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CEREAL DEFICIT MANAGEMENT IN SOMALIA WITH POLICY IMPLICATIONS FOR REGIONAL COOPERATION

CEREAL DEFICIT MANAGEMENT IN

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SOMALIA WITH POLICY IMPLICATIONS FOR REGIONAL COOPERATION

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FOREWORD

The Islamic Research and Training Institute (IRTI) was established by the Islamic Development Bank (IDB) in 1401H (1981). IRTI became operational in 1403H (1982/1983). The primary objective of the Institute is to carry out research in the areas of Islamic economics, banking and finance; to develop the capabilities of professional personnel in Islamic economics to meet the needs of research and *Shari'ah* observing agencies; to train personnel engaged in development activities in the Bank's member countries; and to develop databases in fields related to its activities to help foster the development of the IDB member countries.

The activities of the Research Division in IRTI are conducted within the framework of four research groups, namely: The Islamic Economics Group, Islamic Banking Group, *Shari'ah* Studies Group, and Economic Cooperation Group.

The Islamic Economics Group concentrates on basic and applied studies on the behavior of economic units at the micro and macro levels with emphasis on issues which directly or indirectly relate to the compatibility of actual practices with *Sharia'h.*

This is the second and last in a series of two studies on applied agricultural economics with special reference to the southern region of the League of the Arab States (LAS). The first of these studies was published by IRTI under the title "The Scope of Cereal Food Gap in the Yemen Arab Republic, Somalia and Djibouti".

Problems analyzed in these studies were originally recommended as potential future areas of research in the parent study published in 1985 under the title "Economic Cooperation among the Members of the League of Arab States".

The purpose of these applied series is to identify problems that come in the way of achieving an effective level of cooperation among IDB member countries. Taking into account this objective, the author presents some valuable suggestions that might be used to remedy some of the real-world problems encountered in the geographical area so defined.

Officer-in-Charge, IRTI

ACKNOWLEDGEMENTS

This study benefited critical contributions from several colleagues in IRTI. Perhaps most vocal were those who saw the need to test the hypothesis that income and price elasticities of sorghum-maize cereals are commensurate with normal goods. To these economists, I submit that such is true only if the preference patterns, tastes, and the production modes for sorghum-maize conform to those under normal good category of commodities. In this case-study, sorghum-maize cereals are produced under strictly subsistence conditions and for the sole purpose of subsistence consumption. The commodity sorghum-maize, therefore is essentially an inferior good with the properties of positive own price elasticities and an income elasticity that is negative. I wish to add here that such findings are at parity with the economic realities under which the majority of producers of these commodities function.

Br. Abdullahi M. Nur, of the Information Center-IRTI, helped me with the SAS/ETS software. Br. C.P. Salim's contributions particularly in terms of copy editing, style aspects and proof reading are gratefully acknowledged. The staff of the Administration Division in IRTI have been cooperative and above all tolerant of the many repetitive drafts. To them all, I wish to extend special thanks.

M.A. Gulaid

LIST OF ABBREVIATIONS

ECWA : Economic Commission for Western Asia

FAO Food and Agriculture Organization

IDB Islamic Development Bank

IMF International Monetary Fund

IRTI Islamic Research and Training Institute

LDC Lesser Developed Countries

OAU Organization of African Unity

PCDP Per Capita Domestic Production
(Domestic Subsistence Production)

PCIM Per Capita Merchandise Imports

RMS Root Mean Square

WHO World Health Organization

YAR Yemen Arab Republic

GNP Gross National Product

EXECUTIVE SUMMARY

The cereal food situation in the Arab world in general and Yemen Arab Republic, Djibouti and Somalia, in particular, can best be described as precarious. According to an earlier study by the author, between 500 to 700 thousand metric tons of cereals (a mix of wheat-barley and sorghum-maize) would be required if projections for 1990 are to be satisfied. Domestic production in these countries, as a whole, has often faltered miserably in the past. This had forced each of the individual countries to uniquely seek corrective measures that would rationally manage own deficit.

To assess cereal food supply and demand conditions characteristic of Somalia, this study takes the perspective of case-study analysis. This is believed to be appropriate because in the context of this geograhpic area, Somalia accounts for over 70% of the projected deficit.

A simultaneous system of equations covering prices, requirements, domestic production, and imports are analyzed. Major policy variables are defined that are to be used as impulses and deliberate shocks. These policy choices are analyzed under alternative assumptions each specifying a quantum impulse or shock. Effects thus generated are then evaluated relative to base period prices, kilogram requirements, domestic production and imports.

The findings generated suggest that Gross National Product (GNP) per capita improvements could, by far, have the largest possible positive effects on per capita cereal production and kilogram requirement adjustments. Improvements in the state of the individual's well being, hence, can bring forth larger multiplicative improvements in the per capita domestic production and level of cereal requirements. Similar findings are generated under the option of reduction of the calorie level of requirements. A composite assumption involving simultaneous increases in the level of the GNP per capita and import prices along with reduction in the calorie per capita requirements tends to exert equally large positive adjustments on domestic production, imports and kilogram requirements. Increases, however, in the level of calorie per capita requirements, which in general terms, is synonymous with a deterioration in the level of the well-being of the individual, could exert an impact in the opposite direction of preceding policies. This will tend to adversely affect almost every economic and social aspect of the Somali consumer.

The conclusion made from the study, therefore, is that for these countries to stabilize their supply, they need to build up food stocks in the years of bounty, or alternatively vary the volume of cereal imports inversely, with changes in domes-tic production.

It is recommended that these countries invest in their human resources either by way of improvement of health and the living-working conditions of the population. Investments in these venues maybe burdensome for these countries since the foreign exchange requirements to implement these structural: changes are not available. If funding from international sources is forthcoming, however, then the potential surpluses proven by the case-study analysis could resolve the cereal requirement bottlenecks of the region. In such a case, the countries concerned would need to pool together their know-how and expertise in order to strengthen their economic links and exchange of experiences, so that they may efficiently manage their food stock requirements.

1. HISTORICAL SETTING 1.1

Introduction

1.1.1 Food commodity prices, in most of the OIC countries, are determined by other criteria than the market mechanism as economists know it. Administered prices are common phenomena such that final retail prices become far removed from the farmgate or other real world prices determined by the conventional open market. The marketing margin, simply, becomes too exhorbitant to be economically justified.

1.1.2 National parastatal or autonomous agencies are often held to blame. In most of these countries, the distribution of essential inputs and farm products are left for these institutions to deal with. All too often, then, they are endowed with authority judged superfluous. As such, they remunerate farm output below factor cost and ironically expect to generate revenues for the State. Ironically also, they often deploy these earnings elsewhere as subsidies and supports.

1.1.3 Interventions of this kind have implications on the structure of prices and the terms of trade facing domestic food and fibre production in these countries. Shifts from controlled commodities to those that are uncontrolled are, in fact, a norm among producers in these countries. The expression *"Le Mal de Payson"* very aptly describes the contemporary supply conditions characteristic of the majority of these countries (O'Brain, 1979). Producers are expected to conform to existing price structure and to adjust accordingly. The result is that the market for food commodities bears no relationship either to the efficiency of resource allocation or to the incentives embedded in the intensive use of available inputs. The rewards (read profits) likely to be contained in the price structure are left untapped, therefore are of little use to the producer. Evidence in support of this is overwhelming. Following are some illustrations:

> "In the Gezira Scheme of the Sudan, in the mid seventies the government imposed a tax on the tenants to cover the costs of irrigation and technical services. This tax is collected from the proceeds realized from sales of cotton, and tenants have responded by moving out of the production of cotton and into the production of untaxed commodities. (Bates, P.55)".

1.1.4 In 1970, Senegal imposed controls on the marketing of major export crops, particularly groundnuts with a simultaneous measure of delayed payment . This had evoked some counter measures by the farmers. Subsequently, illegal marketing became rampant. Massive shifts out of goundnuts followed, and the production of other crops subsequently increased.

1.1.5 Somalia's interventions in market prices during early seventies (until just recently) had such an abrupt response from the farmers the impact of which can still be felt nationwide. Producers shifted to different commodites distinct from those traditionally emphasized. Instead of sorghum, maize and sesame, others including watermelons, vegetables and citrus had taken up the fertile landscape.

1.1.6 Conversely, on the demand side, it is often forgotten that given an elastic demand[2] and the expectation of increased hoarding either by parastatals *or* by the producers themselves, a small decline in the supply of these commodites will tend to lead to higher price increases at both farmgate and retail outlets. The correlation between the theorectical paradigm so stated and the practical, social upheavals and food riots in some countries cannot outrightly be ignored.

1.1.7 Policies affecting food prices are wrought with either serious misconceptions or lack of insight on the part of those formulating them. This is particularly true for countries with serious demographic pressures, and in those countries where food prices are critical issues. Hence the demand side of the food equation becomes very pronounced. The increase in the price of bread in Egypt, just a couple of years ago, was a very vivid experience in this regard. The incident had kicked up such a storm, in the form of social unrest and uprise, that the government had to repeal the law immediately. The alternative would have been a disaster the likes of which no democratic government had ever encountered in recent history. Farmers in Egypt were increasingly diverting production factors (land, fertilizers, and other inputs) out of wheat, maize and rice to fruits, vegetables and livestock which, compared to the preceding basket of goods, had no imposed price controls[3]. A replica of this incidence can be cited in Morocco, Tunisia, Bangladesh and, to a greater degree, Somalia.

1.2 Food Situation in the Region

1.2.1 The scope of food deficits in Yemen Arab Republic, Djibouti, Somalia and for that matter neighbouring Eastern African countries, raises serious concern. For Somalia, research findings indicate:

> "... that the role of domestic agriculture to generate food, would continue to worsen if past trends remain operative. Ultimately, the country could be in such a state that it would have to rely heavily on merchandise imports and food aid to cover its food requirement. Under such conditions, the scope of domestic production would be only a trifle. Short of these, Somalia would find itself faced with more disastrous chains of famines beyond its capacity to tackle. The implication is that millions of lives would be in jeopardy..." (Gulaid, 1985, p. 83).

1.2.2 These evaluations were based, in part, on the projections for 1985 which indicated the possibility of domestic production of 337 thousand metric tons. For 1995, some 406 thousand metric tons were projected. By the year 2000, domestic production was supposed to reach some 441 thousand metric tons. Compared with projections for national food requirements for the same period, deficits were expected to loom around 300 thousand metric tons for 1985; 400 thousand for 1995 and over 500 thousand metric tons by the year 2000. These deficit calculations, it should be emphasized, are based on the strength of the domestic agriculture to satisfy requirements, and does not take into account imports .

1.2.3. For Djibouti,

> "... the situation is one of continued dependence on merchandise import until such time when capabilities to generate economically viable options from domestic sources are realized. The constraints here are nature-born and relate to the non-compromising ecology and natural habitat. As such, cereal production can only be at a rudimentary state". (Gulaid, 1985, p.85).

1.2.4 For the region including Yemen Arab Republic (YAR), an Economic Commission for Western Africa (ECWA) report best surmarizes the over-all food situation:

> ".... the countries in the Arab Peninsula would by the year 2000, be in such a state that self-sufficiency in food crops would be reduced to only 30%". (ECWA/FAO, 1981 p. 73).

1.2.5 For YAR in particular, the autoregressive time series forecast-model had shown that some 117 thousand metric tons of cereal deficits would have to be managed by the year 1995. This situation would be true only under the assumption that past trend holds and that deficits are evaluated on the basis of domestic production alone. (Gulaid, 1985, p.74).

1.2.6 Given the dimensions of cereal production, imports and associated deficits in these countries, it can be shown that there is an acute need for critical assessment of the priorities now persued. Policy targets, especially in the agriculture sector, need to be re-defined with a view to restructuring, if need be, the entire economy of these countries so as to resolve this fundamental problem. Only then could food shortage with its social, economic and health ramifications, be corrected. This is the problem addressed in this study.

1.3 Literature Review

1.3.1 The problem of food shortage in Africa has come into focus only recently. The stock of information on Sub-Saharan Africa's dwindling agriculture, however,

indicates that this situation is rooted in Africa's oblivious past, in which the warning signs and indicators of what would soon hit the continent was ignored. Drought-induced famine of the mid-seventies shook the continent from its deep slumber only to find itself confronting a magnitude of human suffering too large for it to counter unaided. Thus:

> "The pitiful picture of human suffering caused by drought, neglect of agriculture, debt-burdened economies, civil war and delays in gifts and distribution of food aid stretches from north-south to east-west, from Morocco to Mozambique, Somalia to Senegal" [5].

1.3.2 The Food and Agriculture Organization of the United Nations (FAO) had persistently been stressing the need to tackle the roots of this problem through concerted efforts of individual countries, the donors, and international organizations. This, it was thought, could be approached by evaluating the technical, developmental, economic and political parameters affecting agriculture in the most affected states. FAO's early-warning forecast of a pending food crises in Africa had apparently been unheeded. The World Bank had also recently pointed out three critical areas that need policy reform and on which critical evaluation need be undertaken; viz. (i) the development of more appropriate price policies; (ii) improvement in institutions, particularly those serving (6) agriculture; and (iii) increased efficiency of resource use in the public sector.

1.3.3 The Organization of African Unity's (OAU) "Lagos Plan of Action", the Harare Foreign Minister's Declaration and the latest African Summit in Addis Ababa had all stressed the priority to food production.

1.3.4 On the more technical grounds, professional literature avails a richness too vital to ignore in terms of information, analysis of critical issues, and recommendations of plausible remedies.

1.3.5 A central theme in the literature, in this regard, is a view that there exist a dynamic balance between food supply and demand that depends on complex relationships among a number of interlocking variables (Mellor - Johnson, 1984). The design and implementation of any developmental strategy, especially in the low-income countries, must hence rest on the level at which these are balanced and explicitly stated in such designs.

1.3.6 Comparable to this view, and perhaps on the opposite spectrum, is the argument that the food equation should be understood essentially as a race between food and population. The latter view has had larger disciples some of whom are in highly reputed academic circles and philanthropic institutions-Malthus being the progenitor, down to the Club of Rome and the World Watch Institute, to mention only a few. The view so expressed and argued cannot be outrightly rejected as obsolete. Rather, one would be very cautious knowing full

well that in the context of majority of the low-income countries where this issue remains critical, there exist strong structural and demographic characteristics capable of sharpening the food-population race to a painfully acute problem [c'].

1.3.7 Consensus among economists is that the supply of staple food crops, over the short and medium term, in the low income countries, tends to be highly inelastic with respect to price. The situation is the result of several technological-cum-ecological oddities associated with agriculture per se. In an attempt to counter these odds, solutions, in the past, have been sought in the relaxation of constraints on the supply side of the equation. The bulk of adjustments hence were directed to alter the fundamental production difficulties. Included in such schemes are the horizontal expansion of the area under cultivation, injection of new technologies that would raise the level of yields historically achieved and some combinations thereof. These options have rigidities, in and of themselves, that would tend to impose upper limits beyond which further horizontal expansion would be difficult to realize. Thus, the familiar limitations characteristic in agricultural production in general and staple food crops in particular (Herdt, 1970).

1.3.8 The demand for staple food in these countries, on the other hand, is quite elastic with respect to price and income. This is seen to come from the high budget share of food (Mellor, 1978).

1.3.9 Between the two sides thus illustrated, a balance is often sought. Otherwise a situation of persistent food deficits would be a reality. The latter is characterized by rapid growth in demand which generally exceeds growth in domestic supply resulting in either upward trend in the real price of food or a rapid growth in net imports (Johnson - Mellor, 1984). Alternatively, the scope of food aid may be seen to gather momentum and eventually become dominant over imports (Huddleston, 1984).

1.3.10 Closely associated with the demand side of the food equation, are issues that cover the nature of poverty, particularly as these relate to the extent of satisfaction of individual food needs. Food needs, per se, have been defined in multitude of ways; some more common, of course, than others. For instance absolute poverty reflects the minimum calorie intake as a basis of food intake below which survival becomes difficult. Under these circumstances, the level of calorie intake is taken to be 2,200 per adult per day as a benchmark (Haaland-Kaadman, 1984).

1.3.11 Income distribution has often been translated or rather interpreted via the level of food intake or budgetary expenditures going to satisfy food purchases. Hence, the definition expressing poverty line through income expenditure patterns, which further alludes to the fundamental distributional aspects of the overall

income level (ILO/JASPA, 1979). For instance using the Somali Shilling, the poverty line was estimated at 60 per capita per month, i.e., 54 Shillings for food and Shillings 6 for non-food. The total of two components define the poverty line equal to Somali Shillings 720 per capita per year, which, incidentally, was equal to the estimated average GNP per capita for 1978 (Hicks, 1978).

1.3.12 Accordingly, the discussion of income distribution, overall food intake, level of nutritional intake, and "absolute poverty" cannot be dissociated from the levels of food needs required and/or satisfied in any one group of people or country. In this connection, also, FAO has periodically presented calculations of per capita food availabilities derived from food balance sheets, expressed as percentage of estimated energy requirements. According to these estimates, the nutritional situation in the developing countries does not appear to have changed significantly since 1961. At that time, per capita availability of food provided 2130 calories, on the average, or an equivalent of 93% of defined requirements as compared to 2950 calories or 115% of defined requirements for the developed market economies (FAO 1976; FAO 1980).

1.3.13 FAO and the World Health Organization (WHO) had jointly undertaken several attempts to correlate nutritional deficiencies and the level of food intake. Their findings indicate that the association is very strong and emphasize that:

> "... nutritional deficiencies, including protein malnutrition, are the result of inadequate intake of food, which, in turn, is unavoidably associated with inadequate intake of energy". (FAO/WHO, 1971, 1973).

