OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

04927

Distr.
LIMITED

ID/WG.160/12
20 August 1973

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Expert Group Meeting on Projections
of Industrial Development

Vienna, 27 - 31 August, 1973

SURVEY ON ECONOMETRIC MODELS FOR PROJECTIONS
OF INDUSTRIAL GROWTH 1/

by

S. Schleicher
Institute for Advanced Studies
Vienna, Austria

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id. 73-5797

CONTENTS

1. Introduction

The aim of this survey is to give an overview of the present state of econometric model building efforts for less developed countries. Special attention will be devoted to the manufacturing sector, however we still recognize that it is almost impossible to study one sector of an economy in isolation.

There is a strong need for medium and long-term projections and policy analysis especially in underdeveloped economies. Planning agencies often want to examine the problems of their countries in a long-term context, they must put together plan documents, and they want to know the amount of foreign assistance required to sustain given target rates of economic growth. International organizations like UNCTAD,ECAFE,IMF, and the World Bank have large research projects under way to apply econometric models for the above mentioned purposes.

After recalling experiences with econometric models in developed countries a typology of models for developing countries is given in section 3. The following two sections deal with data base and parameter estimation problems. Section 7 and 8 are devoted to the two main types of statistical models for developing countries: two gap type models and general equilibrium type macroeconometric models. After concluding remarks the paper ends with a bibliography.

2. Experiences with econometric models in developed economies

On the outset of a survey on econometric model building efforts for less developed countries it might be worth noting that econometric model building is a relatively new profession as most of the classical economics was not concerned with quantitative problems.

We remember that J.M.KEYNES [G.1939] was extremely critical about the first serious attempt of macro econometric model building which was undertaken by J.TINBERGEN [G.1939]. Ironically enough it was Keynesian economics combined with the availability of data and computers which stimulated the pioneering work in the United States and the Netherlands.

Considerable progress was made in recent years as far as programming and disaggregation over time and economic units are concerned. From the computational point of view no limits seem to exist for the size of the models. In project LINK, for example, a large mathematical system of national econometric models is in operation to predict world trade and to simulate the international transfer of policy decisions.

Still many doubts are raised about the current practices in econometric model building for developed countries. Each econometrician will probably agree that his present model represents only one step of an ongoing research effort. But there seems to be a common agreement about the usefulness of econometric models in many ways.

Mention should be made that models have provided an excellent means of organizing the relevant data and the discussion of the problems in a systematic framework. Forecasting meetings of model building centers, as for example the Wharton Forecasting Associates, involve businessmen, government officials and academics in the process of national forecasting and policy analysis in a way that was absent before. These discussions have helped the decision makers to put the relevant questions and to be more articulate about their priorities and constraints. Another advantage of the models which is commonly agreed upon is the ability of the models to work out relativ easily and with a remarkable advantage of speed and consistency the implications of different policy alternatives.

There is still an ongoing controverse about the forecasting ability of econometric models. It seems that for short run projection the problem of a systematic treatment of available prior information has to be further investigated. Comparisons of forecasting records, however, show, that even at the present stage of econometric model building their projections perform very well.

The encouraging experiences with econometric models for developed countries have stimulated similar research projects for less developed countries. A large number of Ph.D. theseses have dealt with the problem of adequate econometric model building for less developed countries and large research projects are under way at international organizations to use econometric models for development planning. A critical evaluation of these research efforts will concentrate on three topics: (1) the economic situation of less developed countries, (2) data base problems, and (3) the adequacy of the estimation techniques.

3. Typology of models for developing economies

Theories of economic development investigate the process by which a poor, stagnant economy can be transformed into one whose normal condition is sustained growth. There is a general agreement on the principal changes that characterize this transformation: an increase in human skills, a rise in the level of investment and saving, the adoption of more productive technology, a substantial change in the composition of output and employment, the develpment of new institutions, etc. The main question is how these changes can be accelerated through the use of external resources over a limited period of time.

Usually three types of these resources are distinguished: (1) the supply of skills and organizational ability; (2) the supply of domestic saving; and (3) the supply of import commodities and services. At any moment in time these factor supplies represent seperate limits to economic growth.

The following evolutionary process in the theory of model building for development countries can be observed:

(1) It soon turned out that the traditional growth models have serious deficiencies for development policy. In focusing only on the savings-investment relationship and the possibilities of substitution between capital and labor they are not adequate for the open economies of less developed countries. In general less developed countries have been able to raise the level of investment much more rapidly than the level of

saving. It was obvious that the one-gap type growth models with a savings gap that causes investment limited growth had to be improved.

(2) It was observed that apart from the investment limitation as a second factor shortages of imported goods provide a limit to further growth for less developed countries. Rapid growth requires a large increase in the supplies of machinery and equipment, raw materials, and other manufactured goods that are typically imported in a poor country. The concept of trade limited growth was introduced by formulating two-gap type models, the trading gap being caused by the limited availability of foreign exchange which is earned by exports. Although two-gap models are still used by international organizations and agencies as a useful point of reference in the analysis of the development assistent needs, there is a general agreement that they are too simple to be able to handle the analysis of the effects of alternative national and international policies. Other objections against the two-gap approach are certain theoretical and measurement problems.

(3) The abundant efforts of macroeconomic model building for developed countries stimulated similar research projects for developing countries. The question arose what kind of macroeconomic model was suitable for developing economies L.R.KLEIN [G.1965]. One conclusion was that the supply side should be given much greater emphasis in the models for developing countries. The UNCTAD staff [G.1973] formulated the following guidelines for building macroeconomic models for developing countries: The models should reflect the dual nature of these economies

and their internal rigidities. They should incorporate both long-run growth aspects and short-run cyclical swings in output and prices. The level of disaggregation and detail should be such as to permit an evaluation of the trade-offs which are of special relevance to the developing economies. To mention a few, the trade-off between price stability (particularly for countries with relatively high rates of inflation as in some of the Latin American countries) and growth, the trade-off between sectoral balance and growth on the one hand and domestic savings rate and external capital requirements on the other and the trade-off between current external capital needs and the constraint which debt service imposes in the future. Fiscal and monetary sectors and the specific country institutional factors should be taken explicitly into account and the size of the models should not be out of proportion to the degree of interdependece and the available data base.

(4) For many developing countries input-output models have been constructed and a natural extension of this technique would be to explain final demand components by stochastic equations which reflect economic behavior. The applicability of this appealing approach will be limited in practice, however, by the enormous data requirements. Recent model building exercises for the United States and Mexico which follow this concepts will provide more information.

4. Data base problems

In his book "Asian Drama: An Inquiry into the poverty of nations", Gunnar Myrdal attributes statistical data for developing countries with "at best uncertain" and "extremely crude guesses". He concludes that "the resulting mountains of figures have either no meaning or a meaning other than imputed to them. Empirical research thus becomes faulty and shallow ...". ([G.MYRDAL A.1968, p.xi of the preface and p.18]).

A similar view is expressed by L.WHITEHEAD [H.1969] in his article "Basic data in poor countries: the Bolivian case" : "We may have to admit that up to now we really are not in a position to tell how the main economic variables are changing in large areas of the third world" (p.226).

Every econometrician who is working on a model is aware of the fact that the underlying data are seriously deficient and usually acknowledges the problems with the data base by some ritualistic disclaimers: the data are of uncertain quality and the period of observation is very short but this is the best that is available; the study shows at least in which areas the data collection efforts have to be strengthened. Having protected his flanks with these disarming assertions the econometrician too often proceeds to act in precisely the way he would have acted had the data been abundant and reliable. ([A.SMOURIE G.1972],p.8).

Trade statistics constitute the only data in which most econometricians are willing to place a good deal of confidence. But even these figures reveal very substantial discrepancies when, for example, compared with the returns of the country's trading partners.

Most dubious are probably price deflators. Weights are very often based on surveys conducted many years ago when the structure of the economy was very different from what it is now.

Before trusting high coefficients of determination it is worth to investigate the manner in which the relevant data were compiled. A.SHOURIE cites an example for Ceylon, were an equation which relates imports of construction materials to value added by construction yields a very satisfactory fit and a highly significant t-ratio. The reason for this is simply that the value added by the construction sector is itself calculated by multiplying the imports of construction materials by the factor 4.25, after allowing for a three months lag.

One also should be aware of the revisions of the national accounts which turn out to be very considerable in less developed countries. For Kenya, e.g., series like gross domestic product at factor cost and gross investment have been revised upward by 15 to 20 per cent. This affects the results of a model dramatically: A model for Kenya based on the unrevised data projects the savings gap to be the dominant one and proposes that Kenya should aim at increasing its marginal savings ratio to 25 per cent in the 1970s. A model based on the revised data with a very similar specification indicates that savings are not likely to be an important issue in the 1970s and that the trade gap rather than the savings gap is liable to be the dominant one. ([A.SHOURIE G.1972], p.6).

In general we have to accept that statistical data for less developed countries contain serious errors and biases which questio.. very often their value of information.

In addition to the erros in the data it is hardly observed that the same notation for an economic variable might have a different meaning in a less developed country compared with a developed country.

E.g it is inappropriate to use the western concept of unemployment for less developed countries, while it is true that in western countries those able to work but not employed are generally unvoluntarily idle, this concept is not applicable for less developed countries. In these countries the phenomen of labor utilization can only be realistically approached by measuring it by a combination of three factors, i.e. participation, duration, and efficiency.

Considering the advances of statistical methodology the data situation is not hopeless or can be improved substantially. Mention should be made of credibility checking by the compiling agencies not only for the aggregated but also for the unaggregated figures. For example the distribution of certain ratios for individual respondents (such as employment cost to value added for individual establishments) has to be found within reasonable limits.

An other means to improve the quality of the data base are post-enumeration sample surveys. These quality checks are carried out with small samples and proved to be extremely usefull in developed countries. This statistical technique enables to quantify biases in particular sets of statistics, e.g. because of lack of returns from respondents. In many cases sampling offers a solution to get the necessary information about important economic variables.

Past experiences with datas from less developed countries might lead international agencies, e.g. the United Nations Statistical Commission, to establish quality standards for statistical data. As a first step it would be highly appreciable for any empirical research work to be informed about the quality of the data by some tolerance measure and more detailed information how the data were compiled. Further measures might call for an agreement on quality standards for statistical data which could be met only by the application of adequate quality control procedures in enumeration and compiling work.

