A MODEL OF INCOME DISTRIBUTION DETERMINATION IN YUGOSLAVIA\textsuperscript{1/}

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INTRODUCTION

During the past two decades the planners of development strategies in less developed economies focused their energies on designing policies to foster higher rates of growth of total output. Implicit in this policy orientation was the belief that higher growth rates would bring the benefits of economic development to all segments of the population. As long as this presumption prevailed, questions about the effects of a given development policy on the relative distribution of economic rewards among different social, economic or political groups were left unasked. Increasingly, however, the available evidence suggests that rapid growth does not improve the economic position of all societal groups. On the contrary, it appears that as economic growth progresses, the poorer strata in most societies lose ground in absolute as well as in relative terms. 1

Because it can therefore no longer be assumed that growth benefits all groups, a careful study of the effects of competing policies upon the distribution of income has become necessary in order to provide planners with the information needed to make the ultimate political decisions about which groups will be favored by development programs. The model presented in this paper represents a first attempt to provide a sufficiently detailed and realistic theoretical framework within which such an empirical study can be undertaken. The model is specifically designed to serve as a microeconomic structure which can be used to examine the implications of different strategies for growth and economic change on the distribution of income in Yugoslavia. In this sense the model is intended to provide social scientists with a substitute for the physical scientist's laboratory which can be used to test the effects of different economic policies on the distribution of income. By design, the model focuses solely on short run economic policies, defined rather loosely as those policies which do not involve substantial pressure on the underlying fabric of society. In other words, the model is not equipped to answer questions about the consequences of large-scale political or social revolutions in the field of government, education or economic structure. Rather, the model attempts to answer questions about the extent to which non-revolutionary, short-run economic policy instruments can influence the distribution of economic rewards in a stable, political environment.
I. THE STRUCTURE OF THE MODEL

In the short run the distribution of income in any economy is the byproduct of all of its production and consumption activities. Therefore, an adequate modelling of the forces impinging on income distribution requires that all such activities are accounted for in a mutually consistent and mutually interactive way. In order to achieve this modelling structure, one must examine the production and consumption decisions of individual economic actors, so that the motivations, incentives and reactions underlying each economic activity are clearly brought into focus. In keeping with this goal, the model presented here is a microeconomic model which describes the behavior of producers, of consumers, and of the government, and analyzes how the decisions of each interact to determine the distribution of income among households. In this sense, the model is in the tradition of applied microeconomic, general equilibrium models first empirically estimated in 1960 by L. Johansen. The model can also be thought of as an extension of dynamic non-optimizing planning models, and can be used in planning and in the study of the effects of economic policies on variables other than the distribution of income.

The model diverges from most of its predecessors, however, in its explicit recognition of rigidities and market imperfections. In Yugoslavia, the most significant of these imperfections include: differences in the prices of capital and labor inputs between economic regions, sectors of production, and individual enterprises; price controls or other price rigidities which hinder the free response of prices to changing supply and demand conditions; barriers preventing the free movement of labor across skills, sectors and regions of production; and rigidities in employment levels and wage rates attributable to the effects of workers' control over enterprise employment and wage policies. A traditional Walrasian general equilibrium model is unable to capture the effects of market distortions and is, therefore, unable to provide a reasonable approximation to Yugoslav economic reality. What is required for realism is a theoretical description which incorporates these distortions and allows for the adjustment of production and prices towards their equilibrium positions without the necessary attainment of full equilibrium from period to period. The model presented here is therefore neither a pure neoclassical general equilibrium model nor a pure disequilibrium or partial equilibrium model.
II. STAGES OF THE MODEL: STAGE I

The model developed here is divided into three main stages, each of which characterizes a different type of economic activity and decision-making. The workings of the entire model are exhibited in Diagrams I to IV. Stage I models the process by which credit supply and demand decisions are made and the process by which monetary policy is formulated. It is this stage which determines the injection of credit into the economy in nominal terms. Stage II describes the product supply and demand decisions for each factor and product market and lays out the patterns of adjustment whereby output levels and prices for each of these markets are determined. In Stage II, the injection of credit from Stage I is fixed and directly influences the absolute level of prices, the composition of real output, and the distribution of income. Thus, the structure of the model reflects some of the processes whereby credit creation and the inflationary or deflationary pressures which it fosters effect the flow of income to different segments of the population. Stage III serves to update the parameter values and expectations and to select the policy regimes on which the Stage I and Stage II models are based.

The Stage I model is essentially a model of the market for loanable funds. The demand for loanable funds is assumed to arise from enterprise plans for capital investment and growth. Producers in each sector are assumed to formulate their investment plans based on their projections of sales and profitability. Each firm is assumed to start with an expected output target, an expected selling price and a set of expected intermediate and final input costs. The firm then plans to hire fixed capital so as to maximize its objective function. The planned investment gives rise to demand for loanable funds to finance the firm's investment program. This demand is a demand for the money which the firm desires to spend on its intended purchases of capital equipment.

