DEVELOPMENT ALTERNATIVES IN EGYPT IN 1974/75

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
SAKR AHMED SAKR

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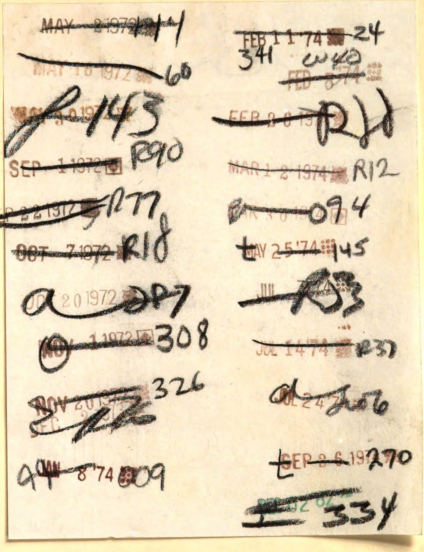
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ABSTRACT

DEVELOPMENT ALTERNATIVES IN
EGYPT IN 1974/75

By

Sakr Ahmed Sakr

The purpose of this study is to construct a macro economic model for Egypt that can be used for the purpose of projection planning. The model divides the economy into the following sectors: Three production sectors (industry, agriculture, and services), household, government, finance and foreign sectors. The model defines the major economic flows in the economy, as well as defining the major limits to growth by 37 variables. To determine the values of these variables in the target year (1974/75), 37 independent equations are postulated.

The intensive effort of the Egyptian government to raise the rate of growth of the economy during 1957-66 has resulted in large structural transformation that strained the balance of payments. At the same time, public consumption has increased considerably. To overcome these two bottlenecks, foreign borrowing increased sharply.

The model is constructed so as to reflect the structural characteristics of the economy. The problems

related to the large structural transformation point to a period of proportional expansion in the major production sectors of the economy as a growth strategy. The feasibility of this strategy is further supported by the accumulated evidence against the existence of disguised unemployment in agriculture. This strategy is incorporated in the model by specifying proportional expansion for the different production sectors. The completion of the High Dam will result in an increase in the cultivated area by 20%, which will make it possible to overcome the balance of payments difficulties through its effect on food imports. This is allowed for in the model by assuming that food imports will be zero in the target year. Furthermore, saving rate, trade policy and foreign borrowing are chosen as policy instruments that could be changed within limits, while public consumption, full employment, and the level of income represent the targets that have to be achieved.

The solution of the model, makes it possible to generate some consistent sets of alternative development programs for the target year, each subject to different assumptions about the values of the policy variables mentioned above. These alternative programs provide the planners not only with the flexibility required for the decision making process, but also with the advantage of readily substitutable programs and many other programs that could be worked out quite easily in case of any uncertainty.

The model can also be used to identify whether the saving bottleneck or the foreign exchange bottleneck is the most restrictive one for growth. In the case of Egypt, it is found that the saving bottleneck is most restrictive up to an annual rate of growth slightly below 6%. In addition, the model can help choose among alternative programs or alternative policy-mix subject to certain values of the policy instruments or the targets respectively, provided that it is possible to construct a social welfare function that reflects the welfare implications of each solution.

The model, however, has some limitations that reduce its operational value. It is of a comparative static nature, and thus, it does not specify the time path of the variables of the model from the base to the target year. In addition, the limited sector division of the production activities, which is necessitated by the availability of data, will tend to give the model an optimistic bias due to the neglect of any possible bottleneck that might occur in any of the sub-sectors. This latter defect could be overcome by subjecting the most promising programs to a detailed input-output analysis, to examine the sub-sectoral effects of each program.

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DEVELOPMENT ALTERNATIVES IN EGYPT IN 1974/75

By

Sakr Ahmed Sakr

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PREFACE

The chief purpose of this study is to construct a macro economic model for the Egyptian economy that could be used for projection planning and policy analysis. My interest in such problems stems mainly from the interest acquired during my work as a research assistant at the Institute of National Planning in Cairo in 1962-64, and from my belief that improvements in policy making is a necessary, though not sufficient, condition for ellevating the problems of underdevelopment that most of the developing countries now suffer from.

This study is part of a program arranged by the I.N.P.C. The program was partly financed by the Ford Foundation and the I.N.P.C., and the author wishes to thank both institutions, as well as the Egyptian Government for their support. I would like also to express my thanks to the staff of the U.A.R. Cultural and Educational Bureau in Washington D.C. for their cooperation and help.

During most of the time I was working on this study, I received a research fellowship from the Institute of Business and Economic Development at Michigan State University, and the author wishes to thank the Institute

and its director, Professor Dale Anderson for his help and encouragement.

I would like to express my deep thanks to Professor Anthony C. Koo, the chairman of my dissertation committee, for his helpful guidance, suggestions, and encouragements. I wish also to thank Professor John P. Henderson, Associate Professor Carl Liedholm, and Professor Suhbiah Kannappan for their cooperation.

Special thanks go also to Professor Jan Kmenta for his helpful comments, and to Professor Bent Hansen for providing me with parts of his work about Egypt, that was not available to me.

My thanks are also due to a lot of my colleagues and friends, especially for Dr. Ragaa Hassan, for their help and stimulating discussion.

I would also like to express my thanks to my family in Egypt, and especially for my uncle, Professor Ibrahim Sakr, and my brother Mohamed Sakr, for their continuous encouragement and moral support.

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CHAPTER I

INTRODUCTION

1. Introductory Remarks

Up to the end of 1956, the Egyptian economy was mainly a private enterprise economy with some direct, though limited, government intervention. Starting from 1957 (immediately after the end of the Suez Crisis of 1956) foreign economic influence, which was prominent in many fields, was liquidated by the government, and the Egyptian economy became a mixed economy from an ownership point of view. A series of land reforms, Egyptianization and sequestration, nationalization, and also through direct government investments helped to achieve this result.

The early efforts of the new regime, that came to power in 1952, to enhance economic development concentrated on the construction of specific projects, where the emphasis in planning was given to demand and cost conditions. In time, the authority became concerned that while such work was important, it was too partial and micro oriented to achieve optimum economic results. Thus, it was not until 1957 that planning on a broad scale was introduced

in Egypt. In that year, two five-year plans, one for industry and the other for agriculture, were adopted and started.

This shift towards more planning was reinforced with the adoption of the first Comprehensive Five Year Plan covering the period July 1, 1960 - June 30, 1965. This plan, which could be considered an extension of the two plans mentioned above, consisted mainly of an investment plan plus a forecast for the rest of the economy. A fundamental sutdy of the possibilities of implementing the plan does not seem to have been undertaken, however. The long term goal was to double national income over a ten-year period comprising two successive five-year plans. In order to achieve this objective, the planners worked out that a 40% increase in national income was required for the first five years, corresponding to a compound growth rate of 7% per annum.[1]

Despite the fact that the goals of the First Five Year Plan has not been fully achieved, the economy has been making impressive progress. Real income grew at an annual rate of 5.5% per year.[2] With this rapid expansion, the

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[1] I. H. Abdel-Rahman, "Comprehensive Economic Planning in the U.A.R.," Memo no. 196, I.N.P. Carrio, 1962.

[2] B. Hansen, "Planning and Economic growth in the U.A.R. 1960-5," Egypt Since the Revolution, in P. J. Vatikiotis, ed. (London: George Allen and Unwin, 1968), p. 31.

deficit in the balance of payment has been substantially growing which is an indication of the strains put on the balance of payment by an active policy to boost the growth rate of the economy. A great part of these deficits have been covered by capital inflows with the result of the sharp increase in the country's indebtedness abroad.

The second plan (for 1965/66 to 1969/70) was supposed to complete the goal of doubling national income in ten years. This goal was reconsidered, and early in 1966 it was decided to extend the period of execution to seven years. It should be mentioned, however, that the second plan was not formally laid down. Developmental activities continued through these years through investment expenditures in the government budget (disregarding 1967 and probably 1968, where the economic development was slowed down as a result of the war of June 1967).[1] It has been mentioned recently that the planners are working on the preparation of a third plan to cover the period from July, 1970 - June, 1975, but no formal document has appeared yet.

The experience of planning during the First Five Year Plan showed that raising the rate of growth of the economy was not the worst problem that faced the planners. Rather, the significant divergencies from the plan were in

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[1] The ratio of gross investment to gross domestic product averaged 17.9% from 1960-1966, but it reached 14.9% in 1967 and 12% in 1968.

the use of resources. The essential problem facing the planners, thus, will be related to plan implementation and the policies necessary to carry it out. If the country has to improve its balance on current account, while maintaining a high rate of growth, there should be a solution to the problem of making private and public consumption grow more slowly than gross national product, and this may mean increased taxation, while wages and salaries will have to be prevented from increasing in step with productivity. Also, increased attention has to be given to the principle of comparative advantage in planning for new industries.

2. Purpose of the Study

The main purpose of this study is to analyze the main development alternatives that are feasible for Egypt in the coming few years, given certain conditions and constraints that are determined by the characteristics and resources of the economy. By development alternatives it is meant a set of consistent and feasible alternative programs for the target year (1974/75) where each program consists of consistent numerical values for a group of key economic variables that are included in the model. The base year chosen for this study will be (1965/66) the latest year for which data is available, and where there was no war time disturbances.

The analysis of development alternatives will be done through the use of a macro-economic model to be

constructed in this dissertation. The advantages behind the use of such models for development planning are numerous: the use of a macro-economic model helps to check the internal consistency of development plans; the impact of changes in broad policy instruments can be computed on policy targets thereby having development alternatives which satisfy part of the need of the planners to know the effects of alternative policies; these development alternatives, furthermore, gives the planners the flexibility that enables them in making policy decisions; and, finally they provide ready substitutes to the existing program, when the value of key variables diverge from their anticipated level. This last point is of crucial importance since, with the situation in the Middle East as it is nowadays, the planners work in a world full of uncertainty. For all these reasons, emphasis will be placed in this dissertation on preparing a set of development alternatives rather than a single program, where the set of alternative programs are defined by the feasible degree of restriction in the relevant instruments, objective variables, and institutional limits.

A development program must be defined within the context of the planners' desired objectives, the instruments that are readily available to the planners, and the limitations imposed by the structure and characteristics of the economy in question:

a. Policy objectives.

The desired objectives of a developing economy can usually be found among the following: rapid increase in per capita income, full employment, a specific income level by a given year, relatively stable prices, improvements in the allocation of factors of production, and a more equal income distribution.[1] The order of priority of objectives that are in fact selected depends on the economic structure of the country in question, the existing disequilibriums, the preference of the various policy makers and their influence.

Based upon the study of the structural characteristics of the Egyptian economy (in Chapter II), it will be shown in Chapter III, that the goals chosen for this model (those which the planners ought to aim at) are the following: (i) maximum gross domestic income (hereafter G.D.Y.), (ii) a fixed level of public consumption (for military and welfare considerations), (iii) full employment, and (iv) a certain level of net foreign borrowing (foreign savings).

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[1] For further detail on this point, see Etienne S. Kirschen and Lucien Morissens, "The Objectives and Instruments of Economic Policy," in Quantitative Planning of Economic Policy, Bert Hickman ed. (The Brookings Institution, 1965), pp.111-133.

b. Instruments.

Among typical instruments[1] one could find tax policy, trade policy, allocation policy, instruments of direct controls such as the control of foreign exchange, foreign trade, prices or other controls on the internal economy, and foreign aid or borrowing. It is important to note the following:

i) Some instrumental variables also partake the nature of policy targets in their own right. An obvious example is government expenditure which may be desired for its direct contributions to welfare in addition to its indirect effect on investment, employment and other target variables.

ii) Some of the instruments used for one objective may have effects on other objectives and some instruments may interfer with each other. Also, the objectives may be found to be independent, complementary, or conflicting. These various interactions may reinforce the efficiency of the instruments, but may also weaken their effects and lead to conflicts that can only be solved by choice.

iii) The use of an instrument to achieve an objective is not without cost to the economy. For example, both a higher level of consumption and a faster rate of

[1] See Ibid, and H. Chenery, "Development Policies and Programmes," Economic Bulletin for Latin America., III, No. 1 (March, 1958), pp. 50-60.

growth are among the common objectives of developing economies that would be achieved, ceteris paribus, with larger amounts of foreign borrowing. Foreign borrowing, on the other hand, is usually thought of as an instrument which can only be obtained at cost. This implies that there is trade off possibilities between the benefits of reaching a chosen objective and the cost of the instrument. All such considerations suggest the necessity of preparing a set of development alternatives rather than a single development program.

In Chapter III, the policies chosen to achieve the objectives chosen for this model are the following: (i) the value of net foreign borrowing or foreign saving; (ii) the value of exports of the industrial sector through changes in various instruments of trade policy such as exchange rate, export subsidies, and the like; and (iii) the saving rate.

c. Institutional Limits.

The more common restrictions or institutional limits are those imposed by the structure of the economy such as balance of payments constraint, supply of saving, the efficiency of factor use and its change over time, the existing factor supply, and the rate of population increase. It is also desirable to include restrictions which reflect both the limited flexibility of the economic system and the political limits to feasible policy changes. The

introduction of such constraints makes the conclusions more realistic, although the results are less susceptible to generalization in the form of simple decision rules.

The institutional limits chosen in this study are the following: (i) foreign savings; (ii) the saving rate; and (iii) the rate of increase in labor productivity.

A word of caution is necessary, however, since there is a tendency to expect too much from planning models. The formulation of a development program is bound to be difficult insofar as there is no theory of development that can be readily translated into a development program. In addition, the ability to formulate such programs has also been severely limited by the lack of requisite data and the imperfect character of such statistics as are available. Recently, there has been some progress in most underdeveloped countries in overcoming the deficiencies in empirical information and in improving planning methods. But regardless of the improvements in the evolution of planning models, the policy maker cannot escape from the making of value judgments, and political decisions are still required.

3. Method of Study

Once the structural characteristics of the Egyptian economy has been determined and the objectives and instruments are chosen, the essential task is to use this

knowledge to construct an economic model that can be used to find a set of feasible and consistent development programs for Egypt for the year 1975.

The functions of an economic model for policy purposes are to determine consistent sets of economic policies and to facilitate the choice among them. The nature and results of development policies are represented by the variables of the model. For the purposes of the model to be constructed in this study, these variables must include the principle elements affecting the rate of growth of the economy such as the existing factor supply, the rate of population increase, the rate of saving, the efficiency of factor use and its change over time, the inflow of foreign resources, the present and future composition of demand, and the ability to plan and carry out development activities.

Drawing on J. Tinbergen's and H. Theil's theories of economic policy, the variables of a policy model could be divided into:[1]

a) predetermined or exogenous variables;

b) instrument variables (i.e., those subject to government control);

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[1] H. Theil, Economic Forecasts & Economic Policy (Amsterdam: North Holland Publishing Company, 1961) and J. Tinbergen, Economic Policy: Principles and Design (Amsterdam: North Holland Publishing Company, 1956).

c) objective variables (i.e., those reflecting the aims of policy and they may be either fixed or variable); and

d) other endogenous variables (i.e., those that are irrelevant for policy analysis).

These variables will be related to each other in the form of equations which express certain economic relationships, that may describe either:

a) the behavior of an economic entity in terms of the response of one economic variable to a change in another variable (as the consumption function);

b) a technilogical relationship (as the production function); or

c) take the form of an accounting identity that must hold true in any economy (as the equality of total demand and supply).

It should be noted that a development model provides a systematic framework for economic programing; the purposes of economic programing, in turn, is to provide for an effective government economic policy which is consistent with the goals pursued. The nature of the development program, and consequently the type of model, will differ in accordance with the characteristics of the economy in question, the nature and extent of government intervention, and consequently the types of

instruments used, and the availability of data.[1] The type of model that is finally chosen would be the result of a deliberate decision on the part of the model builder, who should balance the merits and demerits of using other different types before making his choice.

It is to be noted that the model to be constructed in this dissertation will not be dynamic in nature (that which specify the movement over time of the variables defined by the model), but a projection model (that which accounts only for two time periods, the base and target years) of the Chenery and Bruno type.[2] Since we are concerned with constructing a terminal year model for the Egyptian economy, there exists no need to specify in a complete way the path the economy has to follow from a given initial point to the terminal configuration. Thus the model may be said to give a perspective rather than a plan. However, this construction of a terminal configuration is an essential ingredient in any finite horizon planning model so that the model will provide some guide lines for the planners, even though it does not specify a complete time phased course of action.

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[1] For further details on this point, see the U. N., "Use of Models in Programing," Industrialization and Productivity Bulletin, 4 (April 1961), pp. 7-15.

[2] Hollis Chenery and Michael Bruno, "Development Alternatives in an Open Economy: The Case of Israel," The Economic Journal, Vol. LXXII (March, 1962), pp. 79-103.

The comparative static nature of the model does not mean, however, that in estimating the parameters to be used in this model it is not necessary to take into account, as much as possible, the probable changes in the structure of the economy between the base and target years.

4. Plan of the Chapters Ahead

Chapter II contains a study of the structural characteristics of the Egyptian economy in order that they may be incorporated into the model, so that the model will have a realistic setting. It will also be concerned with identifying in advance the factors that may prove effective limits to growth. The emphasis throughout this chapter will be on planning and policy problems in Egypt in recent years.

Chapter III will be concerned with the development of the analytical tools required for the model:

a. The analysis of Chapter II will be used to determine which goals should the Egyptian planners seek to achieve. Needless to say that this does not need to be the same goals determined by the planners, i.e., that there will be some value judgments involved in the process of selection. It needs to be stressed, however, that the usefulness of the model will depend on the extent to which the determined goals address themselves to the basic problems facing the Egyptian economy.

b. The policy tools will also be specified. The initial study of development problems and possibilities in Chapter II will be designed to permit a choice of policy instruments in the different fields. Such factors as the extent of excess demand for imports, the future amount of unemployed labor, the magnitude of shift in resources needed in particular sectors, and the importance to the rest of the economy of a given investment, can only be determined from such an analysis.

c. The division of the economy into sectors. Here it should be noted that while a greater sector breakdown is more preferable, since it will allow for the discovery of any bottlenecks that may arise in any of the sub-sectors, the final decision will depend on the availability of data.

Chapter IV will be concerned with constructing the model itself which will contain all the last elements. In addition, the range of variation in policy variables; i.e., goals, instruments, and institutional limits will be specified.

In Chapter V, the model will then be solved abstractly in terms of the policy variables, parameters, exogenous variables, and base year variables. It should be observed that there is no need to work with the complete structural model of the economy. Instead, the irrelevant endogenous variables will be eliminated through algebraic manipulation until one is left with a set of equations

expressing the target variables in terms of the instruments, exogenous variables, parameters, and base year variables.

The second section of Chapter V includes the estimates of the exogenous variables and of the parameters that appear in the behavioral equations. It should be noted that these estimates are for the target year of the model (1974/75), and, therefore, they must reflect, as far as possible, any expected change in the behavioral or technological relation in question.

The final section of Chapter V, will be concerned with determining a number of feasible and consistent sets of development programs which can be obtained by varying the values of the policy variables chosen in this study over their relevant range.

Chapter VI contains an analysis of how the model could be used in determining the bottlenecks that may prove to be effective limits to economic growth in Egypt, and how it could be used for the choice among the different types of policies and objectives.

Finally, Chapter VII includes the final conclusions of this study and the recommendations and limitations that were induced by the results of the preceding chapters.

CHAPTER II

STURCTURAL CHARACTERISTICS OF THE EGYPTIAN ECONOMY

1. Introduction

It is important to take the structural characteristics of the Egyptian economy into account in order to give the model a proper and realistic setting. This is due to the fact that the main problem in designing this type of models is to identify in advance the factors that may prove to be effective limits to growth. When one of these elements is omitted, then it is implied that whatever changes take place in this element will not significantly affect the parameters of the model.

It must be mentioned, however, that it is beyond the scope of this chapter to review in detail the structure of the Egyptian economy and its past development. There already exists a large number of recent books doing such a job[1] and, therefore, what needs to be done in this

[1] See Bent Hansen and Girgis Marzouk, Development and Economic Policy in the U.A.R. (Egypt) (Amsterdam: North-Holland Publishing Company, 1965); Magdy El Kammash, Economic Development and Planning in Egypt (Prager, 1966); Charles Issawi, Egypt in Revolution an Economic Analysis (New York: Oxford University Press, 1963); Donald Mead, Growth and Structural Change in the Egyptian Economy (Homewood, Ill.: R. D. Irwin, Inc., 1967); and Patrick O'Brien,

chapter is only to review briefly these structural characteristics and how they could be included into the model.

2. Historical Background

The economic history of Egypt in the last 170 years falls into three unequal periods. The first period (which goes roughly from the 1800's to the great depression) started with the regime of Mohamed Ali [1805-49) who attempted to effect a transition from the subsistence economy prevailing at the beginning of the 19th century to a modern complex economy. His attempts of forced industrialization failed largely due to the lack of political autonomy required to protect infant industries and to support certain important sectors.[1] With the failure of Mohamed Ali's industrial plans, the attempted leap from a subsistence to a complex economy had failed, and instead, the country had landed on the road leading to an export oriented economy. Egypt could now be integrated, as an agricultural unit, with a world wide economic system largely due to converting the economy into a highly specialized one-crop economy (i.e., cotton). In the last three decades of this period, roughly from 1900-1930, the growth of the Egyptian economy has been characterized by

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The Revolution in Egypt's Economic Systems 1952-1965 (London: Oxford University Press, 1966).

[1]Issawi, op. cit., pp. 23-24.

proportional expansion with agriculture playing a consistent and predominant role from both income and employment points of view.[1]

The second period started with the great depression of the 1930's, which resulted in a fall in the price of cotton on which Egypt was mainly dependent as its major export. With these changes in relative prices and the rate of return on capital in favor of manufactured industrial products, domestic capital turned its interests from agriculture to industry. This process has been intensified by several other factors, all of which are responsible for starting the modern process of industrialization in Egypt. These other factors are (1) around the same time of the shift in relative prices [1930], the country gained the control over its tariff which made it possible to protect domestic industry; (2) the efforts of Bank Misr which was founded in 1919 to promote local industrial and commercial enterprises by combining the functions of an investment trust with deposit banking and thereby is similar to such banks that led the early industrial development in some European countries;[2] and (3) the existence of

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[1]Mead, op. cit., p. 16.

[2]Alexander Gershenkron, Economic Backwardness in Historical Perspective (Cambridge: Harvard University Press, 1962.

a fairly mature infrastructure. All such factors have helped to make the 1930's a decade of impressive advance.

The basic characteristics of growth of the Egyptian economy since the 1930's, therefore, is one of structural transformation. In absolute terms, agriculture has retained a primary role in the economy, but the major impetus for growth has come from other sectors of the economy. Manufacturing industry has grown rapidly, although from a small base and also services have grown considerably.

The early attempts of industrialization were unable, however, to bring about any radical change in Egypt's per capita income. From 1928 to 1948, domestic production per capita rose by about 1/4% per annum, and from 1948 to 1956 it stagnated completely.[1] This was due mainly to the increase in the rate of growth of population and to the slack after the Korean boom.

The third period starts with 1956/57 where the annual increase in per capita income often reached 3 to 4%. Thus, the 1956/57 represents the demarcation line between stagnation and development. It is on this most recent period that the following discussion will be concentrated.

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[1] Hansen and Marzouk, op. cit., p. 5.

3. The Demographic Situation

The following table shows the growth of the Egyptian population since the first reliable census.

Table II.1--Population growth in Egypt.

Year	Population	Annual Compound Growth Rate During Inter Census Years (%)
1897	9,715,000	--
1907	11,287,000	1.51
1917	12,751,000	1.23
1927	14,218,000	1.09
1937	15,933,000	1.15
1947	19,022,000	1.78
1960	26,089,000	2.45
1966	30,139,000	2.54

Source: Up to 1960, population censuses, and for 1966, Statistical Handbook U.A.R. 1952-1966 (Cairo: Central Agency For Public Mobilization and Statistics, 1967), p. 7.

This table shows the acceleration in the rate of growth during the 1940's and 1950's. This acceleration may be expected to continue for some time to come due to the decline in the death rate unaccompanied by any appreciable fall in the birth rate.

It is clear from these data that Egypt has not yet made any substantial demographic transition; it is not even in the process of doing so. With increasing urbanization and industrialization, it is hoped that the whole custom and outlook of the population will change to result in a decline in birth rates.

As a result of these developments, the Egyptian population has become younger than before: the average age of population has fallen from 25.8 years in both 1937 and 1947 to 24.4 years in 1960, as could be seen from the following table which shows the percentage age distribution of the population.

Table II.2--Population by Age Groups, 1907-1960 (Percentages).

Age Group	1907	1917	1927	1937	1947	1960
0 - 9	30.1	28.0	27.5	27.2	26.4	36.0
11 - 19	18.5	20.3	20.3	20.5	21.7	15.7
20 - 29	18.0	15.5	16.4	15.2	15.1	12.8
30 - 39	14.7	13.5	14.1	14.7	13.8	12.6
40 - 49	9.0	9.0	9.2	10.1	10.4	9.6
50 & Over	9.7	13.7	12.5	12.3	12.7	13.6
	100.0	100.0	100.0	100.0	100.0	100.0

Source: Population Censuses, Sample Survey of Labor Force, May, 1961.

Thus, it is clear, that the dependency ratio has increased, i.e., to every ten people between 15 and 60 years of age, there are 8.5 children under 15. This, of course, has a bad effect on saving and investment because of the increase in consumption.

It is to be noted that starting in 1962 the government began a serious campaign to convince the public of the importance of birth control and to educate them on various possible methods. But so far this does not seem to have any effect on fertility.

The important question that needs an answer now is how large will Egypt's population be in the target year (1974/75), i.e., what is the expected rate of growth of population?

As it was shown in Table II.1, the rate of growth was 2.54% from 1960 to 1966. If one assumes that the current government efforts to reduce fertility will start to show some results, then an assumption of 2.5% per annum seems to be accurate enough. This will give a total population equal 37,139,000 in 1975.

The expected increase in the labor force during the future period will depend on what happens to the participation ratio. If this does not change, then the labor force will grow by the same percentage as the total population. In recent years (during the first Five Years Plan), participation ratio increased slightly more than

the growth in population. It has actually declined slightly for males and increased slightly for females. The former tendency is expected to continue during the coming few years due to a related fall in child labor as a result of improving educational opportunities. Matters are less clear with respect to the extent of increase with the participation ratio for females. Participation of women is difficult to define precisely in agriculture since it is a function of demand and employment opportunities, and due to habits and tradition married women may still be prevented from working outside family enterprises. Change in social attitudes towards women's work would be a factor in increasing the participation ratio for women.

For all these reasons, it might be beneficial to assume a rate of increase in labor force slightly larger than the rate of increase in population, i.e., of about 2.6%.

It may be mentioned that available statistics do not show the annual figures of the labor force (these are available only for census years). Since full employment was chosen as a policy objective for the model, the only alternative is to apply to the employment figures given in the base year of the model (1965/66), the rate of growth assumed for the labor force (2.6% per annum). The resultant figures will give the total amount of labor force that has to be employed by the target year (1974/75) in order to achieve the full employment goal. The following table (Table II.3) the development of employments in the

different production sectors for the period 1959/60 - 1965/66 is noted.

The full employment goal will, therefore, be achieved if employment in the target year (1974/75) reaches L_s (74/75) = 7,494.9 $(1+.026)^9$ = 9,440.576.[1]

4. The Development of Agriculture

a. General Survey

As it was mentioned earlier, the center of gravity of the economy has shifted from agriculture towards manufacturing and services since the 1930's, slowly but decisively. Inspite of this shift, however, Egypt is still in many ways very much dependent on agriculture. As of 1966, almost 30% of income and over 50% of employment were derived from this sector.[2] This dependence is most clear in the areas of foreign trade, where the overwhelming majority of the country's exports are agricultural, at least in origin, although some have gone through substantial processing before being exported. Furthermore, a substantial part of the activities in other fields, such as commerce, finance, and transport are centered around the processing and handling of agricultural products.

It is to be recognized that Egypt differs from most underdeveloped countries in that it has already had its agricultural revolution. The factors behind such revolutionary change took place through the introduction

[1] This figure is in 1,000 laborers.

[2] Statistical Handbook, op. cit., pp. 220-221.

Table II.3--Development of Employment (In 1,000 laborers).

Sector	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Agriculture	3,245.0	3,600.0	3,600.0	3,623.0	3,673.0	3,751.0	3,857.0
Industry	798.7	804.7	957.1	1,059.0	1,141.8	1,188.2	1,188.2
Services	1,962.3	2,107.2	2.099.8	2,177.2	2,270.2	2,371.4	2,449.7
Total	6,006.0	6,511.9	6,656.9	6,868.2	7,085.0	7,310.0	7,494.9

Source: Statistical Handbook, op. cit., p. 221.

of cotton with perennial irrigation by canals under Mohamed Ali; the rapid expansion of cotton cultivation during the American Civil War; the huge irrigation works; and the various measures to intensify production after the First World War. As a result of these developments, Egyptian agriculture is now marked by a highly developed system of irrigation, a labor intensive technique, intensive use of fertilizers, and dependence on cotton as the major cash crop and as the main item in exports.

As a result of this, agricultural techniques are relatively advanced, while output-productivity in agriculture has continued to increase during the recent period. Not only yields per acre are rising, they are also impressively high in absolute terms. Output per acre in Egypt ranked 14th for wheat, 12th for maize, third for rice, first for check peas, lentiles, and millet, and fifth for cotton (30% above the U.S.).[1]

This is not to deny that increases in agricultural output could be achieved through such means as more widespread use of higher yielding seeds. But the scope for such relatively simple and cheap improvements is limited. Besides this, with some additional capital for better irrigation control, with educated farmers, it might be possible to attain a 30% higher yield. But Mead is

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[1]Mead, op. cit., p. 75.

skeptical that such a large scale increase in agricultural output represents an attainable and wise short run target (within the coming four or five years).

But it should be pointed out that while it may be difficult for Egypt to achieve large scale increases in agricultural output, it is possible to achieve a large increase in agricultural income by shifting output to more profitable products. This is what has been called by Issawi that Egypt is due for a second agricultural revolution.[1] This should be one of the basic problems facing the Egyptian planners. In the past, the government has encouraged grain cultivation, the economic rationale behind such policy is extremely doubtful. An increase in food imports is not necessarily something bad if it is matched by exports of alternative crops with higher value. The essential point to be remembered is that Egypt's soil is much too precious, and its water is too scarce to be wasted on wheat and maize which are better left to countires practicing extensive cultivation, like Canada, United States, or Australia. On the other hand, exclusive reliance on cotton as the major export of the country is admittedly dangerous, and diversification is necessary, but this must be in the direction of increasing the country's real income.

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[1] Issawi, op. cit., p. 127.

In support of this point, W. F. Owen has shown that before the construction of the High Dam, the cropping rotation, which has been closely determined by water availability, need no longer dominate. Egypt now faces the possibility of reorganizing its crop roation, by abandoning wheat production, and concentrating her land and water in areas where she has greater comparative advantage such as rice, maize, and oil crops as well as sugar and vegetables.[1]

The following table shows the costs and returns per feddan of main crops for the period 1954-1957.

Table II.4--Costs and Returns of Main Crops, Per Feddan (L·E·), 1954-57.

	Costs of Cultivation	Net Income (including rent)
Summer Crops		
Cotton	21.7	44.6
Rice	17.9	17.1
Millet	16.6	9.4
Sugar Cane	38.4	49.3
Winter Crops		
Wheat	13.9	16.3
Beans	8.4	16.3
Berseem	7.6	29.8
Onions	25.7	40.9
Barley	9.1	12.5

[1] W. F. Owen, "Land and Water Use in the Egyptian High Dam Era," Land Economics, Vol. XL, No. 3 (August, 1964), pp. 277-293.

Table II.4 (continued)

	Costs of Cultivation	Net Income (including rent)
Autumn Crops		
Maize	13.2	8.8
Vegetables		
Summer	32.5	11.0
Winter	20.5	37.5
Autumn	36.5	11.5
Fruits		
Oranges Grapes Mangos Figs Bananas	68.0	100.0

* * The required change in Egypt's agricultural policy is necessitated by several factors, important among which is the large increase in population. Over the period from 1937 to 1960, population increase reached 64% while the increase in food production reached only 46%, resulting in a 10% fall in per capita food supply from domestic production. With per capita income low as it is, an improvement in average real consumption per capita will necessarily involve an increase in food imports, thereby adding to the balance of payments difficulties. A shift

in the agricultural policy will help to overcome these difficulties.

Another important factor is the rapid growth in the neighboring regions of West Europe, East Europe, and the Middle East. The Egyptian soil, climate, location, and abundance of labor points to it as a vast vegetable, fruit, and flower garden for these neighboring regions. Exports of fresh and canned fruits and vegetables, jams, flowers and dairy produce is now possible due to the development of air transport and refrigeration. It should be mentioned that these changes will require large capital investments in processing plants, refrigeration, transport, and far reaching organizational changes in marketing. Provided there will be price incentives all the way through,[1] the only problem that could face these developments is whether such markets, especially those of West Europe, will be open to Egyptian output.

To summarize, it seems clear that substantial gains for Egypt can be realized through improved drainage and irrigation, through increased use of chemicals (fertilizers and pesticides, etc.), improved cereal seed varieties, and a change in the composition of crops towards more profitable crops. The major additional

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[1]Egyptian farmers have been shown to respond easily to price changes in cotton cultivation. See R. M. Stern, "Price Responsiveness of Egyptian Cotton Producers," Kyklos, Vol. XII, Fasc. 3 (1959).

benefits that have not been discussed yet are the benefits accruing from the High Dam at Aswan, which we are going to discuss in the next sub-section.

b. The High Dam

The work on the High Dam started in 1958. During the first few years of construction (up to 1964/65) approximately half the amount of investment was spent while the benefits started to appear since 1964/65. The project will influence both agriculture and industry in Egypt. For the former there will be a substantial increase in the cultivated area which is estimated to reach 1.3 m. feddan through land reclamation [the cultivated area in Egypt reached 5.9 m. feddan in 1960].[1] At the same time it will enable the abolition of the basin system in upper Egypt which reached 0.7 m. feddan,[2] thereby permitting multiple cropping instead of one crop each year (cropped area in Egypt reached 10.4 m. feddan in 1960). The number of crops per year on the reclaimed areas is not known, but it seems unlikely that none of the reclaimed areas would give more than one crop per year at least in their first few years of cultivation. On this assumption and also assuming that the basin area in upper Egypt will be cultivated twice instead of once

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[1] Hansen and Marzouk, op. cit., p. 52.

[2] Statistical Handbook, op. cit., p. 253.

a year, cropped area will be estimated to increase by 20% (1.3 + .7 = 2 m.f.).

The influence of the High Dam on industrial development will be in providing a cheap source of energy, i.e., electricity. The generators at the High Dam are planned to produce 10 billion kwh per year compared with an output of 5.2 billion kwh in 1964/65 (the first generator was started in 1967 and maximum production was obtained in July, 1970). It is hoped that these structural changes could be included into the model in order to make it a good representation of the real world situation.

c. Disguised Unemployment in Agriculture

There is a large and extensive volume of research about whether such phenomenon does or does not exist in Egypt in recent years. As early as 1936, Egypt was considered to have a large amount of under employment in agriculture.[1] It was again cited by Arthur Lewis as a typical example where unlimited supplies of labor exist. The idea of surplus labor was supported by C. Issawi[2] and D. Mead,[3] while it was attacked recently by several

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[1]W. Cleland, The Population Problem in Egypt (Lancaster, Pa.: Science Press Printing Co., 1936), pp. 104-106.

[2]Issawi, op. cit., pp. 298-299.

[3]D. Mead, op. cit., pp. 80-98.

economists who argue that there is no disguised unemployment in Egyptian agriculture.