5. Parameter estimation techniques

Far too less attention in the model building process fo developing countries is probably given to the statistical estimation problem which is closely related to the quality of the data base.

There is a common agreement that models estimated from time series consisting of 8 to 12 more or less reliable observations which is usually the case for less developed countries, do not need sophisticated simultaneous equation techniques. But one has also to question if the commonly applied single equation ordinary least squares approach is an adequate estimation method.

The easy availability of computers and regression programs tends to suppress crucial assumptions under which this estimation technique is only valid, above all that there is no prior information available about the parameters to be estimated and that there are no errors in the regressors.

The shorter the time series and the more unreliable the data, the less information is contained in the time series for parameter estimation purposes. In this situation the OLS estimator which heavily relies on the content of information in the regressors will soon fail to give reliable paramter estimates.

Given the poor quality of the data base the parameter estimates can be improved only by incorporating as much prior information about the paramters as possible in theestimation procedure.

Usually we have prior information available about the parameter space, a fact which becomes evident when we select from a set of alternative equations the "best" one.

Sources for prior information are economic theory, inter-country comparisons, and the use of cross-section evidence. The latter deserves most attention since it has its own merits in improving the quality of the data base.

A data-adequate statistical estimation technique is expected to combine prior information about the parameter space and time series information according to their reliability. In the case of no prior information the estimator should rely only on the data and produce the familiar ordinary least squares result. In the case of completely unreliable data the observations should have no effect upon the a priori specified parameter values. Between these two extremes a priori information and data information should be optimally combined.

Mention should be made that similar estimation problems occur for the standard statistical model used in systems engineering. The estimator applied usually is of a sequential type, i.e. whenever a new set of observations becomes available the last estimate is updated. The extent of this correction depends upon the reliability of the new observations. This estimation technique also deals with the case of stochastic and time varying parameters. Probably it would be worth to examine the usefulness of this approach for econometric problems.

6. Attempts to integrate noneconomic factors

Although many economists have recognized that differences in the economic performance of different societies cannot be explained by economic factors alone, few have attempted systematic analyses of the respective roles of economic and noneconomic factors. I.ADELMAN and C.T.MORRIS [G.1968] have undertaken an important step toward filling this crucial gap in the literature.

They attempt to build an integrated econometric model of socio-economic and political change in underdeveloped countries. The model is constructed by means of a step-wise regression analysis and is based upon data which summarize the economic, social, and political characteristics of 74 underdeveloped noncommunist nations during the period 19 7 - 1962. The model consists of 14 equations in 19 variables.

Exogenous to the model are: the extent of mass communication, the degree of social tension, the level of adequacy of physical overhead capital, the political strenght of the military, and the political strenght of the traditional elite.

Examples of endogenous model variables are: rate of improvement of financial institutions, of industries, of agricultural productivity, of human resources, the extent of literacy, of social mobility, of social tension, of leadership commitment, and of political stability.

The authors' model building philosophy can be demonstrated by their statement that "there are no firmly validated theories of the process of socio-economic and political change", therefore they "consciously avoided a priori specification of the functions", instead they "let the data specify the model". Therefore extensive use of step-wise regression was made to find the equations of the model. The authors started with a group of 28 variables as candidates for inclusion and let the computer choose those most strongly associated with the dependent variable.

After publication of this model there arose a very fundamental discussion about the methodology of econometric model building ([S.S.BERRY G.1970, P.ECKSTEIN G.1970]).

Heavily criticised were the unstructured statistical techniques for we have at least some information about the logical relationships among variables. "No statistical technique can by itself seperate out causes, effects, and joint effects or even the most important associations among closely correlated variables; but completely unstructured techniques, in which theory and prior knowledge are neither tested nor used to order the relationships are the least likely to produce meaningful results" (P.ECKSTEIN, p.234).

Other comments referred to the question of definition and measurement of socio-economic and political variables and to the problem of causality .

7. Two gap models

7.1 Theory of two gap analysis

Most underdeveloped countries depend heavily on external resources. Theoretical studies on economic development suggest that a moderate volume of external resources may make possible a substantial increase in the rate of growth of an underdeveloped economy through financing investment as well as through providing the additional imports required to sustain a higher level of income.

To determine the amount of external resources for a specific developing country to sustain a specified target rate of economic growth H.B.CHENERY proposed the "two gap" concept. The central idea of this approach is that development tends to create situations which, at various points in time, are characterised by a plentiful supply of all but one or a few of the factors required for continued development. For these few, a gap between the quantity supplied and that required slows growth or halts it completely. When growth is thus limited by a bottleneck, there is underutilisation of other factors. Foreign aid can serve as a means of breaking the bottleneck, thereby permitting fuller utilisation of all resources and a continuation of development.

This gap analysis usually concentrates on a savings-investment gap and on import-export gap. Two gap models are usually of the following structure:

For a given target rate of growth the required investments and imports are derived by stochastic relationships. Similar relationships are specified between consumption and exports and the target rate of growth. A savings gap appears when the domestic savings rate is below the level necessary to permit the investment required to achieve the target. A trade gap appears, however, if with adequate savings, the flow of imports is below the required level. Here aid breaks the import bottleneck and permits the target to be reached. An example of a simple two gap model is the ECAFE model for India United Nations, Economic Commission for Asia and the Far East, [G.1968] , which we present on the following page.

A first extensive treatment of the two gap model approach is given in H.B.CHENERY and M.BRUNO [G.1962] . An extensive and systematic study about the amount of need of foreign assistance for less developed countries is reported in H.B.CHENERY and A.M.STROUT [G.1966] . Two gap models for 50 countries are used for 5 to 10 year projections.

In "Trade prospects and capital needs of developing countries" UNCTAD G.1968 published 38 country models of the two gap type. For each developing country the implications of both a "low" and a "high" rate of growth on the investment-savings and import-export gap were examined. Projections were made with this models for each individual country and for regional aggregates.

A similar volume has been published by ECAFE, "Feasible growth and trade gap projections in the ECAFE region", [G.1968] .

A major objection against these two gap models is that they do no specify explicitely the effects of policy variables on the economies of interest. Such specification would seem very useful in the exploration of the extent to which the developing countries themselves could lower various gaps through appropriate policy mixes. [J.R.BEHRMAN G.1971]

7.2 ECAFE two gap model for India

1. Consumption

$$\ln C = .894\ Y + .192$$

2. Net capital formation

$$\ln I = 1.192 \ln MK + .432$$

3. Imports of raw materials

$$\ln MR = .590 \ln Y + .789$$

4. Imports of investment goods

MK exogenous

5. Imports of other goods and services

$$MO = .43*(MR + MK)$$

6. Total imports required as technical complement by investment and net domestic product in the production process

$$M = MR + MK + MO$$

7. Total exports

$$E = .019\ Y + .0098\ W + 3.871$$

8. Net domestic product of importing countries

W exogenous

9. Net domestic product

Y exogenous

10. Savings gap

$$SG = I - (Y - C)$$

11. Trade gap

$$TG = M - E$$

7.3 UNCTAD two gap model for Argentina

The UNCTAD two gap type model for Argentina was published in "Trade prospects and capital needs of developing countries" [G.1968] and serves in this survey two purposes: First, it is within the class of this type of models of rather large size, second, it can be compared with the UNCTAD general equilibrium model which we will discuss later.

The model contains the usual production function relating real gross domestic product to lagged cumulative investment. In the projections this relation is used to generate required real gross investment levels in period t for exogenously given levels of real gross domestic product in period t+1. Shortages in imports of raw materials and intermediate products have been a major bottleneck which prevented the Argentine economy from operating at full capacity. It therefore seemed reasonable to consider intermediate imports as a factor limiting production, and to introduce them as an explanatory variable in the aggregate production function to account for output below capacity levels.

The outputs of the mining (QMI) and manufacturing (QMF) sectors are determined on the basis of historical growth elasticities and are therefore related to the rate of growth of the gross domestic product rGDP.

UNCTAD two gap model for Argentina

List of equations

1. Capacity gross domestic product at factor cost

   VC exogenous - then normalized on CIF

   $VC = .270\ CIF(1) + 2867.51$

2. Gross domestic product at factor cost

   V exogenous - then normalized on CIF

   $V = .136\ CIF(1) + 3.721\ MR + 4343.89$

3. Changes in stock of agricultural products

   $IS = .03$

4. Private consumption

   $CPR = 1.006\ YW + .633\ YNW - 106.04$

5. Government consumption

   $CG = .055\ V + 390.07$

6. Import of consumer goods

   $MC = .013\ CPR + .163\ PM(1) - 47.32$

7. Import of fuels

   $MF = 3.520\ QMF - 2.095\ QMI + 21.67$

8. Import of raw materials and intermediate products

   $MR = 8.440\ QMF - 2.195\ PM + 3.269\ PPX(1) - 468.75$

9. Import of investment goods

   $MI = .403\ IF - 9.402\ QMF + 1.747\ PM + 64.02$

10. Service payments (excluding factor payments from abroad)

    $MS = .134\ M$

11. Exports of agricultural origin

    $XAG = 10.343\ QAG - 17.406\ TW - .512\ IS$

12. Service receipts (excluding factor payments from abroad)

    $XS = 6.284\ TIME + 72.73$

13. Exports of manufactures

    $XOT =$

14. Exports of goods and services

    $X = XAG + XOT + XS$

15. Imports of goods and services

$$M = MC + MR + MF + MI + MS$$

16. Import-export gap (excluding factor payments from abroad)

$$MRG = M - X$$

17. Interest payments on private foreign debt

$$FPINc = .040\ CBOc(1) -.33$$

18. Net direct investment income

$$FPPRc = .043\ CPIc(1) +4.63$$

19. Gross national income at factor cost

$$Y = V - (FPPR + FPIN)$$

20. Gross wage income

$$YW = .397\ Y -4.375\ ER\ +738.73$$

21. Gross non-wage income

$$YNW = Y - YW$$

22. Indirect taxes minus subsidies

$$TI - SU = .088\ V +17.06$$

23. Gross domestic product at market prices

$$GDP = V - (TI - SU)$$

24. Gross domestic savings

$$SD = GDP + TTE - (CPR + CG)$$

25. Terms of trade effect

$$TT^{*} = (M/PMO - X/PXO)*100$$

26. Index of purchasing power of exports

$$PPX = X/X_{60}*PMO/PMO*100$$

27. Index of the unit values of imports in pesos

$$PM = PMO*ER/100$$

28. Trade gap

$$TG = Max\ (SG, MRG) + (FPINc + FPPRc)$$

29. Foreign exchange reserves

$$FEr = .02\ GDP$$

30. Total net borrowing abroad

$BOc = TG - FIc$

31. Private foreign investment

FIc *

32. Exchange rate in pesos per dollar

ER *

33. Cumulative net borrowing abroad

$CBOc = BOc + CBOc(1)$

34. Cumulative private foreign investment

$CFIc = FIc + CFIc(1)$

35. Cumulative gross fixed investment

$CIF = IF + CIF(1)$

36. Total gross capital formation

$I = IF + IS$

37. Savings-investment gap

$SG = I - SD$

38. Index of mining production

$QMI = QMI_{65} * (1 + 1.74 * rGDP)^{TIME}$

39. Index of manufacturing production

$QMF = QMF_{65} * (1 + 1.38 * rGDP)^{TIME}$

40. Index of the unit value of imports in dollars

$PM\$$ *

41. Index of the unit value of exports in dollars

$PX\$$ *

7.4 ADELMAN-CHENERY model for Greece

We will use a model for Greece published by I.ADELMAN and H.B.CHENERY to demonstrate the relationship between a two gap type model and a general equilibrium macro model [G.1966].