1.4 Objectives of the Study

1.4.1 This study attempts to penetrate the barriers that has blocked earnest efforts in the understanding of the causal factors generating the formation and, most often, persistence of food deficits in our native environment. Efforts made here sharpen the focus for clear definition and identification of causes and interpretation of real-world effects on our envrionment much better than perhaps most literature now available on the region would indicate.

1.4.2 The proximity factor, the character of the producer-consumer behaviour, and the all-too-vital effects of culture on food preference and tastes all make the Southern Red Sea States [8] rather a homogenous spectrum subject to aggregation. The likelihood of mapping the same policy effects exerted on a target segment of the spectrum to others in the region, therefore, requires that we emphasize a more pungent scope of analysis. Such an analysis must necessarily be amenable to aggregation such that results derived from the scrutiny of a segment becomes applicable, given minor alterations([9]), to the remaining segments.

1.4.3 The implementation of this argument must rest on a solid choice of relevant criteria in defining the target country (i.e. segment) relative to others in the region. In this connection, the choice is simplified by the unique food situation associated with the Republic of Djibouti. Djibouti has a small population relative to other countries in the region. Djibouti hardly has any significant agricultural sector capable of generating any substantial food basket. Therefore, analysis of the state of agriculture in general and the food situation in particular cannot be rendered to an exhaustive scrutiny likely to generate useful insights into the cause-and-effect situation of food deficits in the region. Alternatively stated, the food situation in the Republic of Djibouti may uniquely be defined as one which exclusively depends on imports.

1.4.4 The choice between Yemen Arab Republic and Somalia as a study target was at best arbitrary. Criteria of choice between these two countries must rest on other factors than the level of development of agriculture. The availability, consistency and the extent of data required may be taken as a criteria of choice. Taking this into account the conclusion was made that this study emphasize Somalia with the proviso that conclusions reached by the study be able to enlighten us about the overall production - consumption relationships governing agriculture in general and the cereal food sector in particular.

1.4.5 In summary, the following specific goals are defined for the study:

(i) to investigate the dynamics of change of some policy variables affecting the food sector;

(ii) to explore major characteristics of income, price, production and consumption adjustment processes via dynamic multipliers;

(iii) to evaluate the impact of policy changes on factor and product adjustments; and

(iv) to suggest some options for resolving the food deficit situation in the region using results derived from the case study.

1.4.6 Taking into consideration these objectives, one may argue that this study is timely especially for the fact that the Islamic Development Bank (IDB) is planning to launch a programme for countries that need food security and to develop special programme for the same. The conclusions drawn, may perhaps be useful for practical programme build-up for food security in the three countries. The Economic and Policy Planning (E&PP) Department of the Bank may, I hope, find the study helpful for designing and programming such an undertaking. It may as well be helpful for the countries concerned especially with regard to food poduction and management of surplus stocks likely to be generated.

2. METHODOLOGY: ECONOMETRIC MODEL OF SOMALI CEREAL SECTOR

2.1 Rationale

2.1.1. In a dual economy characterized by strong agriculture-pastoral and semi-urban sectors, a complex set of interactions simultaneously take place. The subsistence modes of production and consumption dominate the activities of the rural agriculture-cum-pastoralist sector. On the semi-urban sector, a modified. and sheltered pseudo-market decision-rules affecting the consumption function are put into motion. These activities are often pooled into the day-to-day allocation decisions regarding the scarce resources at hand if only to strike the maximum consumer satisfaction possibility frontiers.

2.1.2 The production decision rules affecting the food basket in the rural environment is not uniquely determined by the marketing mechanism as we know it. Rather, it is the working of a complex interactions tailor-made to the local, social, ecological and economic stimuli that focus on the eventual uses put to food once produced. Since, in this sort of an environment, the exchange function of money is rudimentary at best, food, in general, takes up the role of serving as a medium of exchange. It is not uncommon to find, under these circumstances, that a producer forfeits his harvest to a merchant middleman as a collateral for continued replenishment of needed financial services or credits until the next harvest and/or reprieve. Alternatively, the farmer may mortgage his harvest as a guarantee for an advance payment to meet some perceived future expenditures that cannot wait and have to be incurred at once. Production of cereals hence serve as opportunities towards aquisition of cash outlays that have a command similar to the purchasing power of money. The case of transacting cereals for cash, at any given time, is an ancestral practice that will take quite some time to wither away. Unfortunately, no formal analysis to harmonize these behaviours have to-date been undertaken. The vivid realities of the subsistence agriculture portrays incidences where parents pay taxes, medical bills, their children's school uniforms (when these are compulsory), and the like by resorting to grains stashed away in storage. Barter, in effect, has always been rife between producers and the intermediaries, who own the services or goods demanded by the producers. These are the realities that must be borne in mind at any formal attempt to study this environment.

2.1.3 The social environment of the agricultural-pastoral sector is such that food produced go to meet ceremonial, religious, social and, as recently, tax and

other government related payments and commitments. Cereal producers in Somalia have a great deal to cope with besides the need to meet strictly the daily food requirements of their families.

2.1.4 Ecologically, only specific types of food commodities can be produced in this environment given the state of the art now prevailing. The dominant factor setting this in perpetuity is the seasonality of cereal production. Assurance that two crops can be gotten during the year consistently is, at best, probabilistic. This is due to the risk nature of the mode of operation hightened by the vagaries of weather. The reality of the pastoralists, perhaps signifies, in part, the ecological dictates that forces them to be mobile and to eke out existence from such a capricious environment. These issues need some coverage in any formal analysis of this region.

2.1.5 We cannot, even though earnest, cover the entirety of factors listed in the preceding sections. However, attempts will be made to explore, through alternative model specifications, those for which we have data and which are readily amenable to empirical analyses.

2.2 Definition of Variables

2.2.1 Taking into consideration conditions specified above and the probable root structure of the cereal environment dominating in the Somali situation, Appendix I describes relevant variables stipulated in this study.

2.3 Model Formulation

2.3.1 The models, given in this section, are based on a simultaneous equation representation structured such that they describe the causal relationships underlying major production, consumption, imports and price behaviour and, therefore, decision rules affecting the subsistent Somali agricultural environment.

2.3.2 The cereal production equation describes the behaviour of the subsistence rural production at the farm level. Since the storage of food grains cannot be adequately formulated in the subsistence agriculture, we do not attempt to include it in this equation. The reason is that under existing circumstances, stocks of cereals in storage tend to be either marginal because of persistent pressure leading to their immediate depletion, or they may be absent because the technology and the state of art in the subsistence sector does not allow, in the long run, the formation of stocks in the first place. Traditional storage facilities common in Somalia have a very short life and may at best be transitional. The secrecy of the storage factor is a very highly guarded operation in the subsistence agriculture for fear of tax or outright confiscation by the policing authorities of government.

2.3.3 Price received by farmers is included to account for whatever marketable surplus that exists in the subsistence agriculture. In doing so, a link is established between the marketable surplus (if any) and the market of the outside world. Since also, production at the farm level is meant to serve the priority to feeding the subsistence family, it may be used to link with the relationship expressed via the per capita kilogram requirement of cereals per year. The production equation would never be realistic without the inclusion of the unique ecological considerations affecting subsistence agriculture. To satisfy this condition, we internalize the 1964-65, 1969-72, 1975-77, and 1979-83 droughts that occured in Somalia. These had been detrimental to the point of creating serious distortions in food production, consumption, and imports. Dummy variables are included for each of these occurences to capture the effect of this very vital ecological parameter.

2.3.4 The aggregate consumer demand function is seen to be composed of two parts both of which would satisfy the neoclassical theory of utility maximization. The rural consumption equation is one important component of the aggregate consumption function with some spill-over to the production relations as defined for the subsistence family. The urban consumption function, however, may be uniquely expressed or mapped via import demand specification. These are interesting interpretations for two important reasons: (a) that the subsistence mode of production does not allow, given all the rigidities imposed, generation of marketable surpluses from domestic production operations; and (b) that the consumption or demand relations for the urban sector, which in this model, is not specified but intuitively sub-summed in the overall consumption relations, must logically, thus, come from other than the domestic sources specified.

2.3.5 The role of merchandise imports of cereal in Somalia is such that it is a conjugal component of the urban consumption function. Hence, the attribute characterized as dependence on imports to fill in a very vital gap in the overall national cereal consumption outlook (10)). Within this formulation, it is anticipated that two equations may be defined to account for: (i) the overall national cereal demand, expressed in per capita kilogram requirements; and (ii) a separate consumption- demand relationship for the urban sector that is satisfied via merchandise imports.

2.3.6 Per capita kilogram cereal requirement is a function of the average daily per capita calorie requirement, retail price per kilogram of cereal, GNP per capita as a proxy for disposable personal income, dummy variables as a proxy for drought, and **trend** to account for any other changes, different from those due to seasonality of cereal production.

2.3.7 The import equation is linked to the overall national consumption demand via the kilogram per capita requirement variable. This specification is important beyond the linkage affect because imports could also have the added responsibility of satisfying shortfalls in the rural subsistence sector when ecological con-

ditions force cereal production / consumption to falter as is often the case in Somalia. The average price of cereals at the international grain market serves to ' define a useful functional relationship with quantity of imports. The causal effects of drought are, again, expected to be captured via the dummy variables.

2.3.8 Prices have dual roles depending on the nature of model specification. The formulation that the market determines the equilibrium supply-demand conditions may be far fetched in this special environment. A dis-equilibrium model where prices are responsive to changes in the cereal supply and demand in Somalia, on the other hand, would require that an excess demand relationship be specified such that it is a function of farmgate prices or alternatively as function of excess demand. This formulation will be discussed formally in model II.

2.3.9 If prices are exogenously determined, then their inclusion into the model as explained variables have no justification. In such circumstances, only domestic production, imports and total cereal requirement equations can be specified as dependent variables. Prices specified as explanatory variables may be considered wherever feasible. Model I is specified as such.

2.3.10 On the other hand, the reality of price regulation cannot totally be subdued. In this study we consider the alternative formulation that non-clearing markets are real-world phenomena in Somalia. Where prices are controlled, the effect will lie on the excess demand. The hypothesis is then tested that total cereal requirements are greater than the sum of domestic production and imports (or total availability). Given the persistence of shortages in Somalia and the state of administered prices, the total cereal requirement equation, the production equation and the imports equation could only be explained as is done in Model II.

2.3.11 Only when total cereal requirement is equal to total cereal supply (or availability) is the market cleared. Prices at the farm and retail would then become strong candidates for inclusion into the model formulation. We consider this hypothesis as the target goal for the cereal sector to achieve in the future. Prices at the farmgate, assuming these conditions hold, would then be a function of - lagged own price(s) and the level of domestic production of cereals. Retail prices, 'on the other hand, would be a function of lagged own price(s) and imports. This defines the specification considered in Model Ill.

2.3.11 The preceding methodological discussions are algebraically summarized in Appendix Ill.

2.4 Estimated Structural Models

2.4.1 Given the inter-locking system of dependence among the equations listed, the structural models may be specified algebraically as per:

$$Y_t = yY^L_t + xX_t \quad \ldots\ldots\ldots (1)$$

$$RY_t = yY_t + xX_t \quad \ldots\ldots\ldots (2), \text{ where}$$

Y_t in equation (1) is a vector of G endogenous variables over the time period t;Y_1 is a vector of G lagged endogenous variables, and X_t is a vector of K exogenous variables. Model I has 3 eqauations; Model II and III have 5 equations each. Estimates of these structural equations, using Two-Stage Least Squares (2 SLS), are given in Appendix IV.

2.5 Models I, II and III: Structural Coefficient Estimates for Major Decision Variables

2.5.1 Per Capita Kg. Cereal Requirement

(a) In relation to the per capita kilogram cereal requirements (Y),in Models I, II and III, the following table, excerpted from Appendix IV, indicates that:

Y_6 (Kgs. per capita)

	$\frac{Y_6}{Y_5}$	$\frac{Y_6}{Y_{11}}$	$\frac{Y_6}{E}$
Model I:	1.04	−0.007	−0.005
Model II:	1.03	−0.021	−0.002
Model III:	1.04	−0.005	N.S.

(b) Evaluation of responsiveness of Y_6 over calorie per capita requirements (Y_5) is based on the magnitudes defined by the joint WHO-FAO Expert Committee; GNP per capita (Y_{11}) as a proxy for disposable income and E the ratio of prices (PRT/PRF).

In all the three model specifications, the responsiveness of the calorie requirement is found to be dominant over other explanatory variables and therefore

highly elastic with respect to kilogram per capita requirement. All coefficient estimates for this relationship have positive magnitudes implying that increases in the per capita calorie requirements would also increase kilogram per capita requirement by the amount of the coefficient itself. With respect to income and the ratio of prices, per capita requirement is highly inelastic. The direction of response, negative in both cases, is commensurate with theoretical premises such that any increase in either the level of income or ratio of prices would tend to lower the kilogram per capita requirements even though, in this case, rather slightly. Model III had no price variable specification.

2.5.2 Per Capita Domestic Production (PCDP)

(a) Decision variables specified in Models I, II and III were prices received by farmers for a metric ton of domestically produced cereals (PRF) and the kilogram per capital requirement (Y_6) relative to per capita domestic production. Coefficient estimates for the per capita kilogram requirement in the domestic production equations for all model specifications are negative and highly elastic. The consistency of signs and numerical estimates supports the argument previously postulated, viz. that cereals domestically produced in Somalia are, for all practical purposes, meant to satisfy the subsistence consumption needs of the rural population. Stated in another way, this finding suggests that any increase in the per capita kilogram requirements either by government decree or subject to the joint WHO-FAO recommendations, must take into account the domestic subsistence capabilities to generate the recommended increase. Per capita kilogram requirements have large negative effects on per capita domestic production, Tendency, therefore, would be towards greater consumption gaps given any policy target to boost per capita kilogram requirements. In other words, should per capita kilogram requirements be lowered, deficits in the overall calorie needs per capita would not be a serious problem for Somalia to correct domestically. We shall return to the implications of this finding on management of deficit in Somalia shortly. The relationship discussed above and their coefficient estimates are given below:

PCDP (Kgs. per capita)

	$\frac{PCDP}{Y_6}$	$\frac{PCDP}{P^{RF}}$
Model I:	−4.49	0.175
Model II:	−4.87	N.S
Model III:	−4.24	0.503

2.5.3 Per Capita Merchandise Import (PCIM)

(a) For model specifications in options (Models) I, II and III, Per Capita Merchandise Imports a function of world market prices ($Y1_0$), (E), and the instrumental variables PCOP and Y_6[11]. For Model III, only the world market price and Y_6 are set to be the independent and/or instrumental variables. Coefficient estimates generated for these relations by the 2SLS are summarized below:

PCIM (Kgs. per capita)

	PCIM / Y_{10}	PCIM / E	PCIM / PCDP	PCIM / Y_6
Model I:	-2.41	-0.68	-1.37	N.S.[12]
Model II:	-2.22	-0.61	-1.35	N.S.
Model III:	-2.87	N.S.[13]	- N.S.	6.99

(b) As in the case with PCDP, a dominant causal factor in the configuration of merchandise imports is the per capita kilogram requirement. Model III has a coefficient estimate for this factor of 6.99. Apparently, kilogram requirements are highly elastic with respect to merchandise imports. The interpretation of this finding is that merchandise imports provide a great proportion of the total kilogram requirement of cereals in the Somali setting. Specifically, a single kilogram increase in the requirement tends to raise the merchandise imports by nearly 6.99 kilograms per capita. The relationship between these factors, hence, is positive and highly significant.

(c) With respect to import price, the coefficient estimate bears a negative sign. Import elasticity is large and decisive in all model specifications. Any increase in the import price of cereals would tend to lower quantities imported by Somalia at any given time. The implication is wide and clear in that, given declining trends in domestic cereal production followed as the case often is by increasing tendencies to resort to imports in order to bridge the cereal gap, tremendously large foreign exchange bills will have to be paid to meet these import requirements.

(d) Merchandise imports are relatively elastic with respect to the domestic ratio of prices (E). Any incremental change in this ratio would tend to lower imports even though at a smaller magnitude often less than one kilogram per capita at any given time.

(e) Relationships between merchandise imports (PCIM) and domestic production (PCDP) are polar. Improvements in the domestic per capita cereal production

equal to one kilogram reduces merchandise imports by more than one kilogram. Models I and II estimates are 1.35 and 1.37 respectively, and suggest that these parameters are highly elastic with respect to merchandise imports.

The policy implications of these findings are important in that efforts exerted to improve domestic production capabilities can go very far in resolving Somalia's dependence on merchandise imports. We shall return to these at a later stage in this paper.

2.5.4 Effects of farm and retail prices and the state of excess demand : P^{RF}, P^{RT} and DQ respectively

(a) Own price elasticities in Model III are positive and coefficient estimates are rather large. Only if the cereals consumed in Somalia fall under the inferior type category of goods, would this conclusion be justified in theory. Given the dominant sorghum-subsistence proportion in this cereal consumption relations, it would appear to be reasonable to accept these positive elasticities for prices received at the farm as well as at the retail.

