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ILPES: AN ALTERNATIVE MODEL FOR THE FORMULATION
OF RECOVERY STRATEGIES

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The use of macroeconomic models in the formulation
of alternative development strategies

◦ The purpose of these notes is to present the methodology for macroeconomic models that the Research Programme of ILPES has put forward, in order to give support to the efforts that the planning agencies of Latin America and the Caribbean have been making to design recovery and development strategies since the severe crisis of 1981.

The first section discusses in general terms the nature of the recessive problem affecting the majority of the countries and the role that tools such as models can play in the exploration and preparation of strategies that may significantly reduce the underutilization of resources and permit to recover the growth dynamics in the medium term. It also presents arguments in favour of the fact that such tools make it easier for the economic authorities to have a mechanism to permit the preparation of the main balances of the annual economic programme, which complement the budgetary balance of the public sector and to detect the main disequilibriums that the economic conjunctural situation may show. This would make it possible to carry out an adequate follow-up, assessment and control of the execution of the plan.

The second section posits that such an analytical and programming instrument must necessarily reflect the structural characteristics of the economy and detect the inter-relationships existing between the main macroeconomic variables and the economic policy instruments. To illustrate this the prototype model proposed to serve as the basis for the preparation of specific models for each country is presented, stressing its potential uses as an instrument for the preparation of medium term development strategies and for the discussion of the economic policies required for its implementation in the short term.

Finally, the third section presents a brief outline of the procedures to estimate and use these models, listing its statistical and computing requirements. The document ends with a report on the supportive activities that ILPES has been engaged in vis-a-vis this issue in the countries of the Region.

1. THE ROLE OF MACROECONOMIC MODELS IN DEVELOPMENT PLANNING

a) The preparation of alternative recovery and development scenarios

The formulation, estimation and utilization of macroeconomic models in the planning and design of economic policies is not a new phenomenon in Latin America. Their application is at least just as old as the efforts to plan development which have appeared since 1960. In such efforts the main role of the model was to provide a series of quantitative projections for the life span of the plan which permitted to evaluate the magnitude of the necessary internal and external savings that would make certain global and sectorial targets viable.

Although such tasks may still be valid, the present recessive context that is affecting the majority of the countries involves new and more complex responsibilities. In the first place the severe restriction of foreign resources determines the need, on the one hand, for the careful evaluation of the constraints that the adverse external conditions impose on the domestic economic activity within the prevailing policy framework and, on the other, for the discussion and evaluation of the alternative economic programmes and policies, particularly, in the commercial and financial field that may permit to palliate the negative effects detected.

In the second place, the situation of underutilization of human resources and

productive installed capacity also poses a new challenge to the design of plans and policies. The traditional emphasis laid by models on the creation of a productive capacity should be replaced, in the short term, for a concern for which policies may allow for the better use of the existing capacity.

In the third place, the presence of inflationary processes in the majority of the countries, brought about by the serious internal disequilibrium created or stressed by the external crisis calls for the simultaneous consideration of stabilizing, recovery and development policies. It is no longer possible for the problem to be dissected into short term - stability-directed - and medium term - development-directed policies. At the formal level this leads necessarily to the integration of medium-term planning models and macroeconomics for short-term stabilization and to the explicit stating of how the instrumental policies and variables interact in both periods.

The consideration of the preceding new conditions makes it extremely difficult to prepare deterministic prescriptive programmes, as used to be the case with past planning models. The marked uncertainty vis-a-vis the future evolution of the external framework, the unstable performance of the economic agents, particularly under inflationary conditions, the socio-political change, etc., are factors that invalidate any lineal and unidimensional projection of the future. For this reason, the discussion and formulation of recovery strategies must necessarily be undertaken in terms of alternative scenarios, conditioned to non-controllable exogenous data undergoing a certain evolution and also to the adoption of alternative sets of public policies.

It is only from the use of simulation exercises of alternative scenarios that it will be eventually possible to opt for such alternative as better reflects

a political option within the most probable external framework.

b) Ensuring the internal coherence of the selected plan or strategy

The sole evaluation of the effects of certain internal policies or of changes in external conditions is not enough to design an acceptable programme. Just as or more important than this task of economic forecasting or calculation is to ensure that the series of objectives and policies adopted should conform a non-contradictory package. For this, it is indispensable to have a macroeconomic model available.

