RM-78-38

FIRST VERSION OF THE HUNGARIAN AGRICULTURAL MODEL (HAM-1)

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PREFACE

Because the food production is one of the most decentralized activities of mankind, the focal point in the Food and Agriculture research at IIASA is the modelling of various national food and agricultural systems. The international and East-West characteristics of IIASA offer a good opportunity for the appropriate modelling of market oriented as well as centrally planned agricultural systems.

As a first step in the realization of IIASA's objectives in the modelling of centrally planned agricultural systems, we have begun to work on the Hungarian Agricultural Model (HAM) as a pilot model for the modelling of CMEA countries. First, the general structure of the model and its detailed mathematical description were completed*. As a second stage of the HAM project the first, relatively aggregated, version of the model (HAM-1) based on real data has been elaborated and implemented in both IIASA and Hungarian computers. The experiences gained by this model version serve first of all towards making the final refinements of the model and also led us to some useful conclusions concerning the operation and development of the Hungarian food and agriculture system.

* C. Csaki, A. Jonas, S. Meszaros - Modelling of Centrally Planned Food and Agricultural Systems: A Framework for a National Policy Model for the Hungarian Food and Agriculture Sector. RM-78-11, March 1978

SUMMARY

In this paper, the results of experiments with the first version of the Hungarian Agricultural Model (HAM-1) are summarized. The description of our objectives and the model are followed by a discussion of the actual results and finally our conclusions are presented.

HAM is going to be the first systems simulation model to describe the Hungarian food and agriculture sector. The main objective of HAM-1 is to gain methodological experiences to the further refinement of our model structure and to demonstrate that our approach is suitable for investigations connected with the development of Hungarian food and agriculture.

HAM-1 describes the Hungarian food and agricultural sector in a rather aggregated way (the food and agriculture is represented by nine commodities and the tenth commodity is related to the rest of the economy), but it has all of the basic features of the HAM model structure, namely it is dynamic and has a descriptive character, both the production of agricultural raw materials and food processing are modelled, the governmental economic management and policy-making activities are partly endogenized, the food consumption sphere is incorporated, financial equilibrium is maintained.

Numerous runs of HAM-1 have been executed representing three types of investigations, namely testing the operation of the whole system, studying the impacts of changes in external conditions and how the system reacts on modifications within the model. Some of the results of these runs and the conclusions are discussed at the end of the paper.

CONTENTS

INTRODUCTION

As a first step in the realization of IIASA's objectives in the modelling of centrally planned agricultural systems we have begun to work on the Hungarian Agricultural Model (HAM) as a pilot model for the modelling of CMEA countries. The development of HAM is a joint undertaking of FAP at IIASA and three institutes in Hungary (Research Institute for National Planning at the Hungarian National Planning Bureau - OT TGI, Hungarian Ministry of Food and Agriculture - MEM STAGEK, Department of Agriculture Economics at K. Marx University of Economic Sciences - MKKE). Contributors to HAM-1:

C. Csaki (IIASA): overall model structure and linkages, policy revising and consumption-trade block, coordination of the whole project.

G. Fisher (IIASA): computer program and computation.

C. Forgacs (MKKE): data collection.

A. Jonas (OT TGI): government planning and economic analysis submodel, analysis of results.

K. Kelemen (OT TGI): mathematical structure of the whole model.

L. Kleininger (MEM STAGEK): data collection for production block.

S. Meszaros (MEM STAGEK): production block, savings function, output tables.

Gy. Modos (MKKE): collection of data on consumption.

A. Por (IIASA): estimation of demand system parameters.

M. Sebestyen (MKKE): data base of the whole model, economic analysis and consumption trade block, parameter updating.

J. Strehn (MEM STAGEK): production model's parameter updating.

K. Varga (IIASA): computer programming.

L. Zeöld (OT TGI): development of the basic computer program and computation.

The elaboration of a detailed national agricultural policy model requires intensive economic analysis as well as complex and relatively large scale data collection, modelling and computer programming work. Therefore this kind of venture is generally realized in several stages. In developing HAM, it took several months to complete the general structure of the model and finalize its detailed mathematical outline*. Now, after more than one year of work the first version of HAM (HAM-1) based on real data is operational on both IIASA and Hungarian computers. The development of HAM-1 is a very important step in the HAM project. The experiences gained by this more aggregated model version serves first of all towards making the final refinements of the model and also led us to some useful conclusions concerning the operation and development of the Hungarian food and agriculture system.

