the outcomes of policies which promote either of the two issues with the help of seven policy simulations. In assessing the impacts of these simulations on the economy, we focused our attention to the effects on two variables --- real GDP and the current account balance.

In terms of the effects on real GDP, we find that policies which promote food self-sufficiency via increased productivity have the greatest positive impact. Increased productivity combined with rice price increase also produce substantial increases in real GDP. For these policies predicted increase in real GDP range from 10 to 14 percent.

Yield increases in jute in isolation, or combined with jute price increase, also lead to increases in real GDP. However, the increases here are much smaller and are in the range of 0.8 to 3.3 percent. the effects of jute productivity is smaller because total acreage under jute is significantly smaller than rice. Hence, productivity increases in rice has a much greater impact on real GDP.

It is worth noting here that there are costs in instituting productivity increases. There may be real resource costs if resources are to be diverted from alternative uses. If resources are obtained in the form of foreign aid then the costs are opportunity cost in terms of their alternative use. However, it is beyond the scope of our present work to assess the costs and investigate how they may be financed.

Nevertheless, our simulations predict the expected benefits of the policies which promote productivity increases; once the costs are calculated, net benefits can easily be evaluated.

Policies which focus on pure price changes do not produce clearcut uniform effects on real GDP. They demonstrate a mixture of positive and negative effects. This is evident from the DRGDP figures in tables 6.1 and 6.4 . We can therefore conclude that if increases in real GDP is our target, price policies should be used in combination with policies which promote increases in productivities.

The single most important variable of interest in this study is the current account balance and its reaction to the policy simulations. Among the three components which cause changes in current account --- food imports, non-food imports and jute exports --- changes in food imports are clearly predictable. The policies which promote food self-sufficiency always lower food imports, and export promotion through increased grower's price of jute always increase it.

The second component, non-food imports can only be predicted once the policy effect on real GDP has been determined. Increases in real GDP increase non-food imports which has a negative impact on the current account balance. The reverse happens when real GDP declines.

The third component, changes in jute export revenues, is the product of two changes --- quantity exported and export price. Since price is inversely related to quantity, the effect of a policy on jute export revenue depends on the relative changes in the two variables.

The net effect of the three components on the current account balance is a priori unknown. All seven simulations produce mixed results in the sense that for all of them current account balance improves for some years and deteriorates for others. However, it can be seen from tables 6.1 to 6.7 that in many cases food self-sufficiency policies also produce relatively better current account balance.

The relative lack of success of policies promoting exports is clearly observable. Even a policy simulation which holds the export price of jute constant fails to produce uniform improvements in the current account balance. The gains from export promotion are not substantial interms of increased export revenue, but food import expenditures increase substantially due to increased imports of food volume as well as rising food prices in the international market. Further deterioration is brought about by the high marginal propensity of non-food imports. Whenever real GDP increases, the induced increase in these imports leads to an increase in import expenditures. The net result is mostly an adverse effect in terms of the current account balance.

We can conclude that if the stabilization of the current account balance is an important policy target, it may be done via diversification (of exports or import substitution) and not expansion of traditional exports.

Chapter VII

CONCLUSIONS

This is a thesis on the Bangladesh economy examining primarily the effects of alternative policies on the stability of the current account balance. The alternative policies are broadly policies which change relative prices of rice and jute to producers and policies which increase productivities of the two crops. The effects of these policies on real GDP is also examined.

The basic issue is important for Bangladesh for several reasons. First, Bangladesh has been running an increasing current account deficit over the years and an ever increasing external debt. Second, as an individual item food accounts for the largest proportion of the import bill. Third, jute is the single largest export commodity. Fourth, rice and jute compete for land in agriculture so that any policy move which changes the composition of agricultural output of these two crops will affect not only the real GDP, but also the current account balance. Finally, the issue is important because food self-sufficiency has long been announced to be a major goal by the government. Along with food self-sufficiency we have also sought to examine the effects of the alternative policy of export promotion.

The issues in economic stabilization surveyed in chapter 2 shows that studies have not been undertaken to explicitly examine the external sector stabilization effects of the performance of the agriculture sector and changes in agricultural output composition. This thesis contributes to the literature by explicitly examining these issues.