In general, it may be said that the casuistic approaches to economic policies that have been traditionally adopted have tended to favour economic balance or equilibrium in some areas to the detriment of others. Thus, for example, some conceptions which are more closely linked to orthodox macroeconomic thinking, as is the case of conventional adjustment policies, tend to emphasize the design of policies to attain external balance and monetary equilibrium, despite the fact that this may involve serious imbalances in the goods markets (excess supply) and in factors (unemployment).

The approach proposed aims at ensuring both the external balance and that of the domestic markets. If this does not occur, as will be the case of economies subjected to serious structural disequilibriums, the evaluation in the short term of the magnitude of the alternative costs involved in the different adjustment options will be attempted. This evaluation will also include the resulting structural adjustment policies which will necessarily have to orientate the medium-term development programmes.

In this way, the selected solution generated by the model provides the foundations for the basic proportions of the macroeconomic variables

that will conform the medium and short term plan. This set of variables and parameters will allow the economic authority to have the necessary guidelines to mould the economic performance of the public sector (income and expenditure budget, tariffs, internal and external public debt, etc.) and to orientate the performance of the private sector by means of a series of instrumental policies.

c) Follow-up, evaluation and control of the operation of the programme

There is a third function that a macroeconomic model may efficiently discharge, which has to do with its instrumental capacity to evaluate and control the execution of the plan.

In general terms, it can be said that an economic programme constitutes a projection of desirable results for a set of variables which are representative of economic and social objectives, whose future attainment is conditioned by the occurrence of a series of data which are external to or not controllable by the economic authority, and by the occurrence of a series of specific actions undertaken by the authority on certain controllable variables. Thus, the deviation that may appear between the values of the programmed and the actual target-variables will be due to either unforeseen changes in external conditions or to failing to adopt certain programmed actions on the part of the executive government agencies.

A planning mechanism should necessarily carry out a follow-up to both magnitude orders. On the one hand, it should carry out an anticipatory follow-up and evaluation - forecasting - of the variables relevant to the external framework so as to duly correct by means of conjunctural adjustment policies the deviations that may appear, thus preserving the programmed course of the target variables.

On the other hand, the said mechanism should involve the permanent follow-up to the execution of the policies decided on by the administration.

Because of all this, the existence of a macroeconomic model permits to identify in a clear way which is the matrix of policy variables and parameters whose follow-up and study is essential for the effective control of execution. Besides, this model will permit the rapid evaluation of the foreseeable effects of changes on the internal policies, which originate either in bureaucratic delays or in changes demanded by the very evolution of the conjunctural situation.

In short, the macroeconomic model would thus be a facilitating instrument to follow the evolution of the plan, anticipate possible obstacles to its execution and to evaluate the effects of possible external or policy alterations.

2. MACROECONOMIC MODELS AS ANALYTICAL AND OPERATIONAL STRUCTURES

In order to perform the tasks listed in the preceding section, it is necessary to have a macroeconomic model of the country involved. This model must be a faithful representation of the structural characteristics of the economy, of the existing inter-relationships between sectors and, very particularly, of the way in which the main economic policy instruments and variables controlled by the public sector incide in the performance of the economy as a whole.

This model should necessarily be the result of the careful analysis of each economy in particular and of the framework of objectives and policies defined in each national development project. Therefore, each model applied necessarily has a specificity of its own which is hardly transferrable from one experience to another.

Despite all this, it is possible to define a conceptual macroeconomic framework on the basis of a general set of hypotheses on the operation of the economy. The following section will present the generic structure of the model put forward by the ILPES Research Programme to be applied to the countries of the Region. This model starts from some general premises derived from previous analyses carried out by ILPES, ECLAC and other national and regional agencies on the way in which the Latin American economies work.

a) General structure of the prototype model

The model proposed integrates the different sectors and areas of the economy into five basic blocs.