The implication of this problem to the model to be constructed in this study is rather important. The existence of such phenomenon will necessitate a specific construction of the model which will allow for such labor to be transferred to profitable employment elsewhere in the economy. This will mean that the policy makers should seek an expansion of the industrial and services sectors where such surpluses could be used, and then one could envisage such mechanism as developed by Lewis, and Ranis and Fei of expansion of the capitalist sector.[1,2] On the other hand, if no such surpluses exist, then efficiency in the use of labor must be recognized. It is important, therefore, to analyze in detail the phenomenon of disguised unemployment in Egypt.

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[1]See W. A. Lewis, "Economic Development with Unlimited Supplies of Labor," The Manchester School (May, 1954), Published in A. N. Agrawala and S. P. Singh (eds.) The Economics of Underdevelopment (New York: Oxford University Press, 1963), pp. 400-450; Gustav Renis and John Fei, "A Theory of Economic Development," A.E.R., Vol. XI (Sept. 1961), pp. 533-558; and J. Fei and G. Renis, Development of the Labor Surplus Economy: Theory and Policy (Homewood, Ill.: R. D. Irwin, Inc., 1964).

[2]It may be mentioned that two similar studies were based on such mechanism. See Samuel Ho, "Development Alternatives: the Case of Taiwan," Yale Economic Essays, Vol. 5, No. 1 (Spring, 1965), pp. 63-142. Arthur MacIwan, "Development Alternatives in Pakistan: A Multisectoral and Regional Analysis of Planning Problems," (Unpublished Ph.D. dissertation, Dept. of Economics, Harvard University, 1969).

On the basis of figures on labor requirements per feddan for the various kinds of work for each individual crop, B. Hansen and M. El-Tomy[1] attempted to estimate the total labor requirements in terms of days of work per month per person permanently employed on farms. These calculations showed that the permanent labor force is at certain times of the year fully employed, and that there is a seasonal demand for outside labor. If disguised unemployment is taken to mean that the marginal productivity of workers is near zero, so that labor can be removed permanently without detrimental effects on production, then there is good evidence for the opposite view, viz., that there is not disguised unemployment, but that there is some open unemployment, and a large seasonal underemployment which may very well correspond to 25% of the total permanent labor force calculated on an annual basis.

Some other studies bearing on this problem gave support to the idea that there is no disguised unemployment in the Egyptian agriculture. Production functions studies by M. M. El-Emam[2] and H. Kheir El-Dine[3] showed

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[1]B. Hansen and M. El-Tomy, "The Seasonal Employment Profile in Egyptian Agriculture," J.D.S., I (July, 1965), pp. 399-409.

[2]M. M. El-Emam, "A Production Function for Egyptian Agriculture, 1913-1955," I.N.P.C., Memo No. 259, Dec., 1962.

[3]H. Kheir El-Dine, "The Cotton Production Function in the U.A.R. and its Relation to Technical Progress and Disguised Unemployment," I.N.P.C., Memo. No. 370, 1963.

that rural wages were in line with the value of marginal product of labor. These findings were, however, challenged by D. Mead[1] who argued that the rapid expansion of employment opportunities outside of agriculture may have drained away considerable numbers of people who had previously worked as paid agricultural workers with the result that there were sharp increases in the wage rate during seasons of peak demand in the mid-1960's. Thus, while there has been a tightening in the market for paid agricultural workers in recent years, this tightening was confined to the market for paid workers, leaving considerable disguised unemployment on family farms. He concludes, therefor, that the agricultural sector has more workers than it can use, that there is a considerable number in the agricultural sector whose marginal physical product is virtually zero, who could permanently be withdrawn from the sector with no loss of output and only minor organizational changes in the production process. This conclusion will mean that more people could be absorbed in the agricultural sector only with a reduction in the standard of living, unless this is offset by technical change.

In economies with unlimited supplies of labor, Lewis and Ranis and Fei emphasized that the wage rate is institutionally determined by the subsistence level. An

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[1]Mead, op. cit., p. 63.

indirect test will then be to see whether the behavior of factor rentals followed the subsistence theory or the marginal productivity theory. This test was tried by Hansen[1] who tested two statistical hypotheses: a regression of average agricultural productivity over wages and a regression of agricultural cost of living index over wages. The first hypothesis derived from the marginal productivity theory by using a Cobb-Douglas production function has a higher correlation and more significant regression coefficients.

Furthermore, Hansen discussed the seasonal variations in wages, and found that the index of wages is correlated to an index of employment and that the seasonal variations of wages cannot be explained by correlating month to month movements of the cost of living index. Hansen rules out a subsistence interpretation of these variations. Therefore, it seems that shortage rather than unlimited supplies of labor is experienced during the peak season, and that wages, for these periods at least, are determined by the ordinary laws of supply and demand. Hansen's conclusion supports his earlier one (derived from the labor requirements estimate) that Egyptian

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[1]B. Hansen, "Marginal Productivity Wage Theory and Subsistence Wage Theory in Egyptian Agriculture," J.D.S. (July, 1966), II, pp. 367-407 and B. Hansen, "The Distributive Shares in Egyptian Agriculture," Inter Eco. Rev. (June, 1968), pp. 175-194.

agriculture suffers from seasonal underemployment rather than disguised unemployment.

But it should be noted that seasonal variations in wages are not sufficient evidence against disguised unemployment. Other phenomena have to be considered that may explain the co-existence of seasonal shortage of hired labor and permanent underemployment. This has been done by A. Moheieddin[1] in his case study of agricultural underemployment in Egypt, where he introduces the size of the farm as a new variable in the analysis and takes into account important institutional rigidities that affect the supply of agricultural labor. He shows that a considerable surplus of man-labor is available on small farms (less than 5 feddans) while in the same regions and at the same time large farms can suffer from acute shortage of women and children labor. Moreover, the seasonal pattern of shortages and unemployment varies among regions. This situation results from regional immobility and from a stereotyped pattern of work allocation to men, women, and children, determined by tradition which prevents the substitution of one category of labor for the other when a specific shortage is experienced. Also, custom barriers

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[1]A. Moheieddin, "Agricultural Investments and Employment in Egypt Since 1935" (Unpublished Ph.D. dissertation, Dept. of Economics, University of London, 1966).

prevent women who normally work in the small family farm from hiring their services outside to the large farms.

Thus, these rigidities explain perfectly well the simultaneous existence of shortages of hired labor (with the correlation variation in wages) and the existence of permanent underemployment of a large portion of the labor force. These conclusions are also supported by Mabro.[1]

This controversy about whether or not there exist disguised unemployment in Egyptian agriculture has been settled rather definitely against the surplus labor hypothesis by the publication of the rural employment survey conducted by the International Labor Organization and the Institute of National Planning in Cairo. The survey took place from March, 1964 to February, 1965.[2] The sample was for four hundred eighty households selected from forty-eight villages in six governorates. Following are the main results of this survey:

i) The survey shows that the level of employment in rural areas is much higher than had earlier been thought. For men, the annual number of hours worked corresponds closely, and on the average, to a normal eight-hour day.[3]

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[1] R. Mabro, "Industrial Growth, Agricultural Under-Employment and the Lewis Model: The Egyptian Case, 1937-1965," J.D.S., Vol. III (July, 1967), pp. 322-351.

[2] The main results of this survey were summarized in B. Hansen's, "Employment and Wages in Rural Egypt," A.E.R., Vol. LIX, No. 3 (June, 1969), pp. 298-314.

[3] Ibid., p. 300.

Thus ignoring nonfield work, and nonagricultural work, earlier labor requirements studies systematically and grossly underestimated actual employment.

ii) The work outside the farm shows a seasonal pattern similar to that of the farm's labor input. It seems clear, therefore, that farmers have a real choice between taking paid labor outside the farm or working on the farm. Under these circumstances, there is little reason to believe that the value of marginal product of labor, even on the smallest farms, would be lower than current rural wages.

iii) The use of hired labor is smaller on farms with big families than on farms with small families. This has a bearing on Moheieddin and Mabro who argued that because there is a tendency on large farms to be concentrated in certain regions, household members from the small farms would not get in contact with labor demand where it actually exists. The survey shows that labor demand exists everywhere even if there are no large farms.

iv) The survey supports the seasonal pattern of employment revealed by the labor requirements studies. The difference between seasonal peaks and troughs is much smaller, however, than that found in the labor requirement studies.

v) Wages generally appear to be highly flexible and react strongly and rapidly to changes in demand. The

survey clearly supports the hypothesis of demand and supply determined wages. The seasonal fluctuations of daily wages are very strong. The highest daily wage is about 50% above the lowest for men; the corresponding figures are about 100 and 175% for women and children respectively.

vi) The survey supports Mead's result that employment is at a lower level in Upper Egypt than in the Delta. But, the lower employment in Upper Egypt is concentrated mainly among women and children. Thus, it would seem that women and child labor serves as a buffer, with the men working about full time and the women and children doing what has to be done beyond that. In other words, the differences in the employment possibilities have consequences mainly for the employment of women and children. Thus, one meets here an elasticity of supply of labor, but this is very different from the unlimited supplies of labor found in Lewis' model. Whatever the relationship between supply proper and actual employment of women and children, there can be no doubt that when one turns to social norms and development possibilities, the women and children do not represent a reserve of labor available for industrialization. The former will only be partly available for agriculture, while the latter can be considered a temporary source since a successful development program must include efforts to have children attend

school regularly. This would permit children to work (during the holidays), but satisfactory education for the children would presumably imply an increased demand for adult hired labor in agriculture.

To summarize, with the planned increase in school attendance, with the expected increase in the area cultivated as a result of the completion of the High Dam, and with the rather remote possibility of mechanization of agriculture, it seems very likely that agriculture will need an increase in the adult labor force at least up to the terminal year of the model, i.e., up to 1974/75. Part of the natural increase of population in rural areas will, however, have to find employment outside agriculture, but the supply of unskilled labor from rural areas will be limited to part of the natural increase in the labor force. It is clear, thus, that the supply of labor outside agriculture is rather limited, and that economic planning will go very wrong if it assumes unlimited supply of unskilled laborers, even in the short run. The reserves in agriculture are mainly seasonal, and are partly available for agriculture itself (for married women). It is important, therefore, to economize on the use of labor at all levels, and efficiency in production and an increase in labor productivity become imperative for future developments.

5. Industrial Development

The growth of Egyptian industry did not proceed stage by stage, from handicraft to small factories, and then to large scale factories, but rather it provides a clear example of industrialization through import substitution.[1] In the early stages of industrial developments, Egypt concentrated its efforts on the production of commodities that were previously imported and which were based on existing natural resources such as cement, oil, fertilizers. Several factors have given industrial growth a comparative advantage vis a vis other sectors of the economy, important among which are the government protectionist policy and the movements of the internal terms of trade, of agriculture versus industrial prices (which was partly a result of the pricing policies of the government) in favor of industry.

With the emphasis on industrial growth after 1956, the production of new commodities were started, with great emphasis given to self sufficiency, and without due regard given to the principle of comparative advantage. As will be seen later on, the establishment of

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[1] This gives an example of what Hirschman has emphasized that the presence of imports is an excellent substitute for market research, indicating an already existing demand and enabling enterpreneurs to calculate whether it would be profitable or not to enter into the new business. See A. Hirschman, The Strategy of Economic Development (New Haven and London: Yale University Press, 1958), pp. 120-125.

some of these new industries proved to be questionable from an economic point of view.

A study by the United Nations, in 1955, about the cost and efficiency of the industrial sector in Egypt, concluded that a number of important industries, including fertilizers, cement and several other food processing industries could dispense with tariff protection without danger. Since that time, output per man has continued to grow in many of these industries while wage rates have risen only slowly. Output, similarly, was rising more rapidly than capital stock. Thus, on the whole, these expanding industries maintained or improved their competitive position.[1] These pioneering Egyptian industries have, thus, grown from infancy to maturity mainly due to the fact that they were started in fields where the country has an obvious comparative advantage, and because of the favorable development of wage-cost conditions in the Egyptian industry.

The situation is different for a number of newer products where quality is generally below, and costs is generally above that of world markets. In these cases, the government policy is to provide whatever degree of protection required to support domestic industry.

It should be emphasized that Egypt has no other alternative but to give industrialization a major role.

[1]Mead, op. cit., p. 105.

With the scarcity of agricultural land necessary for vertical expansion of agriculture, with the relatively advanced techniques already in use in agricultural production, it seems unrealistic to expect substnatial and continuing increases in agricultural output. Thus, as a development strategy, Egypt should concentrate on the development of industry and services, since the aggregate growth rate of the economy will be highly dependent on them. It is important to note that this analysis lies behind the sector division chosen in this model. Not only the ratio of national income generated by these sectors is large, but also the development of these sectors is important from a long run developmental policy point of view.

The remaining point in this section is to see the impact of industrialization on value added, employment, and the balance of payments, and to see what are the policy implications of this analysis.

As a result of the impetus given to industrialization in the mid-1950's, Egypt is now no longer an agricultural country. In 1964/65, 24% of gross domestic product was produced in industry (including extraction, public utilities and electricity) against 28% for agriculture. Furthermore, value added per capita in this sector is among the highest in the country (this, inci dentally gives an additional reason for industrialization).

The following table gives gross value added per worker per sector in Egypt.

Table II.5--Gross Value Added Per Worker by Sectors (L·E·) Per Year, at 1954 Prices).

	1947	1960
Agriculture	73.4	88.5
Industry and Electricity	171.5	293.1
Services, total	168.5	237.2
Commerce	130.0	186.7
Transport and Communication	227.7	357.7
Construction	223.2	257.9
All Others	105.4	171.7

Source: D. Mead, op. cit., p. 291.

The development of industrial employment in Egypt shows clearly that the expansion of an industrial sector cannot absorb over a relatively long period of time more than a small share of the natural increase in the labor force. Despite the fact of the high increase in industrial output, additional employment in this sector absorbed 15% of the increase in the number of adult males in Egypt from 1947 to 1960. For the same period, the share of industrial workers in total employment of adult males rose only from 9.8% to 10.8%.

It has been convincingly argued that the economic reasons behind this slow increase in employment opportunities in industry is the monopolistic structure of the Egyptian industry. The number of firms in each branch of activity is small and the industry is protected against foreign competition. If competitive conditions prevail, there would probably have been a tendency towards more labor intensive techniques. Both this factor and the favorable movements of industrial prices relative to the cost of living made it possible for enterpreneurs to choose more capital intensive techniques without remarkable fall in the rate or share of profit.[1]

Reynolds gave two reasons for this behavior of industrial employment:[2] new industries start off at a low level of productivity but by time productivity increases, which means that employment rises less rapidly than output; and due to the tendency of real wages to rise in the developing countries (for social reasons), employers will respond to this in the normal way by capital-labor substitution. This second reason is not true in the case of Egypt, however.

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[1]Mabro, op. cit., p. 344.

[2]Lloyd G. Reynolds, "Economic Developments with Surplus Labor," Oxford Economic Papers, Vol. XXI, No. 1, (March, 1969), p. 95.

With respect to the impact of industrialization on the balance of payments, it should be noted that, theoretically, the new projects were supposed to be chosen such as to maximize income given the constraint on the balance of payments. Actually, these new projects were mainly chosen through a process of bargaining within and among different ministries. In addition, the bias towards self sufficiency through import substitution, which was mentioned before, did have an important influence on the selection of industrial projects. The influence of this bias resulted in the production of such commodities as cars, refrigerators, washing machines, etc. However, the expansion of such commodities was achieved at the cost of greater dependence on imported raw materials and semi-manufactured goods. In this sense, the planners' aim to make the economy less dependent on the outside world did not materialize. Indeed, one of the side effects of this policy was the occurrence of idle capacity in many newly established industries whenever foreign exchange became in short supply or because of sales and marketing difficulties due to inability to compete effectively with the sophisticated products of industrial countries in world markets.

In addition to the imports of raw materials and intermediate products required for the newly established industries, there are two other strains on the balance of

payments. The first is the large imports of capital goods required for the implementation of the development program. The second is that the increase in industrial output of some commodities did not result in as much import substitution as was expected.[1] Thus, the increase in production was only import replacing in the sense that, given the level of effective demand, if domestic production had not risen as much as it did, imports would have had to increase even more than they did.

It seems clear, therefore, that the negative impacts on industrialization on the balance of payments, has thus far outweighed the positive aspects, and this contributed to the balance of payments difficulties experienced on a large scale since the early 1960's. This will be the subject of the next section.

6. Foreign Trade and the Balance of Payments

The following table gives a summary of the balance of current transactions estimates for Egypt from 1950 to 1967.

With respect to merchandise trade, it is to be noted that raw cotton is still the largest export commodity, even though its relative importance has declined somewhat. The normal share of raw cotton in the sixties is around 60% of total exports.[2] It is needless to say that this

[1] Mead, op. cit., pp. 108-110.

[2] See Hansen and Marzouk, op. cit., p. 181.

Table II.6--Balance of Current Transaction Estimates (L.E. million).

Year	Current Transactions				Balance of Current Transactions
	Merchandise Transactions[1]		Other Transactions		
	Payments	Proceeds	Payments	Proceeds	
1950	221.7	188.5	57.2	80.0	- 10.4
1951	241.9	201.9	65.5	90.3	- 15.2
1952	210.5	145.6	61.6	73.1	- 53.4
1953	165.2	135.3	57.8	79.8	- 7.9
1954	150.7	138.8	67.9	82.4	+ 3.6
1955	190.3	133.1	71.0	94.2	- 34.0
1956	192.3	129.9	59.5	88.9	- 33.0
1957	217.5	166.0	50.9	71.2	- 31.2
1958	214.0	161.0	56.3	89.2	- 20.1
1959	235.3	164.3	65.6	100.6	- 36.0
1960	255.2	200.2	70.1	101.5	- 23.6
1961	237.8	161.3	71.6	94.8	- 53.3
1962	294.2	145.2	70.3	101.7	-117.6
1963[2]	402.6	228.8	84.1	135.0	-122.9
1964	399.4	227.6	97.4	146.1	-123.1
1965	413.3	246.8	99.3	155.8	-110.0
1966	410.9	259.5	94.7	170.5	- 75.6
1967	413.2	258.7	86.9	115.9	-125.5

Source: National Bank of Egypt (N.B.E.) Economic Bulletin, Vol. XXII, No. 2, Cairo, 1969, Section 4/1.

[1]As from 1962, merchandise transactions figures include transit trade which was previously included among other transactions.

[2]As from 1963, figures are calculated on the basis of the new exchange rate of L.E. 1 = $2.3 instead of $2.87.

high dependence on one crop for exports leaves the country's balance of trade highly dependent on the fluctuations in the supply and demand for the product.

Starting from the 1950's, other commodities started to make contributions to the country's balance of trade. Other agricultural products such as rice, vegetables, and fruits started to appear on the export side and they are rising in importance. The stabilization of the flow of water as a result of the completion of the High Dam should make possible a more substantial and regular production of rice. This actually started to take place and exports of rice in the first 11 months in 1968 registered a 52.6% increase over the same period the year before. If one adds to this the increased attention given to the exports of other agricultural products such as onions, potatoes, edible fruits, one should expect a larger increase in the exports of these items in the near future. The new additional area of land reclaimed to utilize the water of the High Dam will help in this direction provided that the European market will be open for the Egyptian exports.

With respect to manufacture, the exports of textiles and yarn have increased rapidly since the 1950's. The country started also exporting minerals, cement and other products of the manufacturing sectors such as furniture, artificial silk, shoes, and automobile tires.

It should be stressed, that while the foreign exchange difficulties experienced through the first Five Year Plan affected the efficiency and expansion of some of the newly established industries, it is the increased efficiency and expansion of these industries that will help in relieving these foreign exchange crises in the long run. This is one of the reasons for which exports of the industrial sector was chosen as one of the policy instruments in the model to be constructed in this study. This choice will allow the planners to know the effects of any change in this instrument on the other variables of the model.

The composition of imports has undergone more substantial changes. The main trend from the late 1930's to the early 1950's has been for the share of food items to increase sharply while the share of manufactured and capital goods were about unchanged. From 1952 onward, one could find a further decline in the share of manufacture, more or less unchanged share for food and raw materials, and a large increase in that of capital goods.

The important observation from the last table is that while in 1960 the balance of trade was unfavorable to Egypt by L.E. 55m. in 1960, this imbalance increased sharply where it reached L.E. 154m. in 1967. These increasing deficits were mainly due to the stagnation of exports, while imports were expanding rapidly.

It is to be noted that from the more recent data, this tendency for the trade deficit to increase has stopped or been reversed. During the first eleven months of 1968, for which data is available, exports surged upward by 8.4% to L.E. 246m., while imports declined to L.E. 269.8m., a 9.2% decline over the corresponding period a year earlier. As a result of these changes the balance of trade recorded a deficit of L.E. 23.8m. compared with L.E. 71.6m. in the corresponding period of 1967. This represents a 66.8% improvement over the previous year and is the lowest since 1960.[1]

To round up the current account picture, we have to consider the role of invisibles. Here the main items are Suez Canal dues, interest payments, tourism, and government expenditure. The Suez Canal dues increased sharply during the 1950's from L.E. 26.7m. in 1950 to L.E. 50.4m. in 1960, to L.E. 95.2m. in 1966.[2] As a result of the Middle East war in June, 1967, the Suez Canal was closed and it is still closed up to now. It should be noted that the Egyptian economy has not, so far, felt completely the effect of this loss because of the compensations paid by some of the oil producing countries in the Arab World. Whether these payments will remain as long

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[1] See NBE, Economic Bulletin, op. cit., p. 108.

[2] Ibid., Statistical Appendix, 4/3a.

as the Canal is closed is to be seen, but one could expect (judging from the power structure in the Arab World) that it will remain as long as the Israeli occupation remains.

It is to be observed that there is still a major loss of closing the Canal, although this is of a long term nature. The closure of the Canal in 1967 has created the tendency to build super tankers for shipping oil. These super tankers can't pass through the Canal without a deepening of the Canal. In 1960, the Canal authorities presented a five-year plan for deepening the Canal from 38 feet to 48 feet; this will more than allow the empty super tankers to pass through the Canal. Thus, when the Canal will be opened, a major part of the Middle Eastern oil will not pass through it. This reduction in Canal traffic would be partly overcome, however, by the planned pipeline from Suez to the Mediterranean, the work on it is supposed to start this year (1969/1970).

The other major item is the net interest payments, which are expected to reach a high level as a result of the increase in the country's indebtedness in recent years. Net interest payments abroad reached L.E. 7.1m. in 1965, L.E. 4.4m. in 1966, and L.E. 9m. in 1967.

These developments in the balance of current accounts led to foreign exchange difficulties which became more critical after 1962 when the Egyptian pound was formally devalued, and some drawings on the IMF plus some

adjustments in domestic policies. It is to be noted that the improvements in the terms of trade and the increase in the net invisibles (which were mainly due to the increase in Suez Canal revenues) helped to meet part of the increase in imports; but even this favorable development was not sufficient to prevent a growing deficit. Until 1958, these deficits were financed exclusively through a fall in the reserves of gold and foreign exchange which had even to cover a certain net outflow of capital. Since 1959 a growing part of the deficit has been covered by capital inflows, in particular U.S. counterpart funds which reached L.E. 195.7m. for the period 1959-63.[1] The rest of these deficits have been covered mainly by Russian High Dam deliveries which is covered by Soviet loans agreed on in 1958 and later. Other sources such as changes in the IMF position and short term credits have contributed in covering these deficits, too.

These continuous and substantial deficits in the balance of payments are an indication of the strains put on it by an active effort to accelerate the rate of growth of the economy. In principle, the country should eventually reach a stage where it is less dependent on imports, being able to produce at home a higher portion of the intermediate and final goods needed for domestic uses.

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[1]Mead, op. cit., p. 185.

As was shown in the preceding pages, recent developments point in this direction. These recent developments should be expected to continue in the future as a result of the economic effects of the completion of the High Dam and its effects on agricultural production. It is important to note that, from a development policy point of view, these reductions in imports must not affect the imports of raw materials and capital goods. The whole burden must lie, therefore, on the imports of consumer goods particularly food, which reached 30% of imports in 1964-1965. Gross agricultural production is estimated to increase by 20% due to the effects of the High Dam. These may amount to about L. E. 150m. in 1964/65 prices. All of them are virtually exportables (cotton or rice), or import substitutes (wheat, maize, and barley). Thus, it will be assumed in the model, that food imports will be zero in the target year (1974/75).

It should be noted that an important condition for self sufficiency in food to occur is that domestic consumption of agricultural products should not increase in connection with the increase in agricultural production. If, in addition to such increases, agricultural output increases by 2.5% per year (which is the same rate assumed for population growth up to 1975), it will be possible to keep per capita food consumption constant. It is to be noted, also, that unchanged per capita food consumption

in the near future is a feasible target in regard to the relatively satisfactory average caloric intake in Egypt.

From a domestic policy point of view, the foregoing measures would obviously require tough demand management, not only with respect to disposable income: a change in relative prices sufficient to shift demand somewhat from agricultural products to other goods and services would be necessary.

It should be noted that a policy to equilibrate the balance of payments, by definition, tends also to equilibrate domestic saving and investments.[1] Thus, demand management must face the problem of increasing the domestic savings to reach the level of investment reached in the previous period. This is what is going to be discussed in the next section.

7. Savings and Investment

The following table shows saving and investment and their relation to gross domestic product.

With respect to investment, one can observe that while the investment rate remained in the range of 12-14% of gross domestic product through 1959-60, it has risen during the planning period to reach almost 20%. This has declined somewhat in 1967 and 1968 as was mentioned before.

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[1] Sydny Alexander, "Effects of a Devaluation on a Trade Balance," I.M.F. Staff Papers, Vol. II (April, 1952), pp. 263-278.

Table II.7--Investment, Savings, Balance of Payment Deficit, and Private and Public Consumption.

Year	GDP at Current Market Prices[a] (L.E.m.)	Gross Investment[b] at Current Market Prices (L.E.m.)	Gross Domestic Saving[a] (L.E.m.)	Balance of Payment Deficit (L.E.m.)	Public Consumption (L.E.m.)	Private Consumption (L.E.m)	Total Consumption (L.E.m.)
1959/60	1375.6	171.4	175.9	- 4.5	228.1	971.6	1199.7
1960/61	1459.3	225.6	210.1	15.5	255.9	993.3	1249.2
1961/62	1513.3	251.1	164.7	86.4	247.1	1101.5	1348.6
1962/63	1684.6	299.6	195.6	104.0	318.2	1170.8	1489.0
1963/64	1887.9	372.4	236.8	135.6	401.8	1249.3	1651.1
1964/65	2123.4	364.3	320.6	43.7	431.3	1371.5	1802.8
1965/66	2310.0	379.1	315.9	63.2	475.0	1519.1	1994.1

[a] Statistical Handbook, op. cit., p. 223.

[b] Ibid., p. 218.

During the first Five Year Plan, the planners were highly optimistic about the supply of saving to meet planned investment; in fact, planned savings were expected to exceed planned investment in the final year of the plan by some L.E. 40m. making it possible to start repaying the external debt. The planners assumed high marginal saving rates in all major sectors; for example, household savings were expected to increase from an average saving rate of 3% in 1959-1960 to 6.1% in 1964/65 which would imply a marginal saving rate of 16%. Such high marginal saving rates could, of course, be achieved; they only need tough demand management. But with little or no discussion of how private savings were to be increased in this way and little or no determination to use the government budget to generate public savings, it is not surprising that these plans have not been fulfilled.

The marginal rate of domestic savings over the plan period amounted to 18.8% while the increase in per capita consumption reached 27.7%. As a result of these developments, greater resort has to be made for foreign savings than was originally planned. Gross domestic savings accounted for 72.4% of gross investment during the plan period.

To a large extent the failure to achieve the planned saving target was due to the rapid rate of increase in public consumption, which rose by 89% in the plan period with an annual rate of increase of 14.2%.

These resulted in financial deficits incurred by the public sector, which were partly overcome by a financial surplus in the private sector, and partly through a deficit in the balance of payments that was covered by foreign exchange reserves up to the early sixties when they were virtually exhausted, and later on through an increase in the country's indebtedness to foreign countries.

From a short run point of view, it might be good economic policy to try to depend on foreign loans to finance developmental activities. But with the world market conditions facing the exports of developing countries as it is, exports does not grow fast enough to finance the development process and a large and growing debt service. This means that while foreign loans could be used by Egypt to avoid any reduction in private or public consumption. foreign interest payments would increase continuously and the balance of payments would become more and more strained. Thus, as a growth strategy, it would seem more beneficial if Egypt tries to reduce its dependance on foreign borrowing. This study, however, is concerned with the determination of alternative development programs. The development strategy suggested in this section will be considered by assuming the lower value of foreign saving to be equal to zero.

8. Actual Planning and Planning Techniques

The first Five Year Plan was constructed mainly by a stage by stage method a la Tinbergen, and was not based on a comprehensive econometric model, nor was it based on an up-to-date input-output table which reveals the interdependence among various sectors and industries.

To the target increase in income, which was determined by political considerations, was applied an estimated overall capital-output ratio to reach the required volume of investment. Deducting from this the expected supply of foreign loans, required domestic savings was reached. Once the level of government expenditure was known, the level of private consumption could be easily calculated. A series of income elasticities of demand for various consumer goods, which were obtained from "family budget" studies, made it possible to calculate the expected distribution of consumer demand by sector. As for estimating inter-sectoral demand, a small Leontief input-output table was utilized, but with little success. The sectoral production targets were, therefore, largely determined in an intuitive way. By the application of sectoral capital-output ratios, the investment needed for each sector was then determined. The choice of concrete investment projects was delegated to individual ministries where the tendency has been to choose projects with high

profitability, labor incentive, high import substitution. In practice, when the National Planning Committee was reviewing the proposed projects, they seem to have concentrated on the rate of return to capital.

While the plan consisted mainly of an investment program, its annual realization was based on the annual state budget. It should be noted, however, that the distinction between private and public sector, by itself, does not show the real impact of government on the economy. From an ownership point of view, the economy is a mixed economy but it is highly regulated with a good deal of government intervention in the private part, and decentralization in the public part. In agriculture, current production and investment in stocks are determined by the farmer's response to market prices for inputs and outputs which are generally administered by government. Small scale industries and handicraft, mainly belongs to the private sector, and government has very little influence. On the other hand, the government is able to give big industrial concerns, which are mostly nationalized, any orders as it finds appropriate, but industrial production seems to be decentralized to a large extent. Thus, enterprises function as profit maximizers within the given administrative framework of price fixing, import licensing, etc.

The striking characteristic of the first plan was the overwhelming importance of the industrial sector accounting for over 50% of the planned increase in income over this period. The planned rate of growth was 14.6% per annum, while the realized rate reached a compound rate of 8.5% per annum.[1] The planned patterns of development was planned to result in structural transformation being not on the expense of agriculture (which is generally the standard case), but on the expense of services. The growth rate of agriculture during the plan period, however, was highly below the average of the economy (3.3% compared to 5.5%). If one adds to this that the actual growth of the services sector was quite high, one can see directly that the resulting structural transformation has followed the more familiar pattern, whereby both services and industry have increased their relative importance at the expense of agriculture.

There are some criticisms to the plan that could be summarized as follows:

i) The procedure of selecting investment projects has led to a sub-optimal structure of foreign trade. The plan emphasized self-sufficiency, but a small country such as Egypt can't hope to produce the whole range of manufactures and primary products, and is, therefore, forced to

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[1] B. Hansen, "Planning and Economic Growth in the U.A.R.," op. cit., p. 31.

pay more attention to comparative advantage. Limitations on resource diversity and size of domestic markets suggest that the natural choice of development strategy is "planned specialization" so as to link the growth of the new industries to the expansion of world trade; hence, the relevance of comparative advantage as a guiding principle of development planning.[1]

ii) The method of project selection led to inoptimalities owing to the use of inappropriate shadow prices. The planners assumed that labor is abundant and that, therefore, the marginal product of labor is zero. As a result of this, the rate of return on capital played a central role in selecting investment projects. But, as mentioned earlier, there is a good deal of evidence now that the marginal productivity of labor is positive. This would mean that in the selection of investment projects, it would have been more appropriate to deduct the cost of labor from value added when estimating the rate of return on capital.

Another shadow price problem is related to foreign trade. Domestic prices, and not foreign prices, have been used to arrive at the social profitability of capital, and these include tariffs and/or monoploy profits conditioned

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[1]Naiem A. El-Sherbiny, "Comparative Advantage and Development Planning Under the Foreign Exchange Constraint with Special Reference to Egypt" (Unpublished Ph.D. dissertation, Dept. of Economics, University of California at Berkeley, 1969).

by protection from foreign competition. Unless the infant industry argument for protection is involved this must imply that comparative advantage has not been fully considered.

iii) The planned investment in many fields will lead to excess capacity as compared to domestic demand, it was then taken for granted that the residual will automatically be sold in foreign markets. This gives another major deficiency in the principles of planning with regard to foreign trade since there were no detailed analysis of the question whether such industries could be competitive in the world market.

iv) As was shown through most of this chapter, the significant divergencies from the plan were in the use of resources side, where the plan target has not been even approached. For future planning in Egypt, the rate of growth itself may not be the worst problem facing the planners, but a large number of improvements will be needed in planning for investment and the level of aggregate demand and its distribution among sectors.

By the end of 1963, some theoretical studies were made for the construction of the second plan, namely a model constructed by Ragner Feisch.[1] His model is a linear programming model, like the one to be constructed

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[1]Ragner Frisch, "How to Plan," I.N.P.C., Memo. No. 380, Dec. 1963.

in this study, and is only distinguished from similar other models by the large number of sectors chosen. While he divides the economy into nine sectors, he tries to take into account the dynamics of investment capacity creation process, and, therefore, each year of the plan appears explicitly into the model. The model is kept together by a weighted social preference function which includes total potential income, employment, private and public consumption, and foreign indebtedness. Maximization of this function, under the given constraints, will give the solution for investment, consumption, and foreign trade pattern during the five year period.

The most important theoretical problems related to this model are the problems related to the choice of the appropriate discount rate, and the social preference function, which he tries to determine empirically. There are many reasons to be skeptical about the possibilities of establishing empirical social welfare function. This is a common problem for all models which attempt to apply maximization methods to policy making. But, fortunately, systematic planning is possible without this device. If the planner can get a vague qualitative and imperfect idea about the targets in which the politician is interested, he can work out a series of alternative plans among which the politician can choose. By applying these simulation methods, the planners might be able to present the

government with a series of feasible solutions to choose from; and in this way the problem of the objective function is sidestepped. This dissertation will present an attempt in this direction, within the limitations of data and time available.

9. Summary and Conclusions

The early attempts of industrialization in Egypt started with the Great Depression, but were unable, however, to bring about any radical change in per capita income. This process has been intensified after the Suez Campaign of 1956, where annual increases in per capita income aften reached 3-4%.

The rate of growth of labor force depends on the rate of growth of population and the participation ratio. The former has reached 2.54% per annum in the early 1960's, and the government attempt to reduce it does not seem to have any effect yet. The latter depends on changes in social attitudes (regarding women's work), and educational opportunities (regarding child labor). The net effect of these two factors suggest an annual rate of growth in the labor force equal to 2.6%.

While agricultural techniques are relatively advanced in Egypt, it is still possible to achieve large increases in agricultural income by shifting output to more profitable products. The controversy about whether or not

there exist disguised unemployment in Egyptian agriculture has been settled rather definitely against the surplus labor hypothesis, by the publication of the rural employment survey in 1969. It seems clear, therefore, that with the planned fall in child labor, with the expected increase in the cultivated area due to the High Dam, and with the remote possibility of mechanization, agriculture will need an increase in the adult labor force at least up to 1974/75.