In the light of the above, the Bangladesh economy makes an interesting case study because the single largest import (food) and the most important export (jute) are both agricultural products. Moreover, these are also the two most important commodities of domestic agriculture.

The macroeconomic model constructed in this thesis precisely took these factors into account and laid out a disaggregated model for Bangladesh agriculture. The model also linked the agriculture sector to both real GDP and the current account balance. Any changes in any of the two important crops due to a policy action automatically works its way into real GDP and the current account balance.

The model estimated and simulated in chapter 5 has good simulation characteristics. The error statistics and the time plots of simulated vis a vis actual values presented substantiate the validity of the model.

The seven policy simulations undertaken and analysed in chapter 6 help us evaluate the predicted outcomes of alternative policies. If increases in real GDP is our target, we

find the greatest success with policies which increase rice productivity. Productivity increases in jute register relatively smaller increases in real GDP. We also find that changes in relative prices of rice and jute produce mixed results in terms of changes in real GDP --- increasing in some years and decreasing in the others.

We have also explained that the effects of the policy simulations on the current account balance is a priori unknown. In our policy experiments all seven simulations produce mixed results; for each simulation the current account balance improves for some years and deteriorates for the others. However, it was observed that food self-sufficiency policies in many cases produce relatively better current account balance. The failure of policies promoting exports is also clearly observable because even an export promotion policy which holds export prices of jute constant fails to improve the current account balance for all the years in our sample period.

The general lack of improvement in the current account balance is, as discussed in chapter 6, produced by a combination of different factors. In some cases, the change in product composition and its consequent direct effect on current account balance produced improvements. However, the second round effects of increasing non-food imports due to increases in GDP led to the worsening of the external balance. In other cases, when jute exports were increased,

current account balance deteriorated due to combined effect of decreasing raw jute export prices as well as increasing non-food imports when GDP increased.

Based on the results produced by the policy experiments of our model we would conclude that policies to promote food self-sufficiency are more appropriate for Bangladesh under the current circumstances. This should be achieved by a combination of price and productivity increases for rice. At the same time, if some productivity increases in jute can be attained, the decline in jute production can also be prevented.

Our proposed policy will unambiguously increase real GDP and decrease food imports but its effects on the current account balance is ambiguous. However, the effects are generally better than expansion of traditional exports.

We propose that in order to obtain improvements in the current account balance the policies of food self-sufficiency should be combined with policies that lead to diversification of exports and encourage appropriate import substitution. Export diversification will help reduce the dependence on a singe commodity and import substitution will help reduce the leakages caused by rising real GDP attained through the policy of food self-sufficiency. In other words, these policies will help reduce the marginal and average propensities to import. In view of the resource

endowments of the Bangladesh economy it may be cheaper in terms of resource costs to promote the expansion of small-scale and rural industries.

Limitations and Further Research

It is important to put the thesis in perspective by discussing some of the limitations of the study which give directions for further research.

The study is based on a partial equilibrium model in the sense that all sectors (e.g. the monetary sector) of the economy are not modelled. A general equilibrium model can explain the structure of the economy in a more elaborate fashion.

We are also constrained by a somewhat limited data base. Besides the question of the quality of our data, which is extremely difficult to assess, we also have only 24 observations. Even though our model is not very large, simultaneous estimation techniques could not be used to estimate the parameters of the model. The results, the analyses and the interpretations are made within these constraints of the quality and quantity of data.

In the context of the composition of agricultural commodities and substitution of one crop for another, the model incorporates substitution only between jute and Aus rice.

Aus is the wet season rice which competes with jute for land. This was driven by our objective of examining substitution between jute and rice due to relative price changes. However, changes in the price of rice also affect other varieties of rice grown in other seasons and lead to substitution with other crops. The present model implicitly assumes these effects to be neutral. An expanded model which incorporates these substitutions can help test our maintained hypothesis.