- i) Aggregate supply and demand
- ii) Public sector
- iii) External sector
- iv) Prices, salaries and money
- v) Sectorial product and employment

The characteristics of each bloc will be listed below. All the variables have been measured at constant prices save for the cases indicated.

i) Aggregate supply and demand
- Aggregate supply

Aggregate supply (QB) is defined in this model as the product of the full use of the installed capacity. Therefore, its behaviour depends on capital accumulation, i.e., on net annual investment (IN) and on the incremental product capital relation b_1 . In other words,

$$(1) \quad QB - QB_{-1} = b_1 IN$$

where sub-index (-1) represents the variable showing a 1-year lag. Alternatively,

equation (1) could be rewritten

$$(1a) \quad QB = a_1 + b_1 \sum_{i=1}^{t-1} IN_i$$

Net investment has been conventionally defined as gross investment (IB) minus the capital consumption allocation (CK), which is postulated to be linked to the level of the gross domestic product (PB). On the other hand, gross investment is ^{composed} by public investment (IG) and private investment (IP), the former being exogenous and the latter linked to the past growth of the product (accelerating effect) and to the growth of real credit, both domestic and external, received by the private sector (CR). This last formula assumes that the real interest rate is controlled by the monetary authority and that there is an institutional scheme for the distribution of the credit available. The preceding relations can be summed up like this:

$$(2) \quad IN = IB - CK$$

$$(3) \quad CK = a_3 + b_3 PB$$

$$(4) \quad IB = IG + IP$$

$$(5) \quad IG = \bar{IG}$$

$$(6) \quad IP = a_6 + b_6 (PB - PB_{-1}) + c_6 CR$$

- Aggregate demand and generation of income

Aggregate demand measured through the domestic product can be defined, in the first place, as the sum total of its components: private consumption (CP), public consumption (CG), gross investment (IB), stock variation (VE), exports (XT), minus imports (MT).

$$(7) \text{ PB} = \text{CP} + \text{CG} + \text{IB} + \text{VE} + \text{XT} - \text{MT}$$

Of these components it is certainly private consumption that represents the largest part, for which reason the specification of the consumption function should be particularly thorough. This model postulates that this variable depends on the available income and its distribution between wage-earning (SD) and non-wage earning available income (UD), and on the increase of real credit to the private sector. This is,

$$(8) \text{ CP} = a_g + b_g \text{ SD} + c_g \text{ UD} + d_g \text{ CR}$$

It is therefore necessary to specify the definitions of these two first variables; the former as the difference between total salaries and wages (SS), plus the transfers received from the government (TG), particularly, retirement and other pensions to dependants, minus the social security contributions of workers (PS). The latter (UD) can be defined as the difference between total capital gains and income (UK) minus direct taxes paid by the people (TD). It is assumed that direct taxing on wage-earners is negligible, i.e.,

$$(9) \text{ SD} = \text{SS} + \text{TG} - \text{PS}$$

$$(10) \text{ UD} = \text{UK} - \text{TD}$$

Now, the total mass of wages is defined as the product of the real average wage (SMR) and wage-earning employment (EA), which are determined in subsequent blocs:

$$(11) \text{ SS} = \text{SMR} \times \text{EA}$$

At the same time, total gains and income is defined as the gross domestic product, minus the following items: salaries and wages (SS), employers social

security contributions (PP), direct corporate taxation (TK), net profit of state-owned companies (UG), capital depreciation allocation (CK), indirect taxes (TI) and net income remitted abroad (UX) as profit on foreign investments and interests on the foreign debt; and plus interests on the public debt (ID) due to the fact that these are conventionally not included in the product, and plus subsidies (SU). That is to say,

$$(12) \quad UK = PB - SS - PP - TK - UG - CK - TI - UX + ID + SU$$

These entries are determined in subsequent blocs, as are public consumption (CG), exports and total imports.

Finally, it is necessary to specify that stock variation (VE) responds to factors similar to private investment.

$$(13) \quad VE = a_{13} + b_{13} (PB - PB_{-1}) + c_{13} CR$$

ii) Public sector

The public sector in this model includes only the income and expenditure of the general government, excluding state-owned companies save for the transfer of net profits.