Loanable funds from all sources are assumed to flow through two major channels of intermediation: the banking system and the federal and regional government lending agencies. To reflect the regional segmentation of capital markets in Yugoslavia, the aggregate supply of loanable funds is divided into regional supplies, and a set of rules is specified to allow loanable funds to move among regions.
Figure I. STAGE I: ALLOCATION OF INVESTMENT BY SECTOR OF PRODUCTION WITHIN EACH REGION

- **expected wage structure** (or minimum wages where applicable)
- **expected product prices**
- **expected outputs**
- **expected cost of capital by sector and region**

**profit or objective function maximization**

**demand for investment in fixed capital and hence demand for loanable funds**

**clearing of loanable funds market (rationing or cost of capital changes)**

**total supply of loanable funds or average cost of borrowing**

- **previously accumulated retained earnings by firms**
- **borrowing constraints by firms**

**allocation of investment funds to firms**
FIGURE II. STAGE II: DETERMINATION OF WAGES EMPLOYMENT, PRICES, AND PROFITS NATIONAL GOODS

calculation of capital stocks by region and sector

production functions by region and sector

minimum output constraints

profit maximization or objective function maximization

product supply equations

traded good? yes

regional factor demand equations

labor market clearing for each market

labor employment constraints

minimum wage constraints

nature of traded good

protected import substitute commodity

subsidized export commodity

unsubsidized export commodity

region labor supply functions

calculation of wages and employment by skill categories, sectors, and regions

prices determined by market clearing

prices determined by market clearing: tariffs or subsidize a residual

prices determined by world prices: trade a residual

calculation of product prices and profits for firms

product demand equations (see Figure 3)

material balance equations
Figure III. STAGE II: DETERMINATION OF WAGES, EMPLOYMENT, PRICES AND PROFITS
REGIONAL GOODS

- Reservation price
- Calculation of product prices, inventories, and profits by firm
  - Prices determined by market clearing
  - Material balance equations
- Production function by sector
- Calculation of capital stock by sector
- Profit maximization or objective function maximization
  - Factor demand equations
  - Labor market clearing for each labor market
- Labor employment constraints
- Minimum wage constraints

- Minimum output constraints
- Product supply equations
FIGURES I-IV

A standard notation has been used for all the Figures:

- Variables whose values are specified or calculated.
- Calculations. A set of equations.
- Economic principle governing subsequent calculations.
- A branching point.

→ Arrows indicate the direction of flow of information.
Equilibrium between supply and demand in each regional market is achieved in one of two ways. In one variant of the model, the absolute cost of new capital is specified, for each production sector and region, and firms are permitted to borrow the funds they desire at this price subject to existing foreign exchange availabilities. Under this variant the volume of funds created by the financial sector and the forced savings resulting therefrom will be whatever is needed to satisfy the total demand for loanable funds. In the second variant of the model a fixed supply of loanable funds is specified for each regional market and equilibrium is attained either by varying the cost of borrowing or by defining a detailed set of non-price rationing rules to allocate scarce credit among competing users. (The rigidity of borrowing costs in Yugoslavia suggests that non-price rationing is probably the more realistic assumption.) In this variant, any region with an excess supply of loanable funds is permitted to lend to borrowers in other regions at an interest rate which exceeds the rate charged to borrowers within its own region.

The Stage I model allocates loanable funds among sectors and regions and determines the overall injection of credit into the economy. These are taken as constant in the Stage II or general equilibrium part of the model. Thus, once each firm has made its investment plans and contracted the borrowing commitments for finance of this plan, it cannot change its nominal investment expenditures. The firm's purchases of capital equipment in Stage II will depend solely on the prices of capital goods. Thus, the model explicitly formalizes a view of the investment process whereby investment decisions are made on the basis of expectations, and such decisions lead to actual expenditures and financial commitments which cannot be changed even when these expectations are not realized.

III. STAGE II

Stage II describes the microeconomic structure of the Yugoslav economy and sets up the conditions of supply and demand and the mechanisms of price determination in each individual product and factor market. Three types of
economic agents--enterprises, households, and government organizations--are identified and models of their role in each product and factor market are examined.

1. The Production Sector: Technical Relationships

The model distinguishes nineteen categories of production, seventeen of which fall into what the Yugoslavs refer to as the "social sector" and the remaining two (private agriculture and private crafts) which fall into the private sector. The social sector includes all production activity carried on by self-managed enterprises, the capital assets of which are "socially" owned by the state; the private sector includes all activity carried on in privately owned production units. Because private sector activity has been limited by various laws restricting the size of private establishments and private sector employment, private producers supply a significant share of total output in only two sectors: agriculture, where they account for approximately 73 percent of total production, and crafts and services, where they account for approximately 64 percent of total production. Social and private activity are distinguished in the model because both the behavioral rules and the technical relationships characterizing production differ sharply between them. For each sector of production distinct sets of technical production relationships are also identified for each region where production occurs. The model thus formulates unique factor employment and product supply conditions for individual production units according to three criteria: type of output; region of operation; and nature of ownership of productive assets.