In its early stages of industrial development, Egypt concentrated its efforts on the production of commodities in which she had natural advantages. With the emphasis on industrial growth, after 1956, the emphasis has shifted to self-sufficiency, without due regard to comparative advantage. This resulted in the production of new commodities which was economically questionable. It also percipitated in balance of payments difficulties that affected the efficiency and expansion of these industries themselves. Over the longer run, however, it is the increased efficiency and expansion of these new industries that will help in relieving these foreign exchange shortages.

As a result of the completion of the High Dam, gross agricultural production is expected to increase by 20%. These increases could help in overcoming the balance of payments problem by making Egypt self-sufficient in

food production. This will help toward the suggested growth strategy aiming at reducing the dependence on foreign savings.

The first Five Year Plan was constructed by a stage by stage method a la Tinbergen. In the theoretical studies related to the second plan, which was not formally laid down, R. Feisch constructed a linear programming model, where the aim was to maximize a social welfare function, subject to the given constraints. This approach faces some theoretical problems related to the choice of the appropriate discount rate and the social preference function. Such problems could be sidestepped by having a model that could create consistent and feasible alternative development programs, which is the subject of this dissertation.

CHAPTER III

GOALS, INSTRUMENTS, AND SECTORS

1. Introduction

In this chapter, an attempt will be made to determine the appropriate goals that should be achieved by the target year, 1974/75; the policies chosen to reach these goals will also be specified; and finally, the division of the economy into sectors will be laid down. The study of the previous chapter (Chapter II) will be used as a basis for the determination of which goals should the Egyptian planners try to achieve. Policy instruments will then be chosen where emphasis will be on their manageability to the planners, and their relevance to the problems facing the economy and the goals chosen. The sector division will then be discussed with the aim of making the most important economic flows intersectoral and thereby showing the interdependence among the different sectors in the economy.

2. Goals

The choice of goals for a policy model could either be fixed or variable.[1] We will combine both approaches in our choice, in the sense that if there is any objective variable that it is desired to take certain value in the target year, for political, social, or economic reasons it will be assumed as a fixed goal for the economy. On the other hand, if there exist no such reasons for a fixed goal, then this will be a variable objective which could be determined by the maximum value that the variable take within the feasible region, or by specific values that the variable is allowed to take.

In Chapter II, it was shown that public consumption has increased rapidly during the sixties. Specifically, it rose during the first Five Year Plan by 89% with an annual rate of increase of 14.2%. The ratio of public consumption to GDP rose from 14% in 1959/60 to 25.2% in 1965/66. These developments resulted in financial deficits incurred by the public sector which were partly overcome by a financial surplus in the private sector and partly through a deficit in the balance of payments.

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[1] Professor J. Tinbergen is the advocate of the fixed goals approach. See J. Tinbergen, op. cit., while Professor Theil is the advocate of the variable target approach. This latter approach is more general, see H. Theil, op. cit., Chapter 7.

It is to be noted that part of the public consumption constitutes a contribution to growth process (as expenditures on education, health and so on). An increase in these items in the process of development is understandable and they actually rose from less than four per cent in 1959/60 to more than 5% of gross domestic product in 1965/66. On the other hand, the other part of public consumption on administration and defense have increased sharply from 10% of GDP to 21% in 1965/66. While part of these increases could and should be curtailed, a large portion of it is very difficult to reduce at least for the time being (those expenditures on defense in regard of the current Israeli occupation). To solve this dilemma means that the government should aim at reducing its expenditures on administration gradually. This could be done if one assumes that public consumption will increase by 4% a year. If gross domestic product rises by more than 4% in this coming period, this will mean that the share of public consumption in GDY will tend to fall.

Thus, it will be assumed that government expenditure increases annually by 4%, for political and defense considerations, during the period 1965/66 - 1974/75. This will be a fixed target for the model.

In addition to public consumption as a fixed goal, full employment will constitute the second fixed goal. During our discussion about the problem of disquised

unemployment in the Egyptian agriculture, we came to the conclusion that sufficient evidence is against the existence of such phenomenon in the Egyptian agriculture. The development process, it was shown, cannot be built on an assumption of the transfer of surplus manpower from the agricultural sector to other sectors where they can find more productive employments. It was shown, also, that agriculture will require an increase in labor force, at least up to 1975.

The full employment goal will be specified in the model by the value that GDY has to take in order for full employment of the labor force to be achieved. Once the supply of labor in the target year, and the sectoral demand for labor are known, then a given value for the rate of increase in labor productivity will determine a certain value for GDY. It may be noted that the rate of increase in labor productivity (ℓ) is assumed to be an institutional limit since it is subject to customs and tradition, and it will be allowed to take three different values (ℓ^*, ℓ, and ℓ^{**}) where ℓ^* is a pessimistic value, ℓ is an intermediate one, and ℓ^{**} is an optimistic value.

On the other hand, there are some additional targets where Theil's approach will be more suitable. Most important among these is the level of income. One of the basic problems facing the underdeveloped countries of the world, and Egypt is no exception, is the low level

of per capita income vis-à-vis that of the advanced countries. To make matters worse, the gap among the two groups of countries is widening. This constitutes one of the main impetus behind planning for development. There is no reason to define a fixed target for income (or gross domestic income which is the concept we are using throughout). In contrast, the level of income achieveable at each solution of the model will be the maximum level attainable within the feasible area.

In addition to the level of income as a variable objective, the level of net foreign borrowing will also be considered as another one. It was shown in the previous chapter that due to the effects of the High Dam, Egypt could solve its balance of payments problem which was a major constraint on development recently. A policy to equiliberate the balance of payments will mean that domestic savings and investments must also be equalized. If the government does not wish to retard the development process, this will mean that consumption expenditures, both public and private must be cut, and not investment expenditures. But since public consumption was considered as a fixed goal, then this might result in a large reduction in private consumption.

It might be mentioned that there is some limitations, both political and social, to the extent to which private consumption could be reduced. It is for this

reason that the solution of the model will be considered with different values for net foreign borrowing. A high level of foreign borrowing utilized will mean, ceteris paribus, a high level of private consumption and conversely. An additional reason why it is better to use different values for net foreign borrowing is that the model to be constructed in this dissertation tries mainly to show development alternatives under different assumptions of available resources and resource uses. Thus, it will be assumed that net foreign borrowing will take three different values: $S_f^*=0$; $S_f \geq 0$; $S_f^{**} \geq 0$. The first alternative will allow for achieving equilibrium in the balance of current accounts; and the third will permit an expansion in the development process without putting heavy burden on private consumption, by depending on foreign borrowing to a limited extent, while the second alternative (S_f) is an intermediate value between S_f^* and S_f^{**}.

It should be added that while foreign borrowing is being treated here as one of the variable goals chosen for the model, it could be considered also as one of the instruments available to the planners. This possibility of a target being a policy tool at the same time has already been mentioned in Chapter I.

While foreign borrowing is considered also as an instrument, the government might not be able to achieve any level of it that it considers necessary. This is due

to the fact that foreign lenders might be unwilling, on economic or political grounds, to invest their money in Egypt. Thus, in addition of being a goal, an instrument, foreign borrowing also represents the planners with an institutional limit that they may not be able to raise above certain limits.

3. Instruments

In addition to foreign borrowing, the propensity to save out of household income is taken to be as the second policy instrument. It is obvious that savings out of household income depends on a lot of factors important among which is the level of income, government tax policy, income distribution, and the like. It should be pointed out that the Egyptian government could exercise major influence on household savings since it is defined here so as to include retained profits in private and public enterprises. Since most of the large enterprises are owned by the government, the planners could exercise any kind of influence on such enterprises as the determination of prices and so on. In addition to this, a part of the private sector savings is generated through the government. This is related to pension and insurance funds accumulation collected from the household sector through the government. Thus, the choice of the propensity to save out of household income is suitable since the government plays a major role in its determination.

It may be noted that while the government is free to determine and control the propensity to save, it is not free to determine it at any given level, since there is some social, political, and institutional limits to the rate at which savings could be increased. For all these reasons, three different values for α will be considered: $\alpha^* \leq \alpha \leq \alpha^{**}$ where α^* represents a pessimistic value, α represents a trend value of previous developments, and α^{**} represents an optimistic value which is considered to be high enough, that any increases above this value is highly unlikely.

The last instrument that will be used is trade policy and its effects on the exports of the industrial and manufacturing sector. The planners could exercise some control on these exports through their efforts on export prices: through such measures as export subsidies, variation in the exchange rate and the like.

The choice of trade policy as an instrument seems to be reasonable since the government controls almost completely the foreign trade sector in Egypt.[1] It seems quite clear, however, that there are certain limits to the increase in exports of industry and manufacture within a

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[1]As early as 1961, it was stated in the National Charter that all imports have to be under the supervision of the public sector, while for exports both public and private sectors have to participate in its volume by the ratio of 75% to 25% respectively.

short period of time since a change in exports is a function of many variables as relative cost conditions, quality of the product, conquering new markets, and trade policies of other countries. Most of these variables require time to change in an effective manner, and, therefore, we have to consider only three different values for exports: one which represents a pessimistic value, a trend which represents an extrapolation of the current developments, and an optimistic value that is reasonable within the limiting factors discussed above.

Before concluding this section, it might be advisible to present a table which contains the classification of all the policy variables that will be used in this model, differentiating among goals, instruments, or institutional limits. (See Table III.1, p. 78).

4. Sector Division

In any economy, an innumerable number of economic transactions are performed daily. To provide information about the structure and functioning of the economic system would require splitting up the economy into various sectors so that the internal relationship among these sectors can be observed. It should be mentioned that many different kinds of sector breakdowns are possible, and that different forms of economic problems will require different types of sector breakdown. It is for this reason that no social

Table III.1--Classification of Policy Variables.

Variables	Goals		Instru- ments	Institutional Limits
	Fixed	Variable		
Gross Domestic Income		x		
Public Consumption	x			
Full Employment	x			
Net Foreign Borrowing		x	x	x
Value of Industrial Exports (Trade Policy)			x	
Saving Rate			x	x
Rate of increase in Labor Productivity				x

accounting system could claim competence to embrace all aspects of economic activity with similar throughness for the use of policy makers. Any system will, therefore, be admissable as long as it has a coherently determined plan for the analytical presentation of economic aggregates, so that there is some interdependence between them.

Following the procedure of many national income accounting systems,[1] a functional sector breakdown will be

[1]See for example, H. E. Edey and A. T. Peacock, National Income and Social Accounting (Hutchinson House, London, 1954), Chapter 1; and R. Ruggles and N. D. Ruggles, National Income Accounts and Income Analysis, (McGraw Hill, 1956), Chapter 5.

used. The sectors are functional in the sense that they classify the function of the transaction under consideration rather than the nature of the individual or agency involved in the transaction. For example, a farmer is considered in the producing sector whenever the farmer acts in his role as a producer. This same farmer, however, will be considered in the consuming sector with respect to all transactions concerning his consumption activities.

The sector division to be used in this study distinguishes among two major groups of sectors. The first group relates to production activities, and the second relates to all other activities such as consumption by either household or government, transactions among different sectors on capital account, and the transactions of these different sectors with the rest of the world. The distinction among sectors in this latter group is quite classical, and, therefore, it is better to start with them.

The household sector is concerned with the activities of individual households in their role as private consumers. The household receives income from the production sectors in the form of wages, interest, rent and profit. This income is either consumed, saved, or paid as taxes to the government. Because the household sector constitutes a major part in the use of resources, it is important to keep them as a separate sector.

The government sector could be regarded as delimiting a special section of the consumption activity of the economy performed by government. In discussing the goals chosen for the study, it was decided, for social and military purposes, to keep government expenditures at a given level in the target year. This gives one of the rationale behind separating the government sector from the household sector. An additional reason is that the government as early as 1957 took the main responsibility for development of the economy and therefore it is better to separate it from the household in order to see how much and in what direction it can affect the economy.

The rest of the world sector or foreign sector consolidates the transactions between the various domestic sectors and foreign countries. It is important to show explicitly the relations of other sectors to the rest of the world sector because of the strategic role that foreign trade plays in the economic development of a small country such as Egypt which is highly dependent on it. The residual item in this account (net foreign borrowing) is important from a developmental policy point of view since it shows the extent to which the country can go in depending on foreign countries in its development. Net foreign savings is, in addition, a subject to policy choice (as was mentioned previously) and therefore it is important to keep a close eye on it.

The saving-investment sector or finance sector, like the preceeding one, does not refer to a single sector, but is used instead to record all those transactions or residual items that enter the other current accounts once but do not have a balancing entry in any of the other accounts.

The other group is related to the appropriate way of division of the productive activities in the economy. The argument here is whether to have all the production activities in the economy aggregated in one sector or whether it is beneficial to have some groupings such as agricultural, industrial, and services sector. For the present model, the argument for one production sector could be represented in the following:

a. It is clear from the analysis in Chapter II that Egypt passed a period of structural change from the 1930's up to the 1960's during which foreign trade has had a major role in making possible this continuing growth. In the future, it is clear that the economy will not continue to grow in the same way based on an ever expanding services sector along with an expansion of manufacturing output reaching 10% per year. In other words what is needed is a period proportional expansion all around. Therefore, if the model would indicate a certain target for GDY, which by the application of income elasticity of demand could suggest a certain level of final demand which

in turn, through the use of an input output model could suggest the appropriate levels of output for the different sectors.

b. It was shown also in Chapter II that, contrary to the common belief, there is sufficient evidence that Egypt does not belong to the group of countries characterized by unlimited supply of labor to which such models as those of A. Lewis or Ranis and Fei apply. In such countries the process of economic development is thought of as expanding other sectors such that the surplus labor in agriculture could be employed productively. Because Egypt does not have disguised unemployment in agriculture, there is no need to emphasize any mechanism like this, and one production sector might be sufficient.

Despite these points, the author finds it more advantageous to divide the production sector into three different sectors industrial (which includes industry, manufacture and construction), agricultural, and services sectors, since this will provide us with the major inter-industry transactions in the economy. In addition, since these sectors might differ in their capacity to compete in the world market, their capital-output ratio, or their rate of increase in labor productivity and these proved to be the effective limits to growth in many underdeveloped countries, it is better to have a wider sector division in order that they could be taken into consideration in the

final solution. Finally each of the three production sectors suggested here constitutes a major magnitude in the Egyptian economy. A detailed sectorial division will help to show a clear picture of what to expect as a result of any change in policy objective or instrument.

A detailed sector division, to be sure, increases the complexity of the model. It should be emphasized, however, that it increases the analytical usefulness of the model, and therefore it is the one to be used here. A wider sector breakdown than the one just chosen was not considered because in addition to the increase in the complexity of the model, we will face formidable difficulties with respect to the data requirements of such division.

With the goals chosen, the policy tools decided upon, and the sector division specified, the stage is now set for the construction of the model which is the subject of Chapter IV.

5. Summary and Conclusions

Both public consumption and full employment were chosen as fixed goals that have to achieve a certain level by the target year of the model (1974/75). On the other hand, both the level of GDY and net foreign borrowing are chosen as variable objectives that could be determined either by the maximum value that the variable take within

the feasible region (G.D.Y.), or by the specific value that the variable is allowed to take (net foreign borrowing).

While net foreign borrowing is chosen as an objective, it is also considered as one of the policy instruments that the planners can determine its value within certain limits. In addition, both the saving rate and the level of exports of industry and manufacture are chosen as policy instruments.

A functional sector classification is used in this study. The production activity in the economy is divided into three major sectors: Industry (which includes industry and mining, manufacture, and construction), agriculture, and services (this includes transportation and means of communication, finance and trade, housing, public utilities, and other services). The other sectors are the household sector, the government sector, the rest of the world sector, and the saving-investment sector.

CHAPTER IV

THE DESIGN OF THE MODEL

1. Introduction

Having considered the main structural characteristics of the Egyptian economy, and after discussing the appropriate policy targets and instruments and the division of the economy into different sectors, the stage is now ready for the construction of an aggregate economic model that reflects all these characteristics, and that includes among its key variables the policy instruments and goals chosen for this study, as well as the institutional limits on growth. Before going into the presentation of the detailed relationships of the model, it would seem worthwhile to state explicitly at the beginning certain of the general properties of the model. Some of thes properties have been mentioned in previous chapters, but it is important to bring them explicitly together. These general properties include:

a. The model is comparative statics, i.e., it yields a comparison of the value of the variables in 1974/75 with 1965/66, but it does not reveal anything about the annual time pattern of change during the intermediate years.

b. The variables of the model are measured in 1965/66 prices, which are the base year prices. Prices are not endogenous variables of the system, and price substitution in production and final demand is not considered. This is necessitated by empirical and computational difficulties.

c. In the production sector, deliveries of goods and services among industry and agriculture are recognized. Thus, the model is a simplified type of input-output models.

d. In estimating the parameters of the model, an attempt will be made to anticipate the important structural and technical changes which are expected to take place, rather than assuming the base year's technical relations to hold. Technological change has always been a fundamental factor in bringing about economic growth, and one could expect this to manifest itself both in the structure of input-output tables and in the magnitudes of the capital-output ratios.

e. The model will show the pattern of resource use at the aggregate level with the aid of an internally consistent national income accounting system which will indicate the availability of total resources of domestic and foreign origin as well as the utilization of these resources for development or non-development purposes. It should be noted that the acceptance of such a system is a prerequisite for systematized planning becuase it

focuses the attention on a set of strategic variables appearing in every planning context, and on the structural relations between them. Such a system of accounts, usually help to answer certain questions about overall economic policies especially with regard to its realism: whether it is capable of being achieved with the available resources; its effects: how does the policy affect the operation of the economy and in what magnitudes; and its consistency: whether the policy is consistent with itself, and whether it can be expected to produce a result superior to those alternative general economic policies.

The model that will be presented in this chapter will consist of three types of equations: accounting equations, behavioral equations, and exogenous variables. These will be presented in the following sections.

2. Accounting Equations

These equations will provide the accounting relationships among the different sectors in the model. It is important that the model should satisfy these accounting equations in order to have internally consistent solutions. It is obvious that these equations represent the accounting relationships among the variables of the national income accounts.

One of the neat ways of presenting the figures of national income accounts is the matrix form[1] where each row contains the receipts of one sector and each column contains the payments of one sector, so that each sector has one row and one column, and the payments from one sector to another are shown in the space where the column of one and the row of the other cross one another. A national income matrix which satisfies the sector division used in this model appears in Table IV.1.

There are several observations about the national-income matrix that has to be kept in mind:

a. Because of the fact that all these sector accounts are presented in a consolidated form, the intra-sector transactions cancels out, and we have zero entries in each cell connecting the same sector. All such cells lie on the diagonal of the matrix.

b. Due to the division of the production activities to three sectors, the inter-industry flows among these sectors will be included in the output of each separate sector. This will mean that the total production of these sectors will add up to more than gross domestic product. Further details of inter-industry flows could be shown if one enlarges the sector division than the one adopted here.

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[1] See Eddy and Peacock, op. cit., pp. 18-62.

Table IV.1--National Income Matrix.

Receipts By	Payments By							
	Industry	Agri-culture	Services	House-hold	Govern-ment	S-I	R.O.W.	Total
Industry	0	5	7	35	6	4	1	58
Agriculture	15	0	4	20	2	2	1	44
Services	5	3	0	30	7	4	1	50
Household	29	30	31	0	5	--	--	95
Government	6	5	6	6	0	--	--	23
Saving-Investment	3	1	2	4	3	0	--	13
Rest of the World	--	--	--	--	--	3	0	3
Total	58	44	50	95	23	13	3	286

Note: The figures that appear in this matrix are for explanatory purposes only.

c. In Chapter III, when the sector division was discussed, it was shown that a functional sector breakdown will be follwed; i.e., the system is not one which separates individuals into various groups with respect to their total activity but rather one which separates transactions according to their functions. Accordingly, government activities in the production activities will be recorded in any one of the production sectors, but the rest of the activities of government, those related to the collection of taxes and transfers and government consumption, or public consumption activities in general will be recorded in the government sector.

d. The matrix shows the rather trivial fact which is that total receipts and payments by each sector are equal. This, as will be expalined in a moment, provides the accounting equations which provide the model with internal consistency.

This system of national income accounting could be described more clearly with the help of a pipe diagram where the variables of the model could be represented by the pipes, and where the arrows inside each pipe indicates the direction of money flows in the magnitude indicated inside each pipe. A diagram like this will help to explain the kind of dependency among different variables through the connection of the pipes. When two or more pipes are connected, there exists a direct accounting

relationship among them. These accounting relationships means that at each branch-point (where two or more pipes meet) the value of all inflows must exactly equal the value of all outflows. This is another way of saying that the two sides of a T account must always balance.

Since our sector division is somewhat large, and it takes into account a large number of the relevant inter-sector relations, a presentation of a pipe diagram will be complicated somewhat, and therefore will not be presented here. Instead, a flow chart in the form of a linear graph which shows the intra and inter-sector flows will only be presented. Each line in this chart will represent a relationship between the two branch points that it connects.[1] Thus, these lines represent the monetary transactions or flows among sectors with the arrow showing the direction of these monetary flows. Each variable of the model will be represented by one line. This linear graph form of the model will be represented on the following page.

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[1]For a discussion of how linear graph techniques can be used in the formulation and analysis of development plans, the reader is referred to John C. Fei and Gustav Ranis, "A Study in Planning Methodology with Special Reference to Pakistan's Second Five Year Plan," Monographs in the Economics of Development, No. 1 (Karachi: The Institute of Development Economics, June, 1960). See also, Samuel Ho, op. cit., and F. Harrery, Graph Theory (Addison-Wesley, 1969), Chapters I-IV, pp. 1-40.

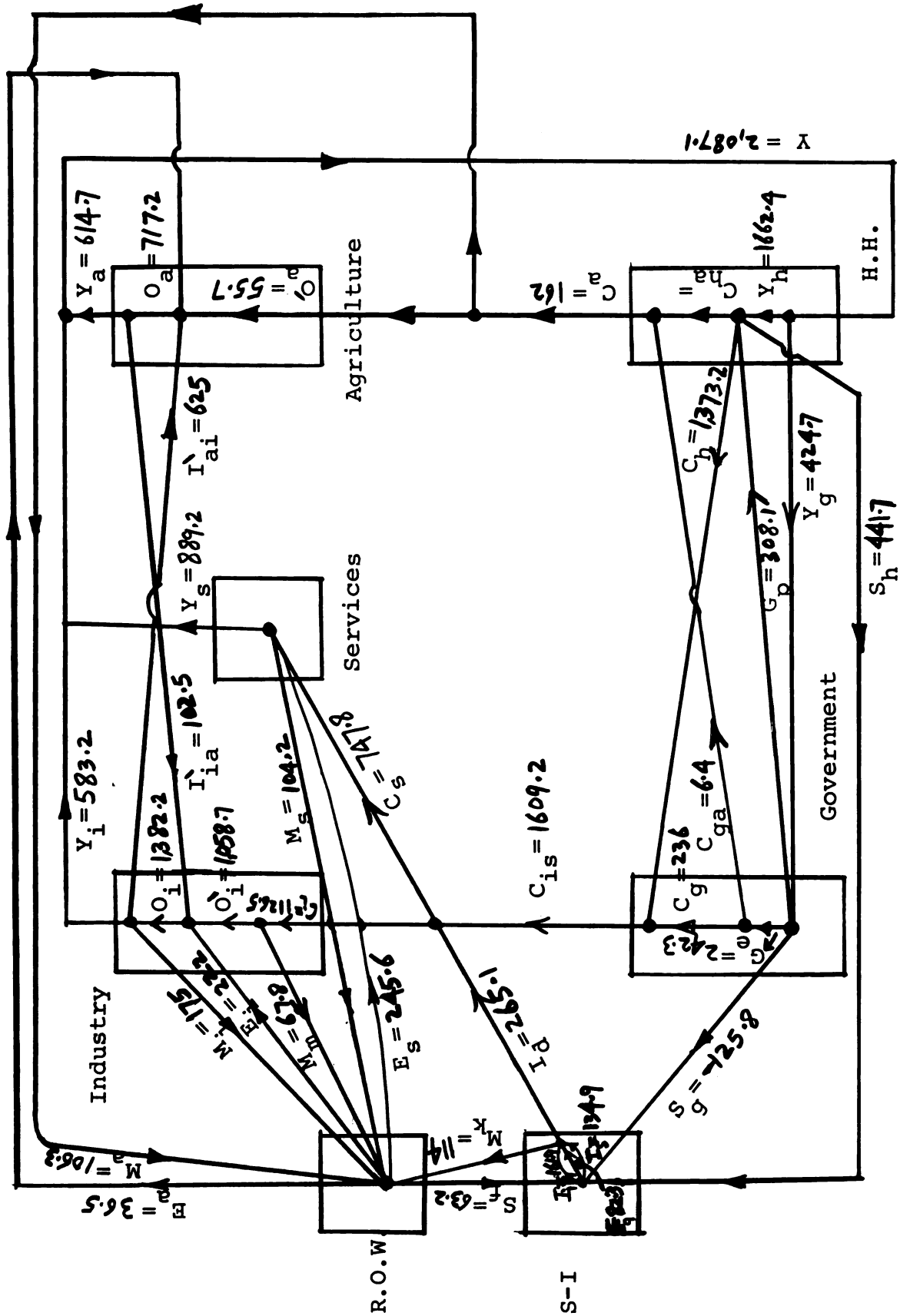


Figure IV-1: Flow Chart

Notes: The variables of the model are represented by the different lines in the flow chart and are defined as follows:

1. Y Gross Domestic Income.

Y_i Gross domestic income generated from the industrial sector.

Y_a Gross domestic income generated from the agricultural sector.

Y_s Gross domestic income generated from the services sector.

Y_h Household income.

Y_g Current budget net revenue.

G_p Government payments to the household sector in the form of wages and salaries, and interest payments and price subsidies.

G_e Government purchases of goods and services produced by any of the production sectors.

C_{ga} Government consumption of goods produced by the agricultural sector.

C_g Government consumption of goods and services produced by the industrial and services sectors.

C_h Household consumption of goods and services produced by the industrial and services sectors.

C_{ha} Household consumption of agricultural products.

C_a Total agricultural goods available for final domestic consumption.

C_i Total industrial goods available for domestic final demand.

C_s Output of services available for domestic final demand.

C_{is} Domestically produced goods from the industrial and services sectors available for final consumption.

S_h Household savings (includes pension and insurance funds accumulation with the government and retained profits of public and private companies).

S_g Government savings in the budget.

S_f Net borrowing from abroad.

I_d Investment expenditures on domestically produced goods and services.

I_i Investments in the industrial sector.

I_a Investments in the agricultural sector.

I_s Investments in the services sector.

M_k Imports of capital goods.

M_m Imports of manufactured goods for final consumption.

M_i Imports of intermediate and primary products for the industrial sector.

M_a Imports of agricultural goods for final consumption.

M_s Imports of services.

E_i Exports of the industrial sector.

E_a Exports of the agricultural sector.

E_s Exports of the services sector.

I'_{ai} Agricultural inputs into industry.

I'_{ia} Industrial inputs into agriculture.

O'_i Domestically produced industrial goods available for final domestic consumption.

O'_a Domestically produced agricultural goods available for final domestic consumption.

O_i Gross output of the industrial sector (net of inputs used by the same sector).

O_a Gross output of the agricultural sector (net of inputs used by the same sector).

2. Appendix I shows the detailed definition of all these variables and the method used for obtaining their values. It includes also annual data for all the variables for the period 1959/60 - 1965/66 in current prices and the sources of these data.
3. The arrows show the direction of monetary flows in the magnitude shown; and
4. When any two or more lines meet they form a juncture or a branch point, and there will result an accounting relationship among them. These will constitute our accounting equations which are represented by heavy dots in the graph.

Certain modifications (or omissions) were introduced in the flow chart either to facilitate exposition or to fit it with available data. These modifications are as follows:

a. In the rest of the world sector, all net foreign borrowing were assumed to accrue to the government. This is the reasonable assumption in the case of Egypt since the government took the main responsibility for the process of development in the early 1950's, and after the Socialization Acts of 1961 and 1963, investment is mainly financed and planned by government funds and government policy. Furthermore, no distinction was made between foreign borrowing or foreign transfers, since the major part of Egypt's foreign assistance comes in the form of loans. This is especially true after 1965 when wheat deliveries from the United States under the P. L. 480 Program were terminated.

b. In Chapter II, it was shown that the major part of the industrial sector is owned by the government.

All the big establishments are virtually government owned, and thus, the profits generated in these establishments are either invested internally or are provided for investments in other industrial establishments (or other sectors) according to the government's investment plan. It is obvious, therefore, that these savings should be included in government savings. Available data, however, does not allow for such treatment, and government savings shown in the chart will include only savings (or dissaving) in the current government budget. Retained profits in public companies, will, therefore, be included in household savings. This has some advnatages, however, since it will enable the government to control household savings, thereby justifying the choice of the saving rate as one of the policy instruments. The same advantage is achieved by including pensions and insurance funds accumulations which are collected by the government from its employees in household savings. These savings are not included in the government budget, and there will be no difficulty in adding them to household savings.

In addition to this, there are some analytical advantages in restricting government savings to those shown in the budget. It has been stressed by some economists[1] that the surplus (or deficit) on the current

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[1]Ursula Hicks, Development Finance: Planning and Control (New York: Oxford University Press, 1965), Chapter 8.

account is a key figure which has great economic significance because it shows the contribution of government to national savings (or dissavings). It is desirable, of course, that there should be a sufficient surplus on the current accounts of the government budget to finance part of the investment plan.

c. Due to the lack of statistics, no inputs of services are assumed to enter either the agriculture or the industrial sectors. Thus, it will be assumed that all the services output is for final consumption.

d. Gross domestic income (Y) is assumed to flow from the production sectors in the form of (Y_i), (Y_a) and (Y_s) to the household sector in the form of wages, rents, interest, profits, and indirect business taxes. Out of this magnitude, current budget net revenue (Y_g) is withheld through the different types of taxes. The remainder will constitute household income (Y_h).

From the chart, the following accounting equations could be easily identified:

Gross domestic income is equal to the sum of income generated from the industrial, agricultural, and services sectors:

$$(4.1) \qquad Y = Y_i + Y_a + Y_s$$

where Y refers to G.D.Y., and Y_i, Y_a, and Y_s refer to gross domestic income generated from the industrial, agricultural,

and services sectors respectively. On the other hand, part of the G.D.Y. is taken by the governments in the form of different types of taxes, and the rest goes to the households.

$$(4.2) \quad Y = Y_h + Y_g$$

To household income (Y_h) we should add government payments to the household sector (G_p) which consists of wages of government employees, interest payments, and price subsidies, the total of which is then spent on the products of either of the production sectors (C_h) and (C_{ha}), or saved (S_h). Thus:

$$(4.3) \quad Y_h + G_p = C_h + C_{ha} + S_h$$

As was mentioned earlier, household savings (S_h) include retained profits for public and private companies, and pensions and insurance funds accumulations with the government.

On the production side, the total supply of agricultural goods for final consumption (C_a) is either produced domestically (O_a) or imported (M_a). On the other hand, from the comsumption side, this total supply of agricultural goods is either consumed by the household sector (C_{ha}) or by government sector (C_{ga}). These give the following accounting equations:

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(4.4) $C_a = O_a^{\wedge} + M_a$; and

(4.5) $C_a = C_{ha} + C_{ga}$.

The current budget net revenue (Y_g) is either paid back to the household sector (G_p) consumed on goods and services produced by either of the production sectors (G_e), or saved (S_g). Thus:

(4.6) $Y_g = G_p + G_e + S_g$

Government expenditures on the consumption of goods and services (G_e) is either spent on agriculture products (C_{ga}) or on the consumption of goods and services produced either by the industrial or the services sectors (C_g). Thus:

(4.7) $G_e = C_{ga} + C_g$

The total supply of industrial goods and services available for final consumption (C_{is}) is either consumed by the government sector (C_g), or by the household sector (C_h). This provides the following accounting equation:

(4.8) $C_{is} = C_g + C_h$

On the other hand, the total supply of industrial goods and services availalbe for domestic final demand (C_i)

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and (C_s) are either provided for final domestic consumption or for investment expenditures on goods and services produced domestically (I_{id}). Thus:

$$(4.9) \quad C_i + C_s = C_{is} + I_d$$

Total industrial goods available for final domestic consumption (C_i) consists of domestically produced industrial goods available for final consumption (O_i') and imports of manufatured goods (M_m):

$$(4.10) \quad C_i = O_i' + M_m$$

Total investment expenditures, which is the sum of investment in industry (I_i), investment in agriculture (I_a), and investment in services (I_s) is either spent on goods and services produced domestically, (I_d), or is spent on capital imports (M_k):

$$(4.11) \quad I_i + I_a + I_s = I_d + M_k$$

Gross output of the industrial sector (O_i), is spent either on imports of raw materials or intermediate products (M_i), on intermediate inputs from agriculture (I_{ai}'), or to pay for the services rendered from the household sector in the form of wages, interest, rent, profits, and indirect business taxes (Y_i). This last component (Y_i) constitutes the contribution of the industrial sector to gross domestic income. Thus:

$$(4.12) \quad O_i = M_i + I'_{ai} + Y_i$$

On the other hand, the total output of the industrial sector (O_i), is either made available for domestic consumption (O'_i), exported to the rest of the world (E_i), or provided as intermediate inputs for the agricultural sector (I'_{ia}) in the form of chemical fertilizers, pesticide, and so on. The following accounting equation, therefore, describes the total use of the output of the industrial sector:

$$(4.13) \quad O_i = O'_i + E_i + I'_{ia}$$

Gross output of the agricultural sector (O_a) is spent either on intermediate inputs from industry (I'_{ia}) or to pay for the services performed by the household in the form of wages, interest, rent, profits, and indirect business taxes (Y_a). Thus:

$$(4.14) \quad O_a = I'_{ia} + Y_a$$

On the other hand, gross output of the agricultural sector (O_a) is either exported (E_a), made available as raw materials or intermediate inputs in the industrial sector (I'_{ai}), or provided for final domestic consumption (O'_a). Thus:

$$(4.15) \quad O_a = E_a + I'_{ai} + O'_a$$

The value of total output of the services sector (Y_s) is assumed to flow to the household sector in the form of wage, interest, rent, profits, and indirect business taxes. The contribution of the services sector to gross domestic income is, therefore, represented by (Y_s). As was shown earlier, to overcome shortage of data, the assumption was made that all the services output is either for domestic consumption (C_s), or net exports (E_s-M_s). So the allocation of services output is expressed by the following equation:

$$(4.16) \quad Y_s = C_s + E_s - M_s$$

The sum of investments in the production sectors ($I_i + I_a + I_s$) should be equal to the sum of household saving (S_h), government saving (S_g) and net borrowing from abroad (S_f). Thus, the equilibrium condition of saving and investments is provided by the following accounting equation:

$$(4.17) \quad I_i + I_a + I_s = S_h + S_g + S_f$$

Finally, in the rest of the world sector, the sum of imports of manufactured goods (M_m), imports of primary and intermediate products for the industrial sector (M_i), imports of agricultural goods for final consumption (M_a), imports of services (M_s), and imports of capital goods (M_k), should be equal to the sum of industrial exports (E_i),

agricultural exports (E_a), services exports (E_s), and net foreign borrowing (S_f). Thus, the balance of payments equilibrium condition is provided by the following accounting equation

(4.18) $M_m + M_i + M_a + M_s + M_k = E_i + E_a + E_s + S_f$

It may be noted that the accounting equations (4.1)-(4.16) are identities that are included in the model for purposes of logical completeness, while the accounting equation (4.17) and (4.18) states the equilibrium condition of saving and investments, and the balance of payments equilibrium. These equilibrium condtions should be stated explicitly in order that the model be complete.