Based on data from 1950 to 1961 a set of disaggregated functions for the following sectors of the economy were estimated: consumption by households and government; private and public gross capital formation; imports of goods and services; exports of goods and services; a depreciation function and two tax functions.

The following equation system simultaneously solved will yield the usual equilibrium solution of a macro economic model. The required net foreign capital inflow F is a result of the simultaneous solution.

Alternatively we might consider net foreign capital inflow exogenously and investigate on which of the two functions of foreign assistance a variation in the capital inflow sets the limits to growth in the given circumstances. The two possibilities are: (1) savings-limited growth, for which it is assumed that the investment determined by the model is essential to sustain the level of GNP; and (2) import-limited growth, for which it is assumed that the amount of imports determined by the system are required by the structure of demand at any given level of GNP.

When import requirements are the limiting factor, the corresponding level of GNP is determined by substituting equations (13) - (17) into equation (18) and solving for V:

$$V = 2.61\ M + 344.9\ PM - 2704$$

Imports are in turn limited to the sum of export earnings and capital inflows. Substituting for M from (20) - (23) and (25) gives the following expression for import-limited GNP (VM) as a function of external capital and time:

$$VM = 2.61\ F + 344.9\ PM + 1782\ TIME + 9780 .$$

A similar expression can be derived for the case of savings-limited growth. To establish the link between investment and capacity we replace the investment equations (7) - (9) with the alternative relation between gross investment and output:

$$I = 2.975*(V - V(1)) + 1076 .$$

Equations (1) - (5), (27) - (30), and (32) yield an estimate of investment as the total of domestic savings and capital inflow. Together with the relation above between gross investment and output they therefore describe the growth of GNP over time when productive capacity and its financing are the factors limiting growth. The expression for savings-limited growth is:

$$VS = 1.078\ V(1) + .3622\ F + .0067\ K(1) - 4390$$

The analysis for Greece shows that up to 1957 the principal function of external assistance was to make up the gap between savings and required investment, while, since then, the import-export gap has become increasingly dominant.

ADELMAN-CHENERY model for Greece

List of equations

1. Consumption expenditures on food, beverages, and tobacco

$$CF = .315\ Y + 11540$$

2. Consumption expenditures on clothing and other peronal effects

$$CC = .131\ Y + 1024$$

3. Consumption expenditures on rent, water, fuel, light, furniture, and household operations

$$CH = .212\ Y - 1522$$

4. Consumption of services

$$CS = .218\ Y - 3171$$

5. Total private consumption expenditures

$$C = CF + CC + CH + CS$$

6. Government consumption expenditures

$$G = .105\ Y + 1459$$

7. Gross domestic investment in residential construction

$$ID = 36.3\ P/K + 264\ TIME - 2049$$

8. Gross domestic investment in non-residential and other construction

$$IC = .84\ IC(1) + 208\ TIME - 413$$

9. Gross domestic investment in transport equipment and in machinery and other equipment

$$IM = .671\ M - 4776$$

10. Increase in stocks

IS *

11. Gross capital formation

$$I = ID + IC + IM + IS$$

12. Index of average rate of return on capital, 1954=100

P/K *

13. Imports of food, beverages, and tobacco, and animal and vegetable oils

MF = .019 V -7.2 PM + 1695

14. Imports of crude materials, mineral fuels, and chemicals

MI = .051 V -17.7 PM + 2301

15. Imports of manufactured goods

MM = .064 V -9.7 PM - 428

16. Imports of machinery and transport equipment

MT = .184 V -76.1 PM -1801

17. Imports of services

MS = .065 V -21.1 PM -732

18. Imports of goods and services

M = MF + MI + MM + MT + MS

19. Index of the relative price of imports, 1964=100

PM *

20. Exports of food, beverages, and tobacco, and animal and vegetable oils

XF = 198 TIME + 2181

21. Exports of crude materials, mineral fuels and chemicals

XI = 146 TIME + 314

22. Exports of manufactured goods and of machinery and transport equipment

XM = 18 TIME + 146

23. Exports of services

XS = 321 TIME + 70

24. Exports of goods and services

X = XF + XI + XM + XS

25. Net foreign capital inflow

F = M - X

26. Gross national product

V = C + G + I - F

27. Direct taxes and transfer payments

$$TD = .092\ V - 757$$

28. Indirect taxes minus subsidies

$$TI = .132\ V - 1284$$

29. Disposable income

$$Y = V - D - TI - TD$$

30. Depreciation

$$D = .021\ K(1) - 88$$

31. End of year capital stock

$$K = (I - D) + K(1)$$

32. Gross savings

$$S = V - C - G = I - F$$

8. Macroeconometric models

8.1 Specific features of macroeconometric models for developing economies

Two groups of macroeconometric models for less developed countries can be roughly distinguished according to the attention they give to supply or demand in the economy. First model building exercises for developing economies followed closely the concepts used for developed economies, which are, by and large, based on the Keynesian theory of effective demand. Since productive capacity in these countries is very large, the emphasis is on the expenditure side of the national accounts, the problem being to create the necessary effective demand.

A typical example for such a demand oriented model is an econometric model of Puerto Rico published by M.DUTTA and V.SU [G.1969]. Total demand is explained by six equations for private consumption, two equations for investment, and three export equations, which together with eight import equations describe the strong linkage of the Puerto Rico economy whith the United States. Gross domestic product is obtained as the difference between total demand and imports. Gross product of the manufacturing sector is determined by a linear production function with total investment and employment in manufacturing as factor inputs.

The same emphasis to the demand side is given in an econometric model of Columbia built by K.MARWAH [G.1969]. The model is developed under the severe constraint of limited availability of data. It uses annual observations for the sample period 1951 - 1962. Total real private consumption per capita is explained by disposable income and the distribution of income.

Investment is disaggregated into machinery and equipment, construction, and inventory. The acceleration priciple is basically used for explanation. In addition imports of capital goods have been added in order to estimate the dependence of investment decisions to the foreign availability of capital goods not produced at home. The five components of merchandise imports (capital goods, raw materials and intermediate goods, construction materials, fuels, and consumer goods) are explained by real GNP, relative prices, net foreign assets as a budget constraint, and the rate of import duties. For the export sector a separate equation is estimated for export of coffee, being a dominant component of total Columbian exports. Production functions are estimated for total output, the manufacturing sector, and the construction sector, respectively. Output is simply determined by the level of capital stock adjusted by the capacity utilisation ratio. For total as well as sectoral output, the same capacity utilisation ratios have been used. The capacity output has been estimated by joining the peak points of output within the sample period. The capacity utilization ratio is determined by the unintended inventory level of the past two years while changes in unintended inventories are approximated by changes in the inventory sales ratio. A generalized version of the quantity theory of money has been used to determine the general price level. An important characteristic of the model is the determination of the exchange rate within the system.

Recent trends in model building for developing countries give substantially more emphasis to the supply conditions. As this approaches are probably not yet well familiar we will give an extensive description of two models built by UNCTAD.

8.2 UNCTAD macroeconometric model for Argentina

A remarkable feature of this model is the highly disaggregated supply side with four broad sectors: agriculture, manufacturing, infrastructure and services. Each sector is in turn divided into a number of subsectors. UNCTAD [G.1973]

As far as the supply of manufacturing output is concerned a distinction is made between capacity output, measured from a trend through peak values, and actual output. Actual output originating in the manufacturing sector depends on utilised capital and labor. Since actual output is determined later in the model, this equation actually determines employment in the manufacturing sector. Equation (31) uses the same coefficients as equation (30) but introduces total available capital and full capacity employment as the independent variables. This gives a measure of full capacity output for manufacturing which can then be related to actual output to form an index of capacity utilization. To determine actual output two groups of manufacturing industries are distinguished, namely, a relatively slowgrowing group highly dependent on agricultural inputs and traditionally referred to as vegetative industries, and another relatively fastgrowing group highly dependent on imported inputs and traditionally referred to as dynamic industries.

Mention should be made that gross domestic product is in this and the following model defined by the supply components. There is no definitional relationship which connects demand with gross domestic product.