The technical relationships underlying primary factor employment decisions and the flow of intermediate inputs require detailed information about sectoral production functions and inter-industry flows of goods and services. The main sources of such information are the 1968 input-output tables for Yugoslavia. These tables are used in conjunction with a study of production conditions in each social sector and each republic in 1969 and 1970, to yield a set of regional output and input levels and a set of regional input-output coefficients for each production unit in the social sector. Regional output and input levels and regional input-output coefficients for private agriculture and private crafts are derived from the national input-output tables and from a study of production conditions on individual household farms.
in different regions in 1969. By combining these three data sources, output levels and primary and intermediate factor usage on a national level are broken down into output levels and primary and intermediate factor usage on a regional level. The data thus obtained are used to estimate production functions for each type of productive unit. Such production functions show the relationships between levels of output and the two primary factors of production, labor and capital. Most of the production functions are of the Cobb-Douglas variety. In those sectors where the Cobb-Douglas assumption appears too restrictive, other production function forms are being experimented with.

The use of production functions in which only labor and capital appear as inputs rests on the assumption of zero substitutability among all intermediate inputs in the production process. Thus, while the capital-labor ratio may vary with the prevailing wage-rental ratio, once the optimal level of output is chosen, all intermediate inputs are directly determined by the fixed coefficients of production in the relevant input-output table.

Associated with each production function is the concept of a net price, defined to be the net revenue or the value-added received by the producer per unit of output. The net price is calculated as the difference between the price per unit of output and the sum of intermediate input costs and indirect taxes per unit of output. It is this price which guides the producer in determining optimal production decisions and optimal factor employment decisions.

By assumption, each production unit within a given sector produces a single homogeneous commodity which is sold in a single market. However, two types of markets are distinguished: regional markets, where equilibrium requires the balancing of regional supply and regional demand; and national markets, where equilibrium requires the balancing of national supply and national demand. The aggregate supply of a national good is defined as the sum of outputs in each region. By definition, the price of a national good does not differ between regional markets. In contrast, the price of a regional good can differ widely across the regional markets where it is sold. The national and regional input-output tables and some knowledge about the structure of transport and trade margins are used to distinguish those products whose price differentials are consistent with national competition from those whose price differentials indicate the regional segmentation of markets.
The technical relationships characterizing production in the model are summarized by the following equations:

(a) **Production Functions** \(X_{iR} = A_{iR} K_{iR}^{\alpha_{iR}} L_{iR}^{\eta_{iR}}\)

where \(i\) refers to commodity \(i\) or the output of the \(i\)th production sector;

\(R\) refers to region \(R\);

\(\lambda\) refers to skill category of labor \(\lambda\);

\(A_{iR}\) is a parameter measuring exogenous technical change;

\(L_{iR\lambda}\) is labor of skill type \(\lambda\) employed by sector \(i\) in region \(R\);

\(K_{iR}\) is the fixed capital stock in sector \(i\), region \(R\); and

\(X_{iR}\) is the level of output in sector \(i\), region \(R\).

(b) **Net Price** \(P_{iR}^{*} = P_{iR}^{*} - \sum_{j} A_{jR} P_{iR}^{*} - \sum_{j} S_{jR} P_{iR}^{*} - \sum_{i} f g_{i} P_{iR}^{*} - \sum_{i} R \theta_{i} P_{iR}^{*}\)

where \(P_{iR}^{*}\) is the price of good \(i\) in region \(R\), \(P_{i}\) is the price of good \(i\) on the national market, and \(P_{iR}^{*}\) for national goods;

\(A_{jR}\) is a set of input-output coefficients characterizing production of good \(j\) in region \(R\);

\(u_{iR}\) is the non-competitive import coefficient for sector \(i\) in Region \(R\) measured in dollars per unit of output and \(g_{i}\) is the exchange rate;

\(f_{i}\) is the federal turnover tax rate net of subsidies in sector \(i\);

\(R \theta_{i}\) is the republican turnover tax rate net of subsidies in sector \(i\).

(c) **National Supply** \(X_{i} = \sum_{R} X_{iR}\)

2. The Production Sector: Behavioral Assumptions

To analyze the process whereby supply is determined, one must go behind the technical relationships of equations (a) through (c) to examine the behavioral rules guiding enterprise product and employment decisions. The principal behavioral rule adopted in the model is one of enterprise maximization of an objective function. The form of the objective function is allowed to vary between the social and private sectors to reflect differences in organizational and ownership patterns of these sectors.
A. Social Sector Production

By Yugoslav law all enterprises in the social sector are required to elect management groups composed of workers employed in the production process. In principle the workers elected represent all the workers in the enterprise and each policy decision therefore reflects the democratic consensus of all enterprise members. In practice, white collar workers appear to have a share of the voting power in the various management bodies which is disproportionate with their share in the total labor force. Moreover, a number of case studies of Yugoslav enterprises have revealed a sharp split between blue collar and white collar interests within the bodies of self-management. In general blue collar workers appear to be concerned with traditional worker issues, such as net income or wage policy, vocational training, hours, fringe benefits, and hiring and firing practices; in contrast, white collar workers apparently take on a managerial attitude focusing on long range business policy issues, such as investment projects, mergers, product development, and prices.