As for total income (TT), this includes the sum total of indirect taxes (TI), direct corporate taxes (TK), direct personal taxes (TD), social security contributions of wage-earners (PS) and of companies (PP) net profits of state-owned companies (UG) and transfers received from abroad (TX). This is

$$(14) \quad TT = TI + TK + TD + PP + PS + UG + TX$$

Now for each of the tax variables considered a relation of dependence is postulated with respect to its respective tax base. In other terms,

$$(15) \quad TI = a_{15} + b_{15} \text{ PB}$$

$$(16) \quad TK = a_{16} + b_{16} \text{ UK}$$

$$(17) \quad TD = a_{17} + b_{17} \text{ UK}$$

$$(18) \quad PP = a_{18} + b_{18} \text{ SS}$$

$$(19) \quad PS = a_{19} + b_{19} \text{ SS}$$

As for the remaining two variables, these are exogenous since they are subjected to policy decisions.

$$(20) \quad UG = \overline{UG}$$

$$(21) \quad TX = \overline{TX}$$

As for expenditure, public consumption (CG), transfers to persons (TG) and subsidies, they are also exogenous.

$$(22) \quad CG = \overline{CG}$$

$$(23) \quad TG = \overline{TG}$$

$$(24) \quad SU = \overline{SU}$$

Current savings of the general government (AX) is defined as the difference between total income and current expenditure.

$$(25) \quad AG = TT - CG - SU - ID - TG$$

There only remains to determine the interests on the public debt (ID). These must needs be a proportion of the total accrued public debt at the end of the previous year (DP_{-1}).

$$(26) \quad ID = b_{26} DP_{-1}$$

We have now that the public debt increases annually in proportion to the total deficit of the general government (DG), according to the financing policy that has been adopted.

$$(27) \quad DP - DP_{-1} = b_{27} DG$$

Finally, the deficit equals the difference between current savings and spending on public investment.

$$(28) \quad DG = AG - IG$$

Equations (25) through (28) constitute a simplified model of the public debt, which serves to illustrate the explosive process undergone by public deficit in recent years. In fact, when a growing proportion of the deficit is financed through debt, the repayment of interests increases, which provides feedback for the magnitude of the deficit, and so on and so forth.

iii) External sector

In the external sector the model postulates performance relations both for exports and imports, on the general hypothesis that the country confronts given terms of trade in its foreign trade. It also includes a feedback mechanism that explains the foreign debt level and the payment of interests.

- Exports

Total exports in terms of volume (at constant prices) depend on the (exogenous) level of the gross product in the purchasing countries (\overline{QX}) and on the prices relation (RPX) between external and domestic prices in domestic currency. By adopting a logarithmic formulation, we shall have,

$$(29) \quad \text{Ln } XT = a_{29} + b_{29} \text{ Ln } \overline{QX} + c_{29} \text{ Ln } RPX$$

If E is the nominal exchange rate index, PX the index of exports prices expressed in foreign currency, PN the domestic prices index and b_{30} the average rate of subsidies to exports we shall have:

$$(30) \quad RPX = (1 + b_{30}) E \times PX/PN$$

In the same way, for total exports we shall have a similar function:

$$(31) \quad \text{Ln } MT = a_{31} + b_{31} \text{ Ln } PB + c_{31} \text{ Ln } RPI$$

If PI is the importation price index in foreign currency and b_{32} the average tariff,

$$(32) \quad RPI = (1 + b_{32}) E \times PI/PN$$

We must point out that it is possible to develop disaggregated functions both for exports and imports. In the former it is possible to have a breakdown of different products or exports fields; in the latter, it is possible to disaggregate into categories of imported goods (consumer, raw materials, energy, capital goods, etc.).

The balance of payments balance on current account (AX) equals:

$$(33) \quad AX = XT - MT - UX$$

Now, in the case of UX, the remittances of profits and interests sent abroad depends, under existing circumstances, on the total foreign debt (DX) accrued at the end of the previous year,

$$(34) \quad UX = b_{34} DX_{-1}$$

The increase in the debt is equivalent to a proportion of the (negative) balance on current account, which is financed by means of new indebtedness.

$$(35) \quad DX - DX_{-1} = -b_{35} AX$$

Equations (33) through (35) also constitute a mechanism that explains the feedback of the interests on the debt in the external deficit, and vice-versa. Naturally, if the country has renegotiated its debt, equation (34) would have to be reformulated, to account for either a quantitative limitation to the amount of UX, or a recalculation of DX, depending on the rescheduling of maturities.

iv) Prices, salaries and money

Owing to the necessary links that should exist between the medium and the short term, the model has considered this bloc that links the mechanisms for the formation of the level of prices with the real and monetary variables of the economy.