Elasticities with respect to prices and DQ

	Prices received by farmers			Prices at retail	
	$\frac{P^{RF}}{DQ}$	$\frac{P^{RF}}{PCDP}$	$\frac{P^{RF}}{P_{t-1}}$	$\frac{P^{RT}}{DQ}$	$\frac{P^{RT}}{P^{RT}_{t-1}}$
Model I:	N.S.(1Z)	N.S.	N.S.	N.S.	N.S.
Model II:	0.006	0.008	N.S.	0.058	N.S.
Model Ill:	N.S.	0.014	0.62	N.S.	1.02

(b) Since prices are assumed to be (exogenously) determined outside the system as a result of, in this case, government intervention, Model I does not contain price stipulations to be estimated. Model II, on the other hand, takes the view that prices can be guaged via the state of excess demand defined as the difference between total requirement and availability. The expectation was that, given the persistence of excess demand or positive residuals due to unsatisfied consumption requirements, prices would, if allowed to correct this scarcity condition, prevail in such a way that they would show a significant response to DQ. Results derived in Model II refute these expected behaviour patterns. Rather, P^{RF} and ^{pRT} are both highly inelastic with respect to excess demand $^{j3'}$

(c) The relative responses of ^{pRF} with respect to the size of domestic subsistence production contained in PCDP, indicate that there is no substantive linkages between the level of prices and subsistence production. The significance of this conclusion is that subsistence production in Somalia is geared to responses beyond prices and, therefore, structured market activities, such that there is no consistent and meaningful marriage between them [14]. This is in conformity with the argument that the subsistence sector in Somalia is, for all practical purposes, removed from the active market exchange and interactions observable in the urban sector.

2.6 Reduced-form Coefficients for the Exogenous Variables In Models I, II and III

2.6.1 Transforming RV_t (see below) into the reduced-form, requires that we uniformly multiply through the inverse (R^{-1}) such that:

$$R^{-1}.\ RY_t = R^{-1}yY^L_t \quad + \quad R^{-1}\ xX_t$$

$$\text{Or } Y_t = \pi_1\ YL_t \quad + \quad \pi_2\ X_t$$

where π_1 denotes the reduced-form co-efficients for the first expression $R^{-1}y$, and π_2 for the second $R^{-1}x$.

2.6.2 Reduced-form equations describe the endogenous variables specified in each model in terms of exogenous, lagged endogenous and error terms. The purpose of generating these coefficients is to evaluate the forecasting properties of models so constructed and to examine the time-path of effects of a change in one or more of the exogenous variables on the endogenous variables. Table I shows the reduced-form coefficients of the set of predetermined variables in each of the models and the root mean squared errors associated with them.

2.6.3 Effects of Change of Exogenous Variables on Endogenous Variables

(A) <u>Per capita daily calorie requirements (Y_5):</u> This decision variable is, by far, the most critical factor in determining the scope of the per capita kilogram cereal requirements, the volume of merchandise imports financed by the government or its parastatals; and the per capita production generated by the domestic cereal food producing sector.

(i) The effect of any increase in the level of daily calorie requirement by-means of policy re-evaluation, as a result, for instance, of food needs of the population, would imply that the volume of the per

TABLE 1
MODELS I, II and III: REDUCED-FORM FOR EXOGENOUS VARIABLES

.	Depen-dent Variables	Cons-rant	EXOGENOUS VARIABLES											Logged Variables	
			Y_5	Y_{10}	Y_{11}	E	DO	PRF	T	D1	D2	D3	D4	RF P t-l	RT t-l
MODEL I	Y_6	-1.48	1.04	-0-	-0.006	0.005	--	--	0.002	0.004	0.007	0.008	0.005	--	
	PCIM	-18.45	6.42	-.2.41	-0.40	-0.71	--	0.24	0.032	0.124	-0.618	0.038	0.933		
	PCDP	18.08	-4.68	-0.-	0.029	0.021		-0.18	0.014	0.086	0.345	0.080	-1.28	--	- -
MODEL 11	Y_6	1.39	1.03	-0-	-0.021	-0.002	- -	--	-0-	0.004	0.002	0.002	0.006	--	--
	PRF	2.00	-0.04	-0-	-0-	-0-	0.006	--	0.007	0.004	0.011	-0.004	-0.021	0.358	--
	PRT	-0.08	-0-	-0-	-0-	-0-	0.058	- -	0.02	-0.01	-0.162	0.159	0.274	--	--
	PCIM	-18.73	6.73	-.2.22	-0.137	-0.626	--	--	0.03	0.132	-0.572	-0.137	0.882	--	--
	PCDP	18.48	-4.99	-0-	0.102	0.009			0.01	-0.014	0.356	0.119	-0.203	--	
MODL III	Y6	-1.48	1.04	-0-	-0.005	--	--	--	0.0002	0.005	0.0009	0.0006	0.005	0.000	-0.0
	PRF	1.30	-0.06	-0-	-0-	--	--	--	0.004	0.008	0.0081	0.0008	-0.036	0.630	0.00
	PRT	-0.005	-0.014	-	-0-	--	--	--	-0.002	-0.032	0.0004	0.0051	-0.010	0.000	1.00
	PCIM	-17.72	7.28	-2.87	-0.04	--	--	--	0.038	0.138	-0.619	-0.105	0.878	0.000	-0.00
	PCDP	15.82	-4.45	-0-	0.021	--	--	--	0.007	0.095	0.336	0.083	-0.184	0.318	0.00

capita daily cereal requirements (measured in kilograms) also be increased. More specifically, the level of increase of the per capita kilogram cereal requirement would approximately be four percentage points higher for each incremental calorie as suggested in models I, II and III, irrespective of theoretical premises subsumed in each model specification. In other words, any increase in the requirement by one calorie, would also increase kilogram requirements by 1.04 kilograms. By the same token, decreases in calorie requirements reveal an equal amount of decline in the size of the physical cereal requirement.

(ii) With respect to merchandise imports, changes in the calorie requirements would, in fact, exert greater effects than the case is in the preceding comparison. Here, and very consistenly so, a unit increase (or decrease) in the calorie requirement would increase (decrease) per capita merchandise imports by more than 6 kilograms. The estimated coefficient for Model I is 6.42 kilograms, Model II, 6.73 kilograms, and Model III, 7.28 kilograms.

(iii) , In relation to per capita domestic subsistence cereal production, calorie requirements have the opposite effect than those observed in the preceding case. Any increase (decrease) in the calorie requirements would decrease (increase) per capita domestic subsistence cereal production by more than 4.5 kilograms. Model I has a coefficient estimate for this parameter of -4.68 kilograms, while Model II reveals an estimate equal to -4.99 kilograms and Model III, - 4.55 kilograms.

(iv) Changes in the level of calorie requirements have no substantive effects on prices as defined in Model II and III.

(B) **Import price, c.i.f. Mogadishu US$/MT (Y10):** The effect of import price can best be evaluated with respect to merchandise imports. In this regard, any increase in the import price for cereals destined for consumption in Somalia would have the effect of reducing the volume of such merchandise. More specifically, a single dollar increase in the import price would lower Somalia's imports by 2.44 kilograms per capita in Model I; 2.22 kilograms per capita in Model II; and 2.87 kilograms per capita in Model III. The reverse situation is interesting in that, if import prices decline by one unit, Somalia's imports would increase by an amount equal to the respective coefficients estimated with this decision variables.

(C) **GNP per capita in US$/year (Y11):** The imported cereal component of the consumption requirement (i.e., PCIM) is more income elastic than the domestically produced component (i.e. PCDP). Given a subsistence economy, we would expect

domestic production to be responsive to the level of income. If at all, then the direction of change would not likely be positive. On the contrary, we find that any increase in income would most likely bring about a decline in the level of consumption of imported cereals in the rural subsistence sector. This position has already been discussed in connection with the price and income elasticities in which case positive coefficient estimates were thought to be meaningful if and only if cereals consumed were defined to be inferior goods. The coefficient estimates for the PCIM parameter suggest this phenomenon such that PCIM is moderately elastic and negative in its effect and PCDP is less elastic and positive with respect to GNP/Capita. Models I, II and III indicate these behaviour patterns consistently without much inter-model disparities. This level of income has no effect on price and per capita calorie requirements.

(D) **Effect of ratio of prices ($E^{=}P^{RT}$ / PRF)(15):** This parameter was generated in order to establish an overall aggregate response of prices over imports and domestic production in Models I and II. Model I indicates that imports are relatively elastic with respect to the ratio of prices. Any increase in the ratio as a result of a boost in the retail price, which is rather a common phenomenon, or raising the denominator i.e., farm-price which is not common but should be reconsidered, would lower imports by something in the vicinity of 70 grams per capita per unit change. Model II shows comparable coefficient estimates for this parameter with respect to the import component of cereal consumption. No useful conclusions can be drawn with respect to the domestic subsistence component of the consumption relations.

(E) **Effect of excess demand (DQ) on prices:** Model II is constructed under the proviso that the condition of the excess demand might have some affect on the state of prices and, therefore, the market clearing conditions of supply and demand for cereals. The coefficient estimates indicating the causal effects of this parameter, with respect to prices received by farmers as well as prices at the retail, are disappointingly low but still useful. The implication of the reduced-form coefficients for these variables suggest that any unit increase in the size of existing excess demand (measured in kilogram per capita and equal to the difference between the requirement and availability), would raise prices at the farm by less than one cent per added kilogram, and slightly over 5 cents to prices at the retail. The importance of these results may be guaged via the alternative option contained in the removal of the excess demand situation. When and if excess demand is reduced, prices, both at the farm as well as at the retail, would automatically rise in the direction of establishing equilibrium in the quantities supplied and demanded for cereals. We shall return to these implications at a later stage of this paper.

(F) Effect of changes in the price received by farmers (P^{RF}):

(i) Model I considers the effect of current prices received by farmers. Since cereal production normally requires, on the average, a single

season, the lag effect is significant and quite decisive as a decision variable, if at all it is to be considered in the subsistence sector model formulation. Effects of current prices, as stated in model I, are inconclusive.

However, *with* respect *to* lagged *own* prices (P^{RF}_{t-1}), *a* different scenario may be observed. Models II and III indicate positive own *price effects with* respect *to* P^{RF} – something *in the tone of* nearly 40 *cents increase in* P^{RF} *in* Model II and *over 60 cents in* Model III. These would be true if previous years' prices were to be used as decision variable on the current state of prices received by farmers. The effect of lagged prices on domestic production are also positive but rather moderate as indicated in Model III.

(*iii) With* respect *to* lagged *retail prices*(16), only *the current* retail *price* is found to be highly sensitive to changes in the level of the former. The reduced-form coefficient estimated for this parameter is 1.02 with respect to P_{RT}

(PG) Drought effect (D_1, D_2, D_3 and D_4):

(i) The drastic effects of drought in Somalia are captured by the specification of a number of significant periods of shortage of rain. Dummy variables were defined for each of the periods 1964-65 (D_1), 1969-72 (D_2), 1975-77[17] (D_3), and 1979-83 (D_4) respectively. The interpretation of the estimated results appear, in general, to be reasonable with the exception of few cases where the direction of change does not conform with *a-priori* knowledge as suggested by experience.

(ii) Specifically, the 1979-83 drought in Somalia was considered rather a very difficult period for agriculture in general, and more acutely the cereal sector. Besides representing the longest and perhaps the most disastrous drought period, there also appeared, at the same time, the most protracted political conflict between Somalia and Ethiopia. The combined effects of these two distortions tended to exert negative impact on Somalia's productive sectors - most of all on rural livestock and subsistence agriculture.

(iii) The reduced-form coefficients generated in Models I, II and Ill for D_4 indicate *the extent of* distortions imparted *on* domestic subsistence production, imports and prices (wherever applicable). In Model I, *the effects of* D_4 *on* PCIM *was* such *that* imports had increased by nearly 93 grams per capita. PCDP, however, declined by nearly 13 grams per capita during the same period.

(iv) In Model II, the effect of D_4 was that PCIM had increased by 88 grams and PCDP had declined by nearly 20 grams. The effect of this factor on prices at the retail was an increase equal to 28 cents per kilogram for cereals purchased. Considering the relative stability of prices in the retail outlets at the semi-urban sector, this is rather a significant change. No such effect can be deduced from our results as regards prices received by farmers which is rather odd.

(v) Model III indicates similar pattern and direction of causal effects on PCIM and PCDP. PCIM increased by approximately 88 grams. PCDP declined by nearly 18 grams during that period. These are very critical developments that tend to sharpen management decisions expected of policy-makers in order to resolve the food deficit situation in Somalia. We will return to this topic at a later stage.

(H) Domestic production, imports and price trends:

(I) When all decision factors are taken into account as model specifications suggest, then growth rates of each dependent variable estimates may be derived from interpretation of the trend variable. The trend coefficients estimated in Model I, II and Ill for PCDP, PCIM, and prices indicate very realistic approximations close to recent FAO figures for Somalia. More precisely, Models I, and II and III indicate a growth rate for PCDP of consistently less than 1% per year for the period 1958-1983. Equally consistent estimates are generated for prices received by farmers equal to less than $1^{0}/_{0}$ per year. For imports, the trend coefficients estimated in Models I, II, and III indicate the following figures 3%, 3% and 4% respectively per year throughout the 1958-83 period. For prices at the retail, Model II estimates indicate a growth rate of 2% per year whereas in III, the growth rate figure for this parameter appears to suggest something less than 1 % per year. These, generally, are in conformity with current (FAO and other) estimates now available.

(ii) Per capita kilogram cereal requirement (Y_6) had hardly changed during the period of study as indicated by the trend co-efficient.

3. DYNAMIC CHARACTERISTICS OF MODEL III

3.1 Dynamic Multipliers

3.1.1 Dynamic multipliers describe the incremental effects of a single-period change in the level of an exogenous variable on the time path of an endogenous variable. A single-period multiplier may be defined as $d X_{k+r} / dW_k$, where X_{k+r} denotes an endogenous variable in period k+r, and r may take values from zero to infinity. The expression W_k denotes an exogenous variable in period k.

3.1.2 If r = o, the multiplier is called impact multiplier. This describes the current period or short-term effect of a change in the exogenous variable W on X. For r > o, the multiplier is called an interim multiplier which describes the effect on X in period k+r of a change in W in period k. The long-run or total (also referred to as the equilibrium) multiplier describes the effect over time (say zero to infinity) of a change in W on X.

3.1.3 The current period effects of a higher order policy factor changes are described by the impact multiplier. The subsequent effects of the same policy change are described by the interim multipliers. The summation over time of the interim multiplier effects generates the total multipliers. Appendix V presents the interim multiplier coefficients for a ten-year period for the Somali cereal sector generated from Model III.

3.2 Current Effects of Higher Order Policy Changes: Impact Multipliers

3.2.1 In general, one can obtain the impact multipliers directly from the reduced-form version of the models given in Table I, section 2.6. The reduced-form coefficients of each unchanged exogenous variable (r = o) is that variable's impact multiplier(18).

3.2.2 Assumptions: taking this into consideration, we may derive the current effects of a single shock in the major policy variables on cereal requirements, prices and domestic subsistence production. This requires that assumptions on the direction of policy variable changes be specified. Following are five major specifications that take into account the base-year period (1983) exogenous variables Y_5, Y_{10} and Y_{11} magnitudes:

1. The average daily per capita calorie requirements be increased by 8%.
2. Alternatively, calorie requirements per capita be reduced by 8%.
3. The import prices for cereals be raised by 15%.
4. The level of GNP per capita be increased by 10%.
5. A single-period shock comprising a simultaneous change in assumptions (2), (3) and (4) be instituted.

3.2.3 Assumptions (1) and (2) have significant implications that need to be brought out. The implication, as in the case of the first, of raising calorie requirements by 8%, is that the current level of individual consumption of cereals is low, therefore, the need to boost up the individual's calorie intake so as to bring it in parity with the recommended level of intake. Alternatively, as in assumption (2), reducing the level of calorie requirements may be interpreted as an overall improvement in the working-living and health conditions of the individual consumer such that his/her calorie requirements become smaller. This option has, on many occasions, been argued as being a more rational target than any drive to boost an already too-high level of calorie requirement as implied in the preceding version[19]

3.2.4 Assumption (3) takes the view that the small size of the cereal market in Somalia with respect to the world, makes it a price taker. It becomes compulsory for it to purchase the needed imports irrespective of the c.i.f. prices charged for these imports. To consider the world market prices to rise to a level fifteen percent points higher, is not at all unbecoming if food donations are zero and if the scarcity conditions of foreign exchange worsens in Somalia. Should such be the case, then we would want to see the effect of such an impulse on Somalia's imports **from** abroad.

3.2.5 Assumption **(4)** has **several** implications. One such implication is that given an overall improvement in the standard of living of the individual, chances are that his/her overall food eating habits would change. The change so instituted by improvements in overall quality of life, would tend to affect the scope of dependence on sorghum-based foods. Such a change, most likely, would be towards more income elastic cereals as wheat and its derivatives. The expectation from instituting this policy change is that the level of calorie requirements as well as imports would decline. These are *a priori* expectations that could be examined by evaluating the impact so effected by this policy parameter.

3.2.6 Assumption (5) stipulates a GNP per capita increase of 10%, import price increase of 15% and a decrease of per capita kilogram requirement can all be instituted simultaneously such that these happen as a single shock. If so, then the effects of scenarios that were previously autonomous can now be pooled into a single period change denoting an overall composite effect. The rationale behind this assumption is that should outside forces augment the Somali drive towards improved standard of living, then the GNP per capita increase as well as the decline in the per capita kilogram requirements can be achieved simultaneously.