3. Behavioral Equations

The preceeding accounting equations, though necessary to guarantee the consistency among the variables of the model, are not sufficient to determine the values of these variables. To make the model determinate, one needs to stipulate some additional independent conditions which could either be exogeous variables that are determined outside the system or behavioral equations that may describe either the behavior patterns of different transactors or the technical relationship between inputs and outputs. It should be mentioned that the system will be determined whether one depends heavily on exogenous

variables or on behavioral equations. A system that relies more heavily on behavioral equations, is, however, a better one since it permits greater play for the contribution of economic theory. Nonetheless, the use of more or less behavioristic equations might not simply be a question of preference but of necessity since some behavioral relationships may not be obtainable, given the state of economic knowledge and available data.

The following behavioral equations (with the exogenous variables that will be specified in the next section) will include all the possible independent economic conditions which the planner might want to take into consideration.

One of the important, yet still weak, parts of any aggregative model of the type to be constructed here is the choice of an aggregate production function for each sector in the economy. In the writer's view, production functions when used to the whole economy or to large parts of it are at best useful fiction. They may suggest underlying reality, but can hardly be expected to replicate it. The function that is finally chosen will depend on the preferences of the model builder who, hopefully, has considered the advantages and diadvantages of tye type he chooses versus other types. The particular production function that is chosen here must be understood in this light.

The production function that will be used for the industrial sector is one of the fixed proportion types of production functions which assumes perfect complementarity among factors of production. Such functions were used in growth models initiated by Harrod and Domer and have been criticized for the omission of substitution among factors of production. This had led to the utilization of a Cobb-Douglas production function in some growth models,[1] but here this type of function proved to have limitation in growth setting.

It is generally recognized, however, that substitution among factors can only take place over a period of time and can only take place with the installation of new equipments, which is more likely to be true in the short run than in the long run. Furthermore, one could assume that relative prices do not change so that it is not efficient to alter input proportions regardless of the shape of production function. There are both theoretical and empirical grounds for expecting relative prices to be fairly stable apart from periods of war time shortages and similar situations.[2]

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[1] R. M. Solow, "A Contribution to the Theory of Economic Growth," Q.J.E., February, 1956 and T. Swan, "Economic Growth and Capital Accumulation," Economic Record, November, 1956.

[2] H. Chenery and P. Clark, Inter-Industry Economics (John Wiley and Sons, 1959), Chapter II, pp. 39-42.

The use of a fixed coefficients production function does not allow also for technical change. A very ingenious justification for using the aggregate Harrod-Domer production function involving only capital as input, with no provision for labor or technical change is given by M. Frankel.[1] He showed that if the output of each industry in an economy is governed by a Cobb-Douglas production function using both capital and labor, but the scale factor, or the "development modifier" as he calls it, in each production function incorporates external effects by being a function of the aggregate capital-labor ratio, then the Harrod-Domer model may give a good approximation to output in the aggregate. Thus, while the conditions of a Cobb-Douglas function hold fully for the enterprise, as the enterprise varies its factor input, say accumulating capital in response to market and other opportunities, the modifier shifts. The shifts are exogenous to the enterprise in question. So, instead of moving along a Cobb-Douglas function, which is an ex-ante function, the enterprise moves along a realized function which mirrors namely Herrod-Domer function.[2]

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[1]Marvin Frankel, "The Production Function: Allocation and Growth," A.E.R., LII, No. 5, (December, 1962), pp. 995-1022.

[2]Ibid., pp. 999-1000.

Since Frankel's results are associated with the external industrial effects of economic development, it provides some justification for what is assumed in this model. A further reason for ignoring labor as an input is that unskilled labor is in large supply and for it to be useful, it must be trained, which is analogous to making an investment in physical plant and equipment. Also, such assumption will permit the consideration of the effects of capital accumulation on growth in the context of a simple linear model, that emphasize the role played by capital accumulation as an "engine of growth."

Thus, the production function for the industrial sector could be written in the form:

$$(4.19) \quad Y_i = Y_i^\circ + b_i(K_i - K_i^\circ)$$

where Y_i refers to G.D.Y. generated from the industrial sector at the target year, while Y_i° refers to the same variable in the base year,[1] b_i refers to the incremental output-capital ratio in industry, while K_i and K_i° refer to capital stock at the target and base year respectively.

Finally, it may be mentioned that the use of such type of production function implies that changes in the

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[1]To avoid complex notation, all variables that have no time subscript will be for the target year, while base year variables will be distinguished by the subscript o.

composition of the output of the industrial sector acts randomly on the overall capital-output ratio of the industrial sector. This is due to the fact that changes in the composition of output reflects mainly changes in final demand, and there is nothing to suggest that demand changes in such a way that the capital-output ratio is consistently pushed in one direction or the other.

With respect to the production function in the agricultural sector, the situation might not be as clear cut. Here there may exist different factors of production, that have to be considered separately. First of all, land could be considered as a factor of production. But as was shown in Chapter II, the cultivated area in Egypt is limited by water supply, and apart from the expected increase in the reclaimed area as a result of the completion of the High Dam at Aswan, additional increases in the cultivated area will not be possible at least in the foreseeable future. Thus, for our purposes, the supply of land could be taken as fixed.

In addition, chemical fertilizers and water supply could be considered as separate factors of production. The contribution of such factors of production to total output seems, however, to be very small when a Cobb-Douglas production function was estimated for the Egyptian agriculture.[1]

[1] El-Emam, op. cit., pp. 32-33.

This leaves labor and capital. In the study about the agricultural production function referred to above, the coefficient of labor was found to be significant. It seems clear, however, that increases in agricultural production during the period of the model will require increases in agricultural investment, both for horizontal and vertical expansion. It is in this coming period that the major part of the area to be reclaimed to utilize the High Dam water is due to be brought to cultivation and this requires a large amount of investment. Vertical expansion, on the other hand, requires investment expenditure on drainage, chemical fertilizers, and improved plant varieties. It seems, therefore, that both labor and capital will both be important as major determinants of agricultural output.

To simplify our analysis, however, a similar argument to the one used for the production function of the industrial sector can be used to write the agricultural production function in the following form:

$$(4.20) \quad Y_a = Y_a^o + b_a(K_a - K_a^o)$$

Similarly, the production function of the services sector could be written as:

$$(4.21) \quad Y_s = Y_s^o + b_s(K_s - K_s^o)$$

The demand for labor in the production sectors will depend on the level of output in each sector and on the rate of increase in the average labor productivity. Obviously, an increase in the average labor productivity will have a negative impact on the demand for labor; i.e., the faster the rate of increase of labor productivity is, the harder will be the full employment goal to achieve.

The demand for labor for each production sector could be represented in the following form:

$$(4.22) \quad L_i = \lambda_i^o(i - \ell_i)^t Y_i$$

Similarly,

$$(4.23) \quad L_a = \lambda_a^o(1 - \ell_a)^t Y_a$$

and,

$$(4.24) \quad L_s = \lambda_s^o(1 - \ell_s)^t Y_s$$

where (λ) refers to the average labor input per unit of output (or the labor-output ratio) in each sector, (ℓ) is the annual increase in the average labor productivity, and (t) refers to the time period of the model. The following points should be noted with regard to the demand functions for labor:

a. Since the production functions in the model (equations 4.19-4.21) assume complementarity among labor and capital, equations (4.22-4.24) could be restated as

the production functions by solving for Y_i, Y_a, and Y_s, if labor should become the limiting factor to the growth process.

b. With regard to the rate of the annual increase in the average labor productivity in each sector (ℓ), it is obvious that while it is subject to government policy such as education, vocational and on the job training, and the like, it must be considered also as an institutional limit since it depends to some extent on tradition and culture, and there might be some limitations to achieve higher values for it in a short period of time. In a study of development alternatives, it seems preferable, therefore, to consider three different values that reflect different levels of efforts of the government policies, and different degrees of flexibility of social customs and traditions. Thus, three different values for (ℓ) will be assumed, where $\ell^* \leq \ell \leq \ell^{**}$ instead of specifying a single value. The first value will reflect modest increase, the second reflects a moderate one, and the third will show large changes.

The behavioral equation describing the investment process in Egypt should be dependent mainly on the planners' decisions to achieve the goals specified by the plan, and on their expectations with regard to the future movement in prices (at least international versus domestic prices). But since these factors are difficult to express

quantitatively, a simple approximation will be assumed that expresses investment as the addition to capital stock.[1]

$$(4.25) \quad \sum_{t=o}^{T-1} I = (K - K_o)$$

where I is the annual gross capital formation, and K_o and K are the capital stock in the base and target years respectively. In order to express the model in terms of initial and final year values only, a simple approximation could be used to relate investment to capital stock:

$$(4.26) \quad I = \rho(K - K_o)$$

where ρ depends on the rate of growth of investment and the length of the planning periods.[2]

Applying this reasoning to the sector division used in our model, annual gross capital fromation in the industrial sector could be represented as follows:

$$(4.27) \quad I_i = \rho_i(K_i - K_i^o)$$

Similarly, for the agricultural sector we have:

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[1]It is to be noted that this same approximation was also used by H. Chenery and M. Bruno, op. cit., p. 89.

[2]If the planning period is equal to 9 years as the one used in our model, then ρ could be expressed as follows:

$$\rho = \frac{I_9}{I_1 + I_2 + \ldots + I_8}$$

$$(4.28) \quad I_a + \rho_a (K_a - K_a^o)$$

Finally, for services, we have:

$$(4.29) \quad I_s = \rho_s (K_s - K_s^o)$$

Now, for the different production sectors, if one goes back to the production functions of these production sectors (equations 4.19, 4.20, and 4.21), one can find that these functions were represented mainly as dependent on changes in capital stock. Since changes in capital stock are, as represented by equations (4.27), (4.28), and (4.29), dependent on the volume of investment, these production functions could be combined with the investment equations to give the following:

$$(4.30) \quad I_i = \frac{\rho_i}{b_i} (Y_i - Y_i^o)$$

$$(4.31) \quad I_a = \frac{\rho_a}{b_a} (Y_a - Y_a^o)$$

and

$$(4.32) \quad I_s = \frac{\rho_s}{b_s} (Y_s - Y_s^o)$$

Through this manipualtion the investment equation and the production function for each sector were combined. It is in this form that these two relations will be represented in the model.[1]

[1] It may be noted that this is the same form used by Samuel Ho, op. cit., p. 98.

While household saving (S_h) depends on the level of per capita income, the distribution of income both between government and household and among household themselves, many of these factors cannot be estimated adequately, and therefore, the relation will take the following form:

With respect to household income (Y_h), it will be assumed that it depends mainly on the level of gross domestic product (which is the sum of (Y_i, Y_a, and Y_s) and on the policies of the government with respect to the determination of its policies, i.e., the government tax policy. Thus

$$(4.33) \quad Y_h = (1 - t)\ (Y)$$

where (t) is the aggregate tax rate. It is to be noted that no distinction will be made between different types of taxes, and the value of (t), therefore, represents the relation between the current budget net revenue of the government and G.D.Y.

Household savings have to be considered as a function of household income (Y_h), and government payments to the household sector (G_p). Thus

$$(4.34) \quad S_h = \alpha(Y_h + G_p)$$

where (α) is the marginal propensity to save, and is assumed to be equal to the average propensity to save.

For the estimation of household saving, ideally household income should be broken down to the different components (profits, wages, and rents), and a separate saving rate should be estimated for each component, thereby showing the effects of changes in income distribution on household savings. But in the absence of information which would make this possible, there is no other alternative than using household income as the major determinant of saving disregarding its composition.

It is to be remembered that the propensity to save (α) was chosen as one of the policy instruments in this model. This seems as a reasonable assumption, since the retained profits of public and private companies (which are mostly reinvested again) are included in the household income (Y_h). As was mentioned earlier, the government exercises its control over those savings. The same argument could be used with respect to pensions and insurance funds accumulation which is determined and collected by the government. This last item has been included with the household savings, because they actually belong to the household even though they are collected by the government, and because it is better to focus attention on the government savings in the budget.

Agricultural inputs for industry (I'_{ai}) such as raw cotton, vegetables, etc., is a technological relation that has to be satisfied by the model. Thus:

(4.35) $I'_{ai} = \beta_i(O_i)$

where (β_i) is the coefficient for agricultural inputs into industry, and (O_i) is gross output in the industrial sector.

Similarly, industrial inputs in agriculture (I'_{ia}) such as fertilizers, machines, etc., could be presented as a function of gross output of the agricultural sector (O_a):

(4.36) $I'_{ia} = \beta_a(O_a)$

where (β_a) is the input coefficient.

For imports of manufactured goods (M_m), it will be assumed to be a function of domestic income generated from the industrial sector. Thus:

(4.37) $M_m = \mu_m(Y_i)$

With respect to imports of intermediate and primary products required for the industrial sector (M_i), it will be assumed to be proportional to industrial output. This might not be unreasonable, at least in the short run, where the industrial structure does not change rapidly. Thus:

(4.38) $M_i = \mu_i(O_i)$

For services imports, an assumption will be made that it is proportional to domestic income generated from the services sector. Thus:

(4.39) $M_s = \mu_s(Y_s)$

With respect to imports of capital goods, an assumption will be made that they will be proportional to gross domestic investment which is the sum of investment in the different production sectors. This seems realistic, at least in the short run, because Egypt is still far away from the stage of producing at home capital goods required for domestic investment. Thus:

(4.40) $M_k = \mu_k(I_i + I_s + I_a)$

Because of the importance of G.D.Y. (Y) for social welfare, in the solution of the model, (Y) has to be expressed in terms of the parameters, base year variables, exogenous variables, and the other polich variables chosen for this model. In order to be able to do this, the different components of G.D.Y., (Y_i), (Y_a), and (Y_s) has to be expressed in terms of G.D.Y. To do this, one needs to know the ratio of any two of these components to G.D.Y. If the ratio of these two components are known, then the third could be known easily as a residual.

It should be noted that these ratios should reflect not only past performances and possible future

trends, but also they should reflect policy goals with respect to the preference for specific growth rates for certain sectors. Thus, if it is desired to put more emphasis on the growth of the agricultural sector, then the ratio of (Y_a) to (Y) should be determined to reflect this preference. In the case of Egypt, the growth of the different sectors was discussed in Chapter II, and it was shown that Egypt has gone through as much structural change as possible between the mid 1950's and the mid 1960's, and that what is needed is another period of proportional expansion all around. The value of these ratios has, therefore, to reflect past performance in addition to any basic trend during the period of the model. Thus, both domestic income generated from both the industrial and services sectors could be expressed in terms of G.D.Y. as follows:

(4.41) $Y_i = \psi_i Y$, and

(4.42) $Y_s = \psi_s Y$

4. Exogenous Variables

In addition to the accounting and behavioral equations mentioned in the last two sections, the variables that are determined outside the system (the exogenous variables) has to be specified. These exogenous variables may

take the form of policy goals, policy instruments, and independent conditions.

With respect to the imports of agricultural products, it was shown in Chapter II that these imports increased sharply in the past decade. The completion of the High Dam will lead, as it was mentioned before, to an increase in the cultivated area in Egypt by 1.3 m. feddan in addition to the conversion of .0538,000 feddan from basin to perennial irrigation. It was also mentioned that Egypt could increase its benefits if it shifts agricultural production away from grain to fruits, vegetables, meat and dairy products. However, these latter benefits should be looked at as a long run goal since the achievement of these radical changes depends among other things on the policy of the European Economic Community with respect to the agricultural products of different countries, upon improvements in agricultural techniques and transporation methods, upon conquering new markets . . . etc., and all of these factors are of long term nature. Thus, it would look more advisable, if one assumes that in the short run part of the newly cultivated area will be diverted to make Egypt self-sufficient in food. It will be assumed, therefore, that imports of agricultural goods for final consumption (M_a) will be equal to

$$(4.43) \quad M_a = \bar{M}_a \qquad \text{where } \bar{M}_a = o$$

It is to be remembered from the previous chapter, that trade policy was chosen as one of the instruments in the model that could be exercised on the exports of the industrial sector (including manufacture). Although a country's exports are a function of many variables, important among which are relative prices, quality of the product, commercial policy, . . . etc. and not all of these are under the government control, still the government, through such things as export subsidies, trade agreements, currency devaluation and the like, could to a large extent affect the level of exports within considerable limits. Thus, three levels will be assumed for (E_i): a pessimistic, moderate, and an optimistic level. Accordingly, in the target year (1974/75), E_i will be assumed to be:

$$(4.44) \quad E_i = \bar{E}_i \qquad \text{where } \bar{E}_i^* \leq \bar{E}_i \leq \bar{E}_i^{**}$$

On the other hand, the values of E_a and E_s, has to be determined for the target year. The values assumed for these variables should reflect, of course, previous rates of growth, possibilities of expansion, and possible future trends. Thus, in the target year, it will be assumed that

$$(4.45) \quad E_a = \bar{E}_a \,, \qquad \text{and}$$

$$(4.46) \quad E_s = \bar{E}_s$$

where E_a is agricultural exports, and E_s is the exports of services.

As was mentioned in the first two chapters, the balance of payments problems were an effective limit to growth in the 1960's. This was behind the choice of net foreign borrowing (S_f) as one of the goals of the model in Chapter III. Equilibrium in the balance of current accounts will, of course, mean that S_f is equal to zero. But since planning usually takes place in a world full of uncertainty, which are the main reasons behind the construction of this model, three different values of S_f will be assumed. Therefore, we have:

$$(4.47) \quad S_f = \bar{S}_f \qquad \text{where } \bar{S}_f^* = o,\ \bar{S}_f \geq o\ ,\ \bar{S}_f^{**} \geq o$$

It is to be noted that one of the policy goals chosen for this model was that, for security purposes, government expenditure was taken as given. Thus:

$$(4.48) \quad C_g = \bar{C}_g\ ,$$

$$(4.49) \quad C_{ga} = \bar{C}_{ga}\ , \text{ and}$$

$$(4.50) \quad G_p = \bar{G}_p\ ,$$

where C_g is government consumption from the industrial and services sector, C_{ga} is government consumption of agricultural products, and (G_p) is government payments to

the household sector in the form of wages and salaries, interest payments, and price subsidies.

5. Development Alternatives

The alternative development programs that are going to be presented in this model are defined with respect to different values of some of the policy variables of the model. These are as follows:

a. The saving rate which will be assumed to take either of the following values:

$$(4.51) \quad \alpha^* \leq \alpha \leq \alpha^*$$

b. The annual rate of increase in the average labor productivity, which will be assumed to take either of the following values:

$$\ell^* \leq \ell \leq \ell^{**}$$

It is to be observed that (ℓ) will enter the model through its effect on the level of G.D.Y. (Y) that is compatible with full employments which is one of the targets in the model.

The full employment target could be expressed as follows:

$$(4.52) \quad L = L_i + L_a + L_s$$

where L is the supply of labor in the target year, L_i, L_a, and L_s are the demand for labor in the target year by the

industrial, agricultural, and services sectors respectively. It may be mentioned that L refers to the size of actually employed workers, and not to the labor force, because it was difficult to get annual data about the labor force in Egypt. The data that are available are those related to the development of employment in the different production sectors. The supply of labor, will, therefore, be assumed to be equal to:

$$(4.53) \quad L = L_o(1 + \delta)^t$$

where (L_o) refers to the number of workers employed in the base year, (δ) is the rate of growth of the labor force,[1] and (t) is the time period of the model. Looking at equation (4.53) it can be seen that (L), the supply of labor that has to be employed in the target year is easily known since (L_o), (δ) and (t) are known.

Once the value that represents the supply of labor in the target year is known, then the value of G.D.Y. (Y) could be expressed in terms of (λ_i^o, ℓ_i); (λ_a^o, ℓ_a), (λ_s^o, ℓ_s) and (L) by substituting (4.22-4.24) into the full employment condition equation (4.52). The values of (λ_i^o, λ_a^o, and λ_s^o) are known parameters in the model, while that of (ℓ_i, ℓ_a, and ℓ_s) are assumed to be institutional

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[1] In Chapter II, the rate of growth of the labor force (δ) was assumed to be equal to 2.6% up to the target year of the model.

constraints that could take any value over a pre-determined range. Thus, depending on which value the annual increase in the average labor productivity in the different production sectors (ℓ_i, ℓ_a, and ℓ_s), the value of G.D.Y. will be determined when labor is the effective constraints on growth. Thus:

(4.54) $Y^* \leq Y \leq Y^*$ depending on whether $\ell = \ell^*, \ell$, or ℓ^{**}.

c. The level of exports of the industrial sector (E_i), which will be assumed to take either of the following values:

(4.55) $E_i^* \leq E_i \leq E_i^{**}$

d. The level of net foreign borrowing (S_f) will be assumed to take either of the following values:

(4.56) $S_f^* \leq S_f \leq S_f^{**}$

6. Summary

The model defines the structure of the Egyptian economy in terms of 37 variables. To determine the values of these variables in the target year (1974/75), the following equations are postulated:[1]

[1]The numbers appearing before each equation in this section are those that are going to be used from now on when any reference is made to any of the equations of the model.

I. Accounting Equations

a. Definitions

(1) $Y = Y_i + Y_a + Y_s$

(2) $Y = Y_h + Y_g$

(3) $Y_h + G_p = C_h + C_{ha} + S_h$

(4) $C_a = O'_a + M_a$

(5) $C_a = C_{ha} + C_{ga}$

(6) $Y_g = G_p + G_e + S_g$

(7) $G_e = C_{ga} + C_g$

(8) $C_{is} = C_g + C_h$

(9) $C_i + C_s = C_{is} + I_d$

(10) $C_i = O'_i + M_m$

(11) $I_i + I_a + I_s = M_k + I_d$

(12) $O_i = M_i + I'_{ai} + Y_i$

(13) $O_i = O'_i + E_i + I'_{ia}$

(14) $O_a = I'_{ia} + Y_a$

(15) $O_a = O'_a + E_a + I'_{ai}$

(16) $Y_s = C_s + E_s - M_s$

b. Equilibrium Conditions:

(17) $I_i + I_a + I_s = S_h + S_g + S_f$

(18) $M_i + M_m + M_a + M_s + M_k = E_i + E_a + E_s + S_f$

II. Behavioral Equations

(19) $I_i = \frac{\rho_i}{b_i} (Y_i - Y_i^o)$

(20) $I_a = \frac{\rho_a}{b_a} (Y_a - Y_a^o)$

(21) $I_s = \frac{\rho_s}{b_s} (Y_s - Y_s^o)$

(22) $Y_h = (1 - t)\ Y$

(23) $S_h = \alpha[Y_h + G_p]$

(24) $I'_{ai} = \beta_i(O_i)$

(25) $I'_{ia} = \beta_a(O_a)$

(26) $M_m = \mu_m(Y_i)$

(27) $M_i = \mu_i(O_i)$

(28) $M_s = \mu_s(Y_s)$

(29) $M_k = \mu_k(I_i + I_s + I_a)$

(30) $Y_i = \psi_i(Y)$

(31) $Y_s = \psi_s(Y)$

III. Exogenous Variables

(32) $M_a = \bar{M}_a$

(33) $E_a = \bar{E}_a$

(34) $E_s = \bar{E}_s$

(35) $S_f = \bar{S}_f$

(36) $C_g = \bar{C}_g$

(37) $C_{ga} = \bar{C}_{ga}$

(38) $G_p = \bar{G}_p$

IV. Development Alternatives

(39) $\alpha^* \leq \alpha \leq \alpha^{**}$

(40) $Y^* \leq Y \leq Y^{**}$

(41) $\bar{E}_i^* \leq \bar{E}_i \leq \bar{E}_i^{**}$

(42) $\bar{S}_f^* \leq \bar{S}_f \leq \bar{S}_f^{**}$

CHAPTER V

DEVELOPMENT ALTERNATIVES IN EGYPT IN 1974/75

1. Introduction

The purpose of this chapter is to determine some consistent sets of development alternatives available to Egypt in 1974/1975 under the constraints imposed by the model. By a consistent set it is meant a set of values for the 37 variables that constitute the model that lie within the different constraints imposed by the model which may be either policy goals, instruments, or institutional limitations. The method through which a consistent set of development alternatives is determined could be explained as follows:

The model that was stated explicitly at the end of chapter IV will first be solved to determine the value of the different variables of the model. These values will, of course, depend on the values of the exogenous variables, parameters, and base year values. This will be done in the following section of this chapter.

To determine the values of the different parameters and exogenous variable is the purpose of the third section. The estimation process, though straight forward,

will try as much as it possibly can to include all the possible shifts or structural changes that might be expected to take place in the near future in the Egyptian economy.

The fourth part of this chapter will be concerned with determining a limited number of development alternatives facing the Egyptian planners in 1974/75. The economic implications of some of these alternative programs will also be discussed.

2. Solution of the Model

There are two possible ways through which the model could be solved. The first is to try to get a solution for Y in terms of the parameters, exogenous variables, base year values, α and E_i. In this case, once α and E_i are determined, then Y is determined, and once Y is known, then all the other variables could be determined too. The second method is to try to reduce the model into two equations that express saving-investment equilibrium and balance of payments equilibrium. The two methods give the same answer, but the former presents the development alternatives more clearly, while the latter will focus the attention on some of the other uses of the model as the identification of the possible bottlenecks and the choice among policies. This chapter is concerned with the determination of some sets of alternative development programs and, therefore, the first

method of solution will be presented here. In Chapter VI, which is concerned with the determination of bottlenecks and the choice of policy, the second method will be presented.

The method through which the solution is determined could be explained as follows:

Once the exogenous variables are known (equations 32-38) one more variable could also be determined. This variable is G_e (in Equation 7) since it depends on two other exogenous variables. To determine the values of the other 29 variables, the remaining equation has to be solved simultaneously. The method through which the solution is obtained could be easily explained by referring to the equations of the model at the end of Chapter IV and to the Flow Chart in Cahpter IV. Looking at the equation that defines Y_s, one can find that Y_s is expressed from equation (16) as:

$$Y_s = C_s + E_s - M_s$$

Moving counter clockwise, C_s could be expressed in terms of C_{is}, I_d, and C_i. $C_s = C_{is} + I_d - C_i$. These in turn could be expressed in terms of other variables until finally one can express C_s in terms of Y. The details of this process is explained in detail in Appendix II, but as an example the process through which I_d is expressed in terms of Y will be shown here:

From equation (11), I_d is expressed as

$$I_d = I_i + I_a + I_s - M_k$$

But from equation (29):

$$M_k = \mu_k (I_i + I_a + I_s)$$

Substituting for M_k from equation (29) into equation (11):

$$I_d = (1-\mu_k)(I_i + I_a + I_s)$$

Substituting for I_i, I_a and I_s from equation (19), (20), and (21) respectively:

$$(5.1) \quad I_d = (1-\mu_k) \left[\frac{\rho_i}{b_i}(Y_i - Y_i^o) + \frac{\rho_a}{b_a}(Y_a - Y_a^o) + \frac{\rho_s}{b_s}(Y_s - Y_s^o) \right]$$

But from equation (30):

$$Y_i = \psi_i Y$$

and from equation (31):

$$Y_s = \psi_s Y$$

and from equations (1), (30), and (31):

$$Y_a = (1 - \psi_i - \psi_s) Y$$

Substituting these values for Y_i, Y_s and Y_a, into equation (5.1), I_d could be expressed in terms of Y and after rearranging the terms, it becomes:

$$(5.2)\quad I_d = (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s}{b_s}\right] Y$$

$$- (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right]$$

This same procedure could also be followed with respect to C_{is} and C_i, and once this is done, C_s could be expressed in terms of Y. C_{is} could be expressed in terms of Y as follows:

$$(5.3)\quad C_{is} = \bar{C}_g + \bar{G}_p + (1-t)Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] Y$$

$$+ \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - \alpha\left[(1-t)Y + \bar{G}_p\right]$$

Similarly, C_i could be expressed in terms of Y as follows:

$$(5.4)\quad C_i = \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right] Y - E_i$$

Once this is done, C_s could be expressed in terms of Y by substituting for I_d, C_{is}, and C_i from equations (5.2), (5.3) and (5.4) into equation (9). Thus:

$$(5.5)\quad C_s = \bar{C}_g + \bar{G}_p + (1-t)\,Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] Y + \bar{E}_a -$$

$$\bar{M}_a + \bar{C}_{ga} - \alpha\left[(1-t)Y+\bar{G}_p\right] + (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i}\right.$$

$$\left. + \rho_a\left(\frac{1-\psi_i-\psi_s}{b_a} + \frac{\rho_s\psi_s}{b_s}\right]\right] Y - (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o +\right.$$

$$\left.\frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right] - \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right]$$

$$Y + E_i$$

The two other variables in equation (16) are either known or could be easily expressed as a function of Y. From equation (34), E_s is known:

$$E_s = \bar{E}_s$$

and from equation (28):

$$M_s = \mu_s(Y_s)$$

substituting for Y_s from equation (31), M_s becomes

$$(5.6) \quad M_s = \mu_s \psi_s Y$$

Thus, Y_s could be expressed in terms of Y through algebraic manipulation of the different relationships in the model. The final result will be as follows:

Equation (16) gives the following

$$Y_s = C_s + E_s - M_s$$

Substituting for Y_s from equation (31), for C_s from equation (5.5), for E_s from equation (34), and for M_s from equation (5.6) one gets:

$$(5.7) \quad \psi_s Y = \bar{C}_g + \bar{G}_p + (1-t)Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right]Y + \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - \alpha[(1-t)Y + \bar{G}_p] + (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right]Y - (1-\mu_k)\left[\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right] -$$

$$\left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right]Y + E_i + \bar{E}_s - \mu_s\psi_s Y$$

which could be written as

$$(5.8) \quad Y = \frac{A + E_i - B(\alpha)}{C(\alpha) + D}$$

where A, B, C, and D are constants and equal to:

$$(5.9) \quad A = \bar{C}_g + \bar{G}_p + \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - (1-\mu_k)\left(\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right) + \bar{E}_s,$$

$$(5.10) \quad B = \bar{G}_p,$$

$$(5.11) \quad C = (1 - t), \text{ and}$$

$$(5.12) \quad D = \psi_s - (1-t) + \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] - (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] + \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right] + \mu_s\psi_s.$$

Once the value of Y is determined, the other variables could also be determined by the use of one or another of the behavioral or accounting relationships in the model. For example, from equation (22) Y_h is expressed as:

$$Y_h = (1-t)Y$$

Once (1-t) and Y are known, then Y_h is determined, and so on for the other variables in the model.

It may be noted that in deriving the solution of the model in terms of Y, E_i, and α, all the relationships of the model were used except 3 equations. Two of these will be used to determine two other variables (once Y is known of course). These equations are the following:

a. Equation (6):

$$Y_g = G_p + G_e + S_g$$

This is one of those equations that has not been utilized yet. It is obvious that once Y is known, then Y_g could be determined by the use of equations (22) and (2), while G_p and G_e are exogenously determined. Thus equation (6) will be used to determine the value of S_g.

b. Equation (18) which shows the balance of payments equilibrium:

$$M_i+M_m+M_a+M_s+M_k = E_i+E_a+E_s+S_f$$

Once Y is known, then the different import components M_i, M_m, M_s and M_k could be easily determined through the use of the behavioral equations (26), (27), (28), and (29). On the other hand, M_a, E_a and E_s are exogenously determined as stated by equations (32), (33), and (34). Thus, the two other unknowns in the equation

are E_i and S_f, and once Y is known, then equation (18) will provide a relationship between S_f and E_i. The derivation of this relationship is also explained in Appendix II, and only one example will be provided here. For example, from equation (26) M_m is expressed as:

$$M_m = \mu_m Y_i$$

But Y_i could be expressed in terms of Y, through equation (30), or

$$Y_i = \psi_i Y$$

Substituting, one gets:

$$M_m = \mu_m \psi_i \, Y$$

and so on for the other import components. Once this is done, S_f could be expressed in terms of Y and E_i as follows:

$$(5.13) \quad S_f = \left(\frac{\mu_i \psi_i}{1-\mu_i-\beta_i} + \mu_m \psi_s + \mu_s \psi_s + \frac{\mu_k \rho_i \psi_i}{b_i} + \frac{\mu_k \rho_a (1-\psi_i-\psi_s)}{b_a} + \frac{\mu_k \rho_s \psi_s}{b_s}\right) Y - \mu_k \left(\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right) + \bar{M}_a - \bar{E}_a - \bar{E}_s - E_i$$

Which, after the substitution for Y from equation (5.8) could be written as:

$$(5.14) \quad S_f = F \frac{A+E_i-B(\alpha)}{C(\alpha)-D} - H - E_i$$

where A, B, C, D, F, and H are constants, of which A, B, C, and D are provided by equations (5.9), (5.10), (5.11), and (5.12), while F and H are equal to:

$$(5.15)\quad F = \left(\frac{\mu_i\psi_i}{1-\mu_i-\beta_i} + \mu_m\psi_i + \mu_s\psi_s + \frac{\mu_k\rho_i\psi_i}{b_i}\right.$$

$$\left. + \frac{\mu_k\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\mu_k\rho_s\psi_s}{b_s}\right), \quad \text{and}$$

$$(5.16)\quad H = \mu_k\left(\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right) + \bar{M}_a - \bar{E}_a - \bar{E}_s$$

c. The third equation, equation (17), will not be explicitly utilized in deriving the solution of the model. It was mentioned in Chapter IV, that one of the accounting relationships is not independent of the other; i.e., once the other accounting equations are satisfied, then this equation will be satisfied, too.

To determine any consistent set of development alternatives, the set has to satisfy equations (5.8) and (5.14), which by themselves consist of a consistent solution to all the variables in the model. But this is not all. A consistent set of development alternatives must also satisfy the restrictions imposed on the values of the policy goals, instruments, and institutional limits for it to be feasible. These restrictions, it is to be remembered, were laid down by the development alternatives restrictions (39-42), which specify certain limits on

α, Y, E_i and S_f. A consistent and feasible development program must, therefore, satisfy the following restrictions:

$$(5.8) \quad Y = \frac{A + E_i - B(\alpha)}{C(\alpha) + D}$$

$$(5.14) \quad S_f = \left[F\frac{A + E_i - B(\alpha)}{C(\alpha) + D}\right] - H - E_i$$

$$(39) \quad \alpha^* \leq \alpha \leq \alpha^{**}$$

$$(40) \quad Y^* \leq Y \leq Y^{**}$$

$$(41) \quad E_i^* \leq E_i \leq E_i^{**}$$

$$(42) \quad S_f^* \leq S_f \leq S_f^{**}$$

Before proceeding on with the determination of alternative development programs, one more step needs to be done. This will be concerned with the estimation of the values that the parameters and exogenous variables has to take in the target year (1974/75). This will be done in the following section.

3. Estimation of the Parameters and Exogenous Variables

In Appendix I, a description of the different variables of the model were presented, and the annual data for these variables for the period 1959/60-1965/66 were presented in Table A.6. The estimates of most of the parameters will be based on these data except in

cases where the parameters seems so essential to the model, and it is possible to get some data consistent with those provided in Table A.6, an attempt will be made to base the estimate on annual data for 1952/53-1965/66.

The details of the estimation process are provided in Appendix III and it might be sufficient here to present only the highlights of this process. But before doing that, some comments about the statistical techniques used in the estimation process might be in order.

First of all, it should be noted that while the data about the Egyptian economy might be better than the average of those of other developing countries, there is much to be desired if the researcher is going to use sophisticated or high powered statistical techniques, especially for a macro-economic model like the one presented in this study. Not all the observations of the different variables were readily available, and some not at all. Moreover, the coverage of some variables sometimes is changed, but without changing the definition, or vice versa. Also, data for some variables are presented for calendar years only (January 1-December 31) and some for fiscal years only (July 1-June 30), and some, not all, are presented for both. Ideally, the data should be on quarterly basis which will make it easier to shift from one type to the other.