UNCTAD macroeconometric model for Argentina

List of equations

Production

Agricultural sector

1. Area seeded with wheat

   AWH = 30.980 (PWH/PCOFX)(1) +.477 AWH(1) +14.45

2. Average yield of wheat per hectare

   AYWH = 643.690 (PWH/PCOFX) +6.556 RWH -241.06

3. Area seeded with flaxseed

   AFX = 60.810 (PFX/PWHCO)(1) +.410 AFX(1) -2.12

4. Average yield of flaxseed per hectare

   AYFX = 207.150 (PFX/PWHCO) + 2.273 RFX + 7.951 TIME + 5.86

5. Area seeded with corn

   ACO = 21.440 (PCO/PFXWH)(1) +1.252 ACO(1) -48.672

* 6. Average yield of corn per hectare

   AYCO = 3.589 RCO +45.253 TIME +279.86

7. Value added in the production of cereals and flaxseed

   VCEFX = .322 QWFC +.279 VCEFX(1) +35.17

8. Value added in other crops

   VCHOT = 2.278 TIME +74.80

9. Slaughtering of bovine cattle

   BESL = -46.801 (PBE/P) +2.036 BEST -.264 RBE -14.30

10. Total production of beef - slaughtering plus increase in stocks

    BEQ = 24.801 (PBE/P)(1) +1.259 BEST -50.81

11. Value added in forestry, hunting and fishing

    VLVFI = 1.975 TIME +65.93

12. Stock of bovine cattle

    BEST = BEQ - BESL - BEST(1)

13. Value added in agriculture

VAG = .227 VCEFX +.562 VCROT +.376 MFQ + VEVFI

14. Output of cereals and flaxseed

QWFC = (47.023 AWH*AYWH +12.280 AFX*AYFX +

+30.620 ACO*AYCO) 102.7

15. Output of wheat

QWH = AYWH*AWH

16. Output of flaxseed

QFX = AYFX*AFX

17. Output of corn

QCO = AYCO*ACO

18. Average quoted prices of corn and flaxseed

PCOFX = .773 PCO +.227 PFX

19. Average quoted prices of wheat and corn

PWHCO = .156 PFX +.844 PWH

20. Average quoted prices of flaxseed and wheat

PFXWH = .156 PFX +.844 PWH

21. Change in the stock of bovine cattle

ISBE = BEST - BEST(1)

22. Average quoted prices of wheat

PWH *

23. Average quoted price of flaxseed

PFX *

24. Average quoted price of corn

PCO *

25. Annual average wholesale price for bovine cattle

PBE *

26. Index of rain fall in the wheat producing areas

RWH *

27. Index of rainfall in the flaxseed producing areas

RFX *

28. Index of rainfall in the corn producing areas

$$RCO *$$

29. Index of rainfall in the cattle breeding areas

$$RBE *$$

Manufacturing sector

30. Value added in manufacturing (norm. on EMF - employment in manuf.)

$$VMF = 1.297\ CUMF + .297\ (CIFMF)(1) * CUMF/100 + $$
$$+ .149\ EMF - 147.49$$

31. Value added in manufacturing at full capacity

$$VMFC = .297\ CIFMF(1) + .149\ EMFC - 17.75$$

32. Value added in vegetative industries

$$V2VG = .642\ V2VGC + .437\ VAG + .238\ d(CRP/WMF) +$$
$$+ .775\ (MR + MF) - 78.05$$

33. Value added in vegetative industry at full capacity

$$V2VGC = VMFC - V3DYC$$

34. Value added in dynamic industries

$$V3DY = .912\ V3DYC + 1.337\ (MR + MF) +$$
$$+ .110\ d(CRP/PM) - 72.77$$

35. Value added in dynamic industries at full capacity

$$V3DYC = .816\ VMFC - 97.48$$

36. Value added in infrastructure (non-residential construction, transport and communications and public utilities)

$$VIF = .145\ CIG(1) + 1.496\ MF + 69.64$$

37. Value added in other sectors

$$VOT = .330\ VMF + 1.713\ CG + 32.70$$

38. Value added in manufacturing

$$VMF = V2VG + V3DY$$

39. Capacity utilization, total manufacturing

$$CUMF = VMF/VMFC * 100$$

40. Capacity utilization, vegetative industries

$$CUVG = V2VG/V2VGC * 100$$

41. Capacity utilization, dynamic industries

$$CUDY = V3DY/V3DYC*100$$

42. Cumulative investment in manufacturing

CIFMF *

43. Cumulative government investment

CIG *

44. Total credit to the private sector

CRP *

45. Gross domestic product

$$GDP = VAG + VMF + VIF + VOT + (TI - GSU)/P$$

Consumption and investment

46. Total private consumption expenditures

$$CP = .738\ YDP/PCP + 164.450\ ((1 - TRW)*YW)/((1 - TRN)*YN - -52.52$$

47. Domestic consumption of meat

$$CAME = .076\ CP - 28.330\ PCAME/PCP + 36.31$$

48. Private consumption of manufactured goods, vegetative industries

$$CMFVG = .284\ CP - 98.510\ PCMVG/PCP + 180.85$$

49. Private consumption of manufactured goods, dynamic industries

$$CMFDY = .282\ CP - 125.910\ PCMDY/PCP + 68.52$$

50. Other private consumption

$$COT = CP - CAME - CMFVG - CMFDY$$

51. Total gross fixed private investment

$$IFP = .261\ (YN - T)/PIF + .636\ r(CRP/PIF) + 19.43$$

52. Gross fixed private investment in manufacturing

$$IFMF = .477\ IFP + 88.201\ YNMF/VMF + 62.15$$

53. Average tax rate on non-wage income

TRN *

54. Average tax rate on wage income

TRW *

<u>Government</u>

55. Total direct tax revenue

$$TD/P = .060\ Y(1) + 44.910\ ((1 - TRW)*YW)/((1 - TRN)*YN)(1) - .298\ rP - .58$$

56. Import tax revenue

$$TM = .168\ M\$ - .98$$

57. Export tax revenue

$$TX = .085\ X\$ - 3.88$$

58. Other tax revenue

$$TO/P = .240\ VMF(1) - .194\ rP + 19.335$$

59. Non-tax current government revenue

$$RO = .003\ Y(1)*PY(1) - .02$$

60. Government consumption expenditures

$$CG*PCG = .108\ Y*PY - 2.17$$

61. Government subsidees

$$GSU = -69.46\ PPU/P + 1.118\ GSU(1) + 73.70$$

62. Government transfer payments

$$GTF = 27.237\ NU + .896\ GTF(1) - 365.91$$

63. Interest payments on the public debt

$$GIN = .031\ CGDF(1) + 3.60$$

64. Government investment

$$IG = .028\ GDP(1) - .859\ rGDP(1) - .136\ rP$$

65. Implicit price deflator of value added in public utilities

PPU *

66. Cumulative government deficit

$CGDF$ *

67. Total indirect tax revenue

$$TI = TM + TX + TO$$

68. Total tax revenue

$$T = TD + TI$$

69. Government deficit

$$GDF = CG*PCG + GSU + GTF + GIN + IG*PIG + GKO - (TD + TI + RO)$$

70. Capital expenditures of the government sector other than fixed investment

GKO *

Population and employment

71. Total population

$$\ln N = .017\ TIME + 2.84$$

72. Urban population

$$NU = .818\ N - 2.94$$

73. Total employment

$$E = 2.620\ GDP - 1752.960\ W/PIF + 4053.82$$

74. Employment in manufacturing for full utilisation of capacity

$$EMFC = 1.565\ VMFC - 582.680\ WMF/PIF + 1438.03$$

External sector

Exports

75. Exports of wheat

$$XWH\$ = .707\ QWH + .409\ XWH\$(1) - 16.61$$

76. Exports of corn

XCO$ *

77. Total exports of crops

$$XCR\$ = 1.120\ (XWH\$ + XCO\$) + 56.03$$

78. Exports of meat

$$XME\$ = .578\ BESL + .696\ XME\$(1) - 25.84$$

79. Exports of greasy wool

$$XWOG\$ = -2.336\ TIME + .804\ XWOG\$(1)$$

80. Exports of livestock, including meat

$$XLVME\$ = 1.106\ (XME\$ + XWOG\$) - 9.29$$

81. Traditional exports of manufactures, vegetative industries (excluding meat)

$$XVGT\$ = 6.818\ TIME - .093\ CMFVG\$ + 518.05$$

82. Non-traditional exports of manufactures, dynamic industries

$$XVGNT\$ = .138\ EREF - .380\ CUVG(1) + 4.276\ DI$$

83. Exports of linseed oil

$$XFX\$ = 1.354\ QFX + .91$$

84. Exports of quebracho extract

XQU$ *

85. Nontraditional exports of manufactures, dynamic industries

$$XDYNT\$ = .073\ V3DY\$ - 2.000\ CUDY(1) + 118.27$$

86. Exports of nonfactor services

$$XSV\$ = 14.470\ TIME + 36.96$$

87. Exports of goods and non-factor services

$$X\$ = XCR\$ + XLVME\$ + XVGT\$ + XVGNT\$ + XFX\$ + XQU\$ + XDYNT\$ + XSV\$$$

87. Annual effective exchange rate effective for non-traditional exports of manufactures

EREF *

88. Dummy variable to represent the impact of the Latin American Free Trade Association

DI *

Imports

89. Imports of fuel

$$MF\$ = .070\ VMF\$ + 113.17$$

90. Imports of raw materials and intermediate goods

$$MR\$ = .076\ VMF\$ + 2.338\ rVMF\$ + 1.799\ d(FAN\$/SUM(1,3)(M\$/3)) + 192.88$$

91. Imports of investment goods

$$MI\$ = .371\ IF\$ - .193\ V3DY\$ + 1.032\ d(FAN\$/SUM(1,3)(M\$/3)) - 69.33$$

92. Imports of services

$$MSV\$ = 26.299\ TIME - 54.44$$

93. Imports of goods and non-factor services

$$M\$ = MC\$ + MR\$ + MI\$ + MSV\$$$

94. Imports of consumer goods

$$MC\$ \ *$$

Net factor income payments

95. Net direct foreign investment income

$$FPNP\$ = .201\ CFDN\$(1) + 711.400\ YNMF/VMF - 380.35$$

96. Net interest payments on theexternal debt

$$FPNI\$ = .025\ ED\$(1) - 3.09$$

97. Net factor income payments abroad

$$FPN\$ = FPNP\$ + FPNI\$$$

98. Net foreign assets

$$FAN\$ = FAN\$(1) + X\$ - (M\$ + FPN\$) + FDN\$ + FBN\$$$

99. Net foreign borrowing

$$FBN\$ \ *$$

100. Net direct foreign investment

$$FDN\$ \ *$$

101. Cumulative net direct foreign investment

$$CFDN\$ \ *$$

102. Total external debt in year 0 plus cumulative net foreign borrowing

ED$ *

Wages and prices

103. Average annual earnings per worker

rW = .511 rPCP +181.840 YN/Y +1.056 CUMF -191.58

104. Average annual earnings per worker in the manufacturing sector

rWMF = .470 rPCP +160.610 YNMF/VMF + 1.049 CUMF -182.46

105. Total wage income

YW = E * W

106. Gross domestic product at factor costs

Y = GDP*P - TI + GSU

107. Total non-wage income

YN = Y - YW

108. Non-wage income in the manufacturing sector

YNMF = VMF*PMF - EMF*WMF

109. Gross disposable income

YDP = Y + GTF - TD - FPN

110. Implicit price deflator of value added in agriculture

PAG = .387 PX +.736 PAG(1) +11.571

111. Implicit price deflator of value added in manufacturing

rPMF = .175 rPM +.668 rWMF +.362 rPAG -8.306

112. Implicit price deflator of value added in other sectors than agriculture and manufacturing

rPOT = .725 rPMF +.197 rPPU +3.60

113. Implicit price deflator of meat consumption

PCAME = .949 PAG -3.39

*114. Implicit price deflator of consumption of manufactured goods, vegetative industries