The degree to which this is realized is not as important as the fact that something along those lines does occur. The 10% increase in the GNP per capita is arbitrary and may, in real terms, never be set as a target to be seriously sought in the short-run.[20]

3.2.7 Effects: Table 2 presents the impact multiplier effects of a single shock of change in the decision variables on cereal requirements, prices, imports, and the associated level of subsistence production. Following are more detailed analyses of these effects:

TABLE 2
MODELS III: IMPACT MULTIPLIER EFFECTS OF CHANGES IN THE DECISION VARIABLESON CEREAL REQUIREMENTS, PRICES, IMPORTS AND DOMESTIC PRODUCTION

Endogenous	Y_6	pRF	pRT	PCIM	PCDP	Total Availability Less Total Requirements (PCIM+PCDP)-Y6	Subsistence Production Less Total Requirement (PCDP- Y_6)
Units	Kgs/ Capita	So.Shs, Kg	So.Shs/ Kg	Kgs/ Capita	Kgs/ Capita	Kgs/Capita	Kgs/Capita
Base Period Values 1983	117.49	2.14	5.50	**51.29**	72.44	(r) 6.24	(-) 45.05
Effect Assumptions	Impact Multipliers - Assumptions and Effects						
Single period Increase in the GNP/C by 10%	112.98	1.30	**4.56**	16.98	**133.35**	(+) 37.35	(+) 20.37
Single period increase of Y_5 by 8%	**143.88**	1.53	4.56	29.58	95.06	(-) 19.24	(-) 48.82
Single period decrase of Y_5 by 8%	121.62	1.31	4.57	8.13	198.61	(+) 85.12	(+) 76.99
Single period increase in $_{Y1}$0 by 15%	126.47	1.30	4.55	10.33	133.05	(+)16.91	(+) 06.58
Single period, simultaneous shock of a) Increase in GNP/C = 10% b) Increase in Y_{10} = 15% and c) Decrease in y_5 = 8%	115.08	1.31	5.02	5.45	199.07	(+) 89.44	(+) 83.99

(A) Single period increase in the GNP per capita by 10%: Relative to base year figures, per capita cereal requirements would fall to approximately 113 kilograms; prices received by farmers would decline to 1.30 Shs. per kilogram; and prices at the retail would be one shilling lower per each added kilogram. The margin between these two sets of prices would remain unchanged. Imports per capita would be reduced by 67% from 51 to 17 kilograms. Per capita domestic subsistence production would double indicating an in-crease of nearly 86% from 72 to 133 kilograms.

(B) Single period increase per capita calorie requirement of 8%: would have the effect of raising the kilogram requirement by nearly 22% from base year period level of 118 kilograms. Prices paid to farmers and at the retail would, for all practical purposes, remain the same as in scenario (a). Imports, however, would be higher than in option (a) but still lower than in the base-period figures by approximately 50%. Domestic production of cereals would increase from the base-period volume of 72 to 95 kilograms. These estimated figures are much smaller compared to those derived in scenario (a), but larger, nonetheless, than those of the base-period by approximately 32%.

(C) Single period decrease in the per capita calorie requirement by 8%: Relative to the base-period estimates and in comparison with scenario (b), the effect of change in this policy variables may be seen as an increase in the per capita kilogram requirement greater than in option (a) but less than those estimated under option (b). No significant price changes relative to preceding options are observable but this is, nevertheless, lower than the base period price figures. It is with respect to imports and domestic production that this assumption seems to be decisive. Imports, relative to the base-period, would be reduced by 83% from 51 to merely 8 kilograms per capita. Reduction in the level of calorie requirement significantly raises domestic production. Relative to the base-period conditions, PCDP would increase by an amount greater than 176% from 72 to 199 kilograms per capita. The effect of this policy decision, hence, is to reduce imports by nearly six folds while simultaneously boosting domestic production per capita by nearly three folds.

(D) Single period increase in the import price (c.i.f. Mogadishu) of 15%: reduces imports by 80% from 51 to 10 kilograms per capita; increases domestic production by 86% from 72 kilograms (in the base year) to 133 kilograms per capita; and increases kilogram requirements per capita by 9 units from 117 to 126 kilograms, *ceteries paribus.* Effects on prices of a single shock or change in this variable is similar to those in the preceding options.

(E) Single period shock/change simultaneously of policy variables as per: (i) increase in the GNP/capita of 10%, (ii) increase in import price of 15%, and (iii) reduction in the level of calories requirement by 8%:
The composite change simultaneously of all of the above policy parameters have some interesting features - viz. the level of per capita kilogram requirement would decline to 115 as in the case of raising the GNP/Capita in option A. Prices at the retail would rise to a level of a little lower than those observed in the base period. The most dominant feature of this scenario, however, is its unique effects on the scope of imports and domestic production. Imports, under this assumption, would shrink to a meagre size less than 6 kilograms per capita. Simultaneously, domestic production would jump to a level nearly three times higher than in the base period.

3.3 Effects of Higher Order Policy Changes: the Interim Multipliers

3.3.1 Interim Multipliers discussed in this paper cover a ten-year period. This was assumed to be a reasonable adjustment period for prices and domestic production. Appendix IV shows summary of the first, fifth and the tenth year adjustment effect on all the endogenous variables contained in Model III. We shall briefly outline some features observable from this configuration.

3.3.2 Generally, none of the exogenous variables specified in Model III have a short-term response effects in relation to the set of simultaneous system of endogenous variables. Apparently, therefore, the adjustment process is longer than hypothesized. Prices, domestic production and cereal requirements are dormant indicating their strong correlation with traditional norms inherited from the past.

3.3.3 Prices (read ^{pRF} and P^{RT}) are, as already argued, sheltered from market induced changes and are either heavily subsidized in the case of P^{RT}or purposely depressed as in the case of P^{RF}. The level at which these are set may be regularly defined and then left to remain so for quite a long time until another arbitrary set is decreed to replace those in place. Only under such autonomous and arbitrarily chosen impulses do prices ever change. Otherwise, they tend to remain fixed irrespective of the supply-demand conditions prevailing in the cereal market.

3.3.4 Domestic production, on the other hand, is, for all practical purposes, rooted in a stigma of factors outside conventional economics. The argument that this mode of production essentially typifies a subsistence mode often at odds with prices and production theories commonly used remain strong. This is essen-

-tially so, because of the norms that define production, consumption and exposure of commodites to market conditions characteristic in this country. The spatial and logistical links that this sector has with pivotal markets in the urban centres is peripheral, therefore, adding to the seclusion of the subsistence cereal sector. Coefficient estimates in Appendix IV, suggest that all the policy variables specified in Model III have very small interim effects from periods one to ten. This is corn-formable to the rural, underdeveloped, subsistence economy known to prevail in the Somali cereal sector.

3.3.5 Equally important and deep - rooted is the strong dependence on sorghum-based cereal consumption. Kilogram per capita requirements hardly change during the interim periods specified for simulation in Model III. This sorghum based dependence is as strong as maize is in other parts of Africa and rice in South-East Asia. Only with few exceptions [21], have these cultures transcended their traditional food base inherited from generations long gone. The ecological impact and Somalia's social dictates reinforce this tendency towards preference for sorghum. The coefficient estimates shown for interim periods 1, 5 and 10 are low and suggest no change throughout the period. This is, therefore, seen as a reflection of the society's desire to maintain its traditional preference pattern based on 117 to 120 kilograms per capita sorghum requirements per year.

3.4 Long-run Effects of Higher Order Policy Changes: The Total Multipliers

3.4.1. Total Multipliers describe the effect over time of a change in the policy variables on the endogenous variables. These are, as explained earlier, derived from the interim multipliers summed over the entire period in which adjustments are presumably to take place. These indicate the cumulative adjustment patterns of the endogenous variables over the ten-year period stipulated in the simulation process given in model III. Table 3, in two parts, shows (A) the long-run or total (equilibrium) multiplier coefficients and (B) the simulation statistics of fit expressed by way of the Root Mean Squared (RMS) errors and the RMS percentage errors. Generally, the smaller the RMS errors, the better the estimated fit in the simulation model specified. In this regard, only ^{pRT} may be considered to be a poor fit. Some explanation of this have, in one form or another, been given elsewhere. Table 4 takes into consideration assumptions listed in Section 3.2.2. in conjunction with Table 4 coefficients to generate long-run outlook of cereal prices, imports; domes-tic production and requirements.

TABLE 3
MODELS III: (A) TOTAL MULTIPLIERS

Exod.var / Indog.Var.	Y5	$_{V}10$	$_{Y}11$	T	D1	D2	D3	D4	Intercept
Y_6	1.04341	-.00082736	-.00512111	-.00019425	-.00051707	0.00100393	0.00146706	0.00374717	-1.46749
pRF	-0.171466	.000135962	.000841565	0.0112764	-0.0196576	0.0218637	0.00208609	-0.0955433	3.48571
$_{P}$RT	-0.584476	0.23065	0.00286865	0.106996	1.37847	-0.0167619	-0.221686	0.444425	0.214792
PCDP	-4.51177	0.00357758	0.0221441	0.0127437	0.110792	0.343035	0.080604	-0.207155	16.9194
PCIM	7.29501	-2.87881	0.0358044	0.0355026	0.103125	-0.618565	-0.099658	0.866949	- 17.731

TABLE 3
MODEL III: (B) STATISTICS OF FIT

Variable	RMS error	RMS % error
Y6	0.00140931	.0678547
pRF	0.093597	2.84697
pRT	0.319459	161.168
PCDP	0.0865117	4.84047
PCIM	0.168563	18.5259

3.4.2. Comparison between Impact and Total Multiplier Effects on endogenous variables: Table 4 describes the level of endogenous variables under the five different assumptions. The coefficient estimates reflect the adjustment that would take place with respect to each endogenous variable summed over the entire period. Compared with single-period shock contained in the impact multipliers, results in this section reflect the long-run dynamics of change that could take place under the assumptions listed.

TABLE 4

, MODEL III: TOTAL MULTIPLIER EFFECTS OF CHANGES IN THE DECISION VARIABLES ON CEREAL REQUIREMENTS, PRICES, IMPORTS AND DOMESTIC PORODUCTION

Endegenous Variables	y 6	pRF	pRT	PCIM	PCDP	Total Availability Less Total Requirements (PCIM +PCDP) -Y6	Subsistence Production less Total Requirement (PCDP-Y6)
Units	Kgs/ Capita	So.Shs/ Kg	So.Shs/ Kg	Kgs/ Capita	Kgs/ Capita	Kgs/Capita	Kgs/Capita
Base Period Values 1983	117.49	2.14	**5.50**	51.29	72.44	(+) 6.24 (a) /	(-) **45.05** (b) /
Effect Assumptions	Total Multipliers - Assumptions and Effects						
Increase in the GNP/C by 10%	115.61	1.66	3.96	26.79	271.64	(+) **182.82**	(+) **156.03**
Increase in y_5 by **8%**	124.17	**2.05**	2.34	48.08	84.72	(+) 8.63	(-) **39.45**
Decrease of Y_5 by 6%	104.95	1.99	2.13	**14.83**	175.39	(+) 71.92	(+) 70.44
Increase in Y_{10} by 15%	115.08	1.67	**2.52**	24.16	116.95	(+) 26.03	(+) 1.87
Simultaneous shock of a) Increase in GNP/C = 10% b) Increase in Y_{10} = 15% and c) Decrease in y_5= 8%	102.57	1.72	2.62	33.42	387.26	(+) 318.11	(+) **284.69**

a /: (+) signs denote excess of total availability or domestic production over total requirement (Y6)
b /: Where a negative sign (-) appears, the reverse condition prevails.

A. PRICES RECEIVED BY FARMERS (P^{RF}), taken together in all the assumptions, would adjust upwards from those given by the impact multipliers. These prices suggest the level at which current P^{RF} are set, in fact, may already be higher than the market equilibrium would warrant. The average, among all alternative assumptions, of P^{RF} indicates a level lower by nearly 25 Cents/Kg than the base-year period level[22]. This has far-reaching conclusions that need to be explored for policy considerations.

B. PRICES AT THE RETAIL (P^{RT}) would adjust downwards in the long-run. Comparison with results from the impact multipliers, indicate that P^{RT} would, on the average, fall to 2.80 Shs/Kg [23]. Only under the assumption of the GNP/capita increase would P^{RT} be higher than 3 Shs/Kg. In the case of the Impact Multiplier simulation, P^{RT} hardly registers below 4.50 Shs. per kilogram. The marketing margin adjustment is towards lower price differences in the long-run. The implications of this finding is important and will be discussed shortly.

C. PER CAPITA KILOGRAM REQUIREMENTS would establish, in the long-run, around the mean of 112 Kgs. This suggests that, on the average, current base-year cereal requirements may already be at peak level, *ceteris paribus,* and that changes in favour of this would tend to further dampen the expansion of this factor [24]. Attempts, therefore, to raise the kilogram requirements by purposefully raising the level of calories available to the consumer, would not necessarily generate per capita kilogram requirements in incrementals higher than already achieved. The short and long-run adjustments, for this variable, are therefore necessarily synonymous. This is a critical observation in the overall definition of the state of food deficit in Somalia.

D. PER CAPITA MERCHANDISE IMPORTS (PCIM) adjustment, in the long-run, is also downwards. Average per capita merchandise imports would establish at approximately 30 Kgs. Only in the event of a policy decision to raise individual calorie intake would merchandise imports rise to 48 Kgs. per capita. Alternatively, should policy choice be in the direction of lowering calorie intakes per capita, then merchandise imports would register at the lowest level possible equal to approximately 15 Kgs. Generally, however, the need to rely on imports would, given the total multiplier effects and the underlying assumptions, *ceteris paribus,* be reduced by nearly 50% from the base-year period level of over 50 Kgs. per capita.

E. DOMESTIC SUBSISTENCE PRODUCTION (PCDP): Unlike in the case of preceding endogenous variables, PCDP, in the long-run, tends to adjust upwards. PCDP in aggregate and around the mean, would increase to nearly three times the level recorded in the base-year to 207 Kgs. per

capita. The short-term effect of the impact multipliers, given assumptions, results in twice the value of the base-year PCDP - an amount equal to approximately 150 kgs. per capita. Individually, the assumption given by the simultaneous changes in GNP per capita, increase in the c.i.f. price of imports and calorie reduction, tends to exert the greatest upward shift in domestic production from 72 Kgs. in the base-year to 387 Kgs. This is nearly five times the level of production in the base-year. The GNP/capita assumption alone exerts an equally strong influence on PCDP. Given this scenario, PCDP would rise to nearly three times the level registered in the base-year equal to 272 Kgs/capita. A purposeful reduction in the level of calories (Y_5) by 8%, would force domestic production to rise to 175 Kgs. per capita - an increase equal to approximately two-and-a-half times that in the base year. Alternatively, should c.i.f. prices of cereal imports rise by 15% as suggested by the assumption, domestic production would increase to 117 Kgs. per capita, possibly in an attempt to substitute for the high-cost imports. Only under the assumption that the level of calorie intake is improved by 8%, would PCDP fail to register similar achievements. Nevertheless, even under these conditions, some remarkable improvements in the PCDP occur([25]. These findings indicate that oppurtunities for managing food deficits in Somalia exist. Section 4. is devoted to the analysis of management and policy options likely to be defined as short and long-term targets.

4. SUMMARY: REGIONAL IMPLICATIONS OF ALTERNATIVE POLICY SCENARIOS ON CEREAL DEFICIT MANAGEMENT

4.1 Summary of Findings

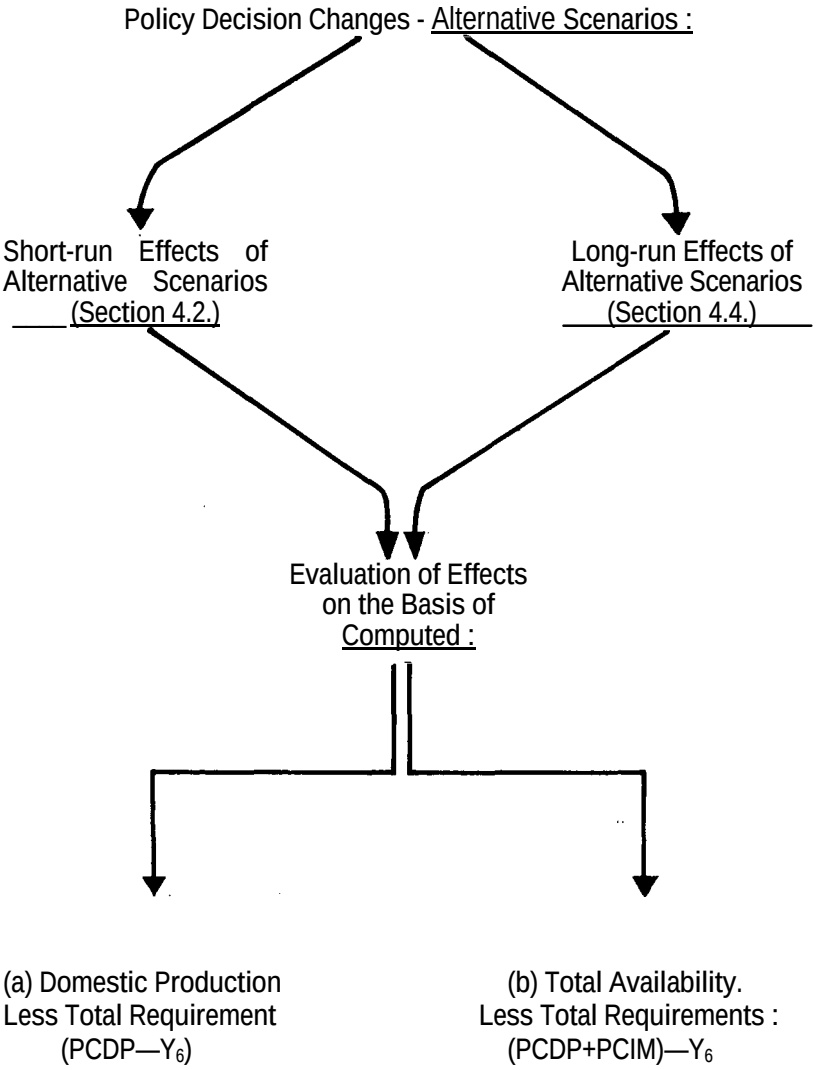
4.1.1 The surplus-deficit conditions in the Somali cereal sector may be evaluated either over domestic subsistence production or over total availability.