With regard to the domestic prices level PN, the model differentiates between agricultural/livestock farming prices (PA) and industrial or manufactures prices (PM), which generate the general level, with certain weightings b_{36} and $(1 - b_{36})$,

$$(36) \quad \ln PN = b_{36} \ln PA + (1 - b_{36}) \ln PM$$

With respect to agricultural/livestock farming prices, the model postulates that their variation, in real terms depends on the level of the agricultural/livestock farming product (PF_1). Stated otherwise,

$$(37) \quad \ln PA = \ln PN + b_{37} \ln PF_1$$

In turn, industrial prices behave according to an equation of wages (PT) and imported costs (PIN), with a variable profit margin, which depends on the degree of use of the installed capacity (GR),

$$(38) \quad \text{Ln PM} = b_{38} \text{ Ln PT} + c_{38} \text{ Ln PIN} + d_{38} \text{ Ln GR}$$

$$(39) \quad \text{Ln PIN} = \text{Ln}(1 + b_{32}) + \text{Ln E} + \text{Ln PI}$$

$$= \text{Ln PN} + \text{Ln RPI}$$

And also,

$$(40) \quad \text{GR} = (\text{QB} - \text{PB}) / \text{QB}$$

The cost of wages depends on the evolution of the nominal average wages index (ISN) and on the index of product per worker (IQT),

$$(41) \quad \text{Ln PT} = \text{Ln ISN} - \text{Ln IQT}$$

The variation in the index of nominal wages responds to a mechanism for the adjustment of wages according to the inflation of the previous year, measured by the consumer price index (PC),

$$(42) \quad \text{Ln ISN} = b_{42} \text{ Ln PC}$$

where b_{42} is a parameter that measures the relative strength of trade unions.

The index of product per worker is defined as

$$(43) \quad \text{Ln IQT} = \text{Ln QB} - \text{Ln EA}$$

where EA is wage-earning employment.

To link this bloc with that of aggregate demand it is necessary to define the

real average index (ISR),

$$(44) \quad \ln \text{ISR} = \ln \text{ISN} - \ln \text{PC}$$

Besides

$$(45) \quad \text{SMR} - \text{SMR}_{-1} = \text{ISR} - \text{ISR}_{-1}$$

To the relations above it is necessary to add the exogenous definition of the prices of exports and imports in foreign currency and of the real rate of exchange (ER).

$$(46) \quad \text{PX} = \bar{\text{PX}}$$

$$(47) \quad \text{PI} = \bar{\text{PI}}$$

$$(48) \quad \text{ER} = \bar{\text{ER}}$$

Alternatively, as discussed in the last section, the real rate of exchange may become endogenous if there are restrictions to the maximum level of foreign indebtedness.

To close the prices bloc and link it with the functions of real spending on consumption and investment, it is necessary to add the monetary sector equations.

On the money supply (OM) side, its increase is due to variations in international reserves, in domestic currency (RI) and to variations in the internal Central Bank credit, given a multiplier \underline{k} . This is,

$$(49) \quad \text{OM} - \text{OM}_{-1} = \underline{k} (\text{RI} - \text{RI}_{-1}) - \text{CI}$$

The variation in reserves is partly explained by the balance of payments on

capital account (DK) expressed in national currency and by the balance on current account, also expressed in domestic currency,

$$(50) \quad RI - RI_{-1} = E \times DK + PN \times AX$$

where the net capital inflow is partly exogenous and partly induced by AX,

$$(51) \quad DK = a_{51} + b_{51} AX$$

As for the variation in internal credit, this may be directed to the private sector (CIP) or to the public sector (CIG)

$$(52) \quad CI = CIP + CIG$$

Private internal credit plus a proportion of the net capital inflow (DK) constitutes the total real credit received by the private sector (CR),

$$(53) \quad CR = (CIP + b_{53} E \times DK) / PN$$

Public internal credit plus the complementary proportion $(1 - b_{53})$ of DK finances the deficit of the general government, assuming that it does not resort to internal indebtedness,

$$(54) \quad DF = CIG + (1 - b_{54}) E \times DK$$

In turn, DF equals the algebraic sum of savings and public investment,

$$(55) \quad DF = AG + IG$$

The model is closed with the specification of a money demand function (DM)