In keeping with this dichotomy the model distinguishes an objective function for workers and an objective function for managers. For managers the model makes the assumption of profit maximization, where profits are defined net of current wages paid to all firm employees. The behavioral rule guiding worker groups is more difficult to specify, since worker interests focus on a variety of issues, such as general working conditions, job security and personal incomes. The model limits its attention to two of these issues: job tenure and wage policy. With respect to job security it is assumed that a certain share of each labor category consists of "permanent" workers who cannot be laid off except at their request or with their consent. It is further assumed that permanent blue collar workers—that is, blue collar workers whose job security is guaranteed at least in the short run by the traditions and laws guiding enterprise layoff policy—maximize a weighted sum of their current wage bill and their share in net profits.

The objective functions for the managerial group and the worker group within each enterprise can be formally expressed as:

\[
V_{IR}^m = P^* \beta_{IR}^L \gamma_{IR}^L - \sum_\lambda w_{IRL}^L \gamma_{IRL}^L - w_{IRK}^K \gamma_{IRK}^K = \pi_{IR}
\]
where $V_{iR}^m$ is the managerial objective function in sector $i$, region $R$;

$\pi_{iR}$ is accounting profits in sector $i$, region $R$;

$W_{iR\lambda}$ is the gross wage paid to labor of skill type $\lambda$ in sector $i$, region $R$;

$W_{iRk}$ is the cost of a unit of capital in sector $i$, region $R$.

\[(e) \quad V_{iR\lambda}^w = \beta_{i\lambda} \pi_{iR} + (1 - \beta_{i\lambda}) (W_{iR\lambda} \rho_{iR\lambda} L_{iR\lambda})\]

where $V_{iR\lambda}^w$ is the objective function for worker group of skill $\lambda$ in sector $i$, region $R$;

$\rho_{iR\lambda}$ is the percentage of labor class $\lambda$ that is permanent in sector $i$, region $R$; and

$\beta_{i\lambda}$ is the weight workers of skill type $\lambda$ place on profit shares in their objective function.

Aggregating across worker classes the total objective function for the worker groups is defined as:

\[(f) \quad V_{iR}^w = \sum_{\lambda} V_{iR\lambda}^w = \sum_{\lambda} (\beta_{i\lambda} \pi_{iR} + \sum_{\lambda} [(1 - \beta_{i\lambda}) (W_{iR\lambda} \rho_{iR\lambda} L_{iR\lambda})])\]

Taking a weighted average of the objective functions of the managerial and worker groups, we can express the objective function of the enterprise in the following way:

\[(g) \quad V_{iR} = \phi_{iR} \pi_{iR} + (1 - \phi_{iR}) (\sum_{\lambda} W_{iR\lambda} \rho_{iR\lambda} L_{iR\lambda})\]

This form of the objective function allows us to parameterize on the relative weights accorded to the objective functions of the individual groups and to examine the implications of different parameter choices on supply and employment decisions within the production sector and on the distribution of income in the economy.

The objective functions discussed here identify categories of permanent workers who cannot be laid off over short periods of time except with their consent. The existence of permanent workers is reflected in minimum labor employment constraints for each category of labor. The labor employment constraints take the following form:

\[(h) \quad L_{iR\lambda} \geq C_{iR\lambda}\]
where \( \bar{C}_{i\lambda} = (1 - f_{i\lambda}) \left( \phi_{i\lambda} L_{i\lambda} \right) t - 1 \)

and \( f_{i\lambda} \) is the percentage of the permanent labor force of skill type \( \lambda \) which leaves voluntarily during a production period.

These constraints reflect the fact that in the short run the number of workers employed by a social sector enterprise cannot be reduced by more than the number of workers who leave the firm voluntarily either because of old age, sickness, or alternative employment opportunities.

The labor employment constraints and the fact that the aggregate capital stock available to each firm is fixed in Stage II imply that during a given production period each social sector enterprise faces a minimum output constraint. Minimum output is defined as the volume of output producible with the available capital stock and the minimum labor force. Given this output constraint the supply decision of each social sector firm can be written as:

\[
(i) \quad x_{iR}^* = \max \left\{ x_{iR} \mid \text{which maximizes the objective function at current prices and factor prices} \right\}
\]

\[
\bar{Q}_{iR} = a_{iR} R_{iR}^2 Q_{iR} = \bar{C}_{iR} \bar{K}_{iR}
\]

Operation at minimum output levels directly influences the profitability of enterprise operations. To see this, define accounting profits at the minimum level of output as:

\[
(j) \quad \pi_{iR} = p_{iR}^* \bar{Q}_{iR} - \sum_{\lambda} \bar{w}_{iR\lambda} \bar{C}_{iR\lambda} - \sum_{k} \bar{w}_{iRk} \bar{K}_{iRk}
\]