4.1.2 The former option takes into consideration the current capacity of the subsistence cereal production mode to meet all the requirements at the rural as well as urban sectors. In the second option, domestic production possibilities are supplemented with merchandise imports and evaluation made as to whether the combined forces can meet the national cereal requirement. The purpose of this dichotamy is to isolate the capacity and the role of domestic cereal sector to generate the country's basic food needs without resorting to merchandise imports in the long-run. Figure 1 presents a schematic representation of the steps involved in this assessment mode.

4.1.3 In order to achieve the goal of a viable domestic production capability, it is necessary that relevant policy parameters be adequately defined in order to assess the surplus-deficit conditions in the cereal sector. The GNP per capita assumption is meant to serve as a proxy for the purchasing power and well-being of the individual consumer. Any improvement of this factor, in the direction of the magnitudes so suggested, would tend to, according to this study, elevate the consumer to higher order preference frontiers; which may be taken to mean, if sustained for a longer period of time, changes in his/her tastes and preferences such that more elastic cereals would replace the sorghum-based foods now common. Improvements along these lines would undoubtedly have large upward adjustment effects on the surplus production of cereals in the long-run. This is what the findings given in sections 3.2 and 3.4 suggest. The GNP per capita decision variable therefore has long-run effects larger than the impact multipliers would suggest (26). Both total and impact multipliers, however, tend to generate within the domestic sector, surplus production possibilities that are, by far, greater than the requirements. The former may, however, be a more effective tool if a sustained self-sufficiency goal is explicitly defined as the target to be sought.

4.1.4 The composite assumption, involving simultaneous improvements in the level of GNP per capita, reduction in the calorie requirements of the individual through, say, methods that would cut down unnecessary physical and mental exertions and/or attrition; and the rise in the c.i.f. import price, is also more effective as a long-run policy tool than would be expected in a matter of one or few years (27). Improvements in the GNP per capita would, of course, require a host of other conditional pre-requisites, such as improvement in the economy's output of goods and services before substantive gains can accrue to the individual. These are, by no means, short-run goals for any national policy drive. The reduction

Fig. 1
IMPLICATIONS OF ALTERNATIVE POLICY SCENARIOS
ON CEREAL DEFICIT MANAGEMENT



in the level of calorie requirements, on the other hand, is highly correlated with improvements in the level of well-being of the individual that would allow for shifts to relatively better diets, more realistic leisure - work relationship, improved living conditions, and the generation of an environment conducive to positive thinking. Mothers would otherwise continue to walk kilometers, often twice a day, to get a five-litre potful of water each time. Similarly, children would continue to practically trek miles on end just to attend school. The farming families, by the same token, would continue to spend a good part of their day wielding the hoe and doing other equally exertive chores that burn up whatever calories they had previously accumulated.

4.1.5 The c.i.f. import price decision variable is not strictly an exogenous variable that Somalia can change at will. Rather, a reflection of the international price for the average of maize, sorghum and rice, and, therefore, the terms of trade facing importers of cereals. Recent trend indicates upward changes in these terms of trade for some cereals about which Somalia has no say but to take it as given. This assumption is also a more effective decision variable in the long-run. As such, its impact could be felt after a long gestation period (28). Alternatively, this factor may be stated as having current period adjustment effects that are too small to be considered viable.

4.1.6 The remaining assumptions as per boosting(29) or lowering(30 the level of calorie requirements, or by the same token, reducing the c.i.f. prices tend to have a proportionately large short-term effect than the total multipliers would indicate. These may be considered as short-term policy variables useful for quick and tangible target goals in the narrowest possible time span. Assumptions of this sort are particularly useful when domestic production is taken as a base for the evaluation of the state of surplus and/or deficit in cereals.

4.1.7 Assessments over total availability, on the other hand, takes into consideration domestic production and merchandise imports subject to fulfilment of total requirements. In this scenario, the decision variables defined as increase(31) or decrease(**32)** in the calorie requirements tend to show up as short-term decision rules that are effective only as quick reprieves from otherwise customary deficit conditions often in place.

4.1.8 The c.i.f. price assumption may be added to these alternative policy tools as an effective instrument in the short-run. Should these instruments be deployed, then the adjustment processes of surplus-deficit conditions would tend towards a positive stock greater than the requirements in a very short span of time (33). An exception to this rule is the assumption to increase per capita calorie requirement which would result in a large amount of cereal deficit, more so in the short-term than in the long-run. Clearly then, the choice to increase the individual calorie requirements, whether evaluated over the domestic production or total availability, is not a feasible option to be recommended as practical policy target for Somalia's drive towards sustained self-sufficiency in cereal foods(**34)**.

4.1.9 The policy to deploy assumptions (4) and (5) in paragraph 3.2.2., would have dramatic effects on the present-day deficit conditions in Somalia. Both of these take long-range perspectives towards resolving the cereal conditions. Necessarily, these policy tools require long gestation periods to mature. Equally important is the conditional necessity required to sustain the impacts of these shocks once set into motion. Should such targets be defined, then the assumption stated as GNP per capita increase, would generate a surplus of cereals large enough to warrant complete re-assessment of the state of food availability in Somalia[35]. The composite assumption given in (5) has the capacity not only to correct the deficit condition but also to bring, within the likelihood of Somalia, potential export surplus of grains that can be shipped to other deficit-prone countries in the region[36]. Section 4.2 explores these potentials in greater details.

4.1.10 In summary, surplus-deficit conditions in terms of national aggregates under different population assumptions for the current and the long-range period[37], in metric ton equivalents, are shown in Table 5.

TABLE 5
CEREAL DEFICITS IN SOMALIA : SUMMARY ASSESSMENTS

Population Forecast (Millions)'	Simulation Assumption	Total Requirement Y_6	Total Availability (PCDP+PCIM)	Domestic Production (PCDP)	Surplus-Deficit Over-Total availabilty	Assessment Over PCDP only
(1)	(2)	**(3)**	**(4)**	**(5)**	**(4-3)**	**(5-3)**
		Current Period (upto 1985) Simulation :				
	No.1.	**792**	**638**	**523**	**(-)104**	**(--)** 269
	2.	**671**	**1,133**	**1,089**	(+) **462**	(+) 418
5.5	**3.**	**693**	787	732	(+) 94	(+) 39
	4.	**622**	**828**	**732**	(+) 206	(+)110
	5.	**633**	**1,123**	**1,095**	**(+)490**	(+)462
		Long-range (1993) Simulation :				
	No.1.	**769**	**825**	**527**	(+) **56**	**(-)** 242
	2.	**651**	1,178	1, 085	(+) 527	(+) 434
6.2	**3.**	**713**	**874**	**725**	(+) 161	(+) 12
	4.	719	**1,853**	1,686	(+)1134	(+) 967
	5.	**639**	**2,604**	**2,399**	**(+)1965**	(+)1760

a /. Source for population forecast is: M.A. Gulaid; Op. cit, p. 54.

4.1.11 Analysis of Table 5 suggests three possible outlooks for domestic cereal production. Colum 5 lists the strength of this sector relative to each alter-native simulation. One such outlook is characterized by very large deficit propositions. This peculiar case is associated with the assumption of increased level of individual calorie requirements 8% above the base-year (1983) value. Should such a policy be deployed, then persistent cereal shortages would continue to be the case. Even if final resort is made to merchandise imports, consumption gaps already created would never be completely filled. The solution to this deficit condition therefore must be found outside the physical and financial capabilities of Somalia. Only food aid (from international donors) can resolve this state of persistent cereal deficits.

4.1.12 The second possible scenario of the cereal surplus - deficit outlook suggests that requirements would be barely satisfied if the c.i.f. import prices rise by 15% from the base-year level in either the short-term or the long-range periods. The recovery from the outlook given in preceding alternative is due to improvements in the domestic production sufficient to create surpluses large enough to render merchandise imports small and negligible in size. Assumption No. 4 also has a similar effect in the short-run relative to domestic production of cereals. In summary, the surplus-deficit conditions would balance each other out thereby creating a temporary break-even solution in the short-term outlook.

4.1.13 The third possible scenario of the cereal surplus - deficit outlook is the result of activation of individual assumptions 2,4 and 5 - i.e., reduction in the level of individual calorie requirements, the GNP per capita, and import prices respectively. That is:

(i) Assumption 2 imparts short-term as well as long-term effects on domestic cereal production. In the short-term, it raises PCDP to over one million metric tons, making the surplus nearly equal to the level of requirements. In the long-run, similar outlook is reflected by imposing this conditions onto domestic production. This perhaps suggests the sustenance of the impact into the long-range periods which may indicate the stability of the relations constructed.

(ii) Assumption 4 imparts only a long-range effect over domestic production and subsequently the surplus-deficit conditions of cereals in Somlia[38]. Domestic production would increase to 1.686 million metric tons. Out of this 719 thousand metric tons would be needed to satisfy national requirements. Thus surplus generated under this condition, would equal to nearly 967 thousand metric tons in the long-run.

(iii) Assumption 5 by far has the largest impact on domestic production possibilities. The estimated size of cereals likely to come as a result of instituting this composite assumption would be 2.399 million metric tons. National cereal.

requirements would delcine to a low level of 639 thousand metric tons. This composite effect tends to boost the surplus outlook to a record-high of 1.76 million metric tons in the long-run period. On the short-term basis, however, surpluses generated would be 462 thousand metric tons only. Under these circumstances, novel approaches to managing such large stocks of surpluses would have to be developed.

4.1.14 Section 4.2 outlines alternative approaches towards management of surplus stocks of cereals likely to be generated if conditions stipulated under these assumptions are operative.

4.2 Policy Implications for Regional Cooperation

4.2.1 To satisfy cereal requirements, there would be a need for 350 to 400, 100 to 150, and 150 thousand metric tons respectively for Somalia, Djibouti and the Yemen Arab Republic in 1990 and 1995. The total of between 500 to 700 thousand metric tons of cereals would be required during these two specified years, if the region is to feed itself. These figures are based on forecasts generated from the first-order autoregressive time-series model[(39)]

4.2.2 The scope of the regional cereal deficit may, alternatively be defined according to stipulations under the dynamic multipliers discussed in this paper. Given the effect of changes in the major policy variables, three options are discernible that may be further analyzed. Activating assumption 4 (see section 3.2.2.), would suggest the generation of a potential surplus of cereals in the domestic sector in excess of 950 thousand metric tons beyond-and-above Somalia's immediate needs in the long-run[(40)]. Should this be the case, then both YAR and Djibouti deficits could easily be met from this surplus with considerable ease[(41)].

4.2.3 The creation of a reasonable emergency or reserve stock in each of these countires is not as remote as many people tend to think. Assumption 5, if allowed to take hold, would make this a reality. A surplus stock of 1.76 million metric tons likely to be generated from this option, suggests the strong possibility of generating emergency stocks that could be based on the real storage potentials and capacities in each country. YAR, for instance, may find it feasible, given its needs and storage facilities, to stock up enough cereals to last three months under this option. Given its projected requirements for the year 1990, this cereal reserve stock would be in the neighbourhood of 242 thousand metric tons. In the case of Somalia, it would be well advised to set a higher reserve stock target because of its unique production seasonality due to irregularities in the amount and frequency of rains. Under these circumstances, a reserve stock that is reason-able in size must necessarily be able to last nearly six months. Such a stock based on 1990 requirement projections would be in the vicinity of 350 thousand

metric tons[42]. If built, a stock of this size would serve as a buffer that could Out Somalia over a bad season in which a complete cereal production failure occurs. Djibouti, on the other hand, may wish to stock up the entire projected annual cereal requirements for 1990, given the potential stated in assumption 5. All these developments are subject to criteria spelled out under the long-range assumptions in the dynamic simulations stipulated, and also on the stamina, on the part of Somalia, to sustain the drive towards higher production capacities and efficient management of cereal surpluses.

4.2.4 It is apparent, therefore, that any drive towards efficient utilization of the potential surpluses with the intent to meet regional deficits, must be met with equally solid and closer intra-regional economic and political linkages. Preference ordering, for instance, with respect to other competitive and substitute cereals must be defined intra-regionally so that native cereals can find their markets unobscured in each of the countries comprising the region. Under these conditions it may become possible to sharpen the strong complementarity between YAR's and Somalia's cereal baskets. This is where the strength lies in establishing viable economic linkages between the countries in the region.

4.2.5 In closing, should Djibouti and YAR reassess their preference ordering scheme and decide to support the utilization of the surplus potential likely to be generated under assumption 5, then Somalia, on its part, must see to it that such potentials are tangible; can be fully exploited and that its neighbours can get the largest share of benefits in the distribution of these resources. Exports of cereals from Somalia to Djibouti and YAR, to cover their immediate requirements and/or reserve stocks and replenishments, must be guaranteed favourable conditions and maximum possible preferential treatments relative to other importers. By the same token, YAR's wheat-barley basket of exportables must also receive similar treatments in Djibouti and Somalia. These vital reciprocal links must be established using any cooperative channel available to these countries. This is necessary if only to solve the region's present basic food commodities shortfalls.

4.3 Recommendations

4.3.1 The magnitude of cereal deficit in the region warrants international attention if this problem is to be brought under control. The Islamic Development Bank (IDB) can join in with the International Monetary Fund (IMF) in financing the excess demand defined in this paper as deficits. The IMF already has, under operation, a program to finance food security, in many lesser developed countries. Such a facility is supposed to resolve domestic variations in production by providing the foreign exchange requirements to purchase imports. In doing so, it implicitly allows for the utilization of the scarce funds for other equally pressing alternatives. This option needs to be studied at a closer range especially in connection with IDB's existing Import Financing Program/or the Longer-term Export Financing Scheme and as such under the added proviso that these are strategic commodities of special interest for inter-OIC cooperation.

4.3.2 Since, in general, improvements in these member countries' overall economic and social welfare situation tends to resolve the stringency of food availabilities (especially cereal deficits), IDB may be well advised to continue its funding of the stream of infrastructural projects and those sectoral programs that have strong linkage effects with other economic and social activities. Financing of health and medical programs that have direct influences on human well-being need to be considered since these have augmentative effects on those social and economic programs previously listed.

4.3.3 In financing cereal deficits, buffer stocks or replenishments via a well conceived food security program IDB may give attention to existing wheat-barley and sorghum-maize complementarities that are characteristic of the region's production relations. In doing so, division of labour, along lines of comparative advantage would implicitly be strengthened and upheld. This undoutbtedly, would sharpen methods to be recommended for future intra-regional cooperation.

4.3.4 In conclusion, this study could have taken a different approach in examining food deficit situation in each of the countries of YAR, Djibouti and Somalia. Unfortunately, sufficient data to warrant simultaneous equation analysis for each country was not available at the time. The decision to approach the issue from a single country point of view was made to circumvent this difficulty. Perhaps future studies would not have to grapple with such fundamental problems now that the Information Centre has been established within IRTI, and that regional linkages have become somewhat more plausible than ever before.

APPENDIXES

APPENDIX I : DEFINITION OF VARIABLES AND DATA SOURCES Y_5

Y_5 = Average per capita calorie requirements per year.

Sources F.A.O., Production Yearbooks (several editions).
F.A.O., Food and Nutrition Series, No. 11, Rome, 1977.
F.A.O., Food Balance Sheet, 1976.

Y_6 = Per capita kilogram requirement of cereals.

Extrapolated from calories per capita per day supply and Y_5.
Sources for the former are FAO Production Yearbooks 1977 - 1981.
Other sources of data are used to augment above to extrapolate 1961-63, 1964-66, 1966-68, 1969-71, 1972-74, 1974-76, 1975-77 and 1978-80. These figures are in kilogram equivalents of annual requirements of cereals.

$P^{RF=}$ (Y8) = Prices received by farmers in Somali Shillings per metric ton.

Sources Ministry of Agriculture and the Agricultural Development Council (ADC). P^{RF} represents the average of sorghum, maize and rice per metric ton.

$P^{RT=}$ (Y_9) = Prices at the retail in Somali Shilling per kilogram.

Sources = P^{RT} denotes the average price per kilogram of sorghum, maize and rice in Mogadishu. Central Bank of Somalia Bulletin.

Y_{10} = Import price, c.i.f., Mogadhishu, in US $ per metric ton.

Sources : UNCTAD, Export structure at SITC 3-digit level. $Y1_0$ represents the average for wheat, rice and maize at the port of entry.

Y_{11} = GNP per capita in US $ per year.

Sources : World Bank Atlas, 1975-76 and 1978-81. Also the Islamic Development Bank 7th and 8th Annual Reports; 1983 and 1984 respectively. 1960-74 GNP per cepita figures are trend extrapolations under the assumption of 4.1% per year growth rate.

P^{RF}_{t-1} = Prices received by farmers lagged one year. =

P^{RT}_{t-1} Prices at the retail lagged one year.

PCDP = Per capita Domestic Production in kilogram of cereals.

Sources : Different Ministry of Agriculture publications, Somalia
IMF : Somalia-Recent Economic Developments,
SM/83/27, February 7, 1983.
U.N : "Country Review Meeting, Country Presentation - Somalia", 1981 (pp. 19-20).
Ministry of Planning, Somalia Statistical Yearbook, 1974-75.
FAO, Production Yearbooks, 1977-1982.

PCIM = Per Capita Merchandise Imports in kilogram of cereals.

Sources : For merchandise imports, the Central Bank of Somalia, Bulletin No. 70. Also, FAO Trade Yearbooks 1976-82; Ministry of Commerce and Trade, Somalia. Population figures used to connvert this to per capita were generated in Gulaid, 1985.

D_1, D_2D_3, D_4 =Dummy variables for drought years (or periods) as follows: 1964-65, 1969-72, 1975-77 and 1979-83 respectively.