$$(56) \quad \ln DM = a_{56} + b_{56} \ln PB + c_{56} \ln PN$$

assuming a fixed interest rate and, also, a money demand equal to the money

supply and defining the nominal rate of exchange (E)

$$(57) \quad OM = DM$$

$$(58) \quad E = ER \times PN$$

In short, when it is thus formulated this bloc posits a mechanism that assumes a passive monetary policy. The expansion of the amount of money is determined by the growth of the product and by the inflation rate determined by costs pressures. Given the external balance on current account, the variation of reserves and, consequently, the external determinant of monetary expansion is determined. The remaining adjustment variable is expansion of internal credit, which will in turn regulate the expansion of private or public spending according to the fiscal and tax policy.

Alternatively, the model may consider an active monetary policy, fixing in advance the expansion of the money supply. In this case, some of the variables of income distribution (such as nominal wages), real spending, or prices level should be adjusted.

v) Sectorial product and employment

- Sectorial products

The sectorial product must be seen from the point of view of demand and supply. This model considers sectorial demand functions starting with aggregate demand, as seen in the first bloc. Consequently, the model determines the growth targets to be met by sectorial production to satisfy the demand forecast. The fact that supply may or may not expand accordingly can be the object of detailed sectorial studies or of specification of supply functions, neither of which have so far been dealt with by this methodology.

A second point has to do with the sectorial disaggregation adopted. This will have to correspond to the real productive structure of the country involved, where one or more products may be very significant. The model has simply adopted the sectorial classification into ten branches of activity of the national accounts. Thus, in the first place, the gross domestic product at factor cost (PF) will be equal to the sum of the sectorial products:

$$(59) \quad PF = \sum_{i=1}^{10} PF_i$$

where subindex i represents each sector as follows: 1, Agriculture; 2, Manufacturing, industry; 3, Power, gas and water; 4, Construction; 5, Commerce; 6, Transport and Storage; 7, Communications; 8, Banks and insurance; 9, Real estate; 10, General Government services.

Demand for farm products is postulated as being a function of private consumption and exports to capture the effects derived from the expansion of the domestic and external market.

$$(60) \quad \ln PF_1 = a_{60} + b_{60} \ln Cp + c_{60} \ln XT$$

Demand for industrial products will be partly explained by the expansion of consumption, gross investment and exports,

$$(61) \quad \ln PF_2 = a_{61} + b_{61} \ln CP + c_{61} \ln IB + d_{60} \ln XT$$

In turn, the construction product will depend on gross investment,

$$(62) \quad \ln PF_3 = a_{62} + b_{62} \ln IB$$

For the remaining sectors, save for the last one, the sectorial product will

be a function of the gross product.

$$(63 \text{ to } 68) \quad \text{LN PF}_i = a_{63+i-3} + b_{63+i-3} \text{ LN PB} \quad (i = 4, \dots, 9)$$

Finally, the product of the general government is a function of the general government consumption,

$$(69) \quad \text{LN PF}_{10} = a_{69} + b_{69} \text{ LN CG}$$

The demands of all the sectors have thus been determined. There only remains to verify the coherence between their aggregation and the total gross product. It is necessary to check that

$$\text{PF} = \text{PB} - \text{TI} + \text{SU}$$

Failure to reach this equivalence will indicate that the sectorial products should be re-estimated and the difference adjusted.

- Employment

Here the model aims at determining the generation of employment, both wage-earning (EA) and non-wage earning (EN), which results from the growth of production and the evolution of investment in order to compare it with the economically active population (PEA) to determine the unemployment rate (DES) that would be produced.

The wage-earning employment generated in each sector becomes a function of sectorial gross product. Besides, in the construction sector gross investment is also considered as determinant in order to capture the employment associated to infrastructure, housing and facilities. In other words, for all the sectors except the fourth one we shall have,

$$(70 \text{ to } 78) \quad \ln EA_i = a_{70+i} + b_{70+i} \ln PB_i \quad (i = 1, \dots, 10; \neq 4)$$