PCMVG = .722 PMF +.383 PCMVG(1) -1.61

115. Implicit price deflator of consumption of manufactured goods, dynamic industries

PCMDY = 1.048 PMF +.70

116. Implicit price deflator of consumption of other goods

PCOT = .737 POT +.343 PCOT(1) +2.31

117. Implicit price deflator of gross fixed investment

rPIF = .724 rPMF +.112 rPM

118. Implicit price deflator of private consumption

PCP = .088 PCAME +.421 PCMVG +.211 PCMDY + .280 PCOT

119. Unit value index of imports in domestic currency

PM = PM$ * ER

120. Unit value index of exports in domestic currency

PX = PX$ * ER

121. Implicit GDP price deflator

P = (VAG*PAG + VMF*PMF + (VIF + VOT)*POT) /
(GDP - (TI - GSU)/P)

122. Unit value index of imports in dollars

PM$ *

123. Unit value index of exports in dollars

PX$ *

8.3 UNCTAD macroeconometric model for India

The supply of output in this model is disaggregated into three broad sectors: agriculture, manufacturing, and a residuary sector consisting mainly of services.

Manufacturing production is divided into the corporate and non-corporate production. In both subsectors capacity output is determined by a simple production function relating capacity output to cumulative investment. Capacity utilisation is related to agricultural output lagged one year which reflects both pressure of demand and also the constraint imposed by the supply of raw materials, to the supply of non-food imports, cumulative investmqnt and capacity utilisation lagged one year. Variation in capacity utilisation are well explained by this equation indicating thereby that the supplies of domestic raw materials and non-food imports are major constraining factors on manufacturing production.

Consumer expenditure may be analyzed either from the consumption side or from the savings side. The models contains behavioral equations for household, government, and corporate savings, respectively, as the data on savings are considered fairly reliable in India.

As a specific feature the model contains a fairly detailed monetary sector. [UNCTAD G.1973]

UNCTAD macroeconometric model for India

List of equations

Production

1. Area under food crops

$$AF = .209\ PF/PNF + .745\ AF(1) + 10.721$$

2. Total area under crops

$$A = .135\ PAW/P + .624\ A(1) + 30.322$$

3. Average yield per acre - food crops

$$AYF = .306\ R + 1.559\ TIME + 63.666$$

4. Average yield per acre - non-food crops

$$AYNF = .086\ R + 1.101\ TIME + 79.522$$

5. Capacity output in manufacturing-corporate sector

$$YMCP = .0008\ KCG(1) + 7.588$$

6. Capacity output in manufacturing-non-corporate sector

$$YMNCP = .0009\ KNC(1) + 12.648$$

7. Capacity utilization

$$CU = .312\ YA(1) + .055\ MOF - .0005\ KCG(1) + .627\ CU(1) + 8.371$$

8. Net output in agricultural sector

$$YA = .260\ QAF + .123\ QANF + 14.357$$

9. Net output of services

$$YS = .0044\ KGD(1) + .139\ Y + 12.085$$

10. Area under non-food crops

$$ANF = A - AF$$

11. Agricultural output - food crops

$$QAF = AYF * AF$$

12. Agricultural output - non-food crops

$$QANF = AYNF * ANF$$

13. Net output in manufacturing-corporate sector

$$YMC = CU * YMCP$$

14. Net output in manufacturing-non-corporate sector

$$YMNC = CU * YMNCP$$

15. Net output in non-agricultural sector

$$YNA = YMC + YMNC + YS$$

16. Net output in non-agricultural sector, current prices

$$YNAc = YNA * PNA$$

17. Net output in agricultural sector, current prices

$$YAc = YA * PA$$

18. Net national product

$$Y = YA + YNA$$

19. Net national product, current prices

$$Yc = YAc + YNAc$$

20. Rainfall, expressed as percentage of normal

$$R *$$

21. Cumulative investment, corporate sector and government sector other than in department undertakings

$$KCG(1) = SUM(0,TIME-1)(ICF + IGO)$$

22. Cumulative investment,government sector, department undertakings

$$KGD(1) = SUM(0,TIME-1)(IGD)$$

23. Cumulative investment,non-corporate sector

$$KNC(1) = SUM(0,TIME-1)(INCF)$$

<u>Savings and investment</u>

24. Savings of the household sector

$$SH = 14.394\ Y\ +4.072\ PNA/PA\ +.341\ SH(1)$$

25. Savings of the government sector

$$SG = .059\ T\ +.567\ SG(1)\ +7.832$$

26. Savings of the corporate sector, current prices

$$SCc = .277\ CPRc\ +.306\ SCc(1)\ +2.642$$

27. Investment in fixed assets, corporate sector

$$ICF = 7.142\ YNA\ +.296\ EFc/P\ -218.552$$

28. Inventory investment, current prices

$$Hc = 2.009\ Yc - 93.816$$

29. Depreciation, current prices

$$DEPc = 2.797\ KGP(1) + 367.150$$

<u>Prices and wages</u>

30. Wholesale prices of food articles

$$PF = -1.060\ SF(1) - 2.397\ SF(2) + 2.583\ YNA + 6.249\ Lc/Y + 92.259$$

31. Wholesale price of agricultural raw materials

$$PNF = -10.315\ QANF(1)/(YMC + YMNC) + 6.849\ Lc/Y + 33.330$$

32. Wholesale price of manufactured articles

$$PFG = .310\ PNF + .462\ CU + .454\ PFG(1) + 16.064$$

33. Wholesale price index

$$PW = .532\ PF + .155\ PNF + .330\ PFG - 1.884$$

34. Implicit GNP deflator

$$P = .654\ PW + 28.647$$

35. Consumer price index

$$PCL = .593\ PF + .447\ PFG + .876$$

36. Wholesale prices of agricultural commodities

$$PAW = .614\ PF + .287\ PNF + 9.754$$

37. Implicit deflator of income in agricultural sector

$$PA = .970\ PAW - 12.840$$

38. Implicit deflator of income in non-agricultural sector

$$PNA = .499\ P + 38.626$$

39. Unit value index of other exports

$$PXO = .563\ PW + .208\ PXO(1) + 14.777$$

40. Average annual earnings per worker in factories, current prices

$$Wc = 6.589\ PCL + 17.894\ YMC + 339.601$$

41. Profits after tax in the corporate sector, current prices

$$CPRc = 2.056\ YNAc + 9.906$$

42. Total supply of food grains

$$SF = .88\ QAF + MF$$

Government and monetary sectors

43. Direct taxes of central and state governments

$$TDc = 139.365\ RDT + 6.517\ YNAc - 443.392$$

44. Indirect taxes of central and state governments

$$TIc = 277.223\ RIT1 + 101.027\ RIT2 + 6.973\ Yc + .0018\ MGc + .0042\ XGc - 1285.959$$

45. Other current receipts of central and state governments

$$TOc = 2.133\ Yc - 49.394$$

46. Total holdings of government securities excluding the Reserve Bank holdings

$$GSBPc = .4592\ GDc + .923\ GSBPc(1) + 149.052$$

47. Currency with the public

$$Cc - Cc(1) = .418\ GDc + 58.334$$

48. Money supply with the public, currency + demand deposits

a $$\ln(Lc/P) = .760\ \ln Y - .275\ \ln RG1 + .556\ \ln(Lc/P)(1) - 1.822$$

b $$\ln(Lc/P) = .590\ \ln Y - .274\ \ln RS1 + .514\ \ln(Lc/P)(1) + 1.524$$

49. Time deposits

$$Tc = 6.687\ YNAc + 238.956\ R12 - 361.656\ RG1 + .694\ Tc(1) + 551.497$$

50. Borrowings of commercial banks from the Reserve Bank

$$BRc = 111.445\ RG - 34.472\ RB + .013\ BLc - 158.157$$

51. Total reserves of commercial banks with the Reserve Bank

$$TRc = .046\ Dc + .064\ Tc - 10.212\ RS1 + 55.266$$

52. Commercial banks advance rate

$$RA = .946\ RB + .0004\ BLc + 2.197$$

53. Call-money rate

$$RS1 = -.554\ TR/Tc + 1.170\ RB - .0004\ Lc + 3.918$$

54. Yield on long-term government bonds

$$RG1 = -.029\ GSBPc/YNAc + .489\ R12 + 3.204$$

55. External finance of the corporate sector

$$EFc = .413\ d(Lc + Tc) + 113.909$$

56. 12-month time deposit rate

$$R12 = .256\ RS1 + .761\ R12(1) + .145$$

57. Average rate of return on government securities held by commercial banks

$$RG = .364\ RG1 + .795$$

58. Commercial bank loans to private sector

$$BLc = 27.492\ YNAc + 1.012\ ICPc - 107.018\ RA - 273.797$$

59. Average rate of direct taxes, expressed as a percentage of national income

RDT *

60. Average rate of indirect taxes, expressed as a percentage of national income

RIT1 *

61. Average rate of customs duties, expressed as a percentage of the value of imports + exports

RIT2 *

62. Government deficit on current account

GDc *

63. Reserve Bank discount rate

RB *

64. Foreign capital inflow

$$Fc = MGc - XGc - XSc + FERc - FER(1)$$

65. Foreign exchange reserves

FERc *

External trade

66. Imports of food grains

$$MF = -.078\ QAF + .148\ YNA - .064\ PMF/PW + 9.557$$

67. Imports other than food

$$MOF = 2.002\ YNA - .0056\ PMOF + .196\ (FR/PM)(1) + 30.905$$

68. Total imports of goods, current prices

$$MGc = MF*PMF + MOF*PMOF$$

69. Exports of tea

$$XT = XT_{65-69}*(1.01)^{TIME}$$

70. Exports of jute manufactures

$$XJ = XJ_{65-69}(1.01)^{TIME}$$

71. Exports of engineering goods

$$XEG = -5.836\ PXEG*ER + 747.570$$

72. Other exports

$$XO = .965\ EW - .156\ PXO*ER + 49.685$$

73. Exports of services

$$\ln XSc = .0625\ TIME - .261$$

74. Total exports of goods, current prices

$$XGc = XT*PXT + XJ*PXJ + XEG*PXEG + XO*PXO$$

75. Factor income paid abroad

$$YFc = .054\ GDP(1) - .059$$

80. Unit value index of food imports

PMF *

81. Unit value index of other imports

PMoF *

82. Unit value index of exports of engineering goods

PXEG *

83. Unit value index of exports of jute manufactures

PXJ *

84. Unit value index of exports of tea

PXT *

85. Volume of world trade

EW *

9. Conclusions

Recent experiences with econometric models for developing countries indicate that these models may serve as a valuable tool to investigate the critical problems of these countries in the seventies: unemployment, debt, inflation.