An important feature of our modelling of the external sector is that there is one to one correspondence between changes in jute output and changes in raw jute exports. This is because we considered the worst possible scenario, especially for expansion in jute output. Since there is an oligopolistic market for jute manufactured goods, we assumed that any expansion in jute output will be sold as raw jute in the international commodity market. To the extent that Bangladesh is able to sell some of the increased jute output in manufactured form, gains from the expansion of jute production will increase --- both as value added to the domestic output and also as increased export earnings. A study which investigates the consequences of the expansion of jute output and its exports in different forms can help determine if more gains can be made from the promotion of traditional exports.

Finally, our study does not model the issues of food aid and the politics of food aid. A large proportion of Bangladesh food imports are aid financed. Instabilities in the external sector can also be caused by sudden changes in food aid situation. The politics of food aid and its potential effects on the stability of the current account balance can be the basis of an interesting expanded research.

Appendix A

Description of Data and their Sources

ACJ: Total acreage under jute production; thousands of acres

ACJL: Acreage of jute lagged by one period; thousands of acres

CA: Current account balance; millions of current taka

DELS: Change in food stock at farm level over last period; thousands of long tons

ER: Exchange rate index for taka; taka per unit of U.S. dollar (1972-73=100)

GDP: Gross domestic product at market prices; millions of current taka

M: Aggregate nominal imports; millions of current taka

MO: Real imports of non-food commodities; millions of constant taka (1972-73 = 100)

MRIK: Imports of raw materials, intermediate goods and capital; millions of constant taka (1972-73=100)

NFI: Net foreign inflow of unilateral transfers from abroad; millions of current taka

NFS: Net foreign service account; millions of current taka

PFW: World price of food (1972-73 = 100) in Taka unit value index

PFJL: Relative price of food and jute lagged by one period; (1973-74=100)

PI: General price index -- GDP deflator (1972-73=100)

PJFL: Relative price of jute and food lagged by one period (1973-74=100)

PJM: Export price index for jute manufactures (1972-73=100)

PMO: Price index for non-food imports (1972-73 = 100)

PRJ: Export price index for raw jute prices (1972-73=100)

PXO: Price index for non-jute exports (1972-73 = 100)

QJ: Total quantity of jute produced; thousands of long tons

QSFD: Total domestic supply of food; thousands of long tons

RC: Real aggregate consumption expenditure; millions of constant taka (1972-73=100)

RCL: Real aggregate consumption lagged by one period; millions of constant taka (1972-73=100)

RDI: Real aggregate disposable income; millions constant taka (1972-73=100)

RG: Real government current expenditures; millions of constant taka (1972-73=100)

RGDP: Real gross domestic product at market prices; millions of constant taka (1972-73 = 100)

RGDPL: Real gross domestic product lagged by one period; millions of constant taka (1972-73=100)

RIG: Real government investment; millions of constant taka (1972-73=100)

RIP: Real private investment, millions of constant taka (1972-73=100)

RMFA: Real aid-financed food imports; millions of constant taka (1972-73=100)

RMFNA: Real non-aid financed food imports; millions of constant taka (1972-73=100)

RXJ: Real exports of jute; millions of constant taka (1972-73 = 100)

RXO: Real exports of non-jute commodities; milions of constant taka (1972-73 = 100)

TAX: Total nominal tax revenues; millions of current taka

TSW: Total supply of wheat; thousands of long tons

YLJ: Average yield per acre of jute production; pounds per acre

Data Sources

Data for this thesis have been compiled from the following sources:

1. Bangladesh Bureau of Statistics (1980), Statistical Year Book of Bangladesh
2. Bangladesh Bureau of Statistics (1983-84), Statistical Year Book of Bangladesh
3. Siddiquee, Baker A. (1988), "Macroeconometric Models for Developing Countries: A Case Study of Bangladesh", Ph.D. Thesis, University of Manitoba
4. World Bank (1984), Bangladesh: Economic Trends and Development Administration, Vol. II: Statistical Appendix, Report No. 4822
5. World Bank (1985b), Bangladesh: Economic and Social Development Prospects, Vol. IV: Statistical Appendix, Report No. 5409
6. World Bank (1986), Bangladesh: Recent Economic Developments and Medium Term Prospects, Vol. II: Statistical Appendix, Report No. 6049