In the case of construction ($i = 4$),

$$(79) \quad \ln EA_4 = a_{79} + b_{79} \ln PB_4 + c_{79} IB$$

Therefore, total wage-earning employment will be

$$(80) \quad EA = \sum_{i=1}^{10} EA_i$$

Non-wage earning employment becomes a function of wage-earning employment,

$$(81) \quad EN = a_{81} + b_{81} EA$$

Considering total employment (ET) and the economically active population (PEA) as an exogenous variable we have,

$$(82) \quad ET = EA + EN$$

$$(83) \quad PEA = \overline{PEA}$$

$$(84) \quad DES = (PEA - ET) / PEA$$

vi) Closing the model

To sum up, the model comprises 84 equations and 84 variables, both exogenous and endogenous. The following variables have been defined as exogenous:

- External sector

PX, prices of exports (in dollars)

PM, prices of imports (in dollars)

QX, external product (not included in the previous count)

ER, real rate of exchange

- Public sector
 - CG, public consumption
 - IG, public investment
 - UG, profits of state-owned enterprises
 - TG, transfers to persons
 - TX, transfers to other countries
 - SU, subsidies

- Employment and income
 - PEA, economically active population

The model determines the remaining 74 equations.

Naturally, the model may be closed with alternative policy schemes. For example, the growth rate of the product could be fixed in advance, in which case some of the exogenous variables listed above should become endogenous, for example, public investment or real exchange rate.

Alternatively, the model could be closed considering an external restriction with respect to the external balance AX. The consequence would be to endogenize the level of the product, the real exchange rate, some other variable or a combination of variables.

A third possibility would be to predetermine the money supply, which would also make it necessary to endogenize some of the variables considered as exogenous.

In short, the model has multiple potential uses to evaluate the effects of alternative policy schemes, with an adequate and coherent definition of the variables considered as exogenous in the simulations. It is necessary to mention that exogenization may also reach the parameters of some equations as, for example,

the coefficients of the taxation functions.

3. A BRIEF OUTLINE OF THE ESTIMATION AND UTILIZATION PROCEDURES OF THE MODELS

a) The necessary statistical and hardware base

The prototype model described in the preceding section can be estimated using the statistical base which is usually available in the countries. For this, the following data are necessary:

- i) National Accounts at constant prices.
- ii) Balance of payments, disaggregating exports according to origin and imports according to destination, with the corresponding unit value indices of exports and imports.
- iii) Series of prices by branch and salaries.
- iv) Sectorial employment and economically active population.
- v) Money supply statistics.

As can be seen, these data are generally available so, in this sense, there are no constraints.

As for hardware requirements, this model may be estimated using a 320 K capacity microcomputer with the suitable software for regression analysis (micro-TSP) and for the simultaneous solving of equations (Lotus, Symphony).

b) Outline of recent ILPES experience in this matter

During the 1984-1985 period, ILPES has carried out the following research and consultancy actions:

i) Paraguay

On the request of the Technical Planning Secretariat, a macroeconomic

model was constructed to prepare the projections of the National Development Plan, 1985-1989. At present, the work is being extended with the preparation of a short term model, which is linked to the former, for the analysis and simulation of alternative policies and as the basis for the preparation of an annual operative plan.

ii) Uruguay

In this country, jointly with the Planning and Budget Office (OPP), a macroeconomic model has been formulated and estimated. The aim of this model is to evaluate the coherence of a series of preliminary definitions and development targets and policies in order to prepare the Governmental Action Programme (PAG), 1985-1989. The model has permitted to prepare a coherent series of projections, which reflect the main real and financial variables of the country under several alternative scenarios. In a second stage, a more detailed short term model will be prepared, to reflect the dynamics of inflation in an adequate way.

iii) Venezuela

In a joint effort with CORDIPLAN, the construction of a macroeconomic model has begun. Its main purpose is to analyze the effects of a series of development policies tending to reduce the strong oil dependence of the Venezuelan economy.

This initiative will lead to the preparation of a model with the capacity to coordinate policies in the short term and to prepare the annual operative programmes to orientate the activities of the Venezuelan public sector.

iv) Honduras

This year ILPES assisted CONSUPLANE in the preparation of a global

planning model for the country. The model has been formulated and used as an instrument for the analysis of alternative scenarios to define the development strategy of each country. It has also been used in the analysis of short term problems.

v) Costa Rica

In this country ILPES also carried out a technical assistance mission which was directed to formulate a medium term macroeconomic model in order to prepare a series of projections of the economy.