The open character of the economies of developing countries requires an international coordination of their policies, for what might be desirable for a single country might conflict with global interests. Therefore a research strategy is required which takes into account the world wide dependencies of all countries via their trade relations.

There is an urgent need to improve the data base of less developed countries and to work on data adequate estimation techniques which take into account all available prior information, which combine time series and cross section information, which attempt to handle the changing structures of these economies.

The national accounts should be integrated with balance of payments, budgeting and monetary accounts. Special emphasis shall be given to the supply side of the models. As a natural extension of the regression type models the combination with input-output techniques is highly recommended to get further insights into the supply structure of the economy.

10. BIBLIOGRAPHY

10. A General views on development planning

BAUER, P.T., and B.S.YAMEY	The economics of the Pearson report (review). J.Dev.Stud., 8 (1972)
HEALY, D.T.	Development policy: New thinking about an interpretation. J.Econ.Lit., 10 (1972)
HIRSCHMAN, A.O.	A bias for hope. Essays on development and Latin America. New Haven: Yale Univ. Press,1971
MADDISON, A. (ed)	Myrdal's Asian drama. An interdisciplinary critique. Liege, Belgium: CIR-IEC,1971
MYRDAL, G.	Asian drama: An inquiry into the poverty of nations. New York: Pantheon, 1968
PEARSON, L.B. et.al.	Partners in development. New York: Praeger, 1969
PREBISCH,R.	The economic development of Latin America and its principal problems. New York: UN, 1950
SZENTES, T.	The political economy of underdevelopment. Budapest: Akademiai Kiado, 1971.

10.B General theory of economic development planning

ABOTT, G.C.	Economic aid as a unilateral transfer of resources. J.Pol.Econ., 78 (1970)
ADELMAN, I., and H.B.CHENERY	Country topologies and development pattern. Paper presented at the Budapest Meeting of the Econometric Society, September 1972
ADELMAN, I., and E.THORBECKE	The theory and design of development. Baltimore: John Hopkins University Press, 1966
ADELMAN, I., M.GEIER, and C.T.MORRIS	Economic development. Instruments and goals in economic development. Amer.Econ.Rev., 59 (1969)
BALOGH, T.	Multilateral vs. bilateral aid. Oxf.Econ.Pap., 19 (1967)
BASCH, A.	A pragmatic approach to economic development. New York: Vantage, 1970
BERILL, K. ed.	Economic development. London: Macmillan, 1964
BHAGWATI, J.N.	Amount and sharing of aid. Washington, D.C.: Overseas Development Council, 1970
BRUTON, H.	The two-gap approach to aid and development: comment. Amer.Econ.Rev., 59 (1969)
CHENERY, H.B., et al.	Studies in development planning. Cambridge, Mass.: Harvard University Press, 1971
CHENERY, H.B., and A.STROUT	Foreign assistance and economic development. Amer.Econ.Rev., 56 (1966)
CULBERTSON, J.M.	Economic development: An ecological approach. New York: Knopf, 1971
FEI, C.H., and G.RANIS	Foreign assistance and economic development: comment. Amer.Econ.Rev., 58 (1968)
FRANK, C.R.	Economic development: Discussion. Amer.Econ.Rev., 59 (1969)
GRIFFIN, K.B., and J.L.ENOS	Planning development. Reading, Mass.: Addison-Wesley, 1971

HARRIS, D.J. — Income, prices, and the balance of payments in underdeveloped economies: A short-run model. Oxf.Econ.Pap., 22 (1970)

HIRSCHMAN, A.O. — The strategy of economic development. New Haven: Yale University Press, 1958

JORGENSON, D.M. — Surplus agricultural labor and the development of a dual economy. Oxf.Econ.Pap., 19 (1967)

JORGENSON, H.G. — Economic policies toward less developed countries. New York: Praeger, 1967

LITTLE, I., T.SCITOWSKY, and M.SCOTT — Industry and trade in some developing countries: A comparative study. London: Oxford University Press for OECD, 1970

PAPANEK, G.F. ed. — Development policy - theory and practice. Cambridge, Mass.: Harvard Univ. Press, 1968

PAPANEK, G.F., D.M.SCHYDLOWSKY, and J.J.STERN — Decision making for economic development. Text and cases. Boston: Houghton Mifflin, 1971

RAHMAN, A.A. — The welfare economics of foreign aid. Pakistan Development Review, 1967

STROUT, A.M. — Factors affecting the allocation of foreign economic aid. Washington, D.C.: Agency for International Development, 1964 (mimeo.)

STROUT, A.M. — Savings, imports, and capital productivity in developing countries. Paper presented at the First World Congress of the Econometric Society, Rome, Sept. 1965

VANEK, J. — Estimating foreign resource needs for economic development. New York: McGraw Hill, 1967

10.C Country studies

Latin America

ARNOLD, A.F. — Foundations of an agricultural policy in Paraguay. New York: Praeger, 1971

AVRAMOVIC, D. — Economic growth in Columbia: Problems and prospects. Baltimore: John Hopkins Press, 1972

BAER, W. — Industrialization and economic development in Brazil. Homewood, Ill.: Irwin, 1965

BAER, W. — The development of the Brazilian steel industry. Nashville, Tenn.: Vanderbilt University Press, 1969

BERGSMAN, J. — Brazil: Industrialization and trade policies. London: Oxford University Press for OECD, 1970

BIRD, R.M. — Taxation and development: Lessons from Columbian experience. Cambridge, Mass.: Harvard University Press, 1970

BROADAWAY, F. — Development problems in Latin America: A review article. Amer.Econ., 1971

CARNOY, M.A. — Welfare analysis of Latin American Economic Union: Six industry studies. J.Polit.Econ., 78 (1970)

CAUAS, J. — Stabilization policy - the Chilean case. J.Polit.Econ., 78 (1970)

CHENERY, H.B., and P. ECKSTEIN — Development alternatives for Latin America. J.Polit.Econ., 78 (1970)

CORREA, H. — Sources of economic growth in Latin America. Southern Econ.J., 37 (1970)

COHEN, S. — Puerto Rico's development paradox. Growth Change, 1 (1970)

DE VRIES, B.A., and J.C. LIU — An econometric analysis of inflation and growth in Brasil. Paper presented to the New York meetings of the Econometric Society, December 1969

ELLIS, H.S. — Essays on the Brazilian economy. Berkeley, 1969.

FLETCHER, L.B., E.GRABER, W.C.MERRILL, and E.THORBECKE — Guatemala's economic development: The role of agriculture. Ames, Iowa: Iowa State University Press, 1971

GIBSON, C.R. — Foreign trade in the economic development of small nations: The case of Ecuador. New York: Praeger, 1971

GRUNWALD, J. — Some reflections on Latin American industrialization policy. J.Pol.Econ., 78 (1970)

HARBERGER, A.C. — Economic policy problems in Latin America: A Review. J.Pol.Econ., 78 (1970)

KING, T. — Mexico: Industrialization and trade policies since 1940. London: Oxford University Press for OECD, 1970

MALDONADO, R.M. — The role of the financial sector in the economic development of Puerto Rico. Federal Deposit Insurance Corporation, 1970

MALLOY, J.M., and R.S.THORN eds. — Beyond the revolution: Bolivia since 1952. Pittsburgh, Pa.: University of Pittsburgh Press, 1971

NELSON, R.R., T.P.SCHULTZ, and R.L.SLIGHTON — Structural change in a developing economy. Columbia's problems and prospects. Princeton, N.J.: Princeton University Press, 1971

REYNOLDS, C.W. — The Mexican economy: Twentieth-century structure and growth. New Haven: Yale University Press, 1970

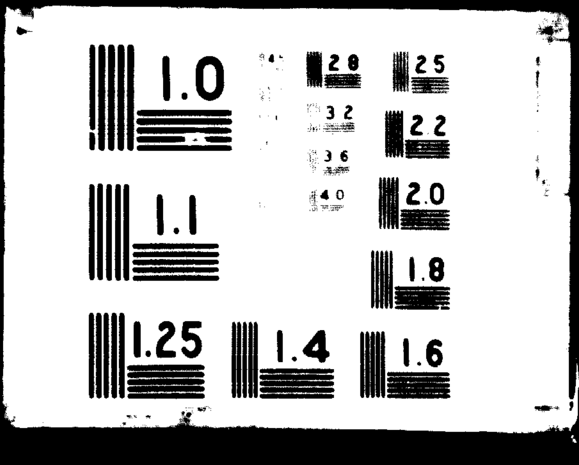
ROEMER, M. — Fishing for growth: Export-led development in Peru, 1950-1967. New York: Praeger, 1970

UNITED NATIONS — The economic development of Latin America in the post-war period. New York: UN, 1964

9. 8. 74

2 OF 2

04927



Asia

ACHARYA, S.N., and B.R. HAZARI — Linkages and imports: A comparative study of India and Pakistan. J.Devel.Studies, 8 (1971)

ADELMAN, I. — Practical approaches to development planning: Korea's second five-year plan. Baltimore, Md.: John Hopkins Press, 1969

ANDERSON, D.A. — Marketing and development: The Thailand experience. East Lansing, Mich.: Michigan State University, 1970

AVERCH, H.A., J.E.KOEHLER, and F.H.DENTON — The matrix of policy in the Philippines. Princeton, N.J.: Princeton University Press, 1971

BALASSA, B. — Industrial policies in Taiwan and Korea. Weltwirtschaftliches Archiv, 106 (1971)

BHARIER, J. — Economic development in Iran, 1900-1970. London: Oxford University Press, 1971.