OBS	YEAR	ACA	ACAL	ACJ	ACJL	CA	D	DCJ	DELJ
1	1960	6017	6139	1375	1350	-76	0	397.07	0
2	1961	6300	6017	1518	1375	-494	0	1352.88	0
3	1962	5874	6300	2061	1518	-399	0	1508.70	0
4	1963	6192	5874	1723	2061	-502	0	580.56	0
5	1964	6586	6192	1700	1723	-846	0	240.46	0
6	1965	6645	6586	1660	1700	-971	0	523.70	0
7	1966	7321	6645	2198	1660	-755	0	174.85	0
8	1967	6965	7321	2165	2198	-881	0	703.70	0
9	1968	8221	6965	2338	2165	-914	0	238.43	0
10	1969	7658	8221	2170	2338	-1084	0	313.03	0
11	1970	8462	7658	2465	2170	-1033	0	873.66	0
12	1973	7241	8462	2215	2158	-2884	1	568.40	813
13	1974	7681	7241	2196	2215	-4383	1	776.36	147
14	1975	7857	7681	1417	2196	-8910	1	704.54	-428
15	1976	8452	7857	1277	1417	-13191	1	340.83	-865
16	1977	7952	8452	1603	1277	-6760	1	639.68	-820
17	1978	7814	7952	1805	1603	-11760	1	390.66	447
18	1979	7995	7814	2052	1805	-12549	1	417.85	1640
19	1980	7505	7995	1874	2052	-22501	1	619.45	1888
20	1981	7689	7505	1569	1874	-23311	1	919.82	-967
21	1982	7774	7689	1412	1569	-31831	1	731.73	-1401
22	1983	7805	7774	1425	1412	-26307	1	796.89	-502
23	1984	7756	7805	1468	1425	-23575	1	896.02	-394
24	1985	7417	7756	1707	1468	-33204	1	1305.04	0

OBS	YEAR	DELS	ER	GDP	M	MO	MRIK	NFI	NFS
1	1960	0	4.7600	14507	1224.4	2705.75	1926.51	-329	69
2	1961	0	4.7600	16373	1840.5	3104.29	2160.56	-347	88
3	1962	0	4.7600	17509	1728.1	3649.72	2416.94	-430	109
4	1963	0	4.7600	18566	1976.1	2919.77	1791.02	-324	92
5	1964	0	4.7600	18766	2343.2	4668.36	3300.64	-374	186
6	1965	0	4.7600	20667	2576.5	5634.66	4027.33	-202	23
7	1966	0	4.7600	22865	2536.7	4721.20	3359.34	-391	34
8	1967	0	4.7600	26450	2891.4	6388.94	4287.11	-207	-29
9	1968	0	4.7600	28192	2845.7	6476.72	4457.97	-264	-21
10	1969	0	4.7600	29876	3235.3	6743.59	4997.96	-147	-74
11	1970	0	4.7600	32627	3480.0	6381.13	4844.49	-171	42
12	1973	1	7.7808	45112	6069.0	3321.87	2449.87	267	162
13	1974	-2	7.9661	71086	7369.0	3424.21	2866.04	155	-90
14	1975	102	8.8759	125741	12429.0	3611.37	2686.34	311	183
15	1976	73	14.8521	107458	18936.0	3957.58	2737.83	429	-108
16	1977	-71	15.4667	105361	13533.0	3011.46	2313.01	933	-449
17	1978	84	15.1215	146365	20399.0	4548.16	3545.01	1712	-482
18	1979	-21	15.2228	172819	23687.0	4745.00	3733.96	2174	-415
19	1980	20	15.4777	197985	36713.0	5002.71	4107.95	3250	62
20	1981	58	16.3447	233263	41401.0	6474.92	4995.67	6196	244
21	1982	3	20.0400	265140	51543.0	6495.78	5075.62	8497	-1403
22	1983	32	23.7600	288420	54862.0	5845.37	4844.39	14921	-2661
23	1984	4	24.9000	349920	58590.0	6191.20	4971.55	15612	-797
24	1985	6	26.0000	397730	68458.0	6583.66	5280.68	12402	-1061