Secondly, the estimates of the parameters basically should reflect the type of behavioral or thecnological relationship in question. To the extent that no other major institutional or structural changes has taken place, the estimate of the parameter will provide an accurate and reliable guide for the magnitude of the relationship in question. For the period for which data are present for Egypt, 1959/60-1965/66, this is not true, however. Major institutional changes were taking place during this period especially those related to the start of comprehensive planning in July, 1960, and the Nationalization Acts of 1961 and 1963. The point is that these institutional changes occured during the period on which the estimates of the parameters are based, and therefore, the estimated value of the parameters might reflect some of these institutional changes in addition to the behavioral or technological phenomena in question.

For these reasons, no attempt will be made to use sophisticated econometric techniques, but simple, straightforward methods will be utilized. For variables where there appears no trend in the relation among them, a simple least square estimate will be utilized. The estimating equation will be of the following form:

$$X = bY$$

where:

X = dependent variable

Y = independent variable, and

b = the slope. Where b > O.

For variables where there seems to be a trend involved, two approaches will be used. A first attempt will be tried to fit a trend line through simple least square techniques of the form:

$$X = a + Bt$$

where:

X = the variable in question

t = time

a and b = constants, where a > o and b > o.

If the estimated value seems reasonable, then it will be the one used in this study. This is true in the case of agricultural exports (E_a).

If the trend value of the parameter or the exogenous variable seems unreasonably high, an attempt will be made to provide a rough figure, based on past performance, knowledge about the economy and the experience of some other developing countries at a similar stage of development. Thus, the value judgment involved in the choice of such parameter or exogenous variable will not be without foundation. Among this group of parameters are ψ_i, ψ_s, μ_k, and β_i. The details of the estimation process ofr these parameters are presented in the

appendix, but some of the relevant factors taken in the decision on the value for each might be in order.

a. ψ_i: this refers to the ratio of domestic income generated from the industrial sector to G.D.Y. This ratio has grown (as shown in Table A. 18) from .886 in 1952/53 to .27943 in 1965/66 (these ratios are in 1965/66 prices). It was shown in Chapter II, that Egypt went through as much structural change as possible during the late 1950's and the early 1960's, and that what is needed is another period of proportional expansion all around. Therefore, it will be assumed that ψ_i = .3 in 1974/75.

b. ψ_s: this refers to the ratio of domestic income generated from the services sector to G.D.Y. As shown in Table A. 18, this ratio has declined from .49873 in 1952/53 to .42604 in 1965/66 (these ratios are in 1965/66 prices). For the reasons mentioned in Chapter II, about the prospects of traffic in the Suez Canal, which is one of the major components in the services sector, it should be expected that this ratio will continue to decline in the near future. It will be assumed, therefore, that ψ_s = .4.

It may be noted that these assumptions about the value of ψ_i and ψ_s imply a value of .3 for the ratio of agricultural income to G.D.Y. From Table A.11, it could be shown that this ratio (in 1965/66 prices) has declined

from .328 for the period 1952/53-1956/57 (on the average) to .283 on the average for the period of 1960/61-1965/66. This trend should not be expected to continue, as a result of the additional new land that will be utilized by the water of the High Dam. In addition, some gains to agriculture income should be expected from the attempt to use better seed varieties. Thus, a ratio of agricultural income to G.D.Y. of .3 seems to be more plausible.

c. μ_k: this refers to the ratio of capital goods imports to total investment. As shown in Table A.10, this ratio (in 1965/66 prices) has increased considerably from .0936 in 1959/60 to .3007 in 1965/66. While capital goods imports should be expected to continue at a high rate during the period of development,[1] there seems to be a certain level that any increases above it will become unrealistic. The level chosen here will be assumed to be .3.[2]

d. β_i: this parameter shows the ratio of agricultural inputs into the industrial sector (I'_{ai}) to total output of the industrial sector (O_i). The least square estimate of β_i in the appendix gives a value for β_i = .45935. An assumed value for β_i of this magnitude in

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[1] J. R. Hicks, Essays in World Economics (New York: Oxford University Press, 1959), Cahpter 8.

[2] It may be noted that a value of .3 for this ratio of capital goods imports to total investment was also assumed by S. Ho, op. cit., p. 113.

1974/75 seems to be highly excessive due to the relative changes that are taking place within the industrial sector in Egypt itself. During the period 1960-1968, the production index of chemical industries has increased from 100 in 1960 to 310 in 1968. Similarly, the production index of engineering and electrical industries has increased from 100 in 1960 to 250 in 1968. Both these groups of industries do not depend on agriculture for raw materials. On the other hand the production index of both food stuff industries, and spinning and weaving industries has increased from 100 in 1960 to 210 and 185 respectively in 1968.[1] Both these groups of industries depend extensively on agriculture as a major supplier of raw material. Thus, it seems more plausible to assume a value of .4 instead of the estimated value of .45935.

With these considerations in mind, the following are the estimates of the parameters, exogenous variables, and the base year values of the Egyptian economy in 1974/75.

a. Parameters

$\rho_i = .22129$

$\rho_a = .18137$

$\rho_s = .13799$

$b_i = .29532$

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[1] N.B.E., Economic Bulletin, Vol. XXII, No. 4, 1969, pp. 322-323.

$b_a = .57684$

$b_s = .24886$

$(1-t) = .80549$

$\alpha = .18893$

$\beta_i = .4$

$\beta_a = .1845$

$\mu_m = .10814$

$\mu_i = .12395$

$\mu_s = .11204$

$\mu_k = .3$

$\psi_i = .3$

$\psi_s = .4$

$\lambda_i^o = 2.099$

$\lambda_a^o = 6.751$

$\lambda_s^o = 2.902$

b. Exogeneous Variables

$M_a = 0$

$E_a = 108$

$E_s = 240$

$C_g = 335.9$

$C_{ga} = 9.1$

$G_p = 438.5$

c. Base Year Values

$Y_i^o = 583.2$

$Y_a^o = 614.7$

$Y_s^o = 889.2$

d. Development Alternatives

$\alpha^* = .175$

$\alpha^{**} = .25$

$Y^* = 3{,}095.169$ when $\ell_i^* = 3\%$, $\ell_a^* = 2\%$, and $\ell_s^* = 3\%$

$Y^{**} = 3{,}730.273$ when $\ell_i^{**} = 5\%$, $\ell_a^{**} = 4\%$, and $\ell_s^{**} = 5\%$

$E_i^* = 265.3$

$E_i^{**} = 375.1$

$S_f^* = 0$

$S_f^{**} = 126.4$

It was shown earlier in this chapter that upon the solution of the model, one can express Y as a function of the parameters, exogenous variables, base year values, industrial exports, and the saving rate as follows:

(5.8) $Y = \dfrac{A + E_i - B(\alpha)}{C(\alpha) + D}$, and S_F could be expressed as:

(5.14) $S_F = F\left[\dfrac{A + E_i - B(\alpha)}{C(\alpha) + D}\right] - H - E_i$

Upon the substitution of the parameters, exogenous variables, and base year values in equations (5.9, (5.10),

(5.11), (5.12), (5.15) and (5.16), the values of A, B, C, D, F, and H are as follows:

$$A = 345.17959$$

$$B = 438.5$$

$$C = .80549$$

$$D = -.02876$$

$$F = .31765$$

$$H = 684.99446$$

Substituting these values for A, B, C, D, F, and H in equations (5.8) and (5.14), these two equations could be written as:

$$Y = \frac{345.17959 + E_i - 438.5\ \alpha}{.80549\ \alpha - .02876}$$

$$S_f = .31765\left[\frac{345.17959 + E_i - 438.5\ \alpha}{.80549\ \alpha - .02876}\right] - 684.9945 - E_i$$

The model is now in a convenient form to determine some of the development alternatives facing Egypt in 1974/75 which is the subject of the following section.

4. Development Alternatives in Egypt in 1974/75

In getting the solution of the model for Y, S_f, and the other variables of the model all the equations of the model were satisfied, except those related to development alternatives. These are the additional

restrictions imposed on policy targets, instruments and institutional limitations that limit their variation within a predetermined range. Thus, any development alternative that satisfies the original model equations (1-38) will be consistent. It will also be feasible, if and only if the values determined by the model for α, Y, E_i and S_f lie within the predetermined range specified by the development alternatives restrictions. In other words, any consistent and feasible development alternative must satisfy:

$$(5.8) \quad Y = \frac{A + E_i - B(\alpha)}{C(\alpha) + D}$$

$$(5.14) \quad S_f = F\left[\frac{A + E_i - B(\alpha)}{C(\alpha) + D}\right] - H - E_i$$

$$(5.17) \quad \alpha^* \leq \alpha \leq \alpha^{**}$$

$$(5.18) \quad Y^* \leq Y \leq Y^{**}$$

$$(5.19) \quad E_i^* \leq E_i \leq E_i^{**}$$

$$(5.20) \quad S_f^* \leq S_f \leq S_f^{**}$$

Using the estimates presented in section 3 of this chapter, these six equations could be written as:

$$(5.8) \quad Y = \frac{345.17959 + E_i - 438.5\alpha}{.80549\alpha - .02876}$$

$$(5.14)\quad S_F = .31764\left[\frac{345.17959 + E_i - 438.5\,\alpha}{.80549\,\alpha - .02876}\right] - 684.9945 - E_i$$

$$(5.17)\quad .175 \leq \alpha \leq .25$$

$$(5.18)\quad 3{,}095.169 \leq Y \leq 3{,}730.273$$

$$(5.19)\quad 265.3 \leq E_i \leq 375.1$$

$$(5.20)\quad 0 \leq S_f \leq 126.4$$

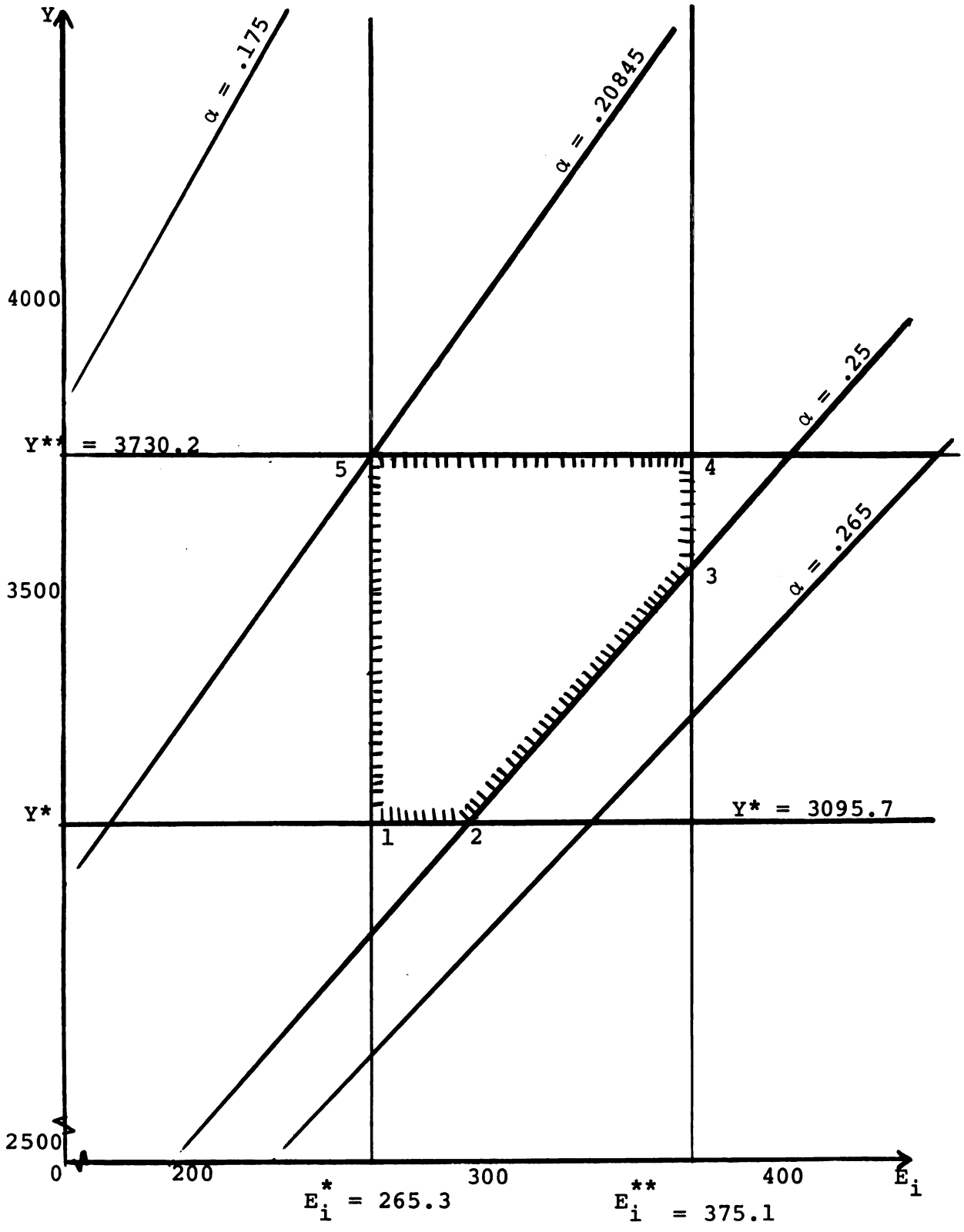
The determination of alternative development programs might proceed in the following manner:[1]

If the restriction imposed on S_f by equation (5.20) is relaxed, i.e., if net foreign borrowing can be obtained without costs to the economy, then given a value for α that lies within the range determined by equation (5.17), equation (5.8) will provide a linear relationship between Y and E_i. A higher value for α will shift the curve to the right, and a lower value for it will shift it to the left. In Figure (V-1) four of these relationships are demonstrated for $\alpha = .175$; $\alpha = .20845$; $\alpha = .25$; and $\alpha = .265$. The additional restrictions on Y and E_i imposed by equations (5.21) and 5.22) are also inserted in the graph as horizontal and vertical straight lines at the given level implied by each of these two equations.

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[1] It may be noted that the method used in drawing the graphic solution is similar to the one used by S. Ho, op. cit., pp. 115-124.

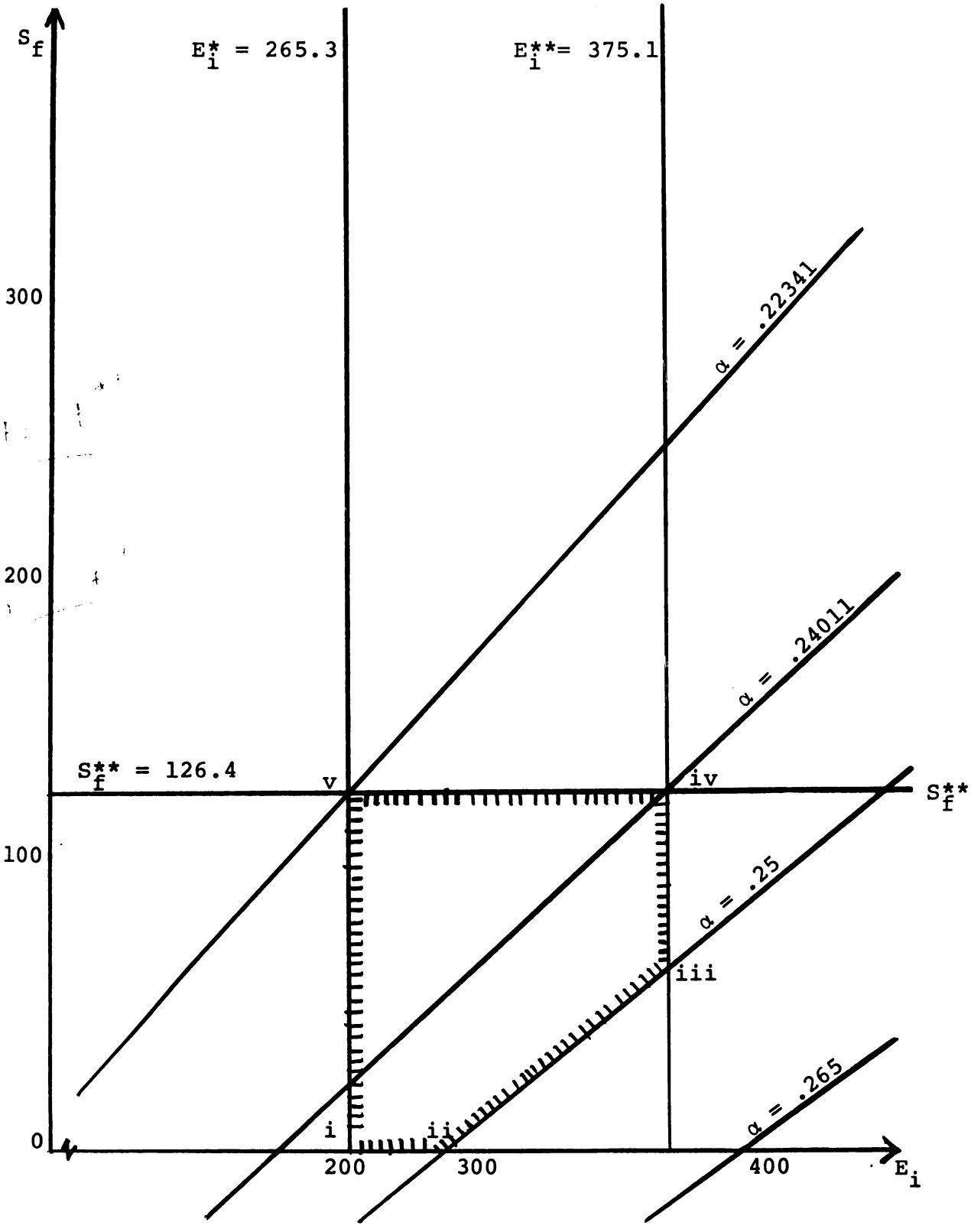
Figure V-1: Development Alternatives when S_f is not constrained.



Looking at Figure (V-1), one can easily see that equations (5.8), (5.17), and (5.18) and (5.19) help in defining the feasible region implied by points 1-2-3-4-5. Any point inside or on the boundary of this area will satisfy the relationships implied by equations (5.8), (5.14), (5.17), (5.18), and (5.19). By satisfying equation (5.8), and (5.14) the point will also satisfy the equations of the original model, equations (1-38) because all of these were used in determining the solution for Y and S_f. The only constraint that is not satisfied by the feasible area delineated as 1-2-3-4-5 in Figure (V-1) is, therefore, the constraint on S_f implied by equation (5.20).

On the other hand, if the restriction imposed on Y, (the full employment target), by equation (5.18) is relaxed; i.e., if Y is permitted to take any value that is consistent with all the other relationships of the model, then given a value for α that lies within the range implied by equation (5.17) equation (5.14) will provide a linear relationship between E_i and S_f. Any change in the value of α will generate a fimily of this relationship (an increase in α will shift the curve to the right and a decrease will shift it to the left). Figure (V-2) provides four curves representing this relationship between E_i and S_f for $\alpha = .22341$; $\alpha = .24011$; $\alpha = .25$; and $\alpha = .265$. The additional restrictions on E_i and S_f imposed by equations (5.19) and (5.20) are also inserted in the

Figure V-2: Development Alternatives when Y is not constrained.



graph as vertical and horizontal lines at the given level implied by each of these two equations.

Looking at Figure (V-2) it is obvious that equations (5.8), (5.14), (5.17), (5.19), and (5.20) help in defining the feasible region implied by the points i-ii-iii-iv-v. Any point inside or on the boundary of this area will satisfy all the relationships implied by equations (5.8), (5.14), (5.17), (5.19), and (5.20). By satisfying equations (5.8) and (5.14), the point will also satisfy all the equations of the original model, equations (1-38), because all these equations were used in determining the value of Y and S_f. The only restriction that remains to be satisfied is the restriction imposed on the value of Y by the full employment condition.

The model constructed in this study for the Egyptian economy, has, however, restrictions on both S_f and Y. Thus, parts of the feasible area delineated by 1-2-3-4-5 in Figure (V-1) or by i-ii-iii-iv-v in Figure (V-2) might not be feasibel since the former might contain some points where the implied value for S_f exceeds (or falls short of) the value of S_f specified by equation (5.20), and the latter might contain some points where the implied value for Y exceeds (or falls short of) the value of Y specified by equation (5.18). To make sure that the feasible region in the $Y-E_i$ plane and that in the S_f-E_i plane contain those points that satisfy both restrictions

on Y and S_f, the area i-ii-iii-iv-v could be mapped in the Y-E_i plane, and the area 1-2-3-4-5 could be mapped in the S_f - E_i plane. The mapping process of one point from one region into the other figure might proceed as follows:

Start from point 1 in Figure (V-1), which implies[1]

$$Y = 3095.1$$

$$E_i = 265.3$$

This means (from equation (5.8)), that $\alpha = .2386$. Substituting these values for α, E_i and Y into equation (5.14), the value of S_f is determined and will be equal to:

$$S_f = 32.9$$

Thus, point 1 in Figure (V-1) corresponds to the point in Figure (V-2) at which:

$$E_i = 265.3$$

$$S_f = 32.9$$

and so on for the other points of the feasible region in Figure (V-1).

Similarly, if one starts from point V in Figure (V-2), one can see that at this point:

$$S_f = 126.4$$

$$E_i = 265.3$$

$$\alpha = .22341$$

---

[1]From now on, all the values mentioned for any variable will be in L.E.m., and in 1965/66 prices, unless otherwise specified.

Substituting these values in equation (5.14), one can easily see that the corresponding value for Y will be:

$$Y = 3389.0$$

Thus, the corresponding point for (v) in Figure (V-2) will be the point in Figure (V-1) at which:

$$E_i = 265.3, \text{ and}$$

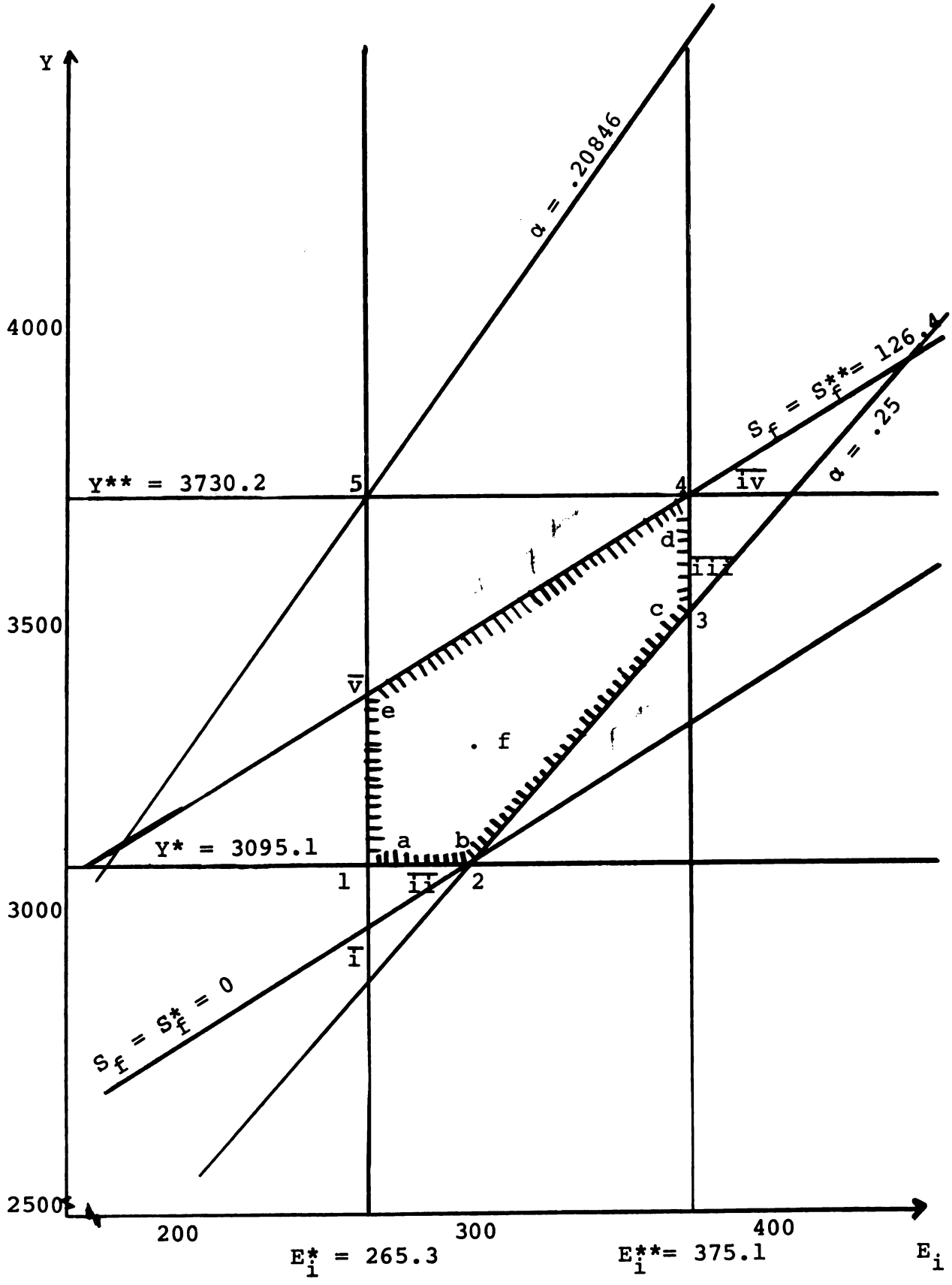
$$Y = 3389.0$$

The mapping process is, therefore, nothing more than the identification of the value of S_f correspondent to the values of E_i, Y, and α in Figure (V-1), and the value of Y correspondent to the values of E_i, S_f, and α in Figure (V-2). The point that should be emphasized is that there is one-to-one correspondence between each point in the two figures.

In Figure (V-3) the feasible region in Figure (V-2), i-ii-iii-iv-v, is mapped out in the Y - E_i plane. To avoid confusion these points will be written in Figure (V-3) as $\bar{i}$, $\bar{ii}$, $\bar{iii}$, $\bar{iv}$, $\bar{v}$. It could be easily seen now from Figure (V-3), that point 5, which was feasible in Figure (V-1) is now not feasible since it implies a value for $S_f = 234.8$ which is greater than the maximum value allowed to it by equation (5.20) which is $S_f = 126.4$.

The mapping out of the feasible region i-ii-iii-iv-v in Figure (V-2) into the Y - E_i plane in Figure (V-3),

Figure V-3: Development Alternatives when both Y and S_f are constrained.

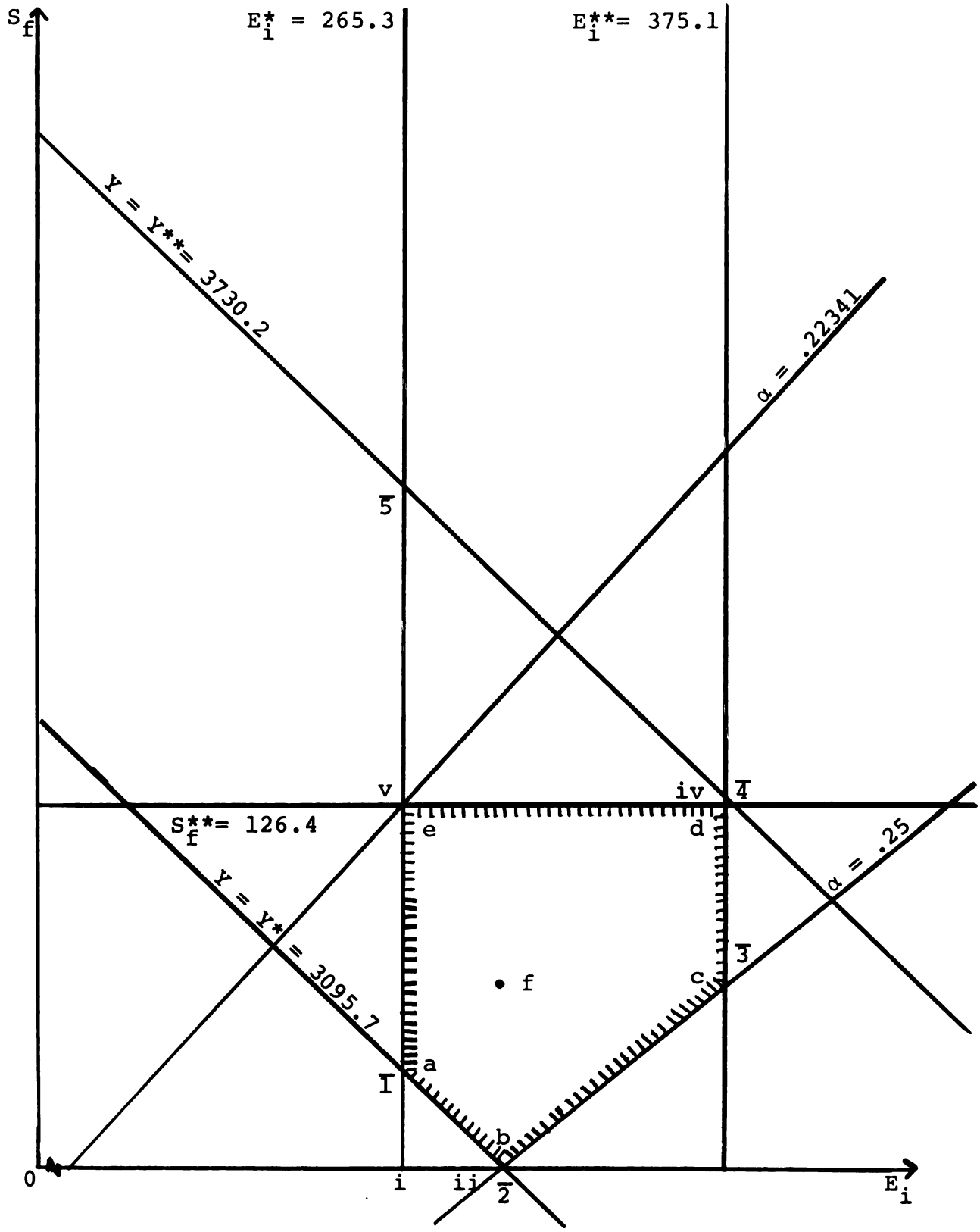


will limit the feasible area available for the choice of development alternatives, as could be seen from the new feasible region delineated by the points (a), (b), (c), (d), and (e). The important point to notice here is that any point in this feasible region in Figure (V-3) satisfies equations (5.8) and (5.14) and all the other restrictions implied by equations (5.17), (5.18), (5.19), and (5.20).

Similarly, in Figure (V-4), the feasible region in Figure (V-1), 1-2-3-4-5 is mapped out into the S_f - E_i plane as $\bar{1}$, $\bar{2}$, $\bar{3}$, $\bar{4}$, $\bar{5}$. As could be easily seen, point (1) which was feasible in Figure V-2, is not feasible now since it implies a value for Y = 2991.6 which is less than the minimum value given by equation (5.18) which is Y* = 3095.1.

The mapping out of the feasible region 1-2-3-4-5 in Figure (V-1) into the S_f - E_i plane, will also limit the feasible area available for the choice of development alternatives. The new feasible region that satisfy equations (5.8) and (5.14), and all other restrictions implied by equations (5.17), (5.18), (5.19), and (5.20), is delineated by the points (a), (b), (c), (d), (e). It is obvious that these points are exactly the correspondent points to points (a), (b), (c), (d) and (e) in Figure (V-3), and any reference to any of these points in one graph will imply the other point.

Figure V-4: Development Alternatives when both S_f and Y are constrained.



Once the feasible region is determined, the stage is now ready for the choice of an adequate number of development alternatives that are facing the Egyptian economy in 1974/75. It is obvious that an infinite number of such alternatives exist within the feasible region in Figures (V-3) and (V-4). To consider all these alternatives is, of course, impossible, but what will be done here is to consider only the corner solution delineated by the points (a), (b), (c), (d), and (e), and one interior point - (f). These selected solution of the model will be presented in the following Table (Table V-1), after which some analysis of the implication of each point will follow.

The economic implications of the various corner solutions that are presented in Table (V-1) can be shown by starting out at point (a) in both Figures (V-3) and (V-4).[1] At this point, both the lower values of the rate of increase in labor productivities in the different production sectors, and exports of the industrial sector are operative. For the level Y and E_i associated with point (a), α is equal to .2386, and, therefore, S_h = 699.5. If one adds to this government saving in the budget, S_g = -181.5, then total domestic savings will be = 518.0. On the other hand, total investment in the production sectors,

[1] It should be emphasized that any reference to any point representing the corner solutions such that a-b-c-d-e and f will refer to each point in both Figure (V-3) and (V-4).

Table V.1 -- Selected Solutions of the Model.[1]

	Y	Y_i	Y_a	Y_s	Y_h	Y_g	O_i	O_A	G_p	G_e
Base Year Value	2087.1	583.2	614.7	889.2	1662.4	424.7	1383.2	717.2	308.1	242.3
a α=.2386	3095.1	928.6	928.6	1238.7	2493.1	602.0	1950.1	1138.7	438.5	345.0
b α=.25	3095.1	928.6	928.6	1238.7	2493.1	602.0	1950.1	1138.7	438.5	345.0
c α=.25	3538.0	1061.4	1061.4	1415.2	2849.8	688.2	2228.9	1301.5	438.5	345.0
d α=.24011	3730.0	1119.1	1119.1	1492.1	3004.6	725.6	2350.1	1372.3	438.5	345.0
e α=.22341	3389.0	1016.7	1016.7	1355.5	2729.8	659.2	2135.1	1246.7	438.5	345.0
f α=.23899	3300.0	990.0	990.0	1320.0	2658.1	641.9	2079.0	1214.0	438.5	345.0

[1]All the figures in this table are in 1965/66 prices and in (L.E.M.).

Table V.1-- Continued.

	C_{ga}	C_g	C_h	C_{ha}	C_a	C_i	C_s	C_{is}	S_h	S_g
Base Year Value	6.4	236.0	1373.2	155.6	162.0	1126.5	747.8	1609.2	441.7	-125.8
a	9.1	335.9	1990.5	241.6	250.7	1574.5	1137.5	2326.4	699.5	-181.5
b	9.1	335.9	2023.9	241.6	250.7	1607.9	1137.5	2359.8	732.9	-181.5
c	9.1	335.9	2171.9	292.8	301.9	1728.5	1333.8	2507.8	822.1	- 95.3
d	9.1	335.9	2298.6	315.2	324.3	1842.8	1419.3	2634.5	826.7	- 57.9
e	9.1	335.9	2183.1	275.6	284.7	1749.6	1267.5	2519.0	707.8	-124.3
f	9.1	335.9	2090.9	265.3	274.4	1662.1	1227.9	2426.8	740.1	-141.6

Table V.1--Continued.

	S_f	I_i	I_a	I_s	I_d	M_k	M_m	M_i	M_a	M_s
Base Year Value	63.2	161.9	82.3	134.9	267.1	114.0	67.8	175.0	106.3	104.2
a	32.9	258.8	98.7	193.4	385.6	165.3	100.4	241.7	000.0	138.8
b	0	258.8	98.7	193.4	385.6	165.3	100.4	241.7	000.0	138.8
c	63.7	358.3	142.2	291.7	554.5	237.7	114.8	276.3	000.0	158.6
d	124.8	401.6	160.6	334.3	627.6	268.9	121.0	291.3	000.0	167.2
e	126.4	324.8	128.7	258.7	498.1	213.4	109.9	264.6	000.0	151.9
f	63.3	304.8	118.0	238.9	463.2	198.2	107.1	257.7	000.0	147.9

Table V.1--Continued.

	E_i	E_a	E_s	I'_{ai}	I'_{ia}	O'_i	O'_A
Base Year Value	222.0	36.5	245.6	625.0	102.5	1058.7	55.7
a	265.3	108.0	240.0	780.0	210.1	1474.1	250.7
b	298.7	108.0	240.0	780.0	210.1	1507.5	250.7
c	375.1	108.0	240.0	891.6	240.1	1613.7	301.9
d	375.1	108.0	240.0	940.0	253.2	1721.8	324.3
e	265.3	108.0	240.0	854.0	230.1	1639.7	284.7
f	300.0	108.0	240.0	831.6	224.0	1555.0	274.4

for this level of G.D.Y., will be equal to ($I_i + I_a + I_s$ = 550.9). It can be easily seen now that available domestic savings fall short of investment requirements by an amount equal to 32.9.