In this paper, the results of our experiments with HAM-1 are summarized. The description of our objectives and the model are followed by discussion of the actual results and finally our conclusions are presented.

The working group of HAM is grateful to Professor Ferenc Rabar and Michiel Keyzer for their continuous support and comments on the whole work. In the elaboration of the model we would also like to express our appreciation to the Bulgarian and Czechoslovakian scientists for valuable discussions on the whole modelling framework.

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* C. Csaki, A. Jonas, S. Meszaros: Modelling of Centrally Planned Food and Agricultural Systems: A Framework for a National Policy Model for the Hungarian Food and Agriculture Sector. IIASA, RM-78-11, March 1978.

1. OBJECTIVES IN DEVELOPING HAM-1

HAM is going to be the first system simulation model to describe the Hungarian food and agriculture sector. The former modelling works offered many useful experiences but in several cases HAM applies entirely new approaches and the development of HAM requires the analysis of several possible alternative methodological solutions. Therefore to avoid the difficulties of immediately working with a large scale system we have decided to develop first a more aggregated, relatively simplified model version (HAM-1).

The main objective of HAM-1 is to gain methodological experiences to the further refinement of our model structure and to the construction of the final model version through:

- testing the operation of the whole model system, investigating alternative methodological solutions for some of the model modules (e.g. instead of linear programming, using nonlinear optimization),
- performing the sensitivity analysis of the crucial model parameters,
- studying the reaction of the system to changing external conditions (e.g. changing the world market prices),
- calculating the impacts of changes within the system (e.g. modification of pricing mechanism or decision making rules) on the performance of the whole system.

HAM-1 is also very important from the point of view of computation of the final model version. Through the implementation of HAM-1 in IIASA and the computer of the Hungarian National Planning Bureau we intended to develop and test a computer program which can serve as a solid basis for the computation of the final model.

Our further objective with HAM-1 was to demonstrate that our model structure is suitable for investigations connected with the development of Hungarian food and agriculture in the following way:

- Based on the model, the realization of major policy goals and plan targets and their main alternatives can be investigated. For example, the key factors and bottlenecks of realization, the considerations for a faster growth, the expected labor outflow from agriculture, and the feasibility of the goals may be analyzed.
- HAM is suitable for studying the adjustments and reactions of the Hungarian food and agriculture system to a changing international market. For example, export and import structure, the desired level of specialization or self-sufficiency, and the reaction of the domestic to the world market may be investigated.
- Finally, HAM is designed to be useful for the further development of the Hungarian economic management system, since the model can analyze the efficiency of policy instruments, the impact of the new instruments, and areas of additional control requirements.

Finally the investigations of data availability and the development of data collecting system for the further work can also be mentioned as an important objective of HAM-1 experiment.

2. DESCRIPTION OF HAM-1

HAM-1 describes the Hungarian food and agricultural sector in a rather aggregated way but it has all of the basic features of the HAM model structure described in RM-78-11 namely:

- the model is dynamic and has a descriptive character,
- the food consumption sphere is incorporated,
- the nonfood production sectors of the economy are represented by assuming that they produce only one aggregated commodity,
- the economic, technical and biological aspects of food production are covered,
- both the production of agricultural raw materials and food processing are modelled,
- the whole agricultural production and food processing is represented and,
- financial equilibrium is maintained.

Compared to our objectives as stated in the general description of HAM structure (see RM-78-11) the aggregated and simplified features of HAM-1 mean the following:

- HAM-1 has a rather aggregated commodity coverage (see Point 2.1),
- different sectors of agricultural production (state farms, cooperative farms, household plots) are not considered, only the so-called socialist agricultural production (state and cocperative farms together) is modelled,
- weather random effects on agricultural production are not directly included,
- in some cases (e.g. savings function) less sophisticated mathematical formulation is applied,
- the description of the government's policy instrument revising activities (e.g. pricing) can be considered as the first preliminary approach,
- no separate CMEA market is considered.