Because \( \bar{Q}_{iR}, \bar{w}_{iR\lambda}, \bar{C}_{iR\lambda}, \bar{w}_{iRk}, \) and \( \bar{K}_{iR} \) are all constants during the production period, this equation can be solved for the output price which just yields zero accounting profits. This price, called the net reservation price, can be expressed as:

\[
(k) \quad (p_{iR}^*)^R = \frac{\sum_{\lambda} \bar{w}_{iR\lambda} \bar{C}_{iR\lambda}}{\bar{Q}_{iR}} + \frac{\bar{w}_{iRk} \bar{K}_{iR}}{\bar{Q}_{iR}}
\]

It gives rise to a market reservation price of the form:

\[
(l) \quad (p_{iR})^R = (p_{iR}^*)^R + \sum_{j} a_{j1} R_{jR} + \frac{F}{P} u_{iR} + \sum_{i} f_i (p_{iR})^R + \sigma_i^R (p_{iR})^R
\]

According to (l), the market reservation price is that price which the firm must charge in order to avoid operating with an accounting loss.
Whether a firm will be able to charge the market reservation price whenever it is constrained to produce at its minimum output level depends on the characteristics of the market in which it sells its products. If that market is competitive, then an individual firm cannot set its price without running the risk of pricing itself out of the market. Under these conditions, the market price of enterprise output will be determined by the prevailing conditions of market supply and market demand. If the resulting price falls short of the reservation price, then an enterprise operating at its minimum output level will run with an accounting loss of the following magnitude:

\[(m) \quad A_{1R} = Q_{1R} \left[ P_{1R}^* R - (P_{1R}^*) \right] \]

On the other hand, if the enterprise is the sole or major producer of a commodity, at least within the confines of the market in which it sells, then it may be able to set the prevailing market price. In this case, the enterprise can avoid an accounting loss whenever it is constrained to produce at minimum factor employment levels by charging the reservation price required to yield zero accounting profits at those levels.

However, the firm will still have an excess of total current period expenditures over total sales receipts since production costs at the minimum output level will exceed current period revenues from sales. The counterpart to this imbalance is the reduction of enterprise cash balances required to finance unplanned inventory accumulation just equal in value to the difference between minimum output and total market demand generated at the reservation market price.\(^\text{11}\)

3. Private Sector Production

The model assumes that private sector producers in agriculture and crafts act to maximize total profits exclusive of total payments to labor and capital. The objective functions characterizing private sector production take the following form:

\[(n) \quad V_{pR} = P_{pR}^* X_{pR} - \sum w_{pR \lambda} L_{pR \lambda} - w_{pR K} K_{pR} - \pi_{pR} \]

where the subscript \(p\) refers to private sectors of production. With Cobb Douglas technology, the maximization of profits in the private agriculture sector is equivalent to the maximization of household net income defined to include returns to labor. Because of the custom of family employment and family production in private agriculture, the maximization of household net income is probably the more appropriate behavioral rule.
3. **The Markets for Primary Inputs**

Output decisions by firms lead to derived demands for labor and capital inputs. In order to understand the process whereby these demands are satisfied, one must examine the workings of the labor and capital markets.

The workings of the capital market are straightforward: Stage I describes how firms form investment plans and contract for loanable funds. Stage II translates each firm's given nominal amount of investment finance into actual acquisitions of individual types of capital goods. The capital coefficients matrix calculated from the 1968 input-output table for Yugoslavia is used to break down a unit of capital equipment in each sector into its constituent parts. In this way general investment demand in each sector of production is translated into demands for different types of output, and such demands enter into the final supply-demand balance equation for each product market.

The workings of the labor market are described by a series of equations determining supply and demand for each category of labor skills. Since the Yugoslav labor market is segmented along republican or regional lines, the model postulates individual labor supply functions for each republic. These functions are defined to include the net volume of migrants flowing into a region during each production period. During a given production period, the supply of labor of each type is assumed to be constant; however, from period to period, the individual components of the labor supply are allowed to adjust in response to changing wage conditions. Finally, to model the dichotomy between the social and private sectors, separate labor supply functions are defined for each.

Labor demand equations are obtained from the relevant maximizing conditions implied by the objective functions. These equations can be combined with the labor supply equations in each region to yield equilibrium conditions for both social and private sector labor markets.

The model assumes that wages in the private sector are determined so as to equate labor supply and labor demand. A more complicated wage formation model is adopted for the social sector labor markets to reflect the fact that workers in self-managed enterprises set nominal wage levels
in advance of each production period and try to maintain these wage levels despite unexpected shortfalls in enterprise receipts and regardless of changing conditions in the relevant labor markets. This practice introduces substantial downward rigidity in social sector wages. This rigidity is incorporated into the model by specifying a minimum nominal wage for each social sector labor market during each production period. The model stipulates that each firm in the social sector makes its factor demand decisions subject to the additional constraint that the wage which it pays to each type of labor does not fall short of the binding minimum wage. The minimum wage constraints model a dual process of wage determination in social sector labor markets. According to this formulation social sector wages are determined by the minimum wage schedules adopted by enterprise workers' councils during periods of excess labor supply and by market clearing conditions during periods of excess labor demand.