Similarly, at the level of Y given by point (a), total import requirements will be equal to ($M_i+M_m+M_a+M_s+M_k$ = 646.2), while total exports ($E_i+E_a+E_s$ = 613.3), and, therefore, the total exports fall short of import requirements by an amount equal to 32.9.

A quick glance at Figure (V-4) will show that at point (a) the level that S_f reaches is equal to 32.9 which is exactly sufficient to achieve both saving and investment equilibrium and the balance of payments equilibrium. This preceding analysis shows clearly the dual role that foreign capital or foreign saving (S_f) plays in supplying both saving and foreign exchange.

It may be noted that if the lower limit of the rate of increase in labor productivity in the production sectors still hold, i.e., if (Y = Y* = 3095.1), but that now it is possible for the planners to increase the saving rate (α) from its previous point (a), which is α = .2386, then it is obvious that further savings will reduce the amount of foreign borrowing required at the same level of G.D.Y., but hence it increases the export requirements at the same time. This process could continue until one reaches point (b), where the saving rate

can rise no longer, because it reaches its maximum level ($\alpha = \alpha^{**} = .25$), and foreign borrowing (S_f) reaches its minimum level, ($S_f = S_f^* = 0$). At point (b), therefore, both domestic savings and exports have increased enough to fill the foreign exchange gap and the domestic resources (or saving) gap from domestic resources instead of depending on foreign borrowing. Point (b) will represent what has usually been called severe national effort case where the country will depend solely for its development on its own domestic resources.

If it is possible now to allow the rate of increase of labor productivity in the different production sectors to increase from its minimum value, which corresponds to ($Y = Y^* = 3095.1$) at point (b), then as long as α remains at its level at point (b), ($\alpha = \alpha^{**} = .25$), then one could move on the boundary line that connects point (b) with point (c), where it will be possible to increase the level of G.D.Y. But with the increase in Y, export requirements from the industrial sector (E_i) has also to increase, and, therefore, this process could continue until one reaches point (c) where E_i can no longer rise (at point (c), $E_i = E_i^{**} = 375.1$). It is important to note that at this point while E_i and domestic savings rise with the increase in income, they do not rise enough in order to meet both the import and investment requirements at the new level of G.D.Y. at point (c) ($Y = 3538$). To

fill these two gaps, the planners must depend on foreign borrowing for an amount equal to S_f = 63.7 at point (c).

Once at point (c), further increases in labor productivity could still raise G.D.Y., but E_i can no longer rise, because it has already reached its maximum value $E_i = E_i^{**}$ = 375.1. Since import requirements increase with the increase in G.D.Y., further increases in Y would require larger dependence on foreign borrowing, and therefore, S_f will tend to increase as one moves from point (c) towards point (d). It is important to note, that as one moves from point (c) toward point (d), the saving rate will tend to decline from its level at (c), ($\alpha = \alpha^{**} = .25$) until finally it reaches ($\alpha = .24011$) at point (d). This is due to the fact that at this range, the foreign exchange gap is the more restrictive, and that further increases in domestic savings will be of no help in increasing the level of G.D.Y. above the level that is permissable by the foreign exchange supply.

The movement from point (d) to point (e) will be possible only if it is difficult to keep both the saving rate (α) at the level it already reached at point (d), ($\alpha = .24011$), and the level of exports of the industrial sector (E_i) at its level at point (d), ($E_i = E_i^{**} = 375.1$). If these values prove to the planners to be impossible to achieve, then the only alternative is to move on the boundary segment from (d) towards (e). Once point (e) is

reached then E_i would have its lowest value that it is allowed to take ($E_i = E_i^* = 265.3$), and Y will be equal to 3,389. The level of foreign borrowing associated with point (e) is ($S_f = S_f^{**} = 126.4$). It should be noted, therefore, that at point (e), α is equal to .22341 which is the level consistent with the values of both Y and E_i at point (e). If, under the conditions prevalent at point (e) with respect to (E_i) and (S_f), it were possible to increase the saving rate from this level, this increase will be of no help in increasing the level of G.D.Y. above its level at (e), because at this range, the foreign exchange gap is the more restrictive bottleneck for economic growth.

This analysis shows clearly how the model constructed in this study could be used by the planners to anticipate the effects of any changes in the economic conditions or the variables of economic policy and how it could help them to analyze the economic implications of each situation and their probable effect on the development program as a whole. Through such type of analysis, the task of economic policy, i.e., the task of deciding on what type of economic measure to be taken and in what magnitude will be facilitated to the planners. The model, in addition, helps the planners in knowing the effects of any action they might take on the other key variables in the economy, thereby satisfying the learning process required for good economic planning.

It may be noted, finally, that the analysis in the preceding paragraphs has been concerned only with the corner solutions of the model, but the same could be applied for any point in the feasible area delineated by points (a)-(b)-(c)-(d)-(e).

CHAPTER VI

OTHER USES OF THE MODEL

1. Introduction

In Chapter V, it was shown how the model that was constructed for the Egyptian economy could be used to determine consistent and feasible alternative development programs, subject to any changes in the magnitude of the policy variables. This chapter will show some other uses through which the model could be useful to the planners. Section 2, will be concerned with the problem of how to use the model to identify two of the major bottlenecks in economic development; i.e., the domestic resources bottleneck, and the foreign exchange bottleneck. Section 3 will be concerned with the use of the model to choose among alternative programs subject to given values of policy instruments. Finally, Section 4 will show how the model could be used to determine the optimum choice among the different policies subject to a given value of one of the targets. It will be shown that the analysis of Sections 3 and 4, are based on the assumption that some information about the properties of social welfare function are available to the planners.

2. Identification of Bottlenecks

The purpose of this section is to show how the model could be used in identifying the domestic resources (saving) bottleneck and the foreign exchange bottleneck. In the analysis that followed the determination of the alternative development programs in Chapter V, it was shown that some information could be obtained about the ranges at which each bottleneck will be most effective. It is possible, however, through the use of a different method in the solution of the model to obtain more precise information about the magnitude of these two bottlenecks and the range at which each will become the effective limit to growth.

It may be noted that while both the saving and foreign exchange bottlenecks must be equal in any ex-post accounting (and equal to the amount of net foreign borrowing that Egypt receives from abroad), it is very important to the planners that these two bottlenecks must be equal in an ex-ante sense if the plan is consistent. Through the use of the model, the planners could discover how much change in saving or exports is required in order that the two bottlenecks are equalized.

In order to show how this could be done, the equations of the model eq.s (1-42) has to be reduced through algebreic manipulation to the following:

(6.1) $S_f = f_1(Y,\alpha)$

(6.2) $S_f = f_2(Y,E_i)$

(39) $\alpha^* \leq \alpha \leq \alpha^{**}$

(40) $Y^* \leq Y \leq Y^{**}$

(41) $E_i^* \leq E_i \leq E_i^{**}$

(42) $S_f^* \leq S_f \leq S_f^{**}$

Equations (39-42) provide the development alternatives chosen in this study, eq. (6.1) provides the equilibrium condition of saving and investments, and eq. (6.2) provides the balance of payment equilibrium condition.

The method through which the equation of the reduced form [eq.s (6.1) and (6.2)] are obtained is explained in detail in Appendix IV, and what is going to be shown here is only a brief summary of this process.

Starting from the saving-investment equilibrium condition, eq. (17), one can find:

$$I_i + I_a + I_s = S_h + S_g + S_f$$

Substituting for these variables from the different relationships of the model, it could be shown that:

(6.1) $$S_f = \left[\frac{\rho_i\psi_i}{b_i} + \frac{(1-\psi_i-\psi_s)\rho_a}{b_a} + \frac{\psi_s\rho_s}{b_s} - \alpha(1-t) - t\right]Y - \left[\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right] - (\alpha-1)\bar{G}_\rho + \bar{C}_{ga} + \bar{C}_g$$

Given a certain value for (α), eq. (6.1) provides a relationship between Y and S_f. For different values for (α), the equation will generate a family of this relationship as shown in Figure (VI-1). Each of those relationships gives the maximum value of Y, that is consistent with the saving-investment equilibrium condition, given a certain value for (α) and (S_f).

Similarly, starting from the balance of payment equilibrium condition, eq. (18), one can find:

$$M_i + M_m + M_a + M_s + M_k = E_i + E_a + E_s + S_f$$

Substituting for these variables from the different relationships in the model, it could be shown that:

$$(6.2) \quad S_f = N + O(E_i) + P(Y) + QY\left[\frac{A-D(Y)+E_i}{C(Y)+B}\right] + R\left[\frac{A-D(Y)+E_i}{C(Y)+B}\right]$$

Where A, B, C, D, N, O, P, Q, and R are constants the components of which are defined in Appendix II (for A, B, C, and D) and Appendix IV (for N. O. P, Q, and R). Given a certain value for E_i, eq. (6.2) will generate a relationship between Y and S_f. For different values of E_i, eq. (6.2) will give a family of this relationship. Each of those relationships gives the maximum value for Y, that is consistent with the balance of payment equilibrium condition, given a certain value for S_f and E_i. When eq.s (6.1) and (6.2) intersect, they will give a value for S_f that will satisfy the equilibrium condition of both saving and investment and the balance of payments.

Upon the substitution of the values of the parameters, exogenous variables, and base year variables, the equations of the reduced form become:

(6.1) $S_f = Y(.346-.80549\alpha) - 438.5\alpha - 339.815$

(6.2) $$S_f = .3198Y - .89925E_i - 650.205 - .08115Y\left[\frac{.02876Y+345.17959+E_i}{438.5+.80549Y}\right] - 44.17889\left[\frac{.02876Y+345.17959+E_i}{438.5+.80549Y}\right]$$

(6.3) $.175 \leq \alpha \leq .25$

(6.4) $3{,}095.1 \leq Y \leq 3{,}730.2$

(6.5) $265.3 \leq E_i \leq 375.1$

(6.6) $0 \leq S_f \leq 126.4$

The graphic solution of the reduced form is presented in Figure (VI-1), and the reader should note the following points:

a. In drawing eq.s (6.1) and (6.2), it was shown in Appendix IV, that all the relationships of the original model, eq.s (1-38) were used in the process of the derivation. Thus, eq.s (6.1)-(6.6) embody all the relationships of the model eq.s (1-42), and any solution that satisfy these six equations will also be found to satisfy the equations of the original model. It is for this reason, that the graphic solution presented in Figure (VI-1)

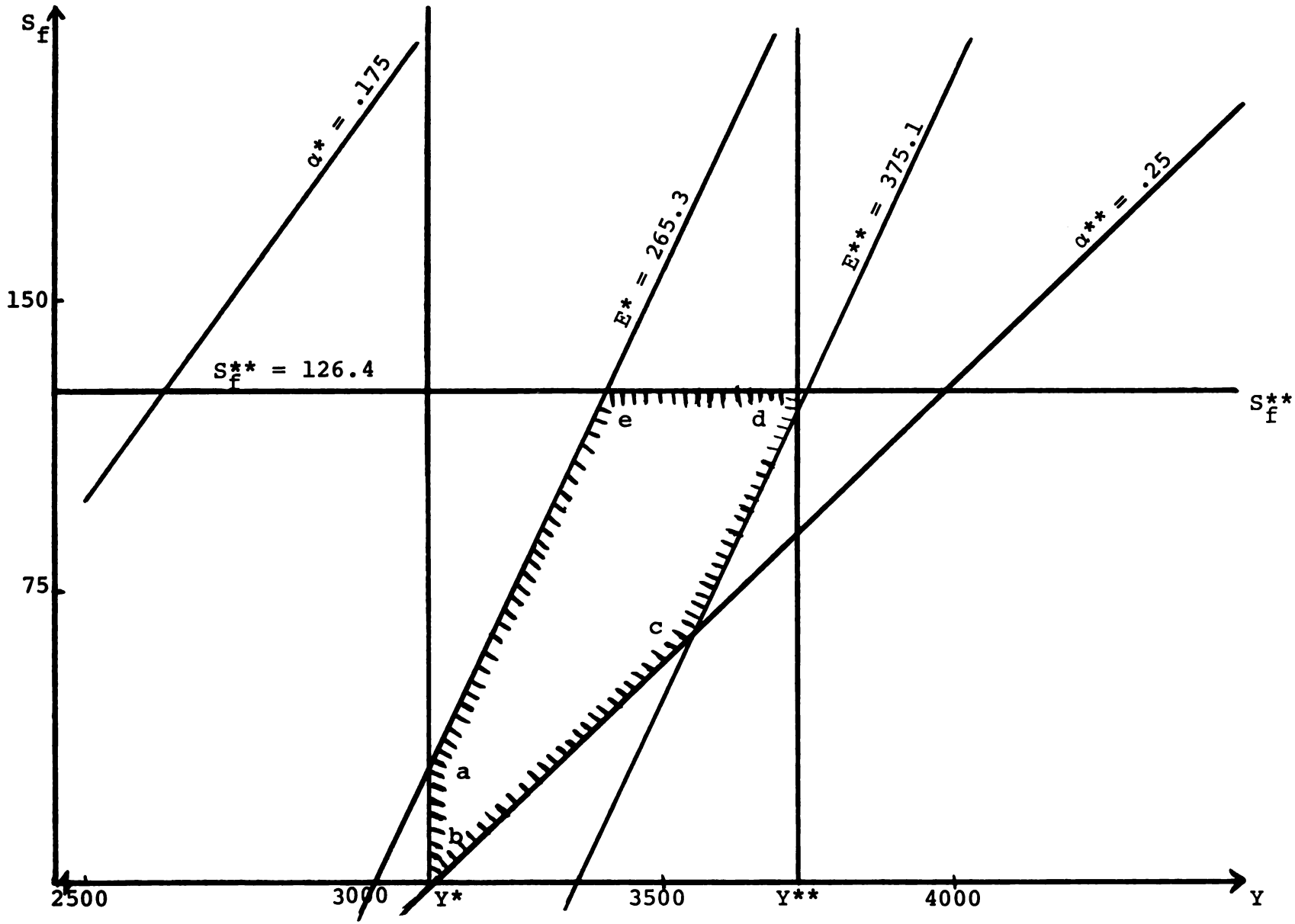


Figure VI-1: Development Alternatives--The Reduced Form.

is exactly similar to the graphic solution presented in Figures (V-3) and (V-4), and the feasible region delimited by (a)-(b)-(c)-(d)-(e) correspond to the similar points in those two figures and to the data concerning the values of each variable at each of those points presented in Table (V-1).

b. It should be noted also, that although eq. (6.2) gives a curve and not a straight line, for the range of G.D.Y. considered here, the curvature is very slight that it could be regarded as a straight line.

Now, assume that the maximum value for α^{**} is .25, and $E_i^{**} = 375.1$, then if the net foreign borrowing $(S_f) = 0$, it can be easily seen from Figure (VI-1) that the growth of G.D.Y. is more severely limited by the shortage of domestic resources, than by the potential level of export, as can be seen at point (b) in Figure (VI-1). This limitation will remain up to point (c), which gives a growth rate of G.D.Y. slightly below 6%. Since import requirements increase more rapidly than saving requirements,[1]

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[1]This can be easily seen if one remembers that the slope of eq.(6.1) which is $\frac{dS_f}{dy}$ gives the requirement of (S_f) for investment purposes as (Y) increases, while the slope of eq.(6.2) which is $\frac{dS_f}{dy}$ gives the requirement of (S_f) for foreign exchange purposes as (Y) increases. A quick look at Figure (VI-1) will show that the relation generated by eq.(6.2) for E** is more steep than the relation generated by eq.(6.1) for α^{**}.

the two bottlenecks become equally restrictive at point (c), while at higher growth rates of G.D.Y., the shortage of foreign exchange is more restrictive than the potential level of saving.

3. Choice Among Alternative Programs

In this section, it will be shown how the model could be used in the choice among alternative programs, given certain values for the policy instruments, and provided that there exists a social welfare function to help in the process of choice among alternative programs. Assume, for example, that the planners are considering the choice of the optimum program, when the following policy instruments and institutional limits take these values: $\alpha = .25$; $E_i = 375.1$; and $\ell_i = 5\%$, $\ell_a = 4\%$, and $\ell_s = 5\%$.

To do this, assume that social welfare is a function of:

(6.7) $W_1 = W_1[C, S_f, K]$

where C is total consumption, S_f is net foreign borrowing, and K refers to the economy's capital stock. The variable K, could be replaced in the social welfare function with G.D.Y., since with fixed capital coeffients, one imply the other.

To determine total consumption at a given level of (Y), one has to deduct from (Y), both (S_h) and (S_g) at that level of G.D.Y. thus $C = Y-S_h-S_g$ substituting from

eq.s (23) and (22), then

$$C = Y-\alpha[Y(1-t) + G_p] - S_g$$

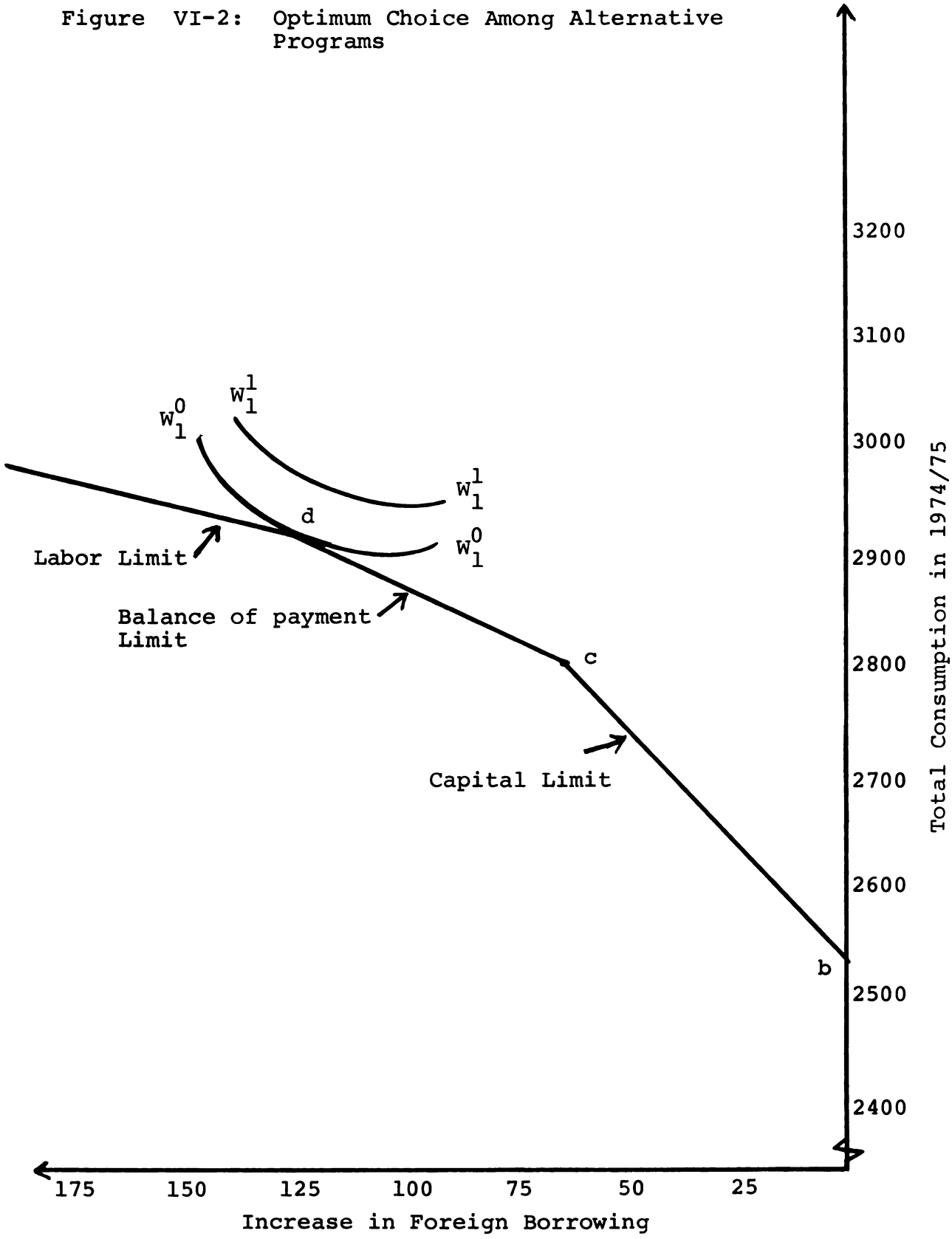
$$(6.8) \quad C = Y[1-\alpha(1-t)] - \alpha G_p - S_g$$

Substituting for the values of parameters, exogenous variables, and for α as assumed in this example ($\alpha = .25$), this eq. could be written as

$$(6.9) \quad C = .79863Y - 109.625 - S_g$$

It should be noted that eq.s (6.1), (6.2), and (6.4) summarize the production possibilities of the economy, with respect to the capital limit, balance of payment limit, and full employment limit respectively. Once the value of the policy instruments and institutional limits are known, then total consumption can be determined for different amounts of foreign borrowing. The consumption possibility frontier is constructed in Figure VI-2 by the use of eq. (6.8) and the data in Table (V-1), on these assumptions. The shape of the curve is due to the fact that increased foreign borrowing have a high productivity at low levels of net foreign borrowing, because an increase in S_f permits a further increase in investment and G.D.Y., from point (b) up to point (c). Between point (c) and point (d) growth is limited by the shortage of foreign exchange, and therefore an increase in S_f permits further increases in G.D.Y. Beyond point (d), G.D.Y. is constant because full employment of labor has been reached and the

Figure VI-2: Optimum Choice Among Alternative Programs



increase in S_f goes only to increase consumption. The three segments of the consumption possibility frontier correspond to the saving-investment limit, balance of payment limit, and full employment limit respectively.

The point that should be mentioned is that each point on the consumption possibility frontier presents an alternative development program. To choose among these alternatives, one needs to determine the properties of the S.W.F. that was specified by eq. (6.7).

If total consumption over time is taken as a measure of welfare, then the welfare loss due to an increase in net foreign borrowing could be measured as the sum of interest costs, reduction in future borrowing power, the loss in future consumption due to the need to develop an export surplus, the implied delay in making the necessary change required to raise savings and exports in the short run, and the hampering of the development of exports where it usually takes some time to conquer markets for new products and so on. If one could visualize the possibility of constructing a social welfare function[1] that could reflect all these considerations, as W_1-W_1 in Figure VI-2, then the optimum program will be discovered

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[1]The social welfare function could either reflect the planners' preferences, or it could reflect the weighted sum of individual preferences. See, John C. Harsenyi, "Cardinal Welfare, Individualistic Ethics, and Interpersonal Comparison of Utility," J.P.E., 63(1955), pp. 309-21.

to be at point (1), where the social welfare function is tangent to the consumption possibility frontier.

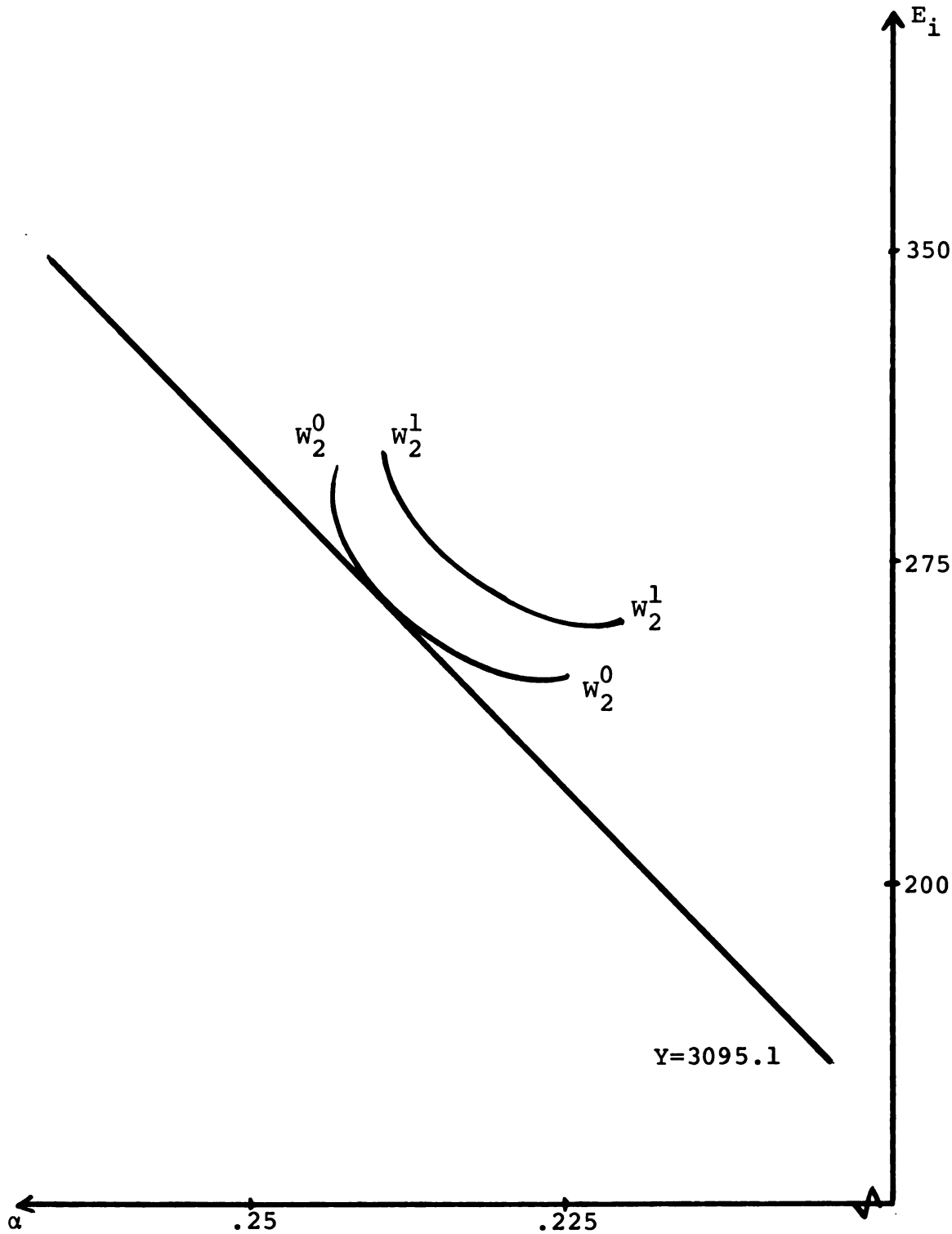
4. Optimum Choice Among Policies

One of the possible uses of the model is also to help the planners in deciding on the optimum level of different types of economic policies, given a certain goal to be achieved. For example, if a certain level of G.D.Y. is to be achieved in the target year, then looking back at Figure (V-3) Chapter V, one can see that along any horizontal line in the feasible area (which specifies certain level of income), there exist a different combination of α and E_i. It should be noted, also, that with any combination of α and E_i, there exists a certain level for S_f.

Figure (VI-3), presents these different combinations of α and E_i, for the level of G.D.Y. = 3090.1, where it turns out that it is a straight line. This line could be called the iso-income line. For different levels of income, we will, of course, have different iso-income lines.

It is obvious that different values for α, E_i, and, therefore S_f will have different welfare implications. An increase in (α) at the same level of income, for example, will mean reduced private consumption, while an increase in exports might lead to a reduction in foreign borrowing. Foreign borrowing, on the other hand, could allow for the achievements of the same level of income, with a reduction

Figure VI-3: Optimum Choice Among Policies.



in the exports of the industrial sector, but this has its costs too in terms of reducing future borrowing power, the sum of interest charges, the loss of future consumption due to the need to develop an export surplus, the implied delay in making the necessary changes required to raise savings and exports in the short run, and the hampering of the development of exports while it usually takes some time to open new markets. If the welfare function reflecting these considerations take the form:

$$W_2 = W_2(\alpha, Ei, S_f),$$

then the optimum level of policies will be determined where the curve representing this function W_2-W_2 is tangent to the given iso-income line.

CHAPTER VII

CONCLUSIONS

The major purpose of this dissertation is the construction of a macro economic model for the Egyptian economy that could be used for projection planning through the generation of feasible and consistent alternative development programs, each subject to different assumptions about the values of the policy variables chosen in this model. The model has been presented in Chapter IV, and the chosen alternative development programs were presented in Chapter V which contains also a discussion about the economic implications of each alternative. In Chapter VI, the model was solved in a different way from that presented in Chapter V, to permit the consideration of the precise identification of the domestic resources bottleneck, and the foreign exchange bottleneck. This method, in addition helped in the process of choice of an optimum program or policy-mix subject to certain values of the policy instruments or targets available to the planners. The remaining thing is to present some concluding remarks about some of the possible uses of the model and also some of the limitations and shortcomings that have to be kept in mind.

1. In a world full of uncertainty, a model of development alternatives provides the planners not only with the flexibility required for the decision making process, but also with the advantage of already existing substitute development programs that can be utilized if it appears that the values of the policy variables are those implied by any of these alternatives. Many other alternative development programs could be computed quite easily subject to different assumptions about the values of these policy variables.

2. It may be noted that the model is of the comparative static type, and therefore, the different development alternatives presented in Chapter V, give only the values of the different variables at the terminal year of the model (1974/75) without specifying the time path for every variable from the base year to the terminal configuration. In this sense, the alternative development programs presented here might give a perspective rather than a plan. It should be emphasized, however, that the construction of a terminal configuration is an essential ingredient in any finite horizon planning model. The model will provide some guidelines to the planners, even though it does not specify a complete time phased course of action. These detailed specifications could be worked out in the annual plans.

3. The variables of the model are measured in the base year prices (1965/66), and, therefore, prices are not endogenous variables in the model. This was necessitated by empirical and computational difficulties.

4. One of the advantages of using the model, even though it is not operational enough for everyday planning is that it will help the planners to focus their attention on the right questions: what are the major constraints and bottlenecks which will have to be overcome to accelerate the rate of growth of the economy, how far should one try to push the economy to grow, and in what direction, etc.... While the model might not provide completely operational answers for these questions, still by concentrating attention on them, it will force the policymakers to come to grips with them instead of ignoring them.

5. It was shown in Chapter VI that the model could provide some help in defining whether the saving bottleneck or the foreign exchange bottleneck is operative at different rates of growth in G.D.Y. It was shown that at lower rates of growth in G.D.Y. (up to a rate of growth slightly below 6% of G.D.Y.), the saving bottleneck (the domestic resources gap) will be most restrictive, while at higher rates of growth in G.D.Y. the foreign exchange bottleneck will be the most restrictive bottleneck. This is due to the fact that import requirements increase faster with the increase in G.D.Y., than investment requirements.

6. The model could also help in the process of choice among alternative development programs, if certain values were given for the policy instruments and institutional limits and provided that some information about the properties of the social welfare function are available. The consumption possibility frontier was shown to express total consumption at various levels of net foreign borrowing, and the point of tangency between the social welfare function and the consumption possibility frontier will provide the optimum program. By providing total consumption at various levels of net foreign borrowing the model could, also, provide the developed countries offering aid to developing countries with some information about the possible rates of productivity of foreign aid, provided, of course, that the productivity of foreign assistance enters at all in the allocation of foreign aid.

7. The model could also help the planners in deciding on the optimum level of different types of economic policies, at a given level of income. For example, if a certain level of G.D.Y. is to be achieved in the target year, then there exist a different combination of α, and E_i, and with any combination of these, a value for S_f that can achieve this level of income. It is obvious that different values for α and E_i, and therefore S_f, will have different welfare implications. If one could visualize the possibility of constructing a social welfare function that could reflect

these considerations, then it will be possible to choose the optimum combination of policies for each desired level of income, where this social welfare function is tangent to the iso income line in the plane that represent the combination of these different policies available to the planners.

8. In its presentation of alternative development programs, the aggregate model will usually contain an optimistic bias. This optimistic bias might result from the implicit assumption that there is no structural difficulties in transforming saving into desired forms of investment. Also, while the magnitude of the shift in resources required to satisfy the balance of payments equilibrium may appear to be relatively small, the total may conceal possible bottlenecks in certain sub-sectors or obstacles to increasing particular kinds of output. To overcome this optimistic bias, some kind of input-output analysis would be required in order to determine the effects of development programs in the various subsectors. This process, beside helping in specifying the various factors that may limit growth, may have the additional advantage of modifying some of the parameters in the original model.

9. From the experience gained through the work on this research, it seems clear that it will be quite some time before the Egyptian data can be relied upon for use in linear optimization models involving explicit intersectoral and intertemporal relationships which satisfies

boundry conditions relating to the initial year as well as to the terminal year of the plan.

10. With respect to available data, some suggestions for improvements might be in order: (i) the data should be published on quarterly basis to make it easier for the researcher to transfer figures from calendar to fiscal years and vice versa; (ii) some care should be given to the specification of the definitions of each variable with some idea about their importance from the point of view of economic theory, (iii) if there is a shift from one type of definition to the other, some attempt should be made as far as possible to provide previous data under the new definition and the new data under the old definition so that the researcher will have the freedom of which definition will be more suitable for his purposes, and (vi) in Egypt there needs to be some decentralization in data collection, since the work of the existing agencies: the Ministry of Planning, the Central Agency for Public Mobilization and Statistics, etc., seem to overlap each other to a great extent. The results are, besides confusion, low quality and small coverage. If each department in the government concerns itself with data gathering in its immediate field of work, and there exist statistical units in each of these departments, while one central agency takes the duty of coordination, and direction, the quantity and quality of data will surely improve.

11. In working with this model about the Egyptian economy, while a good deal of rigorous analysis was called for, there yet was a place for some common sense and intuition. The range of some exogenous variables was decided upon in an intuitive way with the view of making the model manageable and solvable. In addition, in the process of solving the model, a good deal of trial and error was necessary before a satisfactory solution was determined.

12. Finally, it should be emphasized that regardless of improvements in the evolution of planning models, the policy makers cannot escape from the making of value judgments, and political decisions are still required. While the model presented here might point out the economic consequences of alternative development programs, nonetheless, the economist alone cannot determine an optimum program. Furthermore, a development program should be thought of as A. K. Cairncross remarks "as a focus, not a substitute for decision making... it is nonsense to think, that a program settles everything and that no sensible decisions can be taken without one. It furnishes no more than a systematic way of trying to coordinate decisions and improve on uncoordinated decisions. Although uncoordinated decisions may be bad or costly

so also may coordinated decisions: there is no magic about a program that transforms the quality of decisions beyond the virtue that coordination lends."[1]

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[1]A. K. Cairncross, "Programmes as Instruments of coordination," Scottish Journal of Political Economy, June 1961, p. 90.

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APPENDICES

APPENDIX I

DEFINITION OF THE VARIABLES OF THE MODEL

This appendix will be concerned with laying down the definitions of the different variables that constitute the model, and the method used for estimating their values. The first section will be concerned with these two problems, while the second section will show the values of these variables over the period 1959/60-1965/66, in current prices and in m.L.E.

A. Definition of Variables

1. (Y) This represents gross domestic income (G.D.Y.). Data for this variable are provided in the N.B.E. Economic Bulletin, Section 7/1b.
2. (Y_i) This variable shows the contribution of the industrial sector to G.D.Y. The sector is defined here so as to include industry and mining, electricity, and construction. Data concerning this variable are provided in the N.B.E., Economic Bulletin, Section 7/1b.
3. (Y_a) This indicates the contribution of the agricultural sector to G.D.Y. Data for this variable are provided in the N.B.E., Economic Bulletin, Section 7/1b.
4. (Y_s) This variable represents the contribution of the services sector to G.D.Y. The sector is defined such

as to include transportation, communication and storage, trade and finance, housing, public utilities, and other services. Data for this variable are provided in the N.B.E., Economic Bulletin, Section 7/1b.