OBS	YEAR	PFW	PI	PFJL	PJFL	PJMN	PJSN	PMOT	PRJ
1	1960	47.01	43.68	111.07	90.03	218.35	0.00	43.044	69.68
2	1961	37.75	46.82	88.64	112.82	294.46	0.00	50.954	127.96
3	1962	47.11	46.46	35.76	279.66	277.64	0.00	47.155	93.90
4	1963	24.21	48.50	71.29	140.28	272.36	0.00	59.323	82.45
5	1964	45.66	44.74	86.28	115.91	252.90	0.00	43.698	76.22
6	1965	47.11	48.41	73.98	135.17	263.99	0.00	44.237	113.77
7	1966	38.08	51.15	55.63	179.77	346.52	0.00	48.262	85.28
8	1967	50.02	59.03	75.64	132.20	348.32	0.00	40.309	113.43
9	1968	42.03	57.81	75.11	133.14	291.59	0.00	41.343	88.05
10	1969	40.39	59.38	87.74	113.98	289.68	0.00	41.581	99.43
11	1970	34.23	63.65	79.20	126.26	277.22	0.00	43.643	96.35
12	1973	100.00	100.00	89.51	111.72	624.85	0.00	100.000	100.00
13	1974	172.88	140.60	100.00	100.00	658.93	0.00	137.754	101.80
14	1975	219.71	240.70	132.88	75.25	838.96	0.00	211.095	113.00
15	1976	357.96	183.10	170.04	58.81	1073.45	0.00	341.048	111.30
16	1977	288.17	177.20	96.80	103.30	1049.56	0.00	371.938	105.90
17	1978	214.36	231.10	79.02	126.55	1265.37	0.00	370.186	121.80
18	1979	286.33	260.90	69.09	144.74	1594.14	1233.50	435.996	153.60
19	1980	342.34	295.10	75.09	133.17	2385.25	2161.35	541.127	154.00
20	1981	417.59	325.60	122.91	81.36	2067.34	1927.45	576.207	129.10
21	1982	475.04	367.10	115.51	86.57	1902.25	2213.05	705.552	112.40
22	1983	499.98	384.80	112.49	88.89	2591.19	2350.76	791.420	103.40
23	1984	510.68	448.60	110.13	90.80	2989.47	3140.31	786.253	130.10
24	1985	476.67	494.60	84.09	118.92	3962.99	4304.36	848.522	226.20

OBS	YEAR	PRJN	PXO	PXOT	QFO	QJ	QJMX	QJSX	QRJX
1	1960	157.08	66.22	40.511	6241.7	5555.00	1311.66	0.000	4641.27
2	1961	288.46	155.71	95.258	7049.9	5624.19	1328.21	0.000	2943.10
3	1962	211.68	96.27	58.894	7170.0	6966.18	1443.98	0.000	4013.50
4	1963	185.87	77.91	47.662	6572.4	6301.87	1455.05	0.000	4266.26
5	1964	171.83	87.03	53.242	7835.5	5873.50	1636.99	0.000	4378.05
6	1965	256.48	85.18	52.110	7860.9	5324.45	1504.61	0.000	3296.14
7	1966	192.25	54.14	33.121	7447.2	6692.91	2028.17	0.000	4489.89
8	1967	255.71	135.48	82.882	6802.3	6402.99	2187.94	0.000	3511.35
9	1968	198.49	115.45	70.628	7988.4	6669.14	2607.10	0.000	3823.61
10	1969	224.15	144.30	88.277	8569.0	5755.92	2810.72	0.000	3260.17
11	1970	217.21	124.08	75.907	8951.0	7173.15	2789.88	0.000	3509.61
12	1973	368.50	100.00	100.000	7660.2	6512.10	2304.70	0.000	2826.00
13	1974	384.07	120.02	122.878	8912.6	5995.08	2453.72	0.000	2662.00
14	1975	475.01	133.96	152.814	8246.0	3475.19	2120.63	0.000	1549.03
15	1976	782.88	137.87	263.168	9327.5	3936.35	2459.19	0.000	2347.34
16	1977	775.72	200.80	399.151	8555.9	4809.00	2539.84	0.000	2276.48
17	1978	872.28	205.97	400.290	9664.4	5356.34	2925.27	0.000	1667.41
18	1979	1107.38	261.91	512.416	9353.8	6443.28	2566.97	41.887	1967.57
19	1980	1128.86	282.08	561.118	9734.1	5959.32	2632.85	54.012	1968.00
20	1981	999.34	279.26	586.626	10421.2	4942.35	2763.66	79.916	1943.95
21	1982	1066.78	260.87	671.889	10202.0	4645.48	2961.63	72.751	1911.37
22	1983	1163.53	246.32	752.180	10972.9	4873.50	2805.35	121.253	2246.00
23	1984	1534.22	277.19	887.059	11056.5	5369.21	2799.84	165.345	1902.00
24	1985	2785.34	242.63	810.762	10938.3	5253.29	2347.07	193.734	1407.45