BLAUG, M. — A post-mortem of manpower forecasts in Thailand. J.Devel.Stud., 8 (1971)

BWAGWATI, J., and P.DESAI — India's planning for industrialization. Industrialization and trade policies since 1951. London: Oxford University Press for OECD, 1970

CHENERY, H.B., and MACEWAN — Optimal patterns of growth and aid: The case of Pakistan. Pakistan Development Review, 1966

COLE, D.C., and P.N.LYMAN — Korean developments: The interplay of politics and economics. Cambridge, Mass.: Harvard University Press, 1971

DESAI, P. — Growth and structural change in the Indian manufacturing sector, 1951-1963. Indian Econ.J., 17 (1969)

FRANKEL, F.R. India's green revolution: Economic gains and political costs. Priceton, N.J.: Princeton University Press, 1971

GAATHON, A.L. Economic productivity in Israel. New York: Praeger, 1971

GOSH, R. Achievments of five year plans in India. Econ.Aff., 17 (1972)

GOSH, B.C. How far has mixed economy succeded in India. Econ.Aff., 16 (1971)

GUPTA, S.P. Planning models in India: With projections to 1975. New York: Praeger, 1971

HAZARI, B.R. Empirical identification of key sectors in the Indian economy. Rev.Econ.Statist., 52 (1970)

ISHIKOWA, S. Economic development in Asian perspective. Tokyo: Kinokuniya, 1967

JACOBS, N. Modernization without development: Thailand as an Asian case study. New York: Praeger, 1971

KHAN, A.R. The use of multisectoral models in Pakistan's planning with special reference to regional allocation of resources. Pakistan Develop.Rev., 11 (1971)

KHAN, M.S. Planning and economic development in India. New York: Asia, 1970

KIM, S.H. Foreign capital for economic development: A Korean case study. New York: Praeger, 1970

LEWIS, S.R. Economic policy and industrial growth in Pakistan. London: Allen & Unwin for the Pakistan Institute of Development Economics, 1969

LEWIS, S.R. Pakistan: Industrialization and trade policies. London: Oxford University Press for OECD, 1970

MACEWAN, A. — Development alternatives in Pakistan. A multisectoral and regional analysis of planning problems. Cambridge, Mass.: Harvard University Press, 1971

MATHUR, P.N., and R.BHARADWAJ — Economic analysis in input-output framework with Indian empirical explorations. Poona, India: Gokhale Institute of Politics and Economics, 1967

MAUNG, M. — Burma and Pakistan: A comparative study of development. New York: Praeger, 1971

MOORE, F.T., D.M.I.THOMAS et al. — Agricultural development in the Mekong Basin. Goals, priorities, and strategies. Baltimore, Md.: John Hopkins Press for Resources for the Future, 1971

NADEEM, A.H. — Growth of industries in public sector: A case study of Pakistan. Punjab Univ.Econ., 8 (1970)

NARTSUPHA, C. — Foreign trade, foreign finance and the economic development of Thailand, 1956-1965. Bangkok: Prae Pittaya, 1970

PACK, H. — Structural change and economic policy in Israel. New Haven: Yale University Press, 1971

PELRA, N. — A reexamination of the import structure of India. Rev.Econ.Statist., 51 (1969)

POWER, J.H., G.P.SICAT, and M.HSING — The Phillippines: Industrialization and trade policies. London: Oxford University Press for OECD, 1971

REPETTO, R.C. — Time in India's development programs. Cambridge, Mass.: Harvard University Press, 1971

TINTNER, G., and N.S.RAGHAVAN — Stochastic linear programming applied to a dynamic planning model for India. Econ.Int., 23 (1970)

WATANABE, T. — National planning and economic development: A critical review of the Japanese experience. Econ.Planning, 10 (1970)

Africa

	CLARC, P.G.	Development planning in East Africa. East African Publishing House, 1965
	DU PLESSIS, T.A.	The official economic development program of South Africa
	GOUVERNEUR, J.	Productivity and factor proportions in less developed countries: The case of industrial firms in the Congo. London: Oxford University Press, 1971
	HAY, A.M., and R.H.T.SMITH	Interregional trade and money flows in Nigeria, 1964. Ibadan, Nigeria: Oxford University Press for the Nigerian Institute of Social and Economic Research, 1970
*	INTERNATIONAL MONETARY FUND	Survey of African economies, Vol.4: Democratic Republic of Congo, Malagasy Republic, Malawi, Mauritius, and Zambia. Washington, D.C.: IMF, 1971
	STEEL, W.F.	Import substitution and excess capacity in Ghana. Oxf.Econ.Pap., 24 (1972)

10.D Sectoral studies

Agriculture

FLETCHER, L.B. et al.	Guatemala's economic development: The role of agriculture. Ames, Iowa: Iowa State University Press, 1971
ARNOLD, A.F.	Foundations of an agricultural policy in Paraguay. New York: Praeger, 1971
KUNG, E.	Agricultural vs. industrial development in LDC's. Inter-Economics, 1972

Industrial sector

BALASSA, B.	Patterns of industrial growth: Comment. Amer.Econ.Rev., 51 (1961)
BAIN, J.S.	International differences in industrial structure. New Haven: Yale University Press, 1966
BEHRMAN, J.R.	Sectoral elasticities of substitution between capital and labor in a developing economy: Time series analysis in the case of Chile. Econometrica, 40 (1972)
BEHRMAN, J.R.	Sectoral investment determination in a developing economy. Amer.Econ.Rev., 62 (1972)
BEHRMAN, J.R.	Short-run flexibility in a developing economy. J.Pol.Econ., 80 (1972)
BHATT, V.V.	Capital-output ratios of certain industries: A comparative study of certain countries. Rev.Econ.Statist., 36 (1954)
CHENERY, H.B.	Patterns of industrial growth. Amer.Econ.Rev., 50 (1960)

CLAGUE, C.K. Capital-labor substitution in manufacturing in underdeveloped countries. Econometrica, 37 (1969)

ELKON, P.G. A model of industrialization and trade with internal and external scale effects. Oxf.Econ.Pap., 22 (1970)

GOUVERNEUR, J. Productivity and factor proportions in less developed countries: The case of industrial firms in the Congo. London: Oxford University Press, 1971

GRUNWALD J. Some reflections on Latin American industrialization policy. J.Pol.Econ., 78 (1970)

JORGENSON, D.W., and Z.GRILICHES The explanation of productivity change. Rev.Econ.Stud., 34 (1967)

KIM, Y.C. Sectoral output-capital ratios and levels of economic development: A cross-sectoral comparison of manufacturing industries. Rev.Econ.Statist., 51 (1969)

LEIBENSTEIN, H. Incremental capital-output ratios and growth rates in the short run. Rev.Econ.Statist., 48 (1966)

LITTLE, I., T.SCITOWSKY, and M.SCOTT Industry and trade in some developing countries: A comparatative study. London: Oxford University Press for OECD, 1970

MAIZELS, A. Industrial growth and world trade. Cambridge, Mass.: Harvard Univ. Press, 1963

SANKAR, U. Elasticities of substitution and returns to scale in Indian manufacturing industries. Intern.Econ.Rev., 11 (1970)

SANTHANAM, K.V., and R.H.PATIL A study of the production structure of the Indian economy: An International comparison. Econometrica, 40 (1972)

SHEN, T.Y. Economies of scale, expansion path, and growth of plants. Rev.Econ.Statist., 47 (1965)

STRASSMAN, W.P. — Causes of technological stagnation in manufacturing during early industrialization. Oxf.Econ.Pap., 19 (1967)

UNITED NATIONS — A study of industrial growth. New York, UN, 1963

UNITED NATIONS — The growth of world industry, 1953-1965. New York, UN, 1967

UNITED NATIONS — The growth of world industry, 1938-1961. New York: UN, 1965

UNITED NATIONS — Patterns of industrial growth, 1938-1958 New York, UN 1960

WITTE, A.D. — Alternative estimates of capital-labor substitution in manufacturing in developing economies: comments on Professor Clague. Econometrica, 39 (1971)

10.E Selected topics of development economics

Growth

ADELMAN, I., and C.T.MORRIS	An analysis of world income and growth: Comment. Economic Development and Cultural Change, 2) (1972)
CHENERY, H.B.	A study of industrial growth. New York, UN, 1963
CHENERY, H.B.	Growth and structural change. Finance And Development, 8 (1971)
CHENERY, H.B., and L.TAYLOR	Development patterns: Among countries and over time. Rev.Econ.Statist., 50 (1968)
CLINE, W.R.	Potential effects of income redistribution on economic growth: Latin American cases. New York: Praeger, 1972
CORREA, H.	Sources of economic growth in Latin America. Southern Econ.J., 37 (1970)
DESAI, P.	Growth and structural change in the Indian manufacturing sector: 1951-1963. Indian Econ.J., 17 (1969)
DIXIT, A.	Growth patterns in a dual economy. Oxf.Econ.Pap., 22 (1970)
ECAFE	Feasible growth and trade gap projections in the ECAFE region. Bangkok, 1968
GUPTA, K.L.	Development patterns: An interregional study. Quart.J.Econ., 85 (1971)
HAGEN, E., and O.HAWRYLYSHYN	An analysis of world income and growth. Econ.Development and Cultural Change, 17 (1969)

KUZNETS, S. Modern economic growth. New Haven: Yale University Press, 1966

KUZNETS, S. Problems in comparing growth rates for developed and less developed countries. Economic Development and Cultural Change, 20 (1972)

JANOSI, P. Patterns of energy consumption and economic growth and structure. J.Devel.Studies, 8 (1972)

PAPANEK, G. Factor analysis and growth: an empirical test. Quart.J.Econ., 85 (1971)

ROBINSON, S. Sources of growth in less developed countries: A cross section study. quart.J.Econ., 85 (1971)

SOMMERS, P.M., and D.B.SUITS A cross-section model of economic growth. Rev.Econ.Statist., 53 (1971)

UNITED NATIONS Sectoral aspects of projections for the world economy. First International Seminar on Long-Term Projections. New York: UN, 1969

WEISSKOPF, T.E. An econometric test of alternative constraints on the growth of underdeveloped countries. Rev.Econ.Statist., 54 (1972)