2.1 Commodity Coverage and Data Sources

The Hungarian food and agriculture is described in HAM-1 on a relatively high level of aggregation. The Hungarian food and

COMMODITY COVERAGE OF THE FIRST VERSION OF HAM

NUMBER	PRODUCT'S NAME	PRODUCT'S CONTENT
1	SUGAR BEET	SUGAR BEET AND OTHER CROP PRODUCTS TO BE PROCESSED
2	CORN	COARSE GRAINS AND OTHER FEED PRODUCTS
3	WHEAT	FOOD GRAINS AND OTHER DIRECTLY CONSUMED CROP PRODUCTS
4	SWINE	SWINE (PIGS)
5	CATTLE	CATTLE AND OTHER LIVESTOCK PRODUCTS
6	SUGAR	SUGAR AND OTHER PROCESSED CROP PRODUCTS
7	PORK	PORK MEAT
8	PROCESSED MEAT	PROCESSED MEATS
9	BEEF	BEEF AND OTHER MEATS
10	N-TH PRODUCT	PRODUCT OF THE REST OF THE ECONOMY

TABLE 1

agriculture is represented by 5 agricultural and 4 processed food commodities, the 10th commodity is related to the rest of the economy.

As it is shown on Table 1, practically all of the model commodities represent a relatively wide range of products. On the whole, approximately the whole Hungarian food and agriculture and the national economy as well are covered. Therefore the computed results of HAM-1 can be compared with the actual indicators of Hungarian food and agriculture and the national economy. Out of the ten commodities, six - wheat, pork, beef, sugar, processed meat and the n-th commodity - are consumed by the population.

HAM-1 is based on official Hungarian statistics. The methodological character of HAM-1 experiment allowed us to be less exacting and sophisticated in data preparation. Most of the model parameters have been calculated using the data of the Hungarian National Statistical Bureau and the Ministry of Food and Agriculture. The consumers' demand system has been estimated at IIASA based on time series (see Appendix 1).

2.2 Structure of HAM-1

HAM-1 is actually a system of models structured as it was planned in the general HAM outline. Figure 1 shows the structure of HAM-1. On Figure 2, 3 and 4, some of the most important linkages and the operation of the model are shown. Figure 2 shows how the overall government objectives on growth of the economy are realized. The government production control mechanism is outlined on Figure 3 and the government influence on consumption on Figure 4.*

2.2.1 Government Economic Planning Submodel

The GM-P Submodel incorporates three modules. The calculation of major economic goals (GM-P-1) and government targets on consumption (GM-P-2) are executed as stated in general model outline. A linear programming model is applied to fix government targets on food and agriculture (GM-P-3).

GM-P-3 module contains 34 variables and 45 rows, including the objective function describing the maximization of balance of payment of food and agriculture. The whole GM-P-3 model for the first year can be seen in Appendix 2. The model coefficients are updated in each simulated year based on P-3 and P-5 modules as described later on.

2.2.2 Production Block

The Production Block of HAM-1 consists of three major elements. The rest of the economy is modelled (Module P-1) by a Cobb-Douglas type production function as follows:

$$P_n^{(t)} = 290.3(LAN^{(t)})^{0.3} \cdot (RVN^{(t)})^{0.75}$$

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* Figure 2, 3 and 4 have been designed by Prof. Ferenc Rabar.