4. The Demand for Output

The model distinguishes four sources of product demand: (1) the household sector; (2) the enterprise sector; (3) the government sector; and (4) the foreign sector. Enterprise demand consists of the demand for capital goods, which is fully determined by the loanable funds allocations of Stage I and by the relevant set of capital coefficients, and the demand for intermediate inputs, which is fully determined by the level of production and by the relevant input-output coefficients. Federal and republican government expenditures on commodities are specified exogenously in either real or nominal terms. The total amounts of such expenditures are broken down among individual commodities according to the composition of government expenditures in the final demand columns of the 1968 input-output table for Yugoslavia.

The effect of the foreign sector on the demand and supply for each commodity depends on the commodity's role in foreign trade. Three categories of tradeable goods are identified: (1) competitive imports whose prices are determined on the domestic market; (2) exports whose prices are determined on the domestic market; and (3) exports whose prices are determined on the world market. Domestic and world prices for competitive imports and exports differ by the amount of protective tariffs and export subsidies.
Product demand within the household sector depends on household incomes and on the composition of household expenditures. For each type of household, the model contains an income equation showing the different sources of household receipts. Because household incomes depend largely on wages and distributed profits paid out by social and private sectors of production, the household income equations depend crucially on the distribution rules guiding the allocation of net receipts in each of these sectors. Therefore, the model of household income formation includes a formal set of equations indicating the share of enterprise income in each production sector flowing into household incomes.

The development of household income equations is the first step in the derivation of household income distributions. To derive such distributions it is necessary to specify the total number of households falling into each household category and to distinguish such households by their significant demographic characteristics and by their levels of income. The statistical information required is provided by budget and household income surveys of the Federal Statistical Office.

Households are grouped into demander classes, defined as groups of households whose demand for goods can be described by a single set of consumption functions. Household incomes available for expenditure are estimated by calculating a savings rate for each demander class. The model assumes that each household holds a fraction of its total disposable income in cash balances. Total household income available for expenditure must therefore be reduced by the desired increase in cash balances to derive the income available for expenditure on goods and services. Consumer demand equations for each of the demander classes are then defined as:

$$(0) \quad (C_1^1)_{kR} = (\hat{Q}_1^1)_{kR} (n_1^{Y})_{kR} \sum_{j} (n_j^{Y})_{kR}$$

where $k$ refers to demander class $k$ in region $R$;

- $Y_{kR}$ is the total expenditure on goods and services by demander class $k$ in region $R$;
- $(\hat{Q}_1^1)_{kR}$ is a parameter estimated in the base period by the following expression $(C_1^0)_{kR}/(Y_0)_{kR}$;
- $(n_1^{Y})_{kR}$ is the income elasticity of demand for commodity $i$ in demander class $k$;
and \( n_{ij} / kR \) is the price elasticity of demand for commodity \( i \) in
demander class \( k \).

The demand equations (e) are constant elasticity demand functions. The
parameters of these functions are estimated using a technique proposed by
Frisch.17

5. The Demand for Cash Balances

The model assumes that households, enterprises and government
organizations desire to hold a fraction of their income in the form of
money as working balances. These transactions balances need to be included
explicitly so as to allow them to influence the course of the tatonnement
process which determines the absolute price level as well as the relative prices
in the model. The desired increases in the stock of transactions balances
in the household, enterprise and government sectors are given by the
following equations:

\[ \Delta R_t^f = k_t^f \sum_{i \in R} p_{ir} x_{ir} - M_{t-1}^f \]

where \( k_t^f \) is the Cambridge \( k \) for transactions demand by the firm sector;

\( M_{t-1}^f \) is the stock of transactions balances held by the firm
sector at the end of the previous period. Exogenous in this
period.

\[ \Delta W_t^h = k_t^h \sum_{i \in R} y_{ir} - W_{t-1}^h \]

where the subscript \( l \) refers to demander class \( l \);

\( k_t^h \) is the Cambridge \( k \) for households of demander class \( l \);

\( W_{t-1}^h \) is the stock of transactions balances held by households of
demander class \( l \) at the end of the previous period.

\[ \Delta M_t^g = k_t^g \left[ (C_{T} + \sum_{\lambda} w_{\lambda} L_{\lambda}) + \sum_{R} (C_{R} + \sum_{\lambda} w_{\lambda R} L_{\lambda R}) \right] - M_{t-1}^g \]

where \( k_t^g \) is the Cambridge \( k \) for the consolidated government sector;

\( C_{T} \) is total expenditure by the federal government;

\( \sum_{\lambda} w_{\lambda} L_{\lambda} \) is the total wage bill paid by the federal government;

\( C_{R} \) is total expenditure by regional government \( R \);

\( \sum_{\lambda} w_{\lambda R} L_{\lambda R} \) is the total wage bill paid by regional government \( R \);

\( M_{t-1}^g \) is the stock of transactions balances held by the government
sector at the end of the previous period.
It is important to distinguish between the desired change in cash balances in the enterprise sector, given by equation (p), and the actual change in cash balances which occurs in the enterprise sector during a production period. This distinction is necessary because minimum output constraints give rise to the possibility of financial losses and inventory accumulation within the enterprise sector which require financing in the form of reductions in the stock of enterprise cash balances. Actual changes in enterprise cash balances are calculated from the balance sheet accounting equations for each sector of production.