T = Trend variable to cover structural and. technological changes.

E = Ratio of price $^{PRT}/P^{RF}$ to denote aggregate price response weighted relative to prices received by farmers.

DQ =Excess Demand (DQ : LOG 10 ($Y_{„}$), where $Y_{„}$ = (Ys Y_{15}); and Y_{15} is the sum of PCIM and PCDP. This variable appears in Model II only and was used to test prices received by farmers and retail responses to the state of excess demand.

Population = Only in a small number of years did we have figures for this measure. Most of the data available are at best conjunctural. Taking into account recent changes and improvements in Somalia's mortality rates and live expectancies, we extrapolated this parameter being first order-autoregressive time series model. For details see, Gulaid, .1985.

APPENDIX II : ECONOMIC-THEORETICAL MODELS: I, II AND III

MODEL I : Disequilibrium model with price restrictions (ie., price are controlled)

$$Y_6 = f_1 (E, Y_5, Y_{11}, T, D_1, D_2, D_3, D_4)$$

$$PCIM = f_2 (E, Y_{10}, \hat{PCDP}, T, D_1, D_2, D_3, D_4,)$$

$$PCDP = f_3 (P^{RF}, \hat{Y}_6, T, D_1, D_2, D_3, D_4,)$$

MODEL II : Disequilibrium model with excess demand specification

$$Y_6 = f_1 (E, Y_5, Y_{11}, T, D_1, D_2, D_3, D_4)$$

$$PCIM = f_2 (E, Y_{10}, \hat{PCDP}, T, D_1, D_2, D_3, D_4)$$

$$PCDP = f_3 (\hat{Y}^6, T, D_1, D_2, D_3, D_4)$$

$$P^{RF} = f_4 (DQ, \hat{PCDP}, P^{RF}_{t-1}, T, D_1, D_2, D_3, D_4)$$

$$P^{RT} = f_5 (DQ, T, D_1, D_2, D_3, D_4)$$

MODEL III : Disequilibrium model with no restrictions specified

$$Y_6 = f_1 (Y_5, \hat{P}^{RT} Y_{11}, T, D_1, D_2, D_3, D_4)$$

$$PCIM = f_2 (\hat{Y}_6, Y_{10}, T, D_1, D_2, D_3, D_4)$$

$$PCDP = f_3 (\hat{Y}_6, \hat{P}^{RF}, T, D_1, D_2, D_3, D_4)$$

$$P^{RF} = f_4 (P^{RF}_{t-1}, T, D_1, D_2, D_3, D_4)$$

$$P^{RT} = f_5 (P^{RT}_{t-1}, \hat{PCIM}, T, D_1, D_2, D_3, D_4)$$

APPENDIX III : ESTIMATED STRUCTURAL EQUATIONS AND COEFFICIENTS FOR MODELS I, II AND III

MODEL I

(Numbers in parentheses are standard errors) :

$$PCIM = \underset{(0.56)}{6.364} - \underset{(1.04)}{0.68}\,E - \underset{(1.01)}{2.41}\,Y_{10} - \underset{(0.02)}{1.37}\,\hat{PCDP} + \underset{(0.18)}{0.05}\,T + \underset{(0.20)}{0.25}\,D_1 - \underset{(0.20)}{0.15}\,D_2 + \underset{(0.23)}{0.15}\,D_3 + 0.76\,D_4$$

D-W Stat.= 2.34; First Order Autoc. (rho)= −0.177; R^2= 0.608; F(8,17)=3.30

$$Y_6 = \underset{(0.015)}{-1.48} + \underset{(0.002)}{1.04}\,Y_5 - \underset{(0.0036)}{0.005}\,E - \underset{(0.0001)}{0.007}\,Y_{11} + \underset{(0.0007)}{0.002}\,T + \underset{(0.001)}{0.004}\,D_1 + \underset{(0.0008)}{0.0006}\,D_2 + \underset{(0.001)}{0.0008}\,D_3 + 0.006D_4$$

D-W Stat= 1.30; rho: 0.344; R^2= 0.99; F(8,17)=3247

$$PCDP = \underset{(0.653)}{11.42} + \underset{(1.208)}{0.175}\,P^{RF} - \underset{(0.010)}{4.489}\,\hat{Y}_6 + \underset{(0.067)}{0.015}\,T + \underset{(0.75)}{0.105}\,D_1 + \underset{(0.67)}{0.347}\,D_2 + \underset{(0.102)}{0.084}\,D_3 - 0.103\,D_4$$

D-W Stat = 1.849; rho= 0.0574; R^2= 0.60; F(7, 17)= 3.90

MODEL II

$$PCIM = \underset{(0.569)}{6.182} - \underset{(1.306)}{0.612}\,E - \underset{(0.975)}{2.22}\,Y_{10} - \underset{(0.035)}{1.347}\,\hat{PCDP} + \underset{(0.240)}{0.045}\,T + \underset{(0.237)}{0.112}\,D_1 - \underset{(0.228)}{0.091}\,D_2 + \underset{(0.302)}{0.23}\,D_3 + 0.608\,D_4$$

D-W Stat.= 2.29; rho= −0.236; R^2=0.63; F(8,11)= 2.41

$$Y_6 = \underset{(0.011)}{-1.396} + \underset{(0.002)}{1.026}\,Y_5 - \underset{(0.006)}{0.002}\,E - \underset{(0.0001)}{0.021}\,Y_{11} + \underset{(0.0008)}{0.005}\,T + \underset{(0.0007)}{0.004}\,D_1 + \underset{(0.0007)}{0.002}\,D_2 + \underset{(0.001)}{0.002}\,D_3 + 0.006D_4$$

D-W Stat= 0.97; rho: 0.39; R^2= 0.99; F(8,11)=5456,

$$PCDP = \underset{(1.231)}{11.69} - \underset{(0.005)}{4.87}\,\hat{Y}_6 + \underset{(0.087)}{0.00}\,T + \underset{(0.074)}{0.004}\,D_1 + \underset{(0.075)}{0.36}\,D_2 + \underset{(0.0.115)}{0.129}\,D_3 - 0.175\,D_4$$

D-W Stat : 1.72; rho= 0.105; R^2= 0.65, F(6, 13)= 4.15,

$$P^{RF} = \underset{(0.104)}{1.85} + \underset{(0.051)}{0.006}\,DQ + \underset{(0.003)}{0.008}\,\hat{PCDP} + \underset{(0.297)}{0.006}\,T + \underset{(0.020)}{0.358}\,P^{RF}_{t-1} + \underset{(0.012)}{0.003}\,D_1 + \underset{(0.015)}{0.0075}\,D_2 - \underset{(0.028)}{0.005}\,D_3 - 0.019\,D$$

D-W Stat = 2.071, rho= 0.065, R^2= 0.97, F(8, 11)= 45.58,

$$P^{RT} = \underset{(0.059)}{0.079} + \underset{(0.005)}{0.058}\,DQ + \underset{(0.132)}{0.19}\,T - \underset{(0.790)}{0.012}\,D_1 - \underset{(0.102)}{0.162}\,D_2 + \underset{(0.159)}{0.159}\,D_3 + 0.274\,D_4$$

D-W Stat = 2.349, rho= 0.09, R^2= 0.80, F(6, 13)= 9.1,

MODEL III

$$Y_6 = -1.467 + 1.041\ Y_5 - 0.004\ \hat{P}^{RT} - 0.005\ Y_{11} + 0.002\ T + 0.004\ D_1 + 0.0009\ D_2 + 0.0007\ D_3 + 0.0053 D_4$$
$$(0.015)\quad (0.002)\quad (0.004)\quad (0.0001)\quad (0.0008)\quad (0.001)\quad (0.0008)\quad (0.0014)$$

$R^2 = 0.99;\ F(8,18) = 2988$

$$P^{RF} = 1.070 + 0.0624 P^{RF}_{t-1} + 0.014\ \hat{PCDP} + 0.004\ T + 0.009\ D_1 + 0.003\ D_2 - 0.004\ D_3 - 0.033\ D_4$$
$$(0.090)\quad (0.04)\quad (0.001)\quad (0.014)\quad (0.011)\quad (0.012)\quad (0.020)$$

$R^2 = 0.98,\ F(7,18) = 200.09,$

$$P^{RT} = 0.028 + 0.002\ \hat{PCIM} + 1.023\ P^{RT}_{t-1} - 0.034\ T - 0.0.032\ D_1 + 0.002\ D_2 + 0.005\ D_3 + 0.124\ D_4$$
$$(0.023)\quad (0.039)\quad (0.001)\quad (0.013)\quad (0.012)\quad (0.015)\quad (0.024)$$

$R^2 = .99,\ F(7,18) = 1085.87$

$$PCIM = -7.470 + 6.992\ \hat{Y}_6 - 2.873\ Y_{10} + 0.037\ T + 0.107\ D_1 - 0.266\ D_2 - 0.109\ D_3 + 0.841\ D_4$$
$$(4.88)\quad (1.126)\quad (0.021)\quad (0.164)\quad (0.453)\quad (0.185)\quad (0.275)$$

$R^2 = .59,\ F(7,18) = 3.79$

$$PCDP = 8.943 - 4.241\ \hat{Y}_6 + 0.505\ \hat{P}^{RF} + 0.006\ T + 0.12\ D_1 + 0.34\ D_2 + 0.086\ D_3 - 0.143\ D_4$$
$$(1.25)\quad (0.742)\quad (0.011)\quad (0.069)\quad (0.077)\quad (0.069)\quad (0.106)$$

$R^2 = .59;\ F(7,18) = 3.76$

APPENDIX IV: NOTES ON FORECAST PROPERTIES OF MODEL III

Statistics of fit using Root Mean Squared Errors (RMSE) and percentage RMSE estimated for each endogenous variables Y_6, Y_8, Y_9, PCIM and PCDP are given in Table 3. The RMSE defines the statistics of fit, Yt_{+i} represents the forecast value of the endogenous variable at time t+i is the actual value at t+,, and n is the period factor equal to 23 years.

A : MODEL III SIMULATION FORECAST gives the forecast values as prefixed hats, with prefixes indicating the appropriate endogenous variables.

The residuals for each alternative forecast value relative to the corresponding actual value are given immediately following the hatted (A) entries in Appendix IVB.

Casual analysis of the information given in these appendixes and particularly as regards entries for $_{Yt+i}$ and $Yt_{+},$, indicate that Model III has generally been successful in forecasting the actual ex-post values of the endogenous variables. The residuals generated via first differences between Y_{t+l}, and Y_{t+l} are small throughout the data span. This consistency tends to establish the strong association between the forecast and observed actual data elements. Figures 2 to 5 support this conclusion.

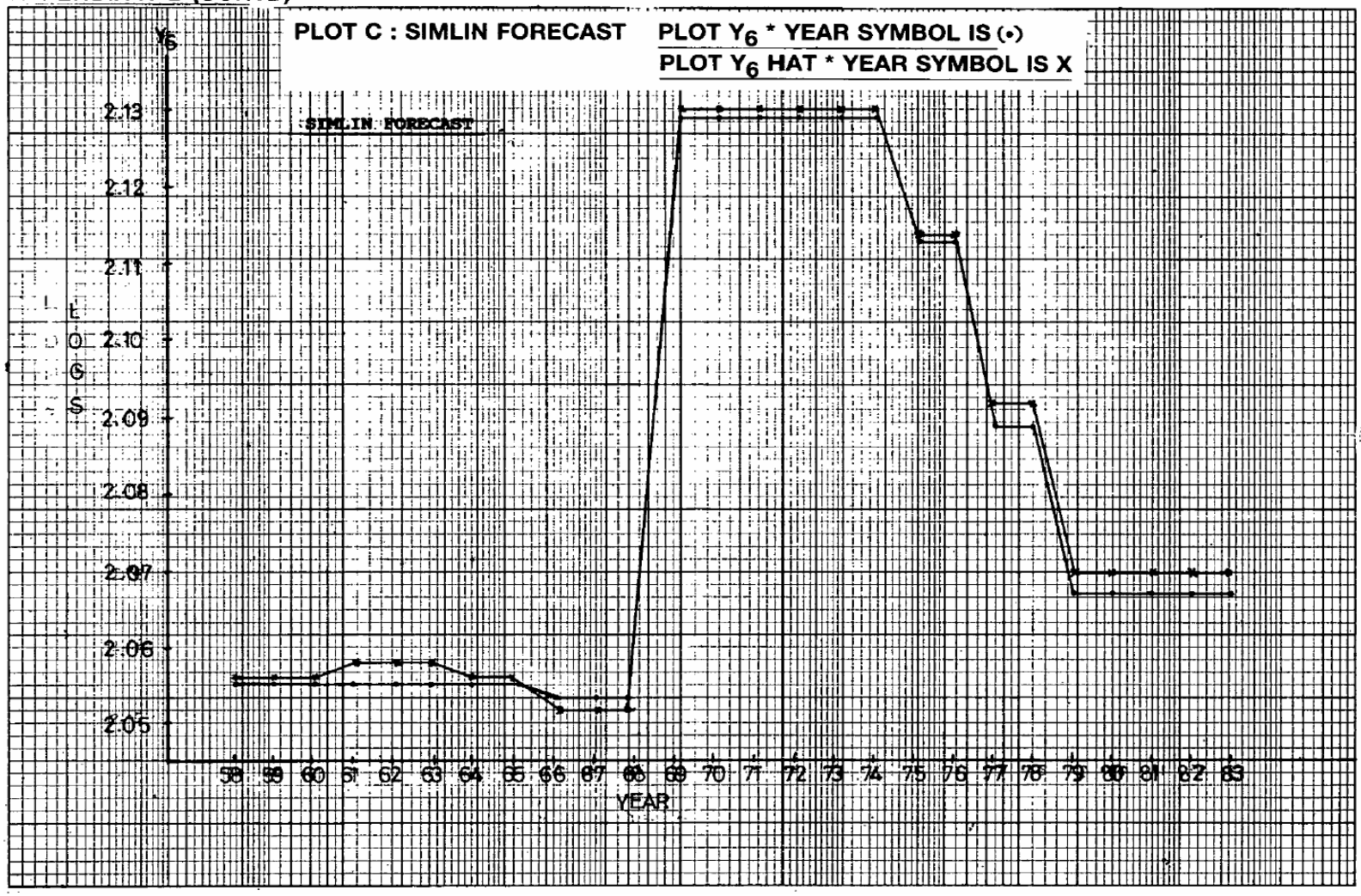
More formally, the percentage RMSE estimates for short-term forecast normally are considered statisfactory if they fall within the unit range, i.e., 1%. However, as the forecast period is increased, we expect to find the RMSE and subsequently the percentage RMSE, to span out and become substantially large. This is the case with such volatile endogenous variables as retail prices (Y_9), which may be raised or lowered at whim and with no regard to the supply-demand conditions in the market or as in the case of imports (PCIM), which are closely associated with the size of expected cereal deficit[43] - an element already known to be extremely sensitive.

Given these forecast properties, any extention of the period of projection beyond the short-term should necessarily be interpreted as an academic exercise, which in turn renders estimates at best hypothetical but nevertheless very useful. Notwithstanding this shortfall, sensitivity analysis generated via exogenous shocks in the policy variables, present reasonable options that could be used as targets for future planning.