OBS	YEAR	QSFD	RC	RCL	RDI	RG	RGDP	RGDPL	RIG
1	1960	7655.5	28354.5	27463.9	31986.0	1581.96	33212.0	32114.2	244.13
2	1961	8592.7	32391.4	28354.5	33572.8	1676.63	34970.1	33212.0	89.21
3	1962	8548.7	33498.0	32391.4	36078.1	1866.12	37686.2	34970.1	414.91
4	1963	7895.5	33245.7	33498.0	36830.9	1816.49	38280.4	37686.2	829.59
5	1964	9441.4	36919.2	33245.7	39798.6	2472.06	41944.6	38280.4	1116.14
6	1965	9325.5	38428.2	36919.2	40378.6	2485.02	42691.6	41944.6	762.77
7	1966	9329.3	38716.5	38428.2	41868.6	2768.33	44701.9	42691.6	594.39
8	1967	8528.7	41109.6	38716.5	42423.3	2353.04	44807.7	44701.9	1438.89
9	1968	9950.9	42819.1	41109.6	46193.6	2698.50	48766.6	44807.7	2391.22
10	1969	10127.4	45113.8	42819.1	47536.5	3019.54	50313.2	48766.6	2888.38
11	1970	10721.4	44525.6	45113.8	48415.6	3305.58	51260.0	50313.2	4118.09
12	1973	9019.5	42136.8	44525.6	43247.0	2888.00	45112.0	41595.0	2650.00
13	1974	10642.6	45447.7	42136.8	48360.6	3125.18	50559.0	45112.0	2286.36
14	1975	10005.9	48293.7	45447.7	49963.4	1883.67	52239.7	50559.0	2815.67
15	1976	11428.2	51917.5	48293.7	55019.1	3149.65	58688.1	52239.7	2866.86
16	1977	10702.6	50228.0	51917.5	55151.2	4211.06	59458.8	58688.1	2769.98
17	1978	11721.0	54019.1	50228.0	59075.3	4064.47	63334.1	59458.8	4639.32
18	1979	11831.4	56618.4	54019.1	61794.9	4005.37	66239.6	63334.1	4412.70
19	1980	11994.5	56470.4	56618.4	62223.7	4532.02	67090.8	66239.6	6545.71
20	1981	13204.3	59651.9	56470.4	66168.6	5003.07	71641.0	67090.8	6633.36
21	1982	12932.9	61807.7	59651.9	66864.3	5419.50	72225.6	71641.0	4699.15
22	1983	13529.5	61475.9	61807.7	69340.4	5414.76	74953.2	72225.6	6497.35
23	1984	13870.3	65433.0	61475.9	72663.0	5538.12	78002.7	74953.2	5772.25
24	1985	13335.3	69890.3	65433.0	74787.7	5620.91	80414.5	78002.7	5321.00