6. Material Balance Equations

The conditions of supply and demand on each commodity market can be summarized by the material balance equations for that market. In the model five different types of material balance equations can be distinguished, one for each of five major types of goods: regional non-traded commodities; national non-traded commodities; competitive imports protected by tariffs; subsidized exports; and non-subsidized exports.

7. The Determination of Output and Price in Each Commodity Market

The problem of solving Stage II is that of finding a set of prices and outputs which characterize each commodity market during the production period. For commodities which are unsubsidized exports, this solution is simply given by the prevailing world price and by the output required to satisfy the total domestic and foreign demand forthcoming at that price. For all other types of commodities, prices and outputs must be determined by the interactions of supply and demand conditions. The solution approach which the model adopts to find these prices and outputs is inherent in the way the system of equations in Stage II has been described. First, a set of absolute prices is assumed and product supplies at this set of prices are calculated. Next, the model assumes that all demands except consumer demands are met by supplies. Then, the net supplies of consumer goods are calculated using the material balance equations. Comparing these net supplies with consumer demands, the model then specifies excess demand equations for goods. The equilibrium condition is that excess demand equals zero for all commodities whose prices are set by the market. For those commodity markets where minimum output constraints are binding and reservation price setting is allowed, the equilibrium condition is that excess supply just equals inventory accumulation.
Given an initial set of absolute prices, the actual transactions demand for money by each spending sector is calculated. These can be added to yield the aggregate demand for cash balances

\[ \Delta M^A = (\Delta M^f)^A + \sum \Delta M^h + \Delta M^S \]

where \((\Delta M^f)^A\) refers to the actual changes in cash balances in the enterprise sector calculated from enterprise accounting equations.

If this were a usual Walrasian model with money, an exogenous money supply could now be specified and one equation for monetary equilibrium could be added. This would yield \(n^* + 1\) equilibrium conditions — where \(n^*\) refers to the number of commodities whose prices are to be freely determined on the domestic market — and \(n^*\) prices to determine. One equation would be redundant because the usual system satisfies Walras' Law that all excess demands, including that for money, equal zero. However, there is nothing in the model economy described here to ensure that Walras' Law will hold in each iteration. In contrast, in this system Walras' Law must be considered as an equilibrium condition and the variable that will be adjusted to achieve aggregate equilibrium will be the average price level. The money supply will not be considered to be an exogenous variable but instead will be set so as to equal money demand at the equilibrium price level. Since money demand in Stage II is in turn an endogenous variable, both money supply and money demand are to be understood as set so as to validate the injection of new credit into the economy determined in Stage I. The resulting inflation or deflation in Stage II can thus be seen as determined by the credit policy pursued in Stage I.

As the discussion here indicates, the model has \(n^* + 1\) equilibrium conditions and \(n^* + 1\) variables to be solved for — the \(n^*\) commodity prices and the average price level. Equation counting is not, of course, sufficient to prove either the existence or uniqueness of a solution. However, the model economy is certainly a member of the family of economies studied by many general equilibrium economists and so should have at least one equilibrium point. There is no guarantee, however, that the solution prices are unique. Moreover, the system of equations is not homogeneous in all prices and wages. One suspects, however, that the system will display what might be called "strong local uniqueness;" that is, for reasonable initial guesses of prices, the solution technique will converge on one set of solution prices.
IV. STAGE III

The function of the Stage III model is to update all of the variables whose values are set exogenously in Stages I and II. There are three different types of such variables: (1) those which are simply data and are updated by setting them equal to the relevant solution values of Stage II; (2) those which are data but which are updated by special rules outlined in Stage III; and (3) those which reflect expectations for the next period and for which there are expectations functions in Stage III.

V. THE MODEL AND POLICY EXPERIMENTS

Once the dynamic version of the model has been made operational on the computer, and once the model has been validated, in the sense that the dynamics of the model economy have been tested against the dynamics of the Yugoslav economy, the model will be used to perform a number of experiments to ascertain the impact of certain policies on the characteristics of the income distribution.

For each policy regime examined, we intend to compare the income distribution and the absolute levels of incomes of the poor in the base period and after five and seven years. The results of such comparisons, while notional in character, are expected to be valid enough to provide a reasonable indication of the ultimate impact of certain economic policies on the distribution of income once the full range of within period adjustments is allowed for and once the short range dynamics of policy changes are traced out.