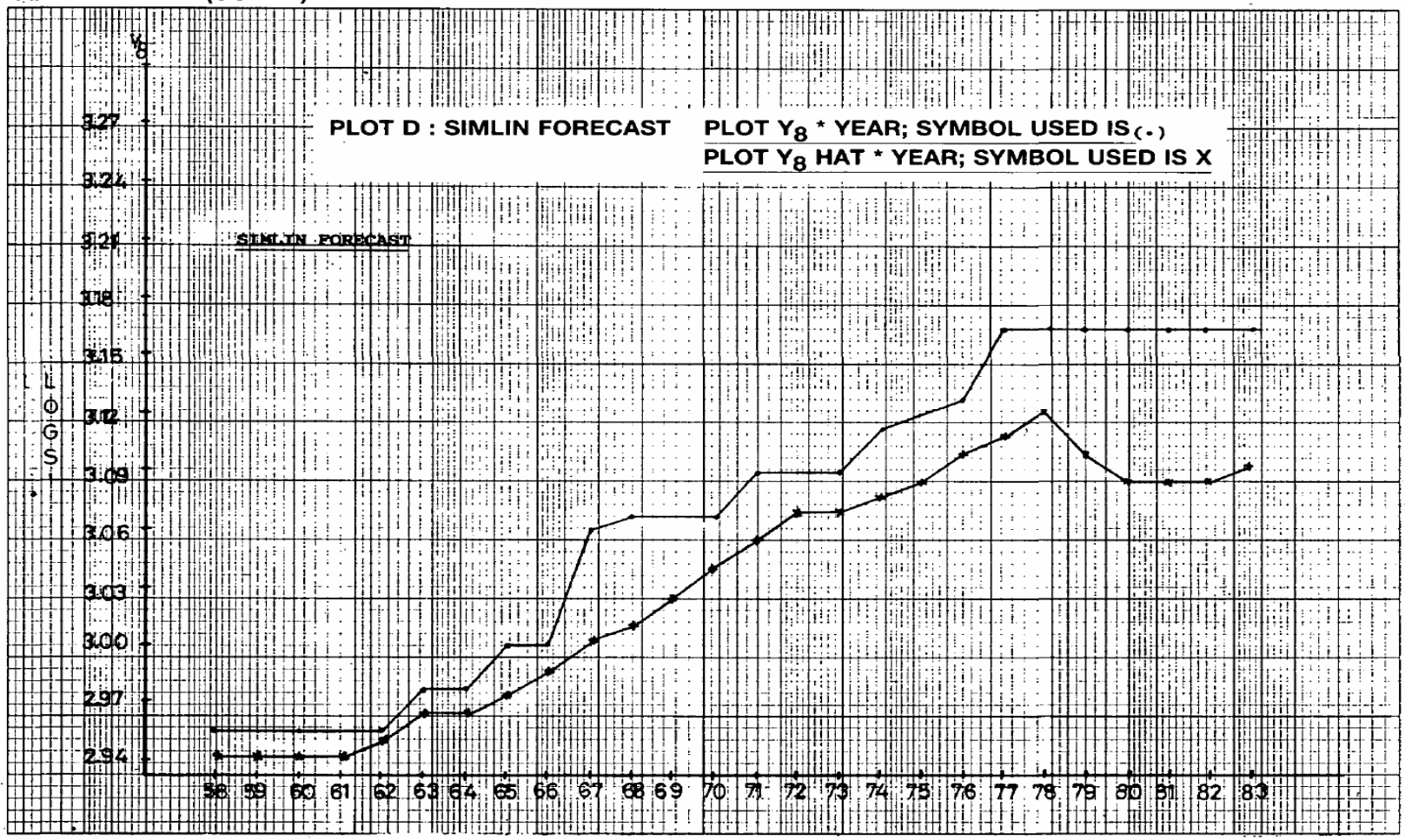
APPENDIX IV B : MODEL III,:EX-ANTE SIMULATION FORECASTS FOR ENDOGENOUS VARIABLES

CBS	Y6HAT	Y8HAT	Y9HAT	PCOPHAT	PCIMHAT	Y6RES	Y0RES	Y9RES	PCOPRFS	PCIMRES
1	**2.05679**	**2.94099**	0.134355	1.70377	**1.44749**	0.0001161	**0.013248**	0.00552	-0.08034	0.00717
2	**2.05688**	**2.93655**	0.163134	1.70742	**1.48495**	0.0000298	0.017696	-0.02326	-0.09123	-0.r3753
3	**2.05697**	**2.93793**	0.190101	1.71397	**1.52246**	-0.0000631	0.016314	-0.05022	-0.11191	-0.08917
4	2.05707	**2.94297**	0.215103	**1.72233**	**1-50059**	-0.0001629	**0.011753**	-0.11130	0.12132	**-0.00939**
5	2.05717	2.95031	0.238074	1.73182	**1.46769**	-0.0002701	**0.003928**	-0.13427	0.14433	**0.08424**
6	2.05708	**2.95911**	0.259121	1.74291	**1.31765**	-0.0001726	0.018610	-0.20222	0.07462	**0.02414**
7	2.05621	**2.96153**	**0.246138**	1.87253	**1.64140**	**0.0006945**	0.016190	-0.18168	0.10858	**0.02429**
8	**2.05646**	2.96722	0.230426	**1.88060**	1.70771	**0.0004486**	**0.034946**	-0.13700	-0.08772	-0.01630
9	**2.05198**	**2.90259**	**0.243562**	**1.79509**	**1.47366**	0.0011005	0.017411	-0.14319	0.03027	0.00587
10	Z.05120	**2.99647**	0.254204	1.81161	**1.34005**	0.0018775	**0.064227**	-0.15040	-0.01013	**0.12612**
11	2.05122	3.00937	**0.262696**	**1.82428**	**1.42199**	0.0010617	**0.055086**	-0.16579	**0.05497**	**0.05239**
12	**2.12912**	**3.02509**	0.270401	**1.84429**	**1.43656**	0.0012089	**0.041239**	-0.19122	**0.07498**	0.13774
13	2.12920	**3.03914**	0.276114	**1.85730**	**1.64053**	0.0011371	0.025322	-0.18975	0.07072	-0.09060
14	2.12922	3.05214	0.279583	**1.86999**	**1.73365**	0.0011131	0.034220	-0.19680	-0.04426	0.09552
15	2.13099	**3.06438**	**0.280420**	**1.87491**	**1.64709**	-0.0006518	**0.025523**	-0.20497	0.00015	-0.12303
16	2.13024	3.06811	0.276707	**1.54987**	**1,38907**	0.0000891	0.018253	-0.19753	0.10441	-0.07001
17	2.13046	3.07462	**0.269557**	**1.55848**	**0.95914**	-0.0001261	0.039328	0.27451	-0.08895	0.3154[0]
1B	2.11397	**3.08476**	**0.265315**	**1.72554**	1.11570	-0.0000285	0.035517	0.27975	**0.07335**	**-0.49947**
19	2.11397	3.09531	**0.259042**	1.73710	**1.44788**	-0.0000291	**0.035024**	**0.25503**	0.0[9]731	0.13267
20	2.09292	3.10741	0.250133	**1.83870**	**1.48013**	-0.0030191	**0.053963**	**0.29394**	-0.09487	**0.33529**
21	2.09233	**3.11836**	0.232712	1.76721	**1.25388**	-0.0024216	**0.043012**	0.38007	**0.00499**	-0.31625
22	2.07052	**3.Q9545**	0.201689	1.71121	**1.94405**	-0.0023354	**0.065920**	0.45152	0.09913	-0.18687
23	2.07069	**3.08523**	**0.166933**	1.71154	**1.69566**	-0.0025064	0.157808	**0.54064**	0.04260	**0.15734**
2[4]	**2.06978**	3.08305	0.128818	1.72063	**1.69452**	-0.0015906	**0.245331**	**0.61540**	0.16050	0.03114
25	2.07011	3.08584	0.087340	1.72685	1.73375	-0.001928°	0.242540	**0.65695**	0.14212	-C.02034
26	2.07047	3.09175	0.042421	1.73459	1.77306	-0.0022796	0.236677	0.70107	0.17838	**-0.06566**

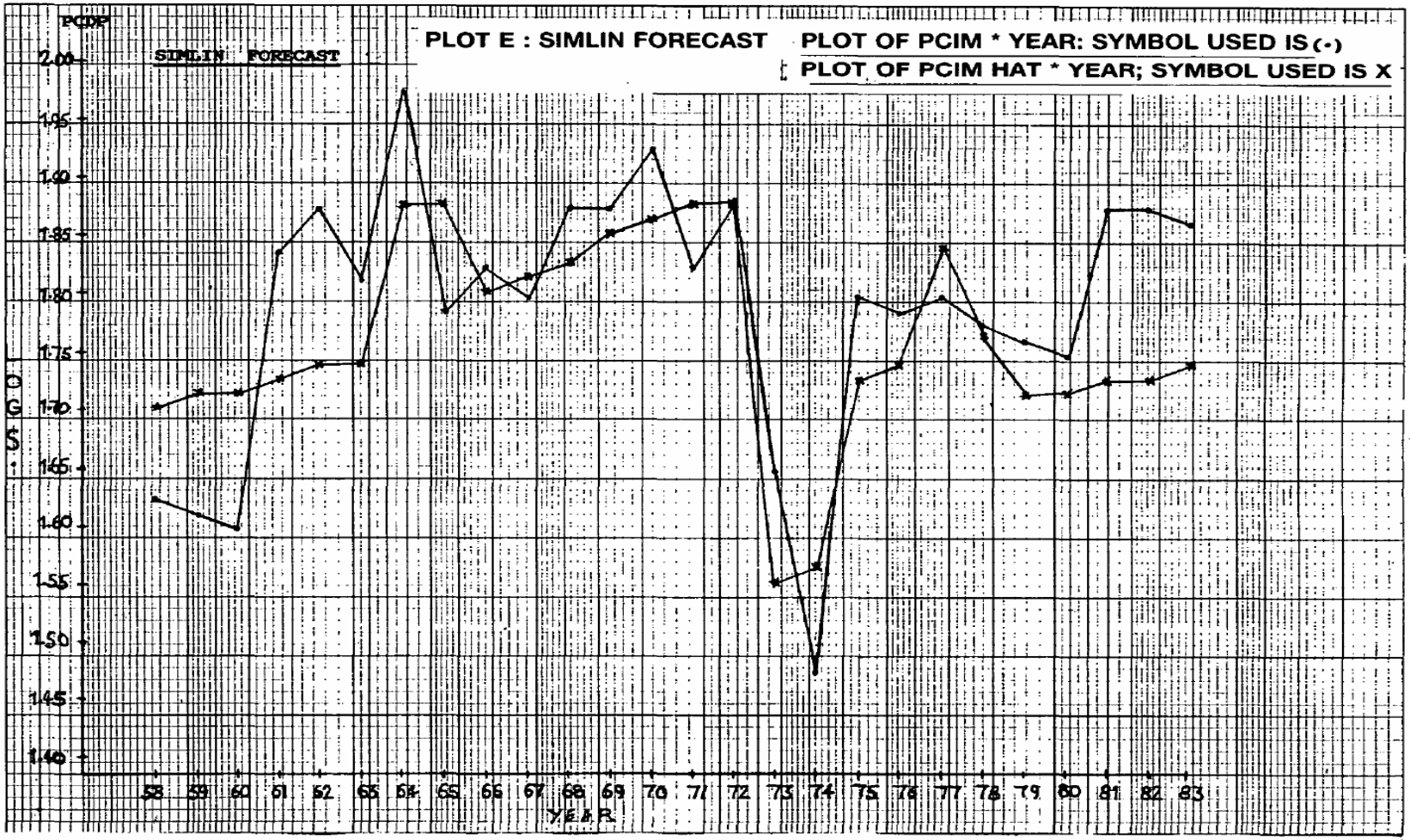
APPENDIX IV B (CONTD)



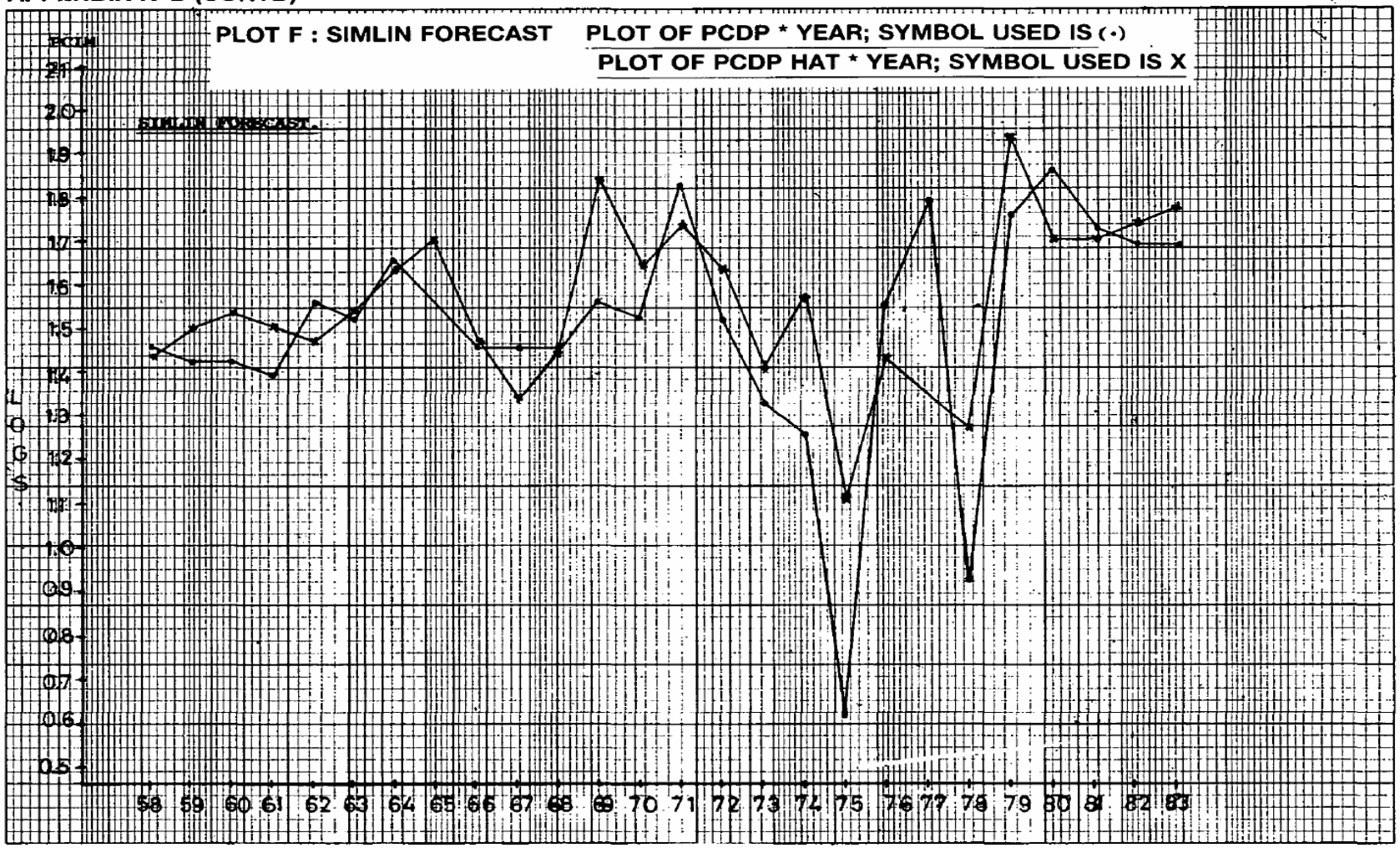
APPENDIX IV B (CONTD)



APPENDIX IV B (CONTD)



APPENDIX IV B (CONTD)



APPENDIX V : MODEL III - INTERIM MULTIPLIERS - (r = 1,5,10)

EXOGENOUS VARIABLES

		Periods	Intercept	Y_5	Y_{10}	Y_{11}	T	D1	D2	D3	D4
ENDOGENOUS VARIABLES	Y_6	r = 1	1.826E-05	-4.971E-05	1.961-05	2.440E-07	9.09E-06	1.17E-04	-1.425E-06	-1.88E-05	8.78E-05
		r = 5	2.00E-05	-5.448E-05	2.14E-05	2.67E-07	9.97E-06	1.28E-04	-1.562E-06	-2.06E-05	4.14E-05
		r = 10	2.24E-05	-6.109E-05	2.41E-05	2.97E-07	1.11E-05	1.44E-04	-1.75E-06	-2.32E-05	4.64E-05
	PRF	r = 1	0.814	-0.039	-1.93E-06	1.96E-04	0.0026	-0.0047	0.0051	5.10E-04	-0.0223
		r = 5	0.126	-0.006	-3.22E-06	3.05E-05	0.0004	-0.0007	0.0007	8.00E-05	-0.0034
		r = 10	0.012	0.0005	-379E-06	2.94E-06	3.81E-05	-9.54E-05	7.80E-05	7.15E-05	-3.47E-04
	PRT	r: 1	-0.00509	0.0138	-0.0054	-6.801E-05	-0.0025	-0.0326	3.90E-04	0.0052	-0.0105
		r = 5	-0.0055	0.015	-0.0059	-7.45E-05	-0.0027	-0.0353	4.00E-04	0.0057	-0.0115
		r =10	-0.0062	0.017	-0.0067	-8.35E-05	3.11E-03	-0.040	0.005	0.00064	-0.0129
	PCDP	r = 1	0.409	-0.0198	-8.417E-05	-9.75E-06	0.0012	-0.0029	0.0025	0.00034	-0.0114
		r = 5	0.063	-0.0028	-9.00E-05	0.00014	0.00016	-0.0009	0.0004	0.00012	-0.0019
		r = 10	0.006	-4.198E-05	-1.00E-04	2.06E-07	-2.88E-05	-0.0006	0.00004	0.00014	-0.00037
	PCIM	r = 1	0.00012	-0.00034	0.00013	1.706E-06	6.36E-06	-0.00081	-9.96E-05	-0.0001	0.00026
		r = 5	0.00013	-0.00038	0.00015	1.899E-06	6.97E-06	0.00089	-1.09E-05	-0.00014	0.00028
		r = 10	0.00015	-0.00042	0.00016	-2.096E-06	7.81E-05	0.0010	-1.23E-05	-0.00016	0.00022

r: denotes the length of the period for which coefficients have been derived; eg. r = 1 for interim period 1; r = 5 for interim period 5; and r = 10 for interim period 10.

NOTES

1. The most likely effect of this is to reduce the actual price of groundnuts.

2. It is a foregone conclusion that the demand for basic food commodities, such as those we have listed earlier, is income and price elastic in most of the LDCs. The root of this lies in the large proportion of the consumer's budget that is normally allocated to satisfy food expenditures. On the other hand, it is price elastic because of the instability of supply of the basic food commodities.
3. Producers in Egypt were given quotas to sell to the government at low controlled prices.

4. Inclusion of imports in the configuration of deficit tends to shadow the dimensions of needs, on the one hand, and the state of food production domestically on the other. This is true in particular since projections for imports appear to be monotonically increasing from 1985 to year 2000 - viz. for 1995, 332 thousand metric tons; and for year 2000, over 350 thosuand metric tons.

5. For this and complete listing of drought-afflicted and drought-ravaged nations in Africa,, See: Africa Research Bulletin, Vol. 21, No.10, November, 1984.

6. These issues were discussed in African Economic Crisis for Coordinated Action; and a subsequent review undertaken since the 1981 report entitled "Accelerated Development in Sub-Sahara Africa: An Agenda for Action". World Bank News; Vol. II, August, 1984.

7. In this .connection, please note the large number of low-income countries that have populations depending on agriculture for livelihood, income and employment. Therefore, a decline in the output of the agricultural sector stands to hurt, not only the individuals directly involved, but also the macro-economic ideals persued by the nation-states.

8. This region includes the Yemen Arab Republic, People's Democratic Republic of Yemen, Djibouti, Somalia and Sudan. For details, See M.A. Gulaid, 1984. This could also apply to any such regional grouping formed in this geographic area.

9. These minor alterations may be necessary, at times, to tailor-make analyses to each individual target country in the region.