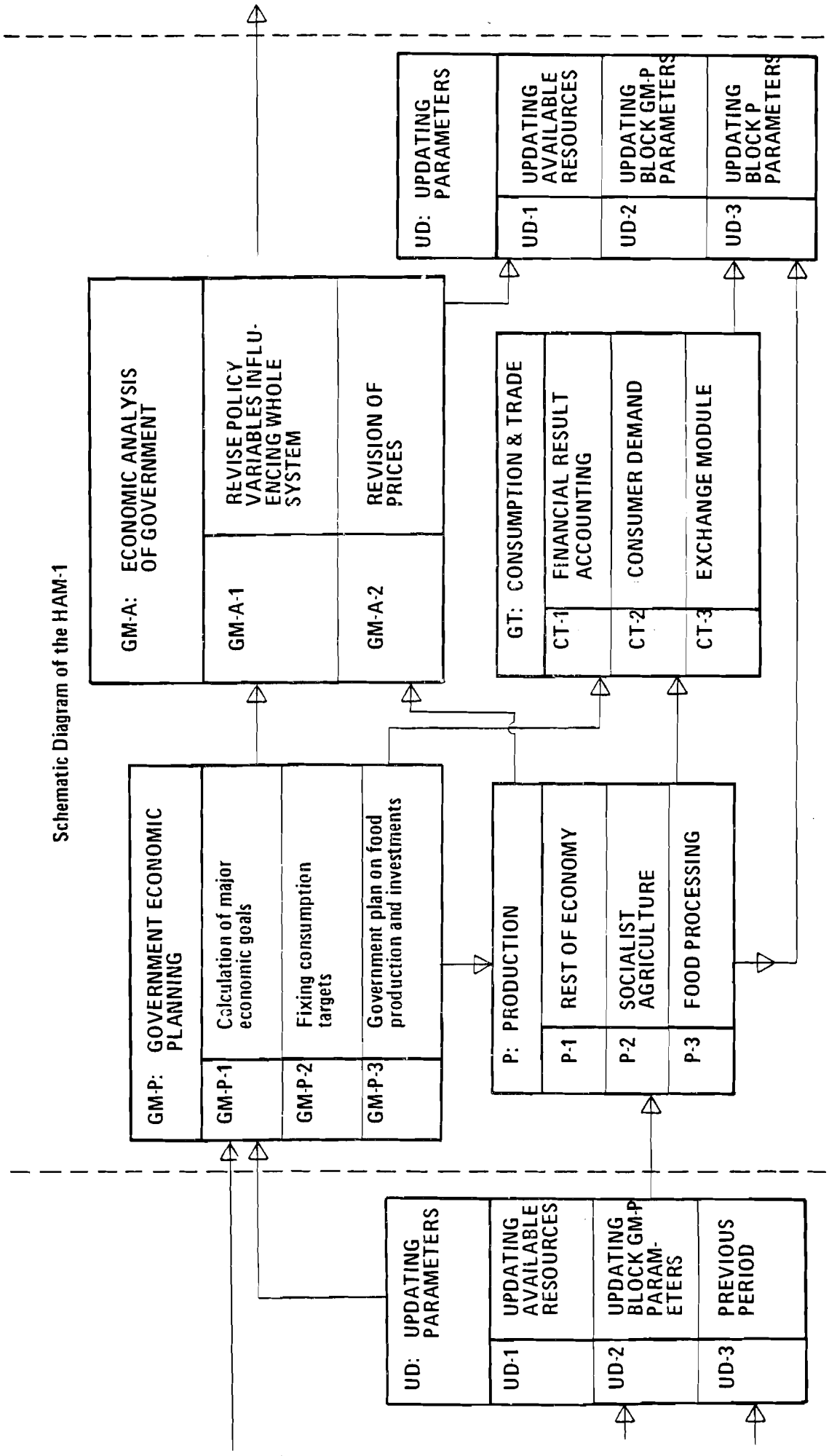

Schematic Diagram of the HAM-1
GM-P: GOVERNMENT ECONOMIC PLANNING
GM-P-1
Calculation of major economic goals
GM-P-2
Fixing consumption targets
GM-P-3
Government plan on food production and investments
GM-A: ECONOMIC ANALYSIS OF GOVERNMENT
GM-A-1
REVISE POLICY VARIABLES INFLU-ENCING WHOLE SYSTEM
GM-A-2
REVISION OF PRICES
GT: CONSUMPTION & TRADE
CT-1
FINANCIAL RESULT ACCOUNTING
CT-2
CONSUMER DEMAND
CT-3
EXCHANGE MODULE
P: PRODUCTION
P-1
REST OF ECONOMY
P-2
SOCIALIST AGRICULTURE
P-3
FOOD PROCESSING
UD: UPDATING PARAMETERS
UD-1
UPDATING AVAILABLE RESOURCES
UD-2
UPDATING BLOCK GM-P PARAM-ETERS
UD-3
PREVIOUS PERIOD
UD: UPDATING PARAMETERS
UD-1
UPDATING AVAILABLE RESOURCES
UD-2
UPDATING BLOCK GM-P PARAMETERS
UD-3
UPDATING BLOCK P PARAMETERS