5. (Y_g) This variable shows current budget net revenue. It includes the classical sources of revenue for the government such as taxes on income and wealth, commodity and other taxes, and other revenues for the government. An estimate for this variable up to 1962/63 appears in B. Hansen, "The National Outlay of the U.A.R. (Egypt)," I.N.P.C. Memo No. 377, 1963. For later years an attempt will be made to obtain these data from the official bulletins. See, The General Assembly, Report of the Plan, Budget, and Final Accounts Committee about Monetary and Economic Policy of the Budget Project of 1965/66, p. 20. (Hereafter referred to as the Report . . .). The estimates in this Report, however, include beside taxes, and other revenues of the government, the surplus of the revenue of the public sector, and the revenue of public utilities, and these have to be excluded to be consistent with estimates for earlier years, and also to satisfy the sector classification used in this study.

6. (Y_h) This shows household income. Data for this variable will be obtained from the accounting equation No. (2): $Y = Y_g + Y_h$. Data for (Y) and (Y_g) is provided

in the next section, and the sources of data were explained in items (1) and (5) above. By subtracting these two figures, the values for (Y_h) is obtained.

7. (G_p) This variable represents government payments to the household sector in the form of wages and salaries, and interest payments and price subsidies (direct social transfers are quite negligible in Egypt). Data for these two components for 1962/63-1965/66 are taken from the Report . . . , p. 19. For earlier years, data about interest payments and price subsidies are taken from B. Hansen and G. Marzouk, op. cit., p. 323, and data about wages and salaries for the first year 1959/60 is taken from the Frame of the First Five Year Plan for Economic and Social Development, p. 160. For the other two years 1960/61-1961/62, the figures are the author's guess. It may be noted that taxes from wages and salaries of government employees has to be deducted from this figure. These are shown for 1959/60-1962/63 in the Budget Reports, several issues, while the additional three figures are the author's estimate. The following table (Table A.1) shows the method of obtaining the values of G_p for the period 1959/60-1965/66.

Table A.1--Government payments to the household sector.

Year	1959/ 60	1960/ 61	1961/ 62	1962/ 63	1963/ 64	1964/ 65	1965/ 66
Wages and salaries	143.3	152.6	162.4	166.9	186.4	208.0	234.9
+							
Interest payments and price subsidies	15.0	18.8	30.3	54.0	56.6	62.2	75.5
-							
Taxes from government employees	1.3	1.7	1.7	1.6	1.8	2.0	2.3
=							
G_p	157.0	169.7	191.0	219.3	241.2	268.2	308.1

8. (S_g) This variable represents government savings in the budget. It will be calculated as follows: From data about current budget net revenue (item 5 above), public consumption and interest payments and price subsidies has to be deducted to get (S_g). Data about public consumption is shown in the Statistical Handbook, United Arab Republic (1952-1967), General Agency for Public Mobilization and Statistics, 1968 (hereafter: S.H.), p. 223; while data for interest payments and price subsidies are taken from Table A.1. The following table (Table A.2) shows the calculation of S_g.

Table A.2--Government saving in the budget.

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Current budget net revenue	259.5	263.6	260.3	325.5	357.0	385.1	424.7
-							
Public consumption	228.1	255.9	247.1	318.2	401.8	431.3	475.0
-							
Interest payments and price subsidies	15.0	18.8	30.3	54.0	56.6	62.2	75.0
=							
S_g	26.4	-11.1	-17.1	-46.7	-101.4	-98.4	-125.8

9. (G_e) Government expenditures on goods and services. This is calculated from the accounting equation No. 6,

$$Y_g = G_p + G_e + S_g.$$

10. (C_{ga}) This represents government consumption of agricultural commodities. Data for this variable are provided in the Report . . . , p. 26, for the years 1962/63-1964/65. For the other years, these figures will be extrapolated with an assumption of 3 per cent annual rate of increase.

11. (C_g) This shows government consumption of goods produced by the industrial and services sectors. Data for this variable will be obtained from the accounting equation No. 7,

$$G_e = C_{ga} + C_g.$$

12. (S_h) This variable represents household savings. Data for domestic savings are provided in the S.H., p. 223, and by subtraction of government savings in the budget (item 8, above), one can get the data for household savings. It should be stressed that these figures for household savings include retained profits in private and public companies, and pensions and insurance funds accumulations outside the government budget. Table A.3 shows how to reach these figures.

Table A.3--Household savings.

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Total domestic savings	175.9	210.1	164.7	195.6	236.8	320.6	315.9
-							
Government savings in the budget	26.4	-11.1	-17.1	-46.7	-101.4	-98.4	-125.8
=							
Household savings	149.5	221.2	181.8	243.3	338.2	419.0	441.7

13. (M_m) This variable represents imports of manufactured goods for final consumption. Data for this variable are provided in the S.H., pp. 229-230. It includes the imports of prepared foodstuffs, beverage and tobacco, paper and paper products, textiles and textile articles, footwear, headgear, umbrellas, artificial flowers, articles of stone, plaster, cement, asbestos and glass,

optical, cinematographic surgical instruments and watches, arms and munition, miscellaneous manufactured articles, and works of art, collectors pieces, and antiques.

14. (M_i) This variable refers to imports of intermediate goods for the industrial sector. Data for this item are provided in the S.H., pp. 229-230, and it includes mineral products, products of chemical industries, artificial resins and plastic materials, cellulose and rubber, rawhides and skins, furskins and articles thereof, wood and its products, base metals and articles of base metals.

15. (M_a) This represents imports of agricultural goods for final consumption. Data for this variable are provided in the S.H., p. 229, and it includes living animals and its products, vegetable products, and fats, oils and its products.

16. (M_s) This variable refers to imports of services. This item includes all invisible imports which are provided in several issues of the Central Bank of Egypt, Economic Review.

17. (M_k) This shows imports of capital goods. It includes machinery, and mechanical appliances electrical, and vehicles, aircraft, and parts thereof. These data are provided in the S.H., pp. 229-230.

18. (E_i) This represents exports of the industrial sector. Data for this variable are provided in the S.H., pp. 227-228. It includes prepared foodstuffs, beverages and tobacco, mineral products, products of chemical industries, artificial resins, and plastic materials, cellulose and rubber, rawhides and skins, furskins and articles thereof, wood and its products, paper and its products, textile and textile products, footwear, etc., articles of stone, of plaster, cement asbestos and glass, pearls, precious stones, etc., base metals and articles of base metals, machinery and mechanical appliances, vehicles, aircraft, and parts thereof, optical, cinematographic, surgical instruments and watches, arms and munitions, miscellaneous manufactures articles, and works of art, collectors pieces and antiques.
19. (E_a) This item represents the exports of the agricultural sector. Data for this variable are provided in the S.H., p. 227, and it includes living animals, and its products, fats, oil and its products.
20. (E_s) This represents exports of services (invisible exports). Data for this variable will be provided through the accounting equation No. 18,

$$M_i + M_m + M_a + M_s + M_k = E_i + E_a + E_s + S_f.$$

21. (I_i) This shows investment of the industrial sector. Data for this variable are provided in the S.H., p. 218,

and it includes investment in industry, electricity, and construction.

22. (I_a) This refers to investment in the agricultural sector. Data for this variable are provided in the S.H., p. 218, and it includes agriculture, irrigation and drainage, and the High Dam.

23. (I_s) This represents investments in the services sector. Data for this variable are provided in the S.H., p. 218, and it includes transportation and means of communications, and Suez Canal, finance and trade, housing, public utilities, and other services.

24. (I_d) Total investment expenditure on domestic products of the industrial and services sectors. Data for this variable will be obtained from the accounting equation No. 11,

$$I_d + M_k = I_i + I_a + I_s.$$

25. (S_f) This shows net foreign borrowing (foreign saving). Data for this variable could be derived from the S.H., by subtracting figures for gross savings, p. 223, from figures for gross investments, p. 218. This will be shown in Table A.4.

Table A.4--Net foreign borrowing.

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Gross investment	171.4	225.6	251.1	299.6	372.4	364.3	379.1
-							
Gross saving	175.9	210.1	164.7	195.6	236.8	320.6	315.9
=							
Net foreign borrowing	-4.5	15.5	86.4	104.0	135.6	43.7	63.2

26. (O_a) This shows the output of the agricultural sector. Data about agricultural production are provided in the S.H., p. 219. For these data to be adequate with the system of national income accounts used in this study, one should deduct from these figures the value of agricultural production that is used as raw materials in the agricultural sector itself. These consist mainly of seeds and fodder. Data about these two items are provided in the N.B.E., Economic Bulletin, Section 5/1.b. The only shortcoming is that these data are for calendar years, while fiscal years are being used here. It will be assumed that the 1959 figures correspond to 1959/60, and so on. The following table (Table A.5) presents these steps.

Table A.5--Agricultural output.

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Gross agricultural production	581.6	582.7	564.8	625.7	677.0	810.8	886.3
-							
Seeds	19.6	19.5	20.4	21.3	19.8	19.4	25.4
-							
Fodder	59.8	62.8	67.1	69.3	72.6	91.7	143.7
=							
O_A	502.2	500.4	477.3	535.1	584.6	699.7	717.2

27. (I'_{ia}) This shows industrial inputs into agriculture, and could be calculated from the accounting equation No. 14,

$$(O_a = I'_{ia} + Y_a).$$

28. (I'_{ai}) This variable represents agricultural inputs into industry. These consist mainly of the raw materials required for the food industries and cotton. An estimate of this variable for the years 1959/60 and 1961/62-1964/65 is provided by the ministry of planning. The rest will be the author's guess.

29. (O_i) This represents industrial output, and will be calculated from the accounting equation No. 11,

$$O_i = M_i + I'_{ai} + Y_i.$$

30. (O'_i) This shows the total amount of domestically produced industrial goods available for final demand. It will be calculated from the accounting equation No. 12,

$$O_i = O'_i + E_i + I'_{ia}.$$

31. (C_i) Total amount of industrial goods available for final domestic demand. It will be calculated from the accounting equation No. 9,

$$C_i = M_m + O'_i$$

32. (C_s) This shows the total amount of services output available for final domestic demand. It will be calculated from the accounting equation No. 16,

$$Y_s = C_s + E_s - M_s.$$

33. (C_{is}) Total amount of goods and services produced by the industrial and services sectors available for final consumption. This variable will be calculated from the accounting equation No. 8,

$$C_i + C_s = C_{is} + I_d.$$

34. (C_h) Total amount of goods and services produced for the industrial and services sectors available for final consumption by the household sector. It will be calculated from the accounting equation No. 13,

$$C_{is} = C_g + C_h.$$

35. (O'_a) Total amount of domestically produced agricultural goods available for final domestic consumption. This variable will be calculated from the accounting equation No. 15,

$$O_a = O'_a + E_a + I'_{ai}.$$

36. (C_a) Total amount of agricultural goods available for final domestic consumption. It will be calculated by the accounting equation No. 4,

$$C_a = O'_a + M_a.$$

37. (C_{ha}) Total amount of agricultural goods available for final domestic consumption by the household sector. It will be calculated from the accounting equation No. 5,

$$C_a = C_{ha} + C_{ga}.$$

B. Values for the variables for the period 1959/60-1965/66

The following table (Table A.6) will show time series data for the variables of the model for the period 1959/60-1965/66. The method and sources of data were explained in the previous section. All the values in this table will be in current prices, and in L. E. Millions.

Table A.6 Data for the variables of the Model (1959/60 - 1965/66).

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
1. Y	1285.2	1363.5	1411.1	1562.8	1739.6	1924.1	2087.1
2. Y_i	313.2	342.0	399.8	452.8	507.6	539.2	583.2
3. Y_a	405.0	402.7	373.0	425.0	475.0	570.1	614.7
4. Y_s	567.0	618.8	638.3	684.8	757.0	814.8	889.2
5. Y_g	259.5	263.6	260.3	325.5	357.0	385.1	424.7
6. Y_h	1025.7	1099.9	1150.8	1237.3	1382.6	1539.0	1662.4
7. G_p	157.0	169.7	191.0	219.3	241.2	268.2	308.1
8. S_g	26.4	-11.1	-17.1	-46.7	-101.4	-98.4	-125.8
9. G_e	76.1	105.0	86.4	152.9	217.2	215.3	242.3
10. C_{ga}	4.4	4.5	4.6	4.8	4.8	6.2	6.4
11. C_g	71.7	100.5	81.8	148.1	212.4	209.1	236.0
12. S_h	149.5	221.2	181.8	242.3	338.2	419.0	441.7
13. M_m	45.4	45.2	50.2	54.5	50.5	51.6	67.8
14. M_i	124.1	115.4	123.2	171.2	156.9	147.2	175.0
15. M_a	42.3	38.4	53.5	76.3	102.7	104.3	106.3
16. M_s	59.6	82.0	73.8	78.6	92.3	92.1	104.2
17. M_k	16.5	25.7	44.4	41.2	108.6	97.6	114.0
18. E_i	169.2	174.3	138.2	173.0	192.3	226.0	222.0

Table A.6 (Continued)

Year	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
19. E_a	10.7	14.7	12.6	24.8	46.0	39.2	36.5
20. E_s	112.5	102.2	107.9	120.0	137.1	183.9	245.6
21. I_i	55.5	73.4	61.6	95.9	145.5	158.3	161.9
22. I_a	29.5	38.2	51.9	73.1	102.1	89.0	82.3
23. I_s	86.4	114.0	142.6	129.9	124.8	117.0	134.9
24. I_d	154.9	199.9	206.7	258.4	263.8	266.7	267.1
25. S_f	-4.5	15.5	86.4	104.0	135.6	43.7	63.2
26. O_A	502.2	500.4	477.3	535.1	584.6	699.7	717.2
27. I'_{ia}	97.2	97.7	104.3	109.8	109.6	129.6	102.5
28. I'_{ai}	444.5	430.0	417.0	494.0	521.0	558.2	614.0
29. O_i	857.3	887.4	940.0	1118.0	1185.5	1300.4	1383.2
30. O'_i	590.9	615.4	697.5	835.2	883.6	944.8	1058.7
31. C_i	636.3	660.6	747.7	889.7	934.1	996.4	1126.5
32. C_s	514.1	598.6	604.2	643.4	712.2	723.0	747.8
33. C_{is}	995.5	1059.3	1145.2	1274.7	1382.5	1452.7	1609.2
34. C_h	923.8	958.8	1063.4	1126.6	1170.1	1243.6	1373.2
35. O'_a	71.5	55.7	47.7	17.3	17.6	46.5	55.7
36. C_a	113.8	93.5	101.2	93.6	119.8	150.8	162.0
37. C_{ha}	109.4	88.6	96.6	88.8	115.0	144.6	155.6

APPENDIX II

SOLUTION OF THE MODEL

In this appendix, the model that was stated explicitly at the end of Chapter IV, will be solved abstractly to determine the value of G.D.Y. (Y) in terms of industrial exports (E_i), saving rate (α), exogenous variables, parameters, and base year values. Once the value of (Y) is determined, it will be shown that all the other variables could be determined too. The process through which the solution is determined could be shown as follows:

In addition to the exogenous variables (eqs. 32-38) that are already known, one other variable could be determined from these exogenous variables, and that is G_e. The remaining (30) equation in (29) variables[1] has to be solved simultaneously in order to find a solution for the model. This is done as follows:

eq. (16) gives the following:

$$Y_s = C_s + E_s - M_s$$

---

[1]It may be noted that one of the accounting equations is not independent, i.e., it could be determined once the others are known. Thus, the number of independent equations is equal to the number of the unknowns.

But, from eq. (31) Y_s is expressed as a function Y;

$$Y_s = \psi_s Y$$

Also from eq. (34), E_s is given:

$$E_s = \bar{E}_s$$

Also from eq. (28), M_s is expressed as a function of Y_s, which could, in turn, be expressed in terms of Y (using eq. 31), thus

(A.1) $$M_s = \mu_s Y_s = \mu_s \psi_s Y$$

The remaining variable in eq. (16) that has to be expressed in terms of Y is C_s. This is done as follows:

Equation (9) gives the following value for C_s:

(A.2) $$C_s = C_{is} + I_d - C_i$$

But, from eq. (10);

$$C_i = O_i' + M_m$$

From eq. (26):

$$M_m = \mu_m Y_i$$

This could be expressed in terms of Y by the use of eq. (30),

(A.3) $$M_m = \mu_m \psi_i Y$$

and, from eq. (13)

$$O'_i = O_i - E_i - I'_{ia}$$

But from eq. (12):

$$O_i = M_i + I'_{ai} + Y_i$$

which could be written, after substituting for M_i from eq. (27) and for I'_{ai} from eq. (24) as

$$O_i = \mu_i O_i + \beta_i O_i + Y_i$$

Rearranging,

$$O_i = \frac{1}{1 - \mu_i - \beta_i} Y_i$$

This could also be expressed in terms of Y be substituting for Y_i from eq. (30), thus:

(A.4) $$O_i = \frac{\psi_i}{1 - \mu_i - \beta_i} Y$$

Also, from eq. (24):

$$I'_{ia} = \beta_a O_a$$

But, from eq. (14):

$$O_a = I'_{ia} + Y_a = \beta_a O_a + Y_a$$

Rearranging,

$$O_a = \frac{1}{1 - \beta_a} Y_a$$

This could be expressed also in terms of Y by substituting for Y_a from eqs. (1, 30, and 31). Thus:

$$O_a = \frac{1 - \psi_i - \psi_s}{1 - \beta_a} Y \tag{A.5}$$

To express I'_{ia} in terms of Y we substitute for O_a from the last equation eq. (A.5):

$$I'_{ia} = \frac{\beta_a(1 - \psi_i - \psi_s)}{1 - \beta_a} Y \tag{A.6}$$

To get the value of C_i in terms of Y, one should substitute for O'_i in eq. (13) from eqs. (A.4) and (A.6), and for M_m from eq. (A.3) into eq. (10):

$$C_i = \frac{\psi_i}{1 - \mu_i - \beta_i} Y - \frac{\beta_a(1 - \psi_i - \psi_s)}{1 - \beta_a} Y - E_i + \mu_m \psi_i Y$$

which by rearranging, becomes:

$$C_i = \left[\frac{\psi_i}{1 - \mu_i - \beta_i} - \frac{\beta_a(1 - \psi_i - \psi_s)}{1 - \beta_a} + \mu_m \psi_i\right] Y - E_i \tag{A.7}$$

The next item that will be considered from eq. (A.2) is C_{is}. From eq. (8):

$$C_{is} = C_g + C_h$$

But from eq. (36), C_g is given:

$$C_g = \overline{C}_g,$$

and from eq. (3), C_h could be expressed as:

$$C_h = G_p + Y_h - C_{ha} - S_h$$

But: Eq. (38) states the following

$$G_p = \bar{G}_p;$$

eq. (22) expresses Y_h as a function of Y:

$$Y_h = (1 - t)Y;$$

eq. (23) expresses S_h as:

(A.8) $$S_h = \alpha(Y_h + G_p) = \alpha[(1 - t)Y + \bar{G}_p]$$

after substituting for Y_h from eq. (22); and from eq. (5):

$$C_{ha} = C_a - C_{ga}$$

But from eq. (4) C_a could be expressed as:

$$C_a = O'_a + M_a,$$

and, eq. (15) expresses O'_a as:

$$O'_a = O_a - E_a - I'_{ai}$$

which by substitution for O_a from (A.5), and for I'_{ai} from eqs. (24) and (A.4), becomes:

(A.9) $$O'_a = \frac{1 - \psi_i - \psi_s}{1 - \beta_a} Y - \frac{\beta_i \psi_i}{1 - \mu_i - \beta_i} Y - E_a$$

Also M_a and E_a are given from eq. (32) and (33) as:

$$M_a = \bar{M}_a$$

$$E_a = \bar{E}_a$$

Substituting for M_a and O'_a from eqs. (32) and (A.9) respectively into eq. (4):

$$(A.10) \quad C_a = \left[\frac{1 - \psi_i - \psi_s}{1 - \beta_a} - \frac{\beta_i \psi_i}{1 - \mu_i - \beta_i}\right] Y - \bar{E}_a + \bar{M}_a$$

Eq. (37) gives C_{ga} as an exogenous variable:

$$C_{ga} = \bar{C}_{ga}$$

Substituting this value for C_{ga} and substituting for C_a from (A.10) into eq. 5, C_{ha} could be determined as a function of Y. Thus

$$(A.11) \quad C_{ha} = \left[\frac{1 - \psi_i - \psi_s}{1 - \beta_a} - \frac{\beta_i \psi_i}{1 - \mu_i - \beta_i}\right] Y - \bar{E}_a + \bar{M}_a - \bar{C}_{ga}$$

To get the value of C_h, one should now substitute into eq. (3) for: G_p from eq. (38), Y_h from eq. (22), for S_h from eq. (A.8), and for C_{ha} from eq. (A.11):

$$(A.12) \quad C_h = \bar{G}_p + (1 - t)Y - \left[\frac{1 - \psi_i - \psi_s}{1 - \beta_a} - \frac{\beta_i \psi_i}{1 - \mu_i - \beta_i}\right] Y$$
$$+ \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - \alpha[(1 - t)Y + \bar{G}_p]$$

Substituting into C_{is} in eq. (8) for C_h from (A.12) and C_g from eq. (36), one gets:

$$(A.13) \quad C_{is} = \bar{C}_g + \bar{G}_p + (1 - t)Y - \left[\frac{1 - \psi_i - \psi_s}{1 - \beta_a} - \frac{\beta_i \psi_i}{1 - \mu_i - \beta_i}\right] Y$$
$$+ \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - \alpha[(1-t)Y + \bar{G}_p]$$

The remaining variable in equation (A.2) that has to be expressed in terms of Y is I_d.

From equation (11), I_d is expressed as

$$I_d = I_i + I_a + I_s - M_k$$

But from eq. (29):

$$M_k = \mu_k(I_i + I_a + I_s)$$

Substituting for M_k, I_d will be:

$$I_d = (1-\mu_k)(I_i + I_a + I_s)$$

Substituting for I_i, I_a, and I_s from eq.s (19), (20), and (21) respectively:

$$\text{(A.14)} \quad I_d = (1-\mu_k)\left[\frac{\rho_i}{b_i}(Y_i-Y_i^o) + \frac{\rho_a}{b_a}(Y_a-Y_a^o) + \frac{\rho_s}{b_s}(Y_s-Y_s^o)\right]$$

Substituting for Y_i, Y_s, and Y_a from eqs. (30), (31), and (30, 31, and 1) respectively, and rearranging:

$$\text{(A.15)} \quad I_d = (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] Y$$
$$- (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right]$$

Returning to the original equation (eq. 16), and substituting for Y_s from eq. (31) for E_s from eq. (34) and for M_s from eq. (A.1) and also substituting for C_i from eq. (A.7), for C_{is} form eq. (A.13) and for I_d from eq. (A.15) into

C_s in eq. (A.2) and substituting this value for C_s into eq. (16), one gets:

$$(A.16)\quad \psi_s Y = \bar{C}_g + \bar{G}_p + (1-t)Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} + \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] Y + \bar{E}_a - \bar{M}_a$$
$$+ \bar{C}_{ga} - \alpha[(1-t)Y + \bar{G}_p] + (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i}\right.$$
$$\left. + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] Y - (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o\right.$$
$$\left. + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right] - \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a}\right.$$
$$\left. + \mu_m\psi_i\right] Y + E_i + \bar{E}_s - \mu_s\psi_s Y$$

Which could be written as:

$$(A.17)\quad Y = \frac{A + E_i - B(\alpha)}{C(\alpha) + D}$$

Where A, B, C, and D are constants, that will be determined after the estimation of the parameters and exogenous variables.

Once the value of Y is determined, the other variables could also be determined by the use of one or another of the behavioral or accunting relationships that constitute the original model. The only variables that are not determined up to now are S_g and S_f. These two variables could be determined through the two equations that have

not been utilized yet.[1] The first of these equations is:

$$Y_g = G_p + G_e + S_g$$

Looking at this equation, one can find that once Y is determined, then Y_h could be determined by the use of eqs. (22) and (2). Since G_p and G_e are exogenous variables, then the value of S_g will be known once Y_g is known.

The second equation that has not been utilized yet is:

$$M_i + M_m + M_a + M_s + M_k = E_i + E_a + E_s + S_f$$

To express S_f as a function of E_i is a relatively easy matter, since E_a and E_s are exogenous variables, and the value of the different import components could be determined once Y is known. The following steps will be concerned with the determination of the value of S_f.

From eq. (18), S_f could be written as:

$$\text{(A.18)} \quad S_f = M_i + M_m + M_a + M_s + M_k - (E_i + E_a + E_s)$$

But:

from eqs. (27), (A.1), and (30):

$$\text{(A.19)} \quad M_i = M_i(O_i) = \frac{\mu_i \psi_i}{1-\mu_i-\beta_i} Y$$

from eqs. (26), and (30):

---

[1]Equation 17 was not utilized in deriving the solution, because it is not independent of the others, i.e., it will be known if the other equations are already known.

(A.20) $M_m = \mu_m Y_i = \mu_m \psi_i Y$

from eq. (32):

$$M_a = \bar{M}_a$$

from eqs. (28) and (31):

(A.21) $M_s = \mu_s Y_s = \mu_s \psi_s Y$

and from eqs. (29) and (A.6):

$$(A.22)\quad M_k = \mu_k (I_i + I_a + I_s) = \mu_k Y \left[\frac{\rho_i \psi_i}{b_i} + \frac{\rho_a (1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s \psi_s}{b_s} \right] - \mu_k \left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o \right]$$

Substituting for M_i, M_m, M_a, M_s, and M_k from eqs. (A.19), (A.20), (32), and (A.21), and (A.22) respectively and for E_a and E_s from eqs. (33) and (34) into eq. (A.18), one gets:

$$(A.23)\quad S_f = \left[\frac{\mu_i \psi_i}{1-\mu_i-\beta_i} + \mu_m \psi_i + \mu_s \psi_s + \frac{\mu_k \rho_i \psi_i}{b_i} + \frac{\mu_k \rho_a (1-\psi_i-\psi_s)}{b_a} + \frac{\mu_k \rho_s \psi_s}{b_s} \right] Y - \mu_k \left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o \right] + \bar{M}_a - \bar{E}_a - \bar{E}_s - E_i$$

which could be simplified upon the substitution for the value of Y from eq. (A.17) as:

$$(A.24) \quad S_f = F\left[\frac{A + E_i - B(\alpha)}{C(\alpha) + D}\right] - H - E_i$$

where F and H are constants that will be determined after the values of the parameters and exogenous variables are determined.

In addition to eqs. (A.17) and (A.24), one additional constraint needs to be specified. This is the constraint imposed by the full-employment target. The full employment goal will be specified, (depending on the value of ℓ_i, ℓ_a, and ℓ_s chosen) by the value that Y has to take in order to achieve full employment.

The full employment equilibrium is given by eq. (IV.25) as follows:

$$(A.25) \quad L = L_i + L_a + L_s$$

The supply of labor (L) in 1975, was estimated by eq. (IV.50) and thus, it is known = $\bar{L}$.

From eqs. (22), (23), and (24) we have

$$L_i = \lambda_i^o(1-\ell_i)^t y_i,$$

$$L_a = \lambda_a^o(1-\ell_a)^t y_a, \text{ and}$$

$$L_s = \lambda_s^o(1-\ell_s)^t y_s.$$

Substituting for L_i, L_a and L_s from these three equations, and substituting for Y_i, Y_a, and Y_s from eqs. (29); (1), (29) and (30); and (30), into eq. (A.23), we get

$$\bar{L} = \lambda_i^o(1-\ell)^t\psi_i Y + \lambda_a^o(1-\ell_a)^t(1-\psi_i-\psi_s)Y + \lambda_s^o(1-\ell_s)^t\psi_s Y$$

$$\bar{L} = [\lambda_i^o\psi_i(1-\ell)^t + \lambda_a^o(1-\psi_i-\psi_s)(1-\ell_a)^t + \lambda_s^o\psi_s(1-\ell_s)^t]Y$$

Which by rearranging gives us the labor supply constraint:

$$\text{(A.26)} \quad Y = \frac{\bar{L}}{\lambda_i^o\psi_i(1-\ell_i)^t + \lambda_a^o(1-\psi_i-\psi_s)(1-\ell_a)^t + \lambda_s^o\psi_s(1-\ell_s)^t}$$

APPENDIX III

ESTIMATES OF THE PARAMETERS AND EXOGENOUS VARIABLES

This appendix will be concerned with the estimation of the parameters of the behavioral equations and of the exogenous variables. Before going into the details of this process, it should be stressed, as it has already been done in the text, that no sophisticated econometrics techniques will be used in this process. This is mainly due to several reasons: the limited number of observations available for each variable; data for some variables were obtained as residuals through the use of one or more of the accounting equations; the institutional changes that took place in the Egyptian economy by the end of the fifties and the beginning of the sixties, which make it difficult to judge if the changes in the data reflect technical and economic changes or that it reflects mainly changes in the institutional structure of the economy; and last but not least the definition of some variables is not availabe, and sometimes they are inconsistent. For all these reasons, the simplest of all statistical methods will be used with the hope that such studies might suggest possible ways of improvement in data collection,

and once these improvements take place, they could be substituted instead of the rough estimates that have been used here (provided, of course, that the structure of the economy will not have been radically changed to make the model inadequate for the analysis).

The process of estimation will depend mainly on the data regarding each variable that was presented in Table A.6. These data, however, were in current prices and to estimate the parameters from these data will mean that the estimates reflect price changes as well as technological and/or behavioral changes. One way of eliminating the effects of price changes is to estimate all the values of the relevant variables in terms of the base year prices (1965/66). The price deflator of G.D.Y. that will be used here is the one prepared by Professor B. Hansen[1] for the years 1959/60-1964/65. For the year 1965/66, the implicit price deflator of G.D.Y. used by the Ministry of Planning in determining constant price estimates of G.D.Y. of that year, will be used.[2]

For some variables, the price deflator chosen was the general number of industrial products and materials prepared by the Central Agency for Public Mobilization and

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[1] B. Hansen, "Planning and Economic Growth in the U.A.R., 1960-65," op cit., p. 28.

[2] N.B.E., Economic Bulletin, Vol. XXII, No. 2, 1969, Section 7/1.b.

Statistics. Finally, for variables related to the foreign trade sectors (imports, and exports), due to the difficulty of finding a price deflator of the Egyptian imports and exports, it was decided to use as a proxy the price deflator of the imports and exports of developing countries in general.[1] Table A.7 expresses these price deflators in terms of 1965/66 prices.

A. Parameters

1. The estimation of ρ_i, ρ_a, and ρ_s.

It was assumed in the text, that these represent the ratio of investment in the production sectors in the target year of the model, to total investment during the preceding years of the model. For example,

$$\rho_i = \frac{I_i^{1974/75}}{I_i^{66/67}+\ldots+I_i^{73/74}} \quad , \text{ etc.}$$

The estimation of these parameters will be assumed to be:

$$\rho_i = \frac{I_i^{65/66}}{I_i^{57/58}+\ldots+I_i^{64/65}} \quad ,$$

and similarly for ρ_a and ρ_s. Table A.8 gives data about these variables in current and 1965/66 prices for these years.

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[1] U.N., "Monthly Bulletin of Statistics," July, 1966.

Table A.7--Price Deflators (1965/66 prices = 100).

	1959/60	60/61	61/62	62/63	63/64	64/65	65/66
Agriculture	115.3	115.3	115.3	115.6	109.9	104.2	100
Industry	117.3	116.2	114.2	109.5	105.9	103.9	100
Services	112.3	111.5	111.5	108.9	104.9	102.0	100
Total G.D.Y.	113.5	112.9	112.4	109.9	106.2	102.2	100
General No. of Industrial Products and Materials	104.6	106.2	108.8	108.8	107.1	103.6	100
Price Index for Imports	102.0	101.0	102.0	103.0	102.0	101.0	100
Price Index for Exports	103.0	102.0	105.2	107.5	105.2	100.0	100

Table A.8--Investment in the Production Sectors.

Year	In Current Prices[1] (L.E.M.)			In 1965/66 Prices[4] (L.E.M.)		
	I_i	I_a[2]	I_s	I_i	I_a	I_s
1957/58[3]	43.3	21.2	100.9	46.2	22.6	107.6
58/59[3]	54.5	24.8	102.1	58.4	26.6	109.5
59/60	55.5	25.3	86.4	58.0	26.5	90.4
60/61	73.4	31.4	114.0	77.9	33.3	121.1
61/62	61.6	37.5	142.6	67.0	40.8	155.1
62/63	95.9	49.8	129.9	104.3	54.2	139.1
63/64	145.5	67.3	124.8	155.8	72.1	133.6
64/65	158.3	70.4	117.0	164.0	72.9	121.2
65/66	161.9	63.3	134.9	161.9	63.3	134.9

[1]Figures for 1959/60-65/66 are taken from Table A.6.

[2]The figures for agricultural investment do not include investment in the High Dam, the exclusion is due to the fact that when the project is completed (around the end of 1970) no further investments will take place.

[3]Current price figures for this year were taken from D. Mead, op. cit., p. 290.

[4]The price deflator is the general number of industrial products and materials.

From the previous table, ρ_i, ρ_a and ρ_s could be estimated as follows,

$$\rho_i = \frac{161.9}{731.6} = .22129$$

$$\rho_a = \frac{63.3}{349} = .18137$$

and $$\rho_s = \frac{134.9}{977.6} = .13799$$

2. The estimation of b_i, b_a and b_s.

The production functions used in this model are of the fixed proportion type, i.e., those for which the average productivity of capital is equal to the marginal productivity. If data about capital stock and its distribution among sectors are available for Egypt, which it is not, it would have been preferable to calculate the average productivity of capital (the output-capital ratio), instead of calculating the marginal productivity. This is especially true in the case of agricultural sector, where agricultural product could be affected by weather conditions and the like. Due to these factors, investments could be positive in one year, while output declines. To overcome this defect, and also to take a more realistic view in the estimation, it was decided to extend the number of observations to start from 1952/53-1965/66. The following tables (Tables A.9, A.10, and A.11) will show these observations both in current prices and in 1965/66 prices. The purpose will be

to fit a simple least square regression line of the form $\Delta Y = bI$. In these tables, figures for gross investment in different sectors at current prices for the period 1952/53-1958/59 will be taken from D. Mead, op. cit., p. 240 and data about G.D.Y. at current prices for the same period, will be taken from the Statistical Pocket Book (1952-1963) published by the Department of Public Mobilization and Statistics, April, 1964. To express these in 1965/66 prices, the general number of industrial products and materials will be used to deflate investment figures, while the implicit G.N.P. deflator used by B. Hansen and D. Mead, The National Income of the U.A.R. (Egypt) 1939-1962, Memo No. 355 (Cairo, I.N.P, July, 1963), Table 8 will be used for the period 1952/53-1958/59. From 1959/60 to 1965/66, current price figures were taken from Table A.6 and the price deflators are taken from Table A.7.

Table A.9--Investment and Income in the Industrial Sector.

Year	In Current Prices (L.E.M.)		In 1965/66 Prices (L.E.M.)		
	I_i	Y_i	I_i	Y_i	ΔY_i
1952/53	35.3	152.0	44.1	194.3	--
1953/54	38.5	167.0	48.9	207.7	13.4
1954/55	40.9	181.0	52.1	219.4	11.7
1955/56	58.7	197.0	67.0	235.0	15.6
1956/57	40.4	224.0	41.8	259.8	24.8
1957/58	43.3	256.0	46.2	297.5	37.7
1958/59	54.5	283.0	58.4	329.7	32.2
1959/60	55.5	313.2	58.0	367.4	37.7
1960/61	73.4	342.0	77.9	397.4	30.0
1961/62	61.6	399.8	67.0	456.6	59.2
1962/63	95.9	452.8	104.3	495.8	39.2
1963/64	145.5	507.6	155.8	537.5	41.7
1964/65	158.3	539.2	164.0	560.2	22.7
1965/66	161.9	583.2	161.9	583.2	23.0

From these figures, the simple least square estimate of b_i will be

$$b_i = \frac{\Sigma I_i \; Y_i}{\Sigma I_i^2} = \frac{34,169.41}{115,704.01} = .29532$$

Table A.10--Investment and Income in the Agricultural Sector.