Trade

ACHARYA, S.N., and B.S.HAZARI — Linkages and imports: A comparatative study of India and Pakistan. J.Devel.Stud., 8 (1971)

BALDWIN, R.E., and G.M.LAGE — A multilateral model of trade-balancing tariff concessions. Rev.Econ.Statist., 53 (1971)

BERGSMAN, J., and S.A.MARLEY — Import constraints and development. Causes of the recent decline of Brazilian economic growth: A comment. Rev.Econ.Statist., 51 (1969)

BHAGWATI, J. — The gains from trade once again. Oxf.Econ.Pap., 20 (1968)

BHAGWATI, J., and C.WIBULSWASDI — A statistical analysis on the import structure in LDC's. Oxford University Institute of Economics and Statistics Bulletin, May 1972

BROADBENT, A.H.C. et al. — Forecasting trade between OECD countries and primary producers. Nat.Inst.Econ.Rev., 1970

CHACHOLIADES, M. — Balance of payments equilibrium with imports as a factor of production. Oxf.Econ.Papers, 22 (1970)

COHEN, B.I. — Measuring the short-run impact of a country's import restrictions on its exports. Quart.J.Econ., 80 (1966)

COHEN, B.I., and D.G.SISTER — Exports of developing countries in th 1960's. Rev.Econ.Statist., 53 (1971)

HUDDLE, D. — Some evidence on price elasticities in international trade. Oxf.Econ.Pap., 22 (1970)

KEMP, M.C. — Some issues in the analysis of trade gains. Oxf.Econ.Pap., 20 (1968)

LEIS, F. and A.SHAPIRO	Long-term international capital flows: A quantitative estimate, Journal of World Trade Law, 6 (1972)
LINNEMANN, K.	An econometric study of international trade flows, Amsterdam: North Holland, 1966
LITTLE, I., T.SCITOVSKY, and M.SCOTT	Industry and trade in some developing countries: A comparatative study, London: Oxford Univ. Press for OECD, 1970
UNITED NATIONS	Trade prospects and capital needs for developing countries, New York, UN, 1968

Import substitution

DESAI, P. — Alternative measures of import substitution. Oxf.Econ.Pap., 21 (1969)

CLARK, P.B. — Planning import substitution. Amsterdam: North Holland, 1970

DOHERTY, N. — Import substitution and the balance of payments. Eastern Africa Economic Review, 1970

FANE, G. — Import substitution and export expansion: Their measurement and an example of their application. The Pakistan Development Review, 11 (1971)

HIRSCHMAN, A.O. — The political economy of import-substituting industrialization in Latin America. Quart.J.Econ., 82 (1968)

HUMPHREY, D. — The determinants and structure of import substitution. Western Economic Journal, 8 (1970)

MARLEY, A., and G.W.SMITH — On the measurement of import substitution. Amer.Econ.Rev., 60 (1970)

MARLEY, A., and G.W.SMITH — Import substitution and foreign investment in Brazil. Oxf.Econ.Pap., 23 (1971)

Financing

GRIFFIN, K. ed. — Financing development in Latin America. London: Macmillan, 1971

KIM, S.H. — Foreign capital for economic development: A Korean case study. New York: Praeger 1970

LITVAK, I.A., and C.J.Maule eds. — Foreign investment: The experience of the host countries.

MANIATIS, G.C. — Promoting industrial investment in development countries: Traditional financing methods vs. industrial leasing. Oxf.Econ.Pap., 23 (1971)

SENGUPTA, A. — Foreign capital requirements for economic development. Oxf.Econ.Pap., 20 (1968)

Inflation

ARGY, V. — Structural inflation in developing countries. Oxf.Econ.Pap., 22 (1970)

BAER, W., and I.KERSTENETZKY — Inflation and growth in Latin America. Homewood, Ill.: Irwin, 1964

BLAIR, A.R. — Import bottlenecks and inflation: The case of Brazil. Oxf.Econ.Pap., 19 (1967)

COCHRANE, S.H. — Structural inflation and the two-gap model of economic development. Oxf.Econ.Pap., 24 (1972)

JOHNSON, H.G. — Inflation and world trade: A "monetarist" point of view. World Trade Law, 6 (1972)

10.F Input-output and programming models

CARTER, A.P., and A.BRODY — Input output techniques. Vol.1: Contributions to input-output analysis. Vol.2: Applications of input-output analysis. Amsterdam: North Holland, 1970

GUPTA, S.P. — Planning models in India: with projections to 1975. New York: Praeger, 1971.

LEONTIEF, W. — Input-Output economics. London: Oxford University Press, 1966

MATHUR, P.N., and R.BHARADWAJ — Economic analysis in input-output framework with the Indian empirical explorations. Poona, India: Gokhala Institute of Politics and Economics, 1967

ROSS, B.J., and B.P.PHILPOTT — Indicative economic planning with a sixteen-sector projection model of the New Zealand economy. Australian Econ.Pap., 9 (1970)

NUGENT, J.B. — Linear programming models for the national planning: Demonstration of a testing procedure. econometrica, 38 (1970)

TINTNER, G., and N.S.RAGHAVAN — Stochastic linear programming applied to a dynamic planning model for India. Econ.Int., 23 (1970)

10.G Econometric models

ADELMAN, I., and H.B.CHENERY	Foreign aid and economic development: The case of Greece. Rev.Econ.Statist., 48 (1966)
ADELMAN, I., and KIM MAHN JE	An econometric model of the Korean economy (1956-66). In: Practical approaches to development planning, ed. by I.Adelman, Baltimore: John Hopkins Press, 1969
ADELMAN, I., and C.T.MORRIS	An econometric model of socio-economic and political change in underdeveloped countries. Amer.Econ.Rev., 58 (1968)
ADELMAN, I., and C.T.MORRIS	An econometric model of development: Reply Amer.Econ.Rev., 60 (1970)
AGARWALA, R.	Tests and uses of macro econometric models: A critical survey. Economics of Planning, 4 (1969)
AGARWALA, R.	An econometric model of India, 1948-61. London: Frank Cass, 1970.
AGARWALA, R.	A survey of the World Banks macro models. Washington, D.C.: IBRD, January 1972 (mimeo.)
AGARWALA, R., and G.PROULX	A study in econometric model building for medium-term macro economic analysis. Economic Council of Canada, 1971 (mimeo.)
BALL, R.J.	The international linkage of national economic models. Amsterdam: North-Holland, 1973
BEHRMAN, J., and L.R.KLEIN	Econometric growth models for the developing economy. Wharton School, University of Pennsylvania, 1968 (mimeo.)
BEHRMAN, J.R.	Econometric model simulations of the world rubber market, 1950-1980. In: Essays in industrial econometrics, III, by L.R.Klein, ed., Philadelphia: University of Pennsylvania, 1971

CARTER, N.G. — A macro economic model of Jamaica, 1959-1966. Washington, D.C.: IBRD, Economics Department Working Paper No. 65, 1971

CHAU, L.C. — An econometric model for forecasting income and employment in Hawaii. Honolulu: Economic Research Center, University of Hawaii, 1970

BERRY, S.A. — An econometric model of development: Comment. Amer.Econ.Rev., 60 (1970)

CHENERY, H.B., and M.BRUNO — Development alternatives in an open economy: The case of Israel. Econ.J., 72 (1962)

CHENERY, H.B., and A.M.STROUT — Foreign assistance and economic development. Amer.Econ.Rev., 56 (1966)

CENTER FOR ECONOMIC RESEARCH, ATHENS — An econometric model of the Greek economy. Athens, 1964

DEANE, R.S. — Towards a model of the New Zealand economy. Wellington, New Zealand: Reserve Bank of New Zealand, Research Paper No.1, 1971.

DE VRIES, B.A., and J.C.LIU — An econometric analysis of inflation and growth in Brazil. Paper presented at the New York meetings of the Econometric Society, December 1969

DUTTA, M., and V.SU — An econometric model of Puerto Rico. Rev.Econ.Stud., 36 (1969)

ECAFE — Feasible growth and trade projections in the ECAFE region. Bangkok: ECAFE, 1968

ECKSTEIN, P. — An econometric model of development: Comment. Amer.Econ.Rev., 60 (1970)

KLEIN, L.R. What kind of macroeconomic model for developing economies ? Econometric Annual of the Indian Economic Journal, 13 (1965)

MANHERTZ, H. An exploratory econometric model for Jamaica. Soc.Econ.Stud., 20 (1971)

MARWAH, K. An econometric model of Columbia: A prototype devaluation view. Econometrica, 37 (1969)

KORUM, U. Econometric models and an attempt for the Turkish economy. Ankara,1969 (Turkish)

SHOURIE, A. The use of macro-economic regression models of developing countries for forecasts and policy prescription: Some reflections on current practice. Oxf.Econ.Pap., 24 (1972)

UNCTAD Trade prospects and capital needs for developing countries. New York: UN, 1968

UNCTAD STAFF Models for developing countries. In: The international linkage of national economic models, by R.J.Ball ed., Amsterdam: North Holland, 1973

KEYNES, J.M. On a method of statistical business cycle research. Econ.J., 49 (1939)

TINBERGEN, J. Statistical testing of business cycle theories. Vol. 1, Geneva: League of Nations, 1939

10.H Data base and statistical methods

BOX, G.E.P. — Use and abuse of regression. Technometrics, 8 (1966)

ELY, J.E. — Some comments on the treatment of problems of the inadequate statistics of South Asia countries in "Asian drama" by Gunnar Myrdal. J.Econ.Lit., 8 (1970)

FARRAR, D.C., and R.R.GLAUBER — Multicollinearity in regression analysis: The problem revisited. Rev.Econ.Statist., 49 (1967)

HAITOVSKY, Y. — Multicollinearity in regression analysis: Comment. Rev.Econ.Statist., 51 (1969)

MENGHES, G., and H.DIEHL — Time stability of structural parameters. In: Econometric analysis for national economic planning, ed. by P.E.Hart et al., University of Bristol, 1964

NAYA, S., and T.MORGAN — The accuracy of international trade data: The case of Southeast Asian countries. Univ. of Wisconsin, 1967 (mimeo.)

SCOTT, J.T., and E.O.HEADY — Econometricians and the data gap: A Reply. Amer.J.Agric.Econ., 51 (1968)

WHITEHEAD, L. — Basic data in poor countries: The Bolivian case. Oxford University Institute of Economics and Statistics, Bulletin, 31 (1969)

9. 8. 74