FIGURE 1

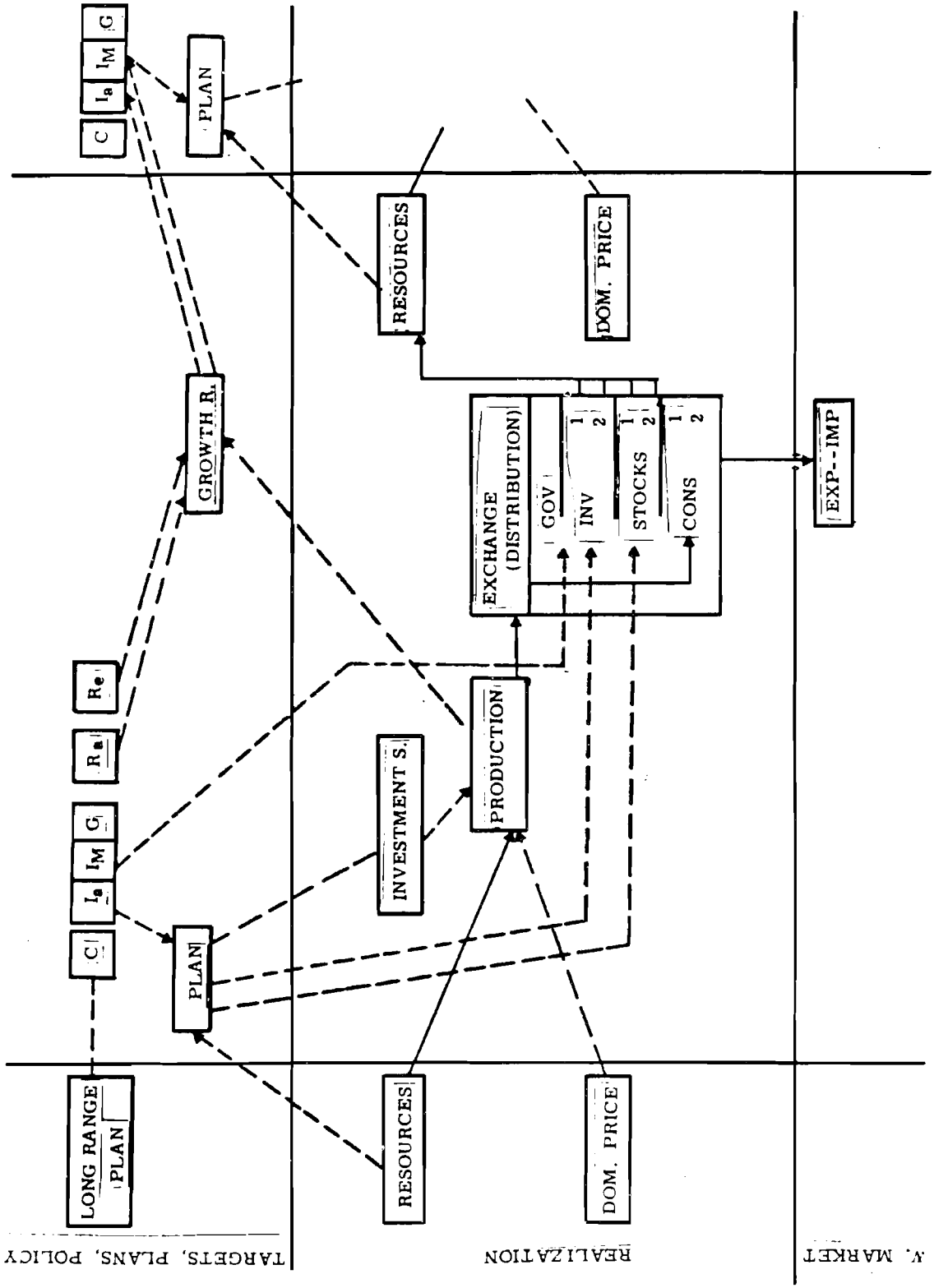


FIGURE 2: Control of the Growth of the Economy in HAM-1