Year	In Current Prices (L.E.M.)		In 1965/66 Prices (L.E.M.)		
	I_a [1]	Y_a	I_a	Y_a	ΔY_a
1952/53	13.7	252.0	17.1	322.1	--
53/54	14.8	262.0	18.8	325.9	3.8
54/55	15.3	301.0	19.5	364.8	38.9
55/56	18.0	342.0	20.5	408.0	43.2
56/57	19.6	374.0	20.3	433.8	25.8
57/58	21.2	381.0	22.6	442.7	8.9
58/59	24.8	364.0	26.6	424.1	-18.6
59/60	25.3	405.0	26.5	467.0	42.9
60/61	31.4	402.7	33.3	446.3	-2.7
61/62	37.5	373.0	40.8	430.1	-34.2
62/63	49.8	425.2	54.2	491.5	61.4
63/64	67.3	475.0	72.1	522.0	30.5
64/65	70.4	570.1	72.9	594.0	72.0
65/66	63.3	614.7	63.3	614.7	20.7

Notes:

1. Figures for High Dam investment were excluded from agricultural investment for the purposes of calculating the output-capital ratio in the agricultural sector since they did not contribute to output during this period of construction of the dam.

From these figures, the simple least square estimate of ba will be:

$$b_a = \frac{\Sigma I_a Y_a}{\Sigma I_a^2} = \frac{13,681.38}{23,717.48} = .57684.$$

Table A.11--Investments and Income in the Services Sector.

Year	In Current Prices (L.E.M.)		In 1965/66 Prices (L.E.M.)		
	I_s	Y_s	I_s	Y_s	ΔY_s
1952/53	69.6	402.0	86.9	513.8	--
53/54	79.1	418.0	100.5	520.0	6.2
54/55	90.0	438.0	114.8	530.8	10.8
55/56	95.4	456.0	108.9	544.0	13.2
56/57	91.0	469.0	94.2	544.1	0.1
57/58	100.9	489.0	107.6	568.2	24.1
58/59	102.1	510.0	109.5	594.2	26.0
59/60	86.4	567.0	90.4	636.7	42.5
60/61	114.0	618.8	121.1	690.0	53.3
61/62	142.6	638.3	155.1	711.0	21.7
62/63	129.9	684.8	139.1	745.7	34.0
63/64	124.8	757.0	133.6	794.1	48.4
64/65	117.0	814.8	121.2	831.1	37.0
65/66	134.9	889.2	134.9	889.2	58.1

From these figures, the simple least square estimate of b_s will be:

$$b_s = \frac{I_s Y_s}{I_s^2} = \frac{45{,}930.03}{184{,}558.75} = .24886$$

3. The estimation of (1-t):

From equation no. (22), $Y_h = (1-t)Y$

From data about Y_h and Y, a simple least square regression line will be fitted, where (1-t) is the slope of this line. Table A.12 gives current and 1965/66 prices for both variables.

Table A.12--G.D.Y. and Household Income.

Year	In Current Prices[1] (L.E.M.)		In 1965/66 Prices[2] (L.E.M.)	
	Y	Y_h	Y	Y_h
1959/60	1285.2	1025.7	1458.7	1164.2
60/61	1363.5	1099.9	1539.4	1244.8
61/62	1411.1	1150.8	1586.1	1293.5
62/63	1562.8	1237.3	1717.5	1359.8
63/64	1739.6	1382.6	1847.4	1468.3
64/65	1924.1	1539.0	1966.4	1634.4
65/66	2087.1	1662.4	2087.1	1662.4

Notes:

[1]These figures for Y and Y_h are taken from Table A.6.

[2]Both Y and Y_h are deflated by the G.D.Y. deflator shown in Table A.7. From these figures, the simple least square estimate of (1-t) will be

$$(1-t) = \frac{\Sigma Y\, Y_h}{\Sigma_Y 2} = \frac{17,397,557.13}{21,598.679.64} = .80549$$

4. The estimate of (α)

The behavioral equation no (23) gives household savings as a function of

$$S_h = \alpha(Y_h + G_p)$$

A simple least square line will be fitted from the observations of S_h, and Y_h and G_p. The following table (Table A.13) shows current and 1965/66 prices for these variables.

Table A.13--Household Saving, Government Payments, and Household Income.

Year	In Current Prices[1] (L.E.M.)		In 1965/66 Prices[2] (L.E.M.)			
	S_h	G_p	S_h	G_p	Y_h	(G_p+Y_h)
1959/60	149.5	157.0	169.68	178.2	1164.2	1342.4
60/61	221.2	169.7	249.73	191.6	1244.8	1436.4
61/62	181.8	191.0	204.34	214.7	1293.5	1508.2
62/63	242.3	219.3	266.28	241.0	1359.8	1600.8
63/64	338.2	241.2	359.17	256.2	1468.3	1724.5
64/65	419.0	268.2	428.22	274.1	1634.4	1908.5
65/66	441.7	308.1	441.70	308.1	1662.4	1970.5

Notes:

[1]These figures for S_h and G_p are taken from Table (A.6).

[2]The current price estimates are deflated by the implicit deflator of G.D.Y., shown in Table (A.7).

From these figures, the simple least square estimate for α will be:

$$= \frac{\Sigma S_h (G_p+Y_h)}{\Sigma (G_p+Y_h)^2} = \frac{3,627,953.60}{19,301,653.35} = .18893$$

5. The estimation of β_i and β_a.

The behavioral equations no. (24) and (25 give the following:

$$I'_{ai} = \beta_i (O_i), \text{ and}$$

Table A.14--Agricultural Inputs into Industry, Industrial Inputs into Agriculture, Industrial Output, and Agricultural Output.

Year	In Current Price[1] (L.E.M.)		In 1965/66 Prices (L.E.M.)		In Current Prices[1] (L.E.M.)		In 1965/66 Prices (L.E.M.)	
	I'_{ai}	O_i	I'_{ai}[3]	O_i[2]	I'_{ia}	O_a[3]	I'_{ia}[2]	O_a
1959/60	444.5	857.3	512.5	1005.6	97.2	502.2	114.0	579.0
60/61	430.0	887.4	595.8	1031.2	97.7	500.4	113.5	557.0
61/62	417.0	940.0	480.8	1073.5	104.3	477.3	119.1	550.3
62/63	494.0	1118.0	571.1	1224.2	109.8	535.1	120.2	618.6
63/64	521.0	1185.5	572.6	1255.4	109.6	584.6	116.1	642.5
64/65	558.2	1300.4	581.8	1351.1	129.6	699.7	134.6	729.1
65/66	625.0	1383.2	625.0	1382.2	102.5	717.2	102.5	717.2

Notes:

[1]These figures are taken from Table A.6.

[2]The price deflator used is the implicit price deflator of domestic income generated from the industrial sector. This was shown in Table A.7.

[3]The price deflator used in the implicit price deflator of domestic income generated from the agricultural sector. This was shown in Table A.7.

$$I'_{ia} = \beta_a(O_a).$$

Table A.14 gives data about I'_{ai} and O_i, and I'_{ia} and O_a in both current and 1965/66 prices in order to estimate the coefficients β_i and β_a by least square techniques.

From Table A.14 the estimates for β_i and β_a will be as follows:

$$\beta_i = \frac{\Sigma O_i I'_{ai}}{\Sigma O_i^2} = \frac{4,610,806.00}{10,037,649.90} = .45935,$$

It may be noted that while industrial inputs into the agricultural sector (I'_{ia}) may be expected to follow the same trend in the past (it may even tend to increase as a result of increases in the use of chemical fertilizers), this seems to be less certain in the case of agricultural inputs into the industrial sector (I'_{ai}). With the increase in the industrial production, the share of industries that depend on agricultural raw materials will decline relative to the whole industrial output. Therefore, the value of β_i will be assumed to be .4 instead of the one estimated above.

$$\beta_i = .4$$

Also:

$$\beta_a = \frac{\Sigma O_a I'_{ai}}{\Sigma O_a^2} = \frac{517,636.06}{2,812,434.9} = .18405$$

6. The estimation of μ_i and μ_s.

The behavioral eqs. no. (26) and (27) give the following:

$$M_i = \mu_i(O_i) \text{ and}$$

$$M_s = \mu_s(Y_s)$$

The table on the following page (Table A.15) gives data about M_i, O_i, M_s and Y_s in both current and 1965/66 prices, in order to estimate μ_i and μ_s.

From this table, the estimates of μ_i and μ_s will be as follows:

$$\mu_i = \frac{\Sigma O_i M_i}{\Sigma O_i^2} = \frac{1,244,144.86}{10,037,649.9} = .12395$$

$$\mu_s = \frac{\Sigma Y_s M_s}{\Sigma Y_s^2} = \frac{454,433.25}{4,056,070.93} = .11204$$

7. The estimation of μ_m.

From the behavioral equation no (26):

$$M_m = \mu_m Y_i$$

Through simple least square techniques, μ_m is estimated to be:

$$\mu_m = \frac{\Sigma M_m Y_i}{\Sigma Y_i^2} = \frac{182,772.73}{1,690,063.25} = .10814$$

Table A.15--Intermediate Imports into Industry, Services Imports, Industrial Output, and Services' Income.

Year	In Current Prices[1] (L.E.M.)		In 1965/66 Prices (L.E.M.)		In Current Prices (L.E.M.)		In 1965/66 Prices (L.E.M.)	
	M_i	O_i	M_i[2]	O_i[3]	M_s	Y_s	M_s[2]	Y_s[4]
1959/60	124.1	857.3	126.6	1005.6	59.6	567.0	60.8	636.7
60/61	115.4	887.4	116.6	1031.2	82.0	618.8	82.8	690.0
61/62	123.2	940.0	125.7	1073.5	73.8	638.3	75.3	711.7
62/63	171.2	1118.0	176.3	1224.2	78.6	684.8	80.9	745.7
63/64	156.9	1185.5	160.0	1255.4	92.3	757.0	94.1	794.1
64/65	147.2	1300.4	148.7	1351.1	92.1	814.8	93.0	831.1
65/66	175.0	1383.2	175.0	1383.2	104.2	889.2	104.2	889.2

Notes:

[1]These values are taken from Table A.6.

[2]The price deflator is the import price deflator in Table A.7.

[3]The price deflator is the one used to deflate income generated from the industrial sector in Table A.7.

[4]The price deflator is the one used to deflate income generated from the services sector in Table A.7.

Table A.16--Industrial Income and Imports of Manufactured Goods.

Year	In Current Prices[1] (L.E.M.)		In 1965/66 Prices[2] (L.E.M.)	
	Y_i	M_m	Y_i	M_m
1959/60	313.2	45.4	367.4	46.3
60/61	342.0	45.2	397.4	45.7
61/62	399.8	50.2	456.6	51.2
62/63	452.8	54.5	495.8	56.1
63/64	507.6	50.5	537.5	51.5
64/65	539.2	51.6	560.2	52.1
65/66	583.2	67.8	583.2	67.8

Notes:

[1]These values are taken from Table A.6.

[2]The price deflators are of industrial income for Y_i and of imports for M_m. These price deflators are shown in Table A.7.

The preceding table shows relevant data about M_m and Y_i for the period 1959/60-1965/66.

8. The estimation of μ_k.

The behavioral equation no. (29) gives the following relationships

$$M_k = \mu_k(I_i + I_a + I_s)$$

Table A.17 gives values for these variables in both current and 1965/66 prices.

Table A.17--Capital Goods Imports and Total Investments.

Year	In Current Prices[1] (L.E.M.)		In 1965/66 Prices (L.E.M.)		
	M_k	$\Sigma I_i+I_a+I_s$	M_k[2]	$\Sigma I_i+I_a+I_s$[3]	$\frac{M_k}{\Sigma I_i+I_a+I_s}$
1959/60	16.5	171.4	16.8	179.3	.0936
60/61	25.7	225.6	26.0	239.6	.1085
61/62	44.4	251.1	45.3	278.6	.1625
62/63	41.2	299.6	42.4	322.9	.1313
63/64	108.6	372.4	110.8	398.7	.2779
64/65	97.6	364.3	98.6	377.4	.2612
65/66	114.0	379.1	114.0	379.1	.3077

Notes:

[1]These figures are taken from Table A.6.

[2]The price deflator is the import price deflator in Table A.7.

[3]The deflation is by the general number of industrial products and materials in Table A.7.

The last column of the previous table shows the ratio of $\frac{M_k}{\Sigma I_i+I_a+I_s}$. From these figures, it can be easily seen that as total investment ($\Sigma I_i+I_a+I_s$) increase, the ratio of capital imports (M_k) to total investment tends also to increase. The simple least square estimation for

the parameter μ_k will not, therefore, give the appropriate magnitude of μ_k because of the trend involved. It can also be seen from the last column of Table A.17, that the value of μ_k is asymptotically approaching 0.3. This will be the value assumed for μ_k. Thus:

$$\mu_k = .3$$

9. The estimate of ψ_i and ψ_s.

The following two equations no (30) and (31) give these relationships

$$Y_i = \psi_i Y$$

$$Y_s = \psi_s Y$$

The table on the following page (Table A.18) gives values for Y_i, Y_s, and Y both in current and 1965/66 prices. It gives also the ratios of $\frac{Y_i}{Y}$ and $\frac{Y_s}{Y}$.

From the last two columns of Table A.18, it can be easily seen that ψ_i has a tendency to increase through time while ψ_s had a tendency to fall. This reflects the structural change that took place in the Egyptian economy during the fifties and the first half of the sixties. As it was shown in Chapter II, such large structural changes might not be forthcoming in the future. It might be reasonable, therefore, to assume the following values for ψ_i and ψ_s, in 1974/75:

Table A.18--G.D.Y., Industrial Income, and Services

Year	In Current Prices[1] (L.E.M.)			In 1965/66 Prices[2] (L.E.M.)			ψ_i[3] $=\frac{Y_i}{Y}$	ψ_s[3] $=\frac{Y_s}{Y}$
	Y	Y_i	Y_s	Y	Y_i	Y_s		
1952/53	806	152	402	1030.2	194.3	513.8	.18860	.49873
53/54	847	167	418	1053.6	207.7	520.0	.19713	.49354
54/55	920	181	438	1115.0	219.4	530.8	.19677	.47605
55/56	965	197	456	1187	235.0	544	.19797	.45829
56/57	1007	224	469	1237.7	259.8	544.1	.20990	.43960
57/58	1126	256	489	1308.4	297.5	568.2	.22737	.43427
58/59	1157	283	510.0	1348.0	329.7	594.2	.24458	.44080
59/60	1285.2	313.2	517.0	1458.7	367.4	636.7	.25186	.43648
60/61	1363.5	342.0	618.8	1539.4	397.4	690.0	.25815	.44822
61/62	1411.1	399.8	638.3	1586.1	456.6	711.0	.28787	.44826
62/63	1562.8	452.8	684.8	1717.5	495.8	745.7	.28867	.43417
63/64	1739.6	507.6	757.0	1847.4	537.5	794.1	.29094	.42984
64/65	1924.1	539.2	814.8	1966.4	560.2	831.1	.28488	.42265
65/66	2087.1	583.2	889.2	2087.1	583.2	889.2	.27943	.42604

Notes: (Table A.18)

[1]Annual figures for 1952/53-1958-59 are taken from the Statistical Pocket Book, op. cit.; from 1959/60-1965/66 are taken from Table A.6.

[2]The price deflator for 1952/53-1958/59 is the implicit G.N.P. deflators used by Bent Hansen and D. Mead, op. cit., and for later years the price deflators of G.D.Y., industrial income, and services income are taken from Table A.7.

[3]Figures for these two ratios are those in 1965/66 prices.

$$\psi_i = .3$$

$$\psi_s = .4$$

The change in the value of ψ_i is not very great, since it has already reached more than .285 in four out of the last five years for which data are shown. The reduction in the value of ψ_s, while small by itself, will allow for an increase in the share of agricultural production in G.D.Y. to allow for the additional land provided by the completion of the High Dam.

10. The estimation of λ_i^o, λ_a^o, and λ_s^o.

From Chapter Iv, equations (22) (23) and (24), the demand for labor in the different production sectors is represented by:

$$L_i = \lambda_i^o(1-\ell_i)^t Y_i,$$

$$L_a = \lambda_a^o(1-\ell_a)^t Y_a, \text{ and}$$

$$L_s = \lambda_s^o(1-\ell_s)^t Y_s.$$

To estimate the values of λ_i^o, λ_a^o, and λ_s^o, a straight line will be fitted by least square techniques from data on L_i, Y_i; L_a, Y_a; and L_s, Y_s. The following table (Table A.19) gives these data.

Table A.19--Employment and Income in the Different Production Sectors.

Year	Figures are in (000) laborers[1]			In 1965/66 Prices[2] (L.E.M.)		
	L_i	L_a	L_s	Y_i	Y_a	Y_s
1959/60	798.7	3,245.0	1,962.3	367.4	476	636.7
60/61	804.7	3,600.0	2,107.2	397.4	464.3	690.0
61/62	957.1	3,600.0	2,099.8	456.6	430.1	711.7
62/63	1,059.0	3,632.0	2,177.2	495.8	491.5	745.7
63/64	1,141.8	3,673.0	2,270.2	537.5	522.0	794.1
64/65	1,188.2	3,751.0	2,371.4	560.2	594.0	831.1
65/66	1,188.2	3,857.0	2,449.7	583.2	614.7	889.2

Notes:

[1]These figures are taken from the S.H., p. 221.

[2]These figures are taken from Table A.6 and are deflated by the price deflators of industrial, agricultural, and services income respectively (shown in Table A.7).

From these figures, one can obtain the following estimates:

$$\lambda_i^o = \frac{\Sigma Y_i L_i}{\Sigma Y_i^2} = \frac{3,547,599.6}{1,690,063.25} = 2.099$$

$$\lambda_a^o = \frac{\Sigma Y_a L_a}{\Sigma Y_a^2} = \frac{12,637,485.9}{1,871,884.84} = 6.751$$

$$\lambda_s^o = \frac{\Sigma Y_s L_s}{\Sigma Y_s^2} = \frac{11,773,239.71}{4,056,070.93} = 2.902$$

B. Exogenous variables

This section will be concerned with the estimation of the value of the exogenous variables in 1974/75. Some of these exogenous variables (E_i and S_f) determine the development alternatives, and, therefore, three different values for these variables has to be estimated (one reflecting an optimistic, intermediate, and a pesimistic value).

1. The estimation of M_a.

In the discussion about the balance of payment problems in Egypt, it was shown that the additional agricultural land made possible by the utilization of the water of the High Dam could help in solving the Egyptian balance of payments problems, through eliminating food imports. The value assumed for M_a will, therefore, be zero. Thus,

$$M_a = 0.$$

2. The estimation of E_a.

An estimate of E_a will be obtained by fitting a straight line of the form:

$$E_a = a + bt$$

through simple least square techniques where t is time, and a and b are the constant and the slope of the trend line respectively. The following table (Table A.20) gives figures about these two variables.

Table A.20--Agricultural Exports.

Years	In 1965/66 Prices (L.E.M.)	
	E_a	t
1959/60	11.0	1
60/61	15.0	2
61/62	13.3	3
62/63	26.7	4
63/64	48.4	5
64/65	39.2	6
65/66	36.5	7

From these figures, the fitted line will be as follows:

$$E_a = -1.229 + 6.82(t)$$

For the target year of the model t is (16), and thus:

$$E_a = 107.89 \approx 108$$

3. The estimation of E_i and E_s.

The attempt to fit a trend line for E_i and E_s similar to the one fitted for E_a, produces highly unreasonable figures for E_i and E_s. Thus, it will be assumed that the medium value for E_i will be a growth rate of 4% annually (this 4% figure was chosen on the performance of E_i in the period 1959/60-1965/66). The lower and higher values for E_i will be assumed to be an annual growth rate of 2% and 6% respectively. Thus, in 1974/75:

$$E_i = 316.0$$

$$E_i^* = 265.3$$

$$E_i^{**} = 375.1$$

To estimate the 1974/75 value for E_s, the situation is not as easy as E_i. Based on 1965/66 figure (which seem unreasonably high) E_s has grown by over 10% annually during the period (1959/60-1965/66) as a whole. Even on the assumption that this figure is accurate, it seems certain that a rate of growth similar to this in the coming few years will be impossible for factors already mentioned in Chapter II. Thus, the more moderate assumption of 4%

annual rate of growth for E_s seems more plausible. To base the estimate on the value of E_s in 1965/66 might be misleading, since this figure is obtained through the use of one of the accounting equations. Instead, the average of exports of services in 1965 and 1966 is taken to represent the 1965/66 figures for the purpose of this projection. This value is = 168.1, and with a 4% annual growth rate, it will give a value for E_s in 1974/75 as:

$$E_s = 240$$

4. The estimation of S_f.

It was shown earlier, that the country's indebtedness to foreign countries was increasing sharply over the past few years. This might strain the economy in the future due to the burden on the current account balance to service a large amount of debt. The level reached in 1965/66 was a moderate one, and it will be assumed to be the moderate value that S_f can take in 1974/75. The higher value will be assumed to be twice this amount, while the lower value for S_f will be assumed equal to zero. This lower value for S_f will represent a severe national effort case, where the country will depend mainly for its development on its own resources. Thus, in 1974/75:

$$S_f = 63.2$$

$$S_f^* = 0$$

$$S_f^{**} = 126.4$$

5. The estimation of C_g, C_{ga}, and G_p.

In Chapter III, government expenditure was chosen as a fixed target of the model. It will be assumed here that C_g, C_{ga}, and G_p will grow by 4%[1] annually over their 1965/66 values. Thus, in 1974/75:

$$C_g = 335.9$$

$$C_{ga} = 9.1$$

$$G_p = 438.5$$

6. The estimation of alternative values for α:

In the previous section, α was estimated to be equal to

$$\alpha = .18893$$

this value will be taken to represent the intermediate range. The lower value of α, (α^*) will be assumed to be equal to .175, while the optimistic value (α^{**}) will be assumed to be .25. Thus, in 1975,

$$\alpha^* = .175$$

$$\alpha = .18893$$

$$\alpha^{**} = .25$$

---

[1]This figure was decided upon after consultation with some of the officials at the Ministry of Treasury.

7. The estimation of the different values of ℓ_i, ℓ_a, and ℓ_s.

Hansen has estimated the rate of increase of labor productivity in different sectors during the first five year plan, to be as follows:[1]

Agriculture	2%
Industry	3%
Electricity	10%
Transport, etc.	6%
Public Utilities	0%

For the sector classification used in this study, these figures would be equivalent to 2% in agriculture, 3% in industry. For services, it will be assumed that the relevant figure is 3%. The figures for agriculture and industry were largely the same figures that prevailed prior to the plan period,[2] and, therefore, an assumption will be made that these values constitute the lower limit for the rate of increase of labor productivity. The intermediate and higher value will be higher--1% and 2% respectively from the lower value. Thus:

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[1] B. Hansen, "Planning and Economic Growth in the U.A.R.," op. cit., p. 33.

[2] Ibid.

$\ell_i^* = 3\%$ $\ell_i = 4\%$ $\ell_i^{**} = 5\%$

$\ell_a^* = 2\%$ $\ell_a = 3\%$ $\ell_a^{**} = 4\%$

$\ell_s^* = 3\%$ $\ell_s = 4\%$ $\ell_s^{**} = 5\%$

8. The estimation of Y*, Y, Y**.

The labor supply of 1974/75 was given in Chapter II to be:

$$L = 9,440.576$$

Substituting this value in equation (A.24) and also substituting for the values λ_i^o, λ_a^o, λ_s^o, ψ_i, ψ_s, ℓ_i^*, ℓ_a^*, and ℓ_s^* from the estimates provided in this section, one gets:

$$Y^* = \frac{9,440.576}{2.099(.3)(.7603)+6.751(.3)(.8338)+2.902(.4)(.7603)}$$

$$= 3,095.169$$

For the value of Y we should substitute as above, except changing ℓ_i^*, ℓ_a^*, and ℓ_s^* to ℓ_i, ℓ_a, and ℓ_s.

$$Y = \frac{9,440.576}{2.099(.3)(.6925)+6.75(.3)(.7603)+2.902(.4)(.6925)}$$

$$= 3,396.257$$

To get the value of Y**, we have to substitute for ℓ_i, ℓ_a, and ℓ_s by ℓ_i^{**}, ℓ_a^{**}, and ℓ_s^{**}. Thus:

$$Y^{**} = \frac{9,440.576}{2.099(.3)(.6302)+6.751(.3)(.6925)+2.902(.4)(.6302)}$$

$$= 3,730.273$$

APPENDIX IV

THE REDUCED FORM

In this appendix, the model that was presented at the end of Chapter IV will be reduced to two equations that express the equilibrium condition of saving and investments, equation (17); and the balance of payments equilibrium, equation (18). The other relationships of the model will be substituted in these two equations in order to eliminate all the irrelevant endogenous variables. Since all these relationships will be substituted into the reduced form equations, these two reduced form equations will embody all the relationships represented by equations (1-38) that constitute the structural model.

1. Saving-Investment Equilibrium

From equation (17):

$$I_i + I_a + I_s = S_h + S_g + S_f$$

Substituting for I_i, I_a and I_s on the left hand side from equations (19), (20), and (21) respectively, one gets:

$$\frac{\rho_i}{b_i}(Y_i - Y_i^o) + \frac{\rho_a}{b_a}(Y_a - Y_a^o) + \frac{\rho_s}{b_s}(Y_s - Y_s^o) = S_h + S_g + S_f.$$

Substituting for (Y_i), (Y_s), and (Y_a) from equations (30), (31), and (1) respectively, on the left hand side, one gets:

$$I_i + I_a + I_s = \frac{\rho_i}{b_i}\left[\psi_i(Y) - Y_i^o\right] + \frac{\rho_a}{b_a}\left[(1-\psi_i-\psi_s)(Y) - Y_a^o\right] + \frac{\rho_s}{b_s}\left[\psi_s(Y) - Y_s^o\right] = \frac{\rho_i\psi_i}{b_i} Y - \frac{\rho_i}{b_i} Y_i^o + \frac{(1-\psi_i-\psi_s)\rho_a}{b_a} Y - \frac{\rho_a}{b_a} Y_a^o + \frac{\psi_s\rho_s}{b_s} Y - \frac{\rho_s}{b_s} Y_s^o$$

$$\text{(A.27)} \quad I_i + I_a + I_s = Y\left[\frac{\rho_i\psi_i}{b_i} + \frac{(1-\psi_i-\psi_s)\ a}{b_a} + \frac{\psi_s\rho_s}{b_s}\right] - \left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right]$$

On the other hand, if we substitute for S_h, S_g, and S_f on the right hand side of equation (17) from equations (23), (22), and (38); (6), (2), (22), (38), (7), (36), and (37); and (35) respectively, we get:

$$S_h + S_g + S_f = \alpha[(1-t)Y + \bar{G}_p] + t\,Y - \bar{G}_p - \bar{C}_{ga} - \bar{C}_g + \bar{S}_f$$

$$\text{(A.28)} \quad S_h + S_g + S_f = Y[\alpha(1-t) + t] + \bar{G}_p\,(\alpha-1) - \bar{C}_{ga} - \bar{C}_g + \bar{S}_f$$

Substituting for the left and right hand sides of equation (17) from equations (A.27) and (A.28) respectively, we get:

$$Y\left[\frac{\rho_i\psi_i}{b_i}+\frac{(1-\psi_i-\psi_s)\rho_a}{b_a}+\frac{\psi_s\rho_s}{b_s}\right]-\left[\frac{\rho_i}{b_i}Y_i^o+\frac{\rho_a}{b_a}Y_a^o+\frac{\rho_s}{b_s}Y_s^o\right]$$

$$=Y\left[\alpha(1-t)+t\right]+\bar{G}_p(\alpha-1)-\bar{C}_{ga}-\bar{C}_g+\bar{S}_f$$

Rearranging, we get:

$$Y\ \frac{\rho_i\psi_i}{b_i}+\frac{(1-\psi_i-\psi_s)\rho_a}{b_a}+\frac{s\ s}{b_s}-\alpha(1-t)-t$$

$$=\frac{\rho_i}{b_i}Y_i^o+\frac{\rho_a}{b_a}Y_a^o+\frac{\rho_s}{b_s}Y_s^o+\bar{G}_p(\alpha-1)-\bar{C}_{ga}-\bar{C}_g+\bar{S}_f$$

which could be written as:

$$\text{(A.29)}\quad S_f=\left[\frac{\rho_i\psi_i}{b_i}+\frac{(1-\psi_i-\psi_s)\rho_a}{b_a}+\frac{\psi_s\rho_s}{b_s}-\alpha(1-t)-t\right]Y$$
$$-\left[\frac{\rho_i}{b_i}Y_i^o+\frac{\rho_a}{b_a}Y_a^o+\frac{\rho_s}{b_s}Y_s^o\right]-(\alpha-1)\bar{G}_\rho+\bar{C}_{ga}+\bar{C}_g$$

Equation (A.29) gives the first reduced form equation which expresses saving-investment equilibrium.

2. Balance of Payment Equilibrium

From equation (18):

$$M_i+M_m+M_a+M_s+M_k=E_i+E_a+E_s+S_f$$

Starting with M_s, one can find from equation (28):

$$M_s = \mu_s(Y_s)$$

But, from equation (16),

$$Y_s = C_s + E_s - M_s$$

Substituting for Y_s in equation (28), M_s could be expressed as:

(A.30) $$M_s = \mu_s[C_s + E_s - M_s]$$

But C_s could be expressed as:

$$C_s = C_{is} + I_d - C_i$$

Also, from equation (A.13), C_{is} could be expressed as:

$$C_{is} = \bar{C}_g + \bar{G}_p + (1-t)Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] Y$$

$$+ E'_a - M'_a + \bar{C}_{ga} - \alpha[(1-t)Y + \bar{G}_p]$$

and from equation (A.15), I_d is equal to

$$I_d = (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] Y -$$

$$(1-\mu_k)\left[\frac{\rho_i}{b_i} Y^o_i + \frac{\rho_a}{b_a} Y^o_a + \frac{\rho_s}{b_s} Y^o_s\right]$$

and, from equation (A.7), C_i could be expressed as:

$$C_i = \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right] Y - E_i$$

Substituting for (C_{is}) from equation (A.13), for (I_d) from equation (A.15), and for (C_i) from equation (A.7), C_s in equation (A.2) could be expressed as:

$$\text{(A.31)}\quad C_s = \bar{C}_g + \bar{G}_p + (1-t)Y - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] Y + \bar{E}_a - \bar{M}_a + \bar{C}_{ga} - \alpha[(1-t)Y + \bar{G}_p] + (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] Y - (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho s}{b_s} Y_s^o\right] - \left[\frac{\psi_i}{1-\mu_i-\beta_i} - \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right] Y + E_i$$

which could be written as

$$\text{(A.32)}\quad C_s = J + K(Y) - (1-t)\alpha Y - \alpha\bar{G}_p + E_i$$

where:

$$J = \bar{C}_g + \bar{G}_p + \bar{E}_a - \bar{M}_a + \bar{G}_{ga} - (1-\mu_k)\left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right],$$

and,

$$K = (1-t) - \left[\frac{1-\psi_i-\psi_s}{1-\beta_a} - \frac{\beta_i\psi_i}{1-\mu_i-\beta_i}\right] + (1-\mu_k)\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right] - \left[\frac{\psi_i}{1-\mu_i-\beta_i} \quad \frac{\beta_a(1-\psi_i-\psi_s)}{1-\beta_a} + \mu_m\psi_i\right]$$

Substituting this value for (C_s) into equation (A.30)

$$(A.33) \quad M_s = \frac{\mu_s}{1+\mu_s} [J + K(Y) - (1-t)\alpha Y - \alpha \bar{G}_p + E_i + \bar{E}_s]$$

On the other hand, from equation (A.19):

$$M_i = \frac{\mu_i \psi_i}{1-\mu_i-\beta_i} \quad Y$$

from equation (A.20):

$$M_m = \mu_m \psi_i \quad Y$$

from equation (32)

$$M_a = \bar{M}_a$$

and from equation (A.22):

$$M_k = \mu_k \left[\frac{\rho_i \psi_i}{b_i} + \frac{\rho_a (1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s \psi_s}{b_s}\right] Y - \mu_k \left[\frac{\rho_i}{b_i} Y_i^o + \frac{\rho_a}{b_a} Y_a^o + \frac{\rho_s}{b_s} Y_s^o\right]$$

Substituting for M_i from equation (A.19); M_m from equation (A.20); M_a' from equation (32); M_s from equation (A.33); E_a from equation (33); and for E_s from equation (34), into equation (18), S_f could be expressed as:

$$(A.34)\quad S_f = \frac{\mu_s}{1+\mu_s}\left[J + K(Y) - (1-t)\,\alpha Y - \alpha\bar{G}_p + E_i + \bar{E}_s\right] + \frac{\mu_i\psi_i}{1-\mu_i-\beta_i}\,Y + \mu_m\psi_i\,Y + \bar{M}_a + \mu_k\left[\frac{\rho_i\psi_i}{b_i} + \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right]Y - \mu_k\left[\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right] - E_i - \bar{E}_a - \bar{E}_s$$

which could be written as

$$(A.35)\quad S_f = N + O(E_i) + P(Y) + Q(\alpha Y) + R(\alpha)$$

where N, O, P, Q, and R are constants and equal to:

$$N = \frac{\mu_s}{1+\mu_s}\left[J + \bar{E}_s\right] + \bar{M}_a - \mu_k\left[\frac{\rho_i}{b_i}Y_i^o + \frac{\rho_a}{b_a}Y_a^o + \frac{\rho_s}{b_s}Y_s^o\right] - \bar{E}_a - \bar{E}_s$$

$$O = \frac{\mu_s}{1+\mu_s}\,E_i - E_i$$

$$P = \frac{\mu_s}{1+\mu_s}K + \frac{\mu_i\psi_i}{1-\mu_i-\beta_i} + \mu_m\psi_i + \mu_k\left[\frac{\rho_i\psi_i}{b_i} \quad \frac{\rho_a(1-\psi_i-\psi_s)}{b_a} + \frac{\rho_s\psi_s}{b_s}\right]$$

$$Q = -\frac{\mu_s}{1+\mu_s}(1-t), \text{ and}$$

$$R = -\frac{\mu_s}{1+\mu_s}(\bar{G}_p)$$

In order to be able to present graphical analysis of the two reduced form equations, (α) has to be removed from equation (A.35) in order to show S_f as a function of Y and E_i only. Looking at equation (A.17) one can find that (α) could be expressed in terms of (Y) and (E_i) as follows:

$$(A.36) \quad \alpha = \frac{A - D(Y) + E_i}{C(Y) + B}$$

Substituting for (α) into equation (A.35), S_f could be expressed as:

$$(A.37) \quad S_f = N + O(E_i) + P(Y) + Q\left[\frac{A - D(Y) + E_i}{C(Y) + B}\right] Y + R\left[\frac{A - D(Y) + E_i}{C(Y) + B}\right]$$

Equation (A.37) gives the second reduced form equation that expresses the balance of payments equilibrium. It may be noted that by reviewing these two reduced form equations (A.29 and A.37), it can be easily seen that all the relationships of the model equations (1-38) have been used in the process of derivation. The two reduced form equations, therefore, embody all the relationships specified by the model.

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