7. According to a 1963 survey, white collar workers make up 44.7% of the enterprise management boards, while accounting for only 20.4% of the work force. The situation is not as skewed in the workers' councils, where blue collar workers who account for 49.6% of the work force hold 70.3% of the seats. See D. Gomipic and I. Paj, *Workers' Self-Management in Yugoslav Undertakings*, (Zagreb: Ekonomjski Institut, 1970) p. 196.


9. This assumption is consistent with blue collar interests in current wage levels; it also reflects the fact that profit shares account for an important part of total worker incomes. According to recent evidence, such profit shares may make up 2 to 10% of the total income payments received by enterprise workers. See H. Wachtel, *Workers' Management in Yugoslavia*, p. 109.

10. Because of legal and traditional constraints on enterprise hiring and firing practices, workers who are employed by the firm in accordance with "indefinite-time" contracts can be laid off only at their request or with their consent. In contrast, workers who are employed by the firm in accordance with temporary, "specific-time" contracts can be laid off when such contracts expire. Workers employed under temporary contracts account for only 3.8% of the total labor force in the social sector.

11. The existence of constraints limiting the downward flexibility of output levels in social sector firms in the short run can explain two major characteristics of cyclical downturns in the Yugoslav economy: namely, the tendency for inventories to increase sharply during periods of
slowdowns in aggregate demand and the tendency for the enterprise sector to run down its cash balances and become illiquid during such periods. For an extended discussion and empirical evidence of these characteristics, see B. Horvat, Yugoslav Economic Policy in the Post-war Period, American Economic Review, Supplement, Part 2, June 1971; pp. 71-161; pp. 141-144.

12. Because of data limitations, we are obliged to use the same capital coefficients matrix for all regions. This matrix is taken from Z. Pjanik et al., Specifinca Cena Proizvodnje i Stvarne Cene u Privredi Jugoslavije, 1964-68, (Beograd: Institut Drustvenih Nauka, 1971), Table 44a, Appendix.

13. Government expenditures include all expenditures of the so-called "non-productive sectors" in the Yugoslav system of accounts. These sectors include health, education, culture and entertainment, and financial and professional services.

14. In the model we identify the following types of households for each republic: agricultural households in which the income earners are self-employed on their own farms or are employed on other private farms; private crafts households in which the income earners are either self-employed craftsmen or are employees of other craftsmen in a privately-owned business; worker households of shell type λ in which the income earners are workers of shell type λ employed in social sector enterprises; households in which the income earners are employed by the government and "non-productive" sectors; households in which the income earners are unemployed; households in which the income earners are pensioners; and households in which the income earners are self-employed professionals.


16. We define eight such demander classes for each region: agricultural households, private sector households, and six categories of worker households differentiated by the level of their periodic income receipts.


18. There are a number of ways in which non-homogeneity is manifested in the model economy. First, changing prices will change the structure of demand for transactions balances and so change the demand for real goods. Second, total investment expenditure in Stage II is assumed fixed in nominal terms from Stage I. Thus, any increase in the general price level will lower the amount of capital goods demanded in Stage II. Third, interest payments by firms and interest incomes to households are fixed in nominal terms, independently of the absolute price level. Fourth, the exchange rate is specified in nominal terms in a number of equations.
SUMMARY

This paper describes the theoretical structure of a multi-sectoral, general equilibrium model of the Yugoslav economy designed to provide some insights into the potential impact of different economic policies on the distribution of income in the short run. Because the distribution of income is the byproduct of all of the production and consumption activities in an economy, the model developed here is of necessity a microeconomic model which lays out in a detailed fashion the conditions of supply and demand on each primary factor and commodity market. Because, in addition, the distribution of income in Yugoslavia is significantly influenced by barriers to the flow of factors of production and commodities across traditional regional boundaries, the model distinguishes individual product supply and demand decisions by region. However, the model departs from the traditional general equilibrium framework characterizing most microeconomic analyses by allowing for certain persistent rigidities and imperfect adjustments which have been of particular importance in the Yugoslav economy. The model also endeavors to capture the possible influence of another unique feature of the Yugoslav economy -- namely, workers' self-management at the enterprise level -- on patterns of income distribution by formulating enterprise objective functions which reflect the competing goals of the different interest groups responsible for enterprise decisionmaking.

The overall model discussed in the paper consists of three stages. Stage I is essentially a model of the market for loanable funds in each region and describes how credit supply and demand decisions are made and how such decisions lead to the allocation of loanable funds both inter-sectorally and interregionally. Stage II is a microeconomic market model designed to determine output and price on each commodity and factor market, given the amount and allocation of loanable funds determined in Stage I. Because credit policy is fixed in Stage I, inflation or adjustments in the aggregate price level have a definite impact on real output and employment decision in Stage II. Stage III consists of a series of rules and equations guiding the updating of the model parameters before Stages I and II are resolved for the next economic period. Together, the three stages of the model yield a dynamic path of outputs, price and factor employments and a dynamic picture of the period and regional distributions of income over time. The model thus permits some conclusions about the effects of different policy regimes on the patterns of income distribution in the short run.