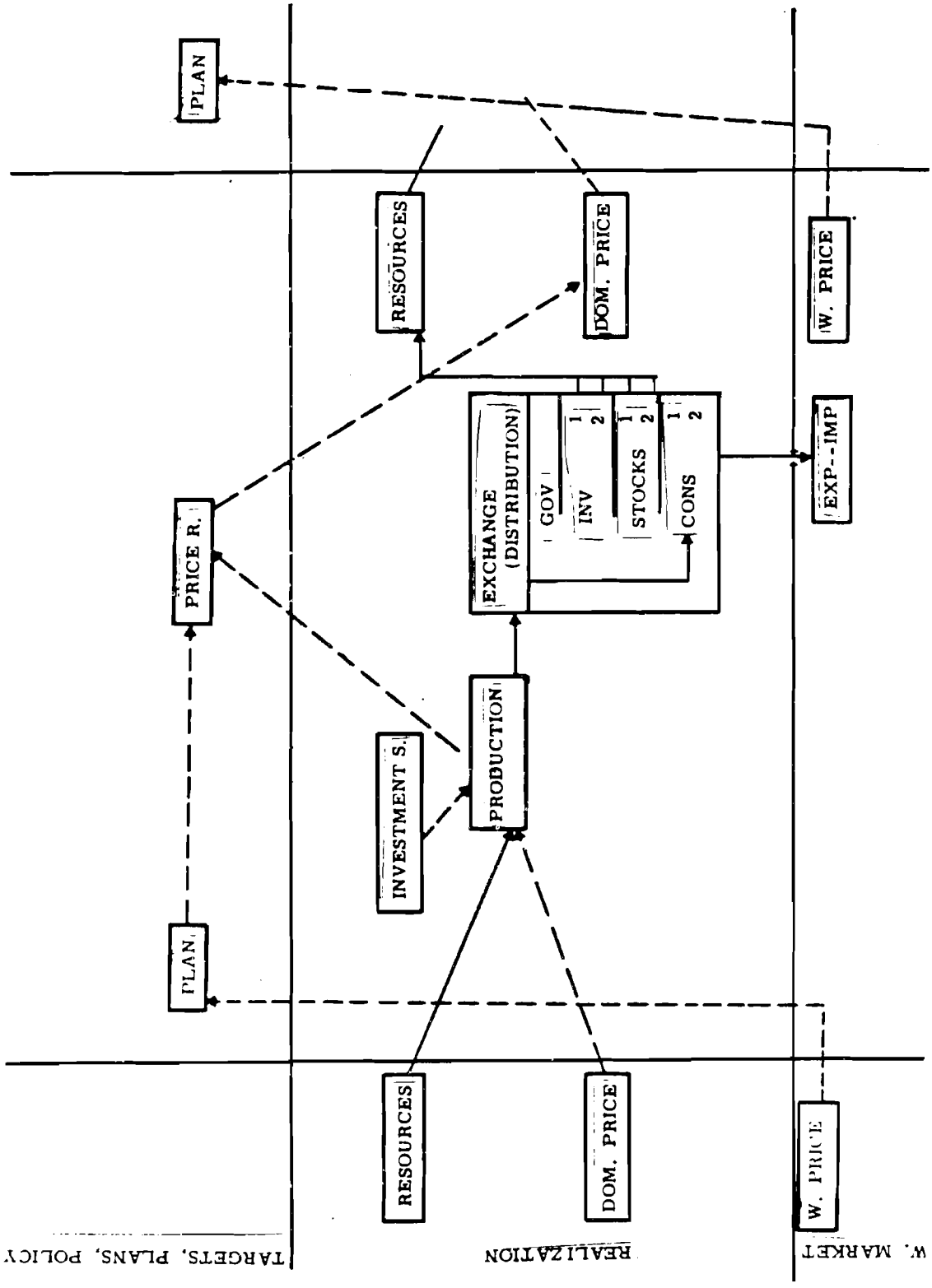


FIGURE 3: GOVERNMENT CONTROL ON PRODUCTION IN HAM-1

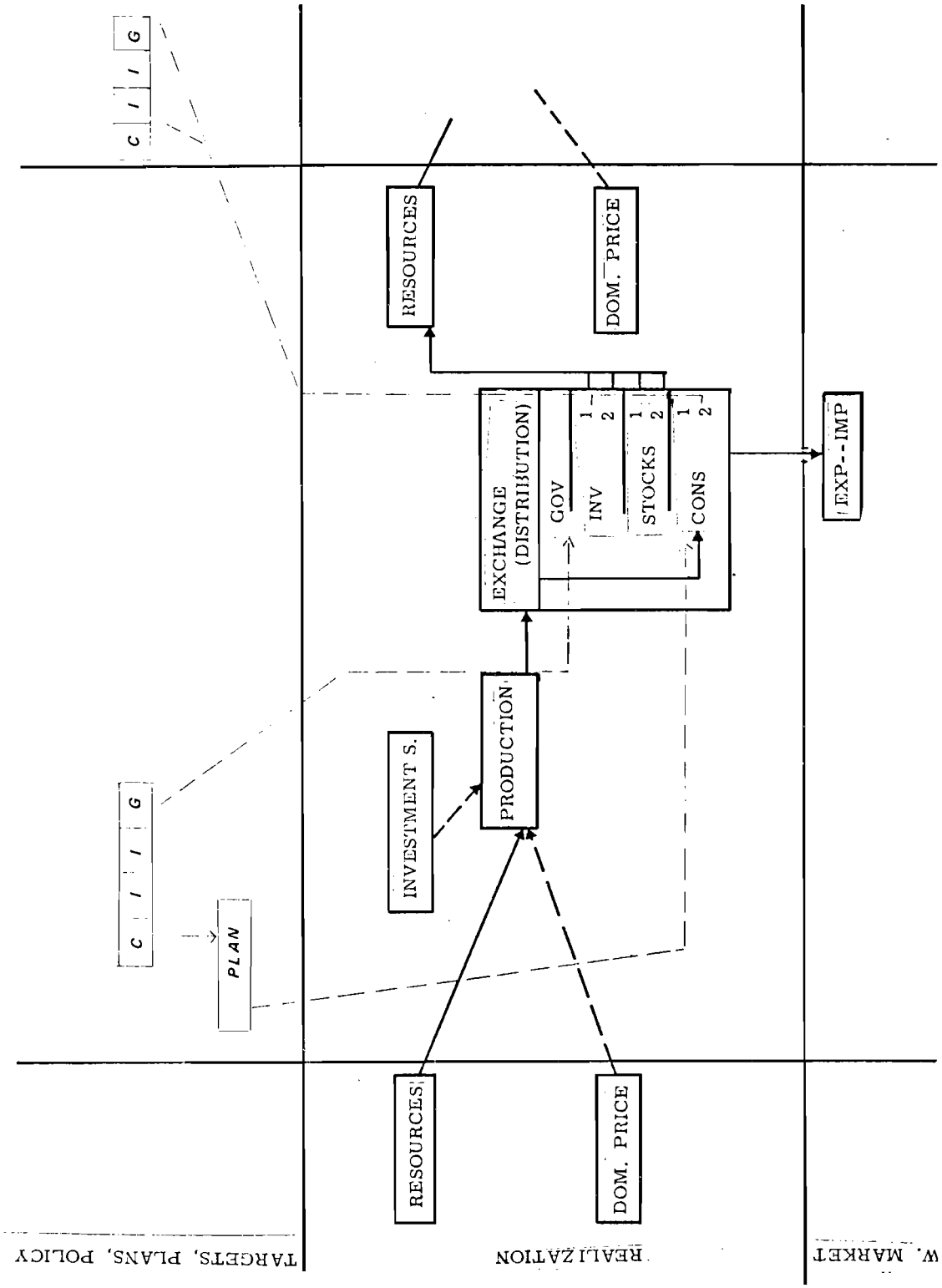
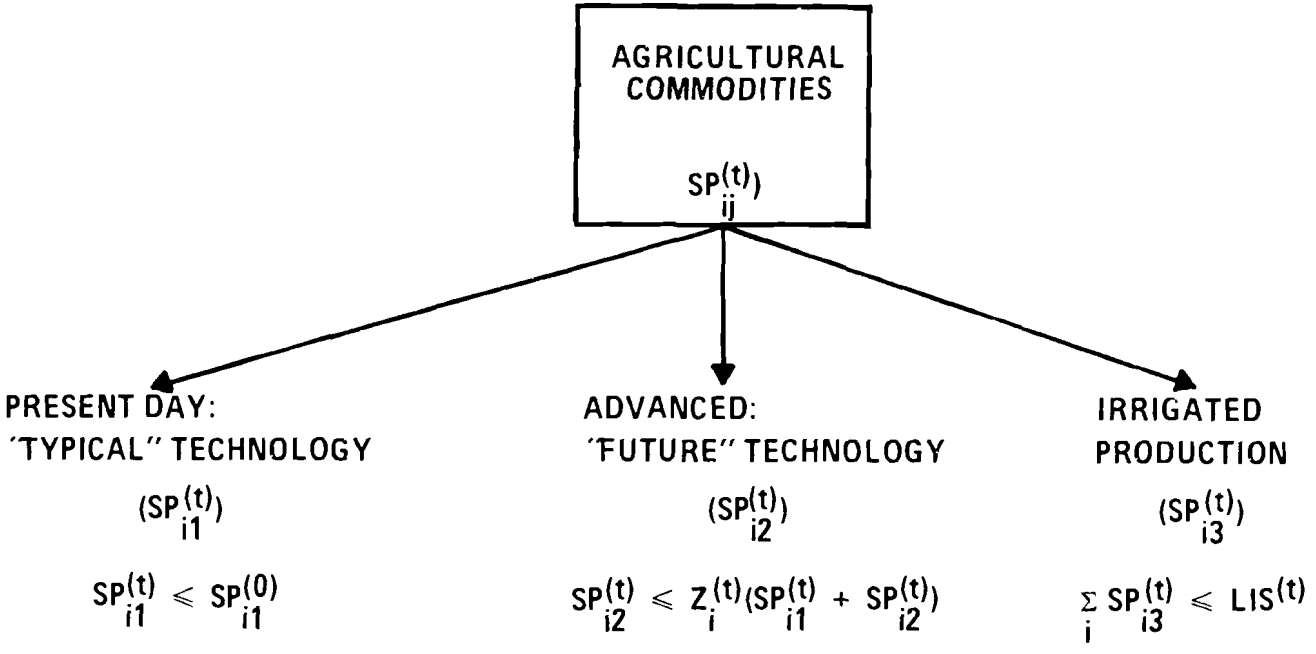


FIGURE 4: Government Influence on Consumption in HAM-1

Figure 5

TECHNOLOGICAL CHANGE IN HAM



PRODUCTION RESOURCES AND INPUTS IN HAM

CROP PRODUCTION

LAND

- PLOWLAND
- PASTURES AND MEADOWS
- IRRIGATED LAND
- PLANTATIONS

MACHINERY

- TRACTORS
- OTHER EQUIPMENT

BUILDINGS
LABOR
MATERIALS AND SERVICES

- FERTILIZER
- PESTICIDES
- OTHER INDUSTRIAL MATERIALS AND NON-AGRICULTURAL SERVICES
- MATERIALS OF AGRICULTURAL ORIGIN

ANIMAL HUSBANDRY

BUILDINGS

- STABLES
- OTHER BUILDINGS AND EQUIPMENT

LABOR
MATERIALS

- FEEDS
- OTHER AGRICULTURAL MATERIALS
- INDUSTRIAL MATERIALS AND SERVICES

FOOD PROCESSING

PROCESSING FACILITIES
LABOR
MATERIALS

- AGRICULTURAL RAW MATERIALS
- INDUSTRIAL MATERIALS AND SERVICES

TABLE 2

where:

$P_n^{(t)}$ is the production of the rest of the economy in period (t);

$LAN^{(t)}$ is the labor force of the rest of the economy in period (t);

$RVN^{(t)}$ is the available assets of the rest of