10. Recent development in the area of food aid distribution in Somalia is such that a large volume have recently been received to fill in a substantial segment of the country's cereal needs. These have not been incorporated into the model because of lack of data.

11. Instrumental variables are denoted by "hats" and refer to the first stage estimates of the 2SLS process.
12. N.S.: Denotes that the relevant factor is not specified in this model formulation.

13. This is in line with theoretical findings discussed and generated in section 1.3.7.

14. For similar findings, see propositions by Behrman, R. and K.N. Murty. AJAE, Vol. 67, No.3 (pp. 539-549).

15. These may be considered as weighted prices with PRF serving as weights.

16. The period of lag is one year - which implies an average of two seasons or production cycles.

17. D, period may also have an added effect in that Somalia was on a war-footing as a result of 1977 conflict with Ethiopia.

18. The remaining dynamic multipliers, however, cannot be determined from the inspection of the model. Instead, one must perform a simulation in which each exogenous variable is increased appropriately and the resulting changes in the endogenous variables obtained by examining the simulation solution. These are discussed in section 4.3.

19. For similar expositions,, see arguments made in Michael Liption's "Poverty, Under-Nutrition, and Hunger". World Bank Staff Working Paper No. 597 (page 9). The FAO has also suggested likewise. Central to these view, is the argument that an improvement in the infrastructure and welfare-support systems such as health, education, housing and other basic need requisites, in the often remote rural and underdeveloped sectors of the LDCs, fewer calories would be required by the individual to meet his/her physical and biological activities%exertions. Implicitly, reductions in day-to- day exertions, such as walking long distance to get to the market, or by the same token, toiling with hand-implements too long to prepare land for planting, etc., would sufficiently lower the level of calorie requirements.

20. Discussions on the interim and total or equilibrium multipliers will cover this longer-than-short-term implications. This is dealt with in section 4.3.

21. Only under the condition of sustained affluence, presumably beyond ten years in the case of Somalia, would changes away from sorghum-based foods perhaps begin to take place. However, shifts to more superior cereals is already observable in the more affluent and rich urban classes.

22 . On the average, across assumption, ^{pRF} would adjust at 1.88 Shs/Kg. This is lower than the base-year prices received by nearly 25 Cents/Kg.

23 . Comparison of this with base year P^{RT} of 5.50 Shs/Kg. suggests that current retail prices are too high to be economically justified.

24 . This does not take into consideration. other unique factors governing the state of cereal require-ments necessary for the Somali individual.

25 . The impact of this assumption, given the long-run multiplier effects, is that PCDP would improve from 72 kgs. per capita in the base-year to 85 kgs. per capita.

26 Surplus production adjusts upwards from a short-run estimate of 20 kgs. per capita given by the impact multipliers to nearly 156 kgs. per capita as suggested in the long-run period of 10 years by the total multipliers.

27 . The composite effect of assumption 5 would be such that surpluses would be large. This would be small in the short-run (only 84 Kgs/capita) but large over the longer period. Grain surpluses in the vicinity of 285 Kgs./capita may be expected over time.

28 . Increase in c.i.f. import price would affect the overall short-run surplus-deficit conditions only marginally. The impact of this assumption, over an extended period, would dampen to only a triffle. Precisely, the impact of this factor disappears and is rendered mute.

29 The incremental effect of a boost in the level of calorie requirement becomes smaller as time period tends towards infinity. Therefore, greater impact at the start, declining thereafter. Increse in this policy factor would maintain strong cereal deficit greater than 269 Kgs./capita in the short-run, narrowing to slightly over 240 Kgs. per capita in the long-run.

30 . A decline in the calorie requirement has a greater impact over the surplus-deficit conditions in the short-run than in the long-run. The reason is that large surplus stocks usually exert dramatic effects in the short-run than they tend to do in the long-run, simply because there are alternative uses that these large positive stocks could be put to given an extended period of time. This is true especially when something in the range of 423 to 437 Kgs./capita surpluses are in question.

31 . Increase in the level of calorie requirements from historic level tends to worsen the shortage or deficit conditions. The current effect of an 8% boost in this variable tends to produce 19.24 Kgs./capita deficit. Over the ten-year period, the total multiplier effects suggest deficits equal to 8.64 Kgs./ capita, a reduction of over 50% from the preceding short-run deficit.

32 . A decrease in the level of calorie requirement would produce a condition of surplus: 85.12 Kgs. per capita in short-run and a smaller but equally significant amount equal to 72 Kgs./capita in the long-run. This option, therefore, suggests the reverse impact on the state of cereal surplus-deficit conditions as compared to the preceding option.

33 . The increase in the c.i.f. policy parameter exerts large impact over the horizon equal to nearly 26 Kgs./capita. On a relatively shorter span of time, the same policy factor tends to impart a change in the level of surplus generation equal to 16.92 Kgs./capita - a smaller but equally significant effect.

34 . One viable case contained in the assumption underlying this policy definition cannot be totally ignored. Should cereal availability, in aggregate, or the domestic component alone get worse to the extent that individuals barely meet their requirements, then this condition would warrant increse in the calorie requirements by way of increased imports. Under such a condition the assumption stipulated here becomes legitimate.

35 . Note that a comparison with current effects, as suggested by impact multipliers, the long range effect would raise per capita surplus availability from 37 kgs. (in the short-run) to nearly three items that figure-183 kgs. per capita.This is a very large stock of grains that need alternative uses to be explored.

36 . The composite assumption by far, exerts the largest impact on total cereal availabilty. This shock, as suggested earlier, requires a long-term adjustment that eventually produces a per capita availability equal to 318 kgs. The impact multiplier effects are only 89 kgs. per capita. Evaluated on the basis of requirements, the composite shock apparently produces a tremendous amount of cereal surplus that needs efficient and cost-effective disposal methods.

37 . The current period, denoted by short-term, describes the short-run effects of a change in the policy variable(s), in this case, upto 1985. The long-range period reflects the ten-year period for which interim multipliers have been generated and, subsequently, the total or equilibrium multipliers.

38 . In the short-term, the GNP/capita increase does not affect the level of surplus-deficit conditions. This option, nevertheless, can be counted upon to boost the surplus production capabilities of the cereal sector in the long-range perspective.

39 . In every respect, these forecasts may be considered dynamic, since they allow for changes due to temporal effects, thereby adjusting the dependent variables accordingly. The assumption that past trends hold so that subsequent outlooks may be mapped is explicitly stated in the model, viz. X_i= a+bx„ + Ut, where X, denotes the forecast value at period t, X_{t_l} the preceding value of the dependent variable, and where, U, defines the random characteristics of the forecast. For details see, Gulaid, 1985, p.65.

40 . This period 1993-1995, is comparable to that given in the autoregressive time-series forecast. Ibid., p.65.

41 By comparison, the option represented by invoking assumption 2, represents an autarkic condition under which Somalia just satisfies its immediate requirements, buffer stocks and replenishments. This condition does not, therefore, allow for linkage with other countries by way of shipment of cereals in order to resolve deficits.

42 This figure is based on a national requirement of approximately 700 thousand metric tons given under the long-range simulation option in table 5. Reserve stocks are assumed to be 50% of requirements, which in other words, would provide enough cereals for one complete production cycle equal to six months.

43 . Exceptions, in Model III forecast estimates, are the per capita kilogram requirements (Y_6), prices received by farmers (Y_8), and domestic production (PCDP), which normally tend to change slowly through time. The statistics of fit via RMSE and percentage RMSE for these endogenous variablels are found to be small and whithin the desired range as compared to those of the preceding set of endogenous variables.

BIBLIOGRAPHY

Bates, Robert HJ., Markets and States in Tropical Africa - The Political Basis of Agricultural Policies. University of California Press, Berkeley, CA; 1981.

Behrman, R. and K.N. Murty, "Market Impacts of Technological Change for Sorghum in Indian Near-Subsistence Agriculture". In American Journal of Agricultural Economics, Vol. 67, No. 3, August 1985, (539-549).

Brown, Gilber T.; "Agricultural Pricing Policies in Developing Countries". Development Digest. Vol. XIX, No. 3, July 1981.

F.A.O.; Agriculture: Toward 2000. Rome, 1981.

F.A.O.; State of Food and Agriculture 1975. Rome, Italy, FAO, 1976.

F.A.O.; State of Food and Agriculture 1981. Rome, Italy, FAO, 1982.

FAO/WHO: Food and Nutrition Strategies in National Development. Report of the 9th Session, Joint FAO/WHO Expert Committee on Nutrition. FAO Nutrition Meetings Report Series No. 584. Rome, Italy: FAO; and Geneva, Switz.: WHO, 1976.

Gulaid, Mahamoud A; Economic Cooperation Among the League of Arab States. IRTI/IDB, 1985.

Gulaid, Mahamoud A; Scope of Cereal Food Gap in the Yemen Arab Republic, Djibouti and Somalia. IRTI-IDB, 1985.

Haaland, G. and W. Keddeman; "Poverty Analysis: The Case of Somalia". Economic Development and Cultural Change. Vol. 33, No. 4, June 1984, University of Chicago Press.

Hicks, M.J.; "Somalia and Basic Needs: Some Issues". ILO World Employment Programme Research, Working Paper, WFP 2-32 WP8, Geneva, ILO, January 1978.

Huddleston, Barbara; "Closing the Cereal Gap with Trade and Food Aid". IFPRI, Research Report No. 43, January, 1984. (pp. 47-63).

IFPRI; Food Needs of Developing Countries: Projections of Production and Consumption to 1990. Research Report No. 13, Washington, D.C., 1977.

ILO/JASPA; Economic Transformation in a Socialist Framework. Addis Ababa, 1977.

Intriligator, Michael D.; Econometric Models, Techniques, and Applications. Prentice-Hall, INC., 1978.

Johnson, D. Gale and G. Edward Schuh (ed.); The Role of Markets in the World Food Economy. Westview Special Studies in Agriculture Science and Policy; 1982.

Kmenta, Jan.; Elements of Econometrics: Macmillan Publishing Co., Inc., 1971.

Lappe', Frances M. and Josep Collins; Food First, the Myth of Scarcity. Souvenir Press, 1977.

Leipziger, Danny M. (ed.); Basic Needs and Development. Oelgeschlager, Gunn & Hain Publishers, Cambridge, Massachusettes, 1981. (Contains series of papers).

Lele, U.; "The Role of Risk in an Agriculturally Led Strategy in Sub-Sahara Africa". AJAE, Vol. 66, No. 5, December, 1984 (pp. 677-682).

Mellor, John W.; "The World Food Equation; Interrelations Among Development, Employment and Food Consumption". Journal of Economic Literature, Vol. XXII, June 1984 (pp. 531-574).

_____ "Food Price Policy and Income Distribution in Low-income Countries". Econoic Development and Cultural Change. October, 1978, (pp.1-26).

Mikesell, Raymond F.; The Economics of Foreign Aid and Self-sustaining Development. Westview Special Studies in Social, Political, and Economic Development, 1983.

Shultz, Theodore W., (ed.); Distortions of Agricultural Incentives, Indiana University Press, Bloomington, Indiana, 1977 (pp. 83-101).

_____ "On the Economics and Politics of Agricultural Icentives". Development Digest, Vol. XXI, No. 1 July 1983, (pp. 10-21).

Shaw, Timothy M. (ed.); Alternative Futures for Africa. Westview Special Studies on Africa. Boulder, Colorado, 1982.

Theil, Henri; Principles of Econometrics. John Wiley & Sons, INC., 1971.

Tolley, George S. et.al.; Agricultural Price Policies and Developing Countries: The John Hopkins University Press, 1982.

Valdes, Alberto (ed.); Food Security for Developing Countries. Westview Special Study, Boulder, Colorado, 1981.

ADDENDUM

This study was completed in 1986. Since then several regional institutions have been established in the region. Of particular relevance to this study is the Inter-Governmental Authority on Drought and Development (IGADD) which brings together the countries in the Eastern Africa Region of Sudan, Ethiopia, Uganda, Kenya, Somalia and Djibouti.

IGADD's major priorities include, among others, food security, remote sensing for early warning systems, traditional storage and food reserves management, infrastructure development, trade promotion, desertification control and protection of the environment to mention only a few. For instance, in its Workshop held in Djibouti, during 25 February to 1 March 1990, several far-reaching recommendations were made by the participants. The studies prepared for this occasion presented tangible project profiles that explored methods of circumventing some of the region's bottlenecks in the areas listed above.

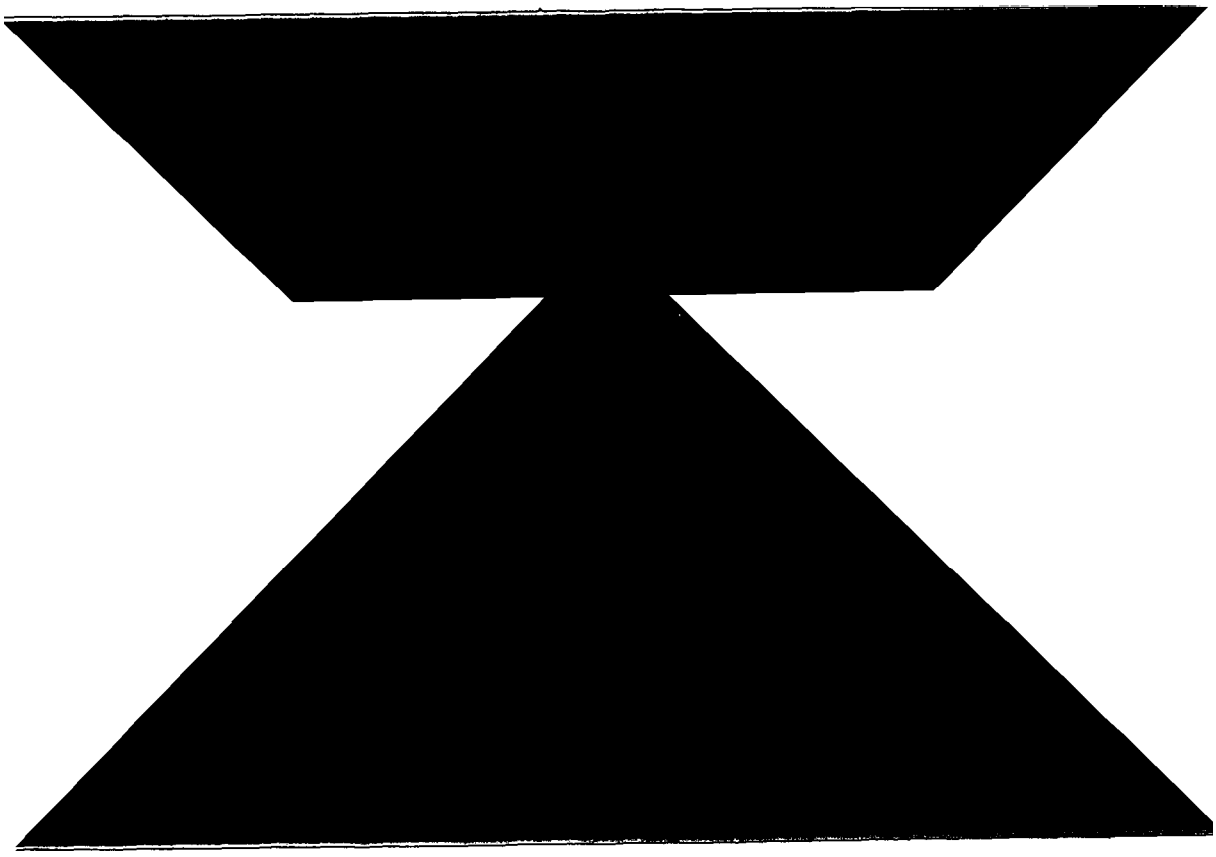
Significant among the profiles presented was a project that envisioned formation of a Cereal Food Fund. The Fund would finance cereal food stocks required by the member countries of IGADD. This would be designed with the objective of eliminating one of the most serious and nagging problems of the region, viz. cereal food shortages. The recommendations put forth by country representatives and participating donor groups regarding the formation of the Fund was considered, in the opinion of the majority, a positive step in the right direction. It was resolved in this forum that greater attention should be focussed on the real-world issues facing the region thereby improving the capability of IGADD to resolve the food shortage problems encountered.

A similar recommendation suggesting the formation of such a Fund was made in this IRTI study though for a different combination of countries and under different methodological specifications. The terms of reference for the IGADD and IRTI studies may have been defined to address somewhat different perspectives, but it should, nevertheless, be stressed that there appears to be, at this time, a strong merging of ideas on the part of these applied research studies to resolve the problems envisioned.

Be that as it may, the role of the International Donor is a pivotal one in this matter, particularly when and if ideas formed in such a forum as IGADD, need to be taken up in order to shape a concrete plan of action that is amenable for implementation. IDB, in this context, has a unique role in that its member countries are overwhelmingly represented in this geographic definition of the region in

question. Taking this into consideration, it is reasonable to assume that IDB would take up a leading role, as it had always done in the past, in financing some of those streams of bankable projects and programs that may be proven to bear optimal results.

Taking these new developments into consideration, it might be timely to suggest that IDB constitute a unit in the Bank that would be composed of experts from the Projects and Operations Department, the Trade Promotion Department and other relevant departments, whose terms of reference would include, among other things, (i) to carefully study the objectives, programs, and projects proposed by IGADD in its last Workshop and in the First Donors' Conference held in 1987; (ii) to analyze these positions in the context of likely participation by the IDB; (iii) to synthesize a comprehensive policy stance that would define IDB's role and level of participation in these projects and programs; and (iv) to explore how best to tailor-make this policy position with respect to the Sahel and other OIC regional groupings which are exposed to similar problems.



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