OBS	YEAR	RIP	RMFA	RMFNA	RNFID	RXJM	RXJS	RXO	RXRJ
1	1960	2353.27	32.33	167.61	-98.23	819.59	0.0000	1053.88	1710.30
2	1961	2332.37	92.19	638.93	-87.52	829.94	0.0000	401.44	1084.53
3	1962	2534.26	93.82	31.42	-117.20	902.28	0.0000	766.64	1478.97
4	1963	2778.14	194.55	871.12	-70.19	909.19	0.0000	1114.61	1572.11
5	1964	3173.90	80.38	692.72	-110.00	1022.88	0.0000	1068.58	1613.31
6	1965	3638.86	158.78	64.10	-58.69	940.16	0.0000	1079.53	1214.62
7	1966	3359.10	90.07	658.35	-104.12	1267.31	0.0000	1811.35	1654.52
8	1967	3611.11	40.78	724.91	-66.00	1367.14	0.0000	788.62	1293.93
9	1968	3758.13	198.19	325.24	-82.07	1629.05	0.0000	1061.79	1409.00
10	1969	3262.63	26.00	1142.61	-45.44	1756.29	0.0000	983.48	1201.37
11	1970	3342.04	43.24	2036.81	-50.36	1743.26	0.0000	1393.30	1293.29
12	1973	750.00	1420.80	1326.35	34.32	1440.10	0.0000	274.75	1041.38
13	1974	1911.54	1053.79	487.33	14.46	1533.22	0.0000	239.43	980.94
14	1975	2809.60	1544.40	656.21	18.93	1325.08	0.0000	353.20	570.81
15	1976	3459.97	1300.73	246.41	16.17	1536.63	0.0000	397.27	864.99
16	1977	3179.16	652.64	156.70	32.24	1587.03	0.0000	465.46	838.88
17	1978	3821.58	1254.25	419.69	59.44	1827.86	0.0000	569.39	614.44
18	1979	4050.56	952.19	97.95	64.08	1603.98	20.6965	597.96	725.05
19	1980	4572.35	1694.08	1158.57	77.19	1645.15	26.6876	428.61	725.21
20	1981	4674.27	759.72	234.34	138.20	1726.88	39.4868	664.60	716.34
21	1982	4694.83	972.38	231.46	154.78	1850.58	35.9466	713.09	704.34
22	1983	5675.78	1213.71	506.95	242.31	1752.93	59.9116	814.96	827.65
23	1984	5912.57	1347.60	592.04	255.19	1749.49	81.6976	945.45	700.89
24	1985	5544.56	1333.63	1389.42	187.85	1466.57	95.7248	1263.44	518.64

OBS	YEAR	TAX	TJD	TQF	TSW	UJ	WY	YLA	YLJ
1	1960	535.5	6350.00	8506.1	0.00	795	24.79	843	1616
2	1961	654.2	5624.19	9547.4	0.00	0	24.96	888	1482
3	1962	747.1	6966.18	9498.6	0.00	0	29.55	888	1352
4	1963	703.0	6301.87	8772.8	0.00	0	31.81	796	1463
5	1964	960.1	6255.50	10490.5	0.00	382	34.95	903	1382
6	1965	1119.7	5324.45	10361.7	0.00	0	39.30	843	1283
7	1966	1449.2	6692.91	10365.8	0.00	0	43.27	893	1218
8	1967	1407.5	6402.99	9476.4	0.00	0	47.12	860	1183
9	1968	1487.5	6669.14	11056.6	0.00	0	50.72	836	1141
10	1969	1648.8	6383.92	11252.7	0.00	628	60.35	785	1061
11	1970	1810.5	7173.15	11912.7	0.00	0	66.75	784	1164
12	1973	1865.0	5699.10	9932.7	89.98	0	100.00	703	1176
13	1974	3091.0	5892.08	11714.1	108.95	44	106.08	817	1092
14	1975	5479.0	4374.19	11104.7	114.92	471	106.40	815	981
15	1976	6718.0	5147.35	12557.4	213.60	346	105.80	856	1233
16	1977	7633.0	5456.00	11566.3	254.44	-173	111.30	848	1200
17	1978	9842.0	4983.34	12765.6	341.77	74	115.47	889	1187
18	1979	11596.0	4994.28	12641.0	484.00	191	119.89	921	1256
19	1980	14363.0	5274.32	12541.8	805.46	1203	123.69	838	1272
20	1981	17818.0	5707.35	13658.2	1071.29	-202	125.21	943	1260
21	1982	19681.0	5677.48	13419.2	953.72	-369	127.20	927	1316
22	1983	21598.0	5969.50	13990.4	1074.36	594	126.59	866	1368
23	1984	23954.0	5763.21	14228.1	1187.37	0	128.59	916	1463
24	1985	27830.0	5253.29	13686.5	1136.51	0	128.38	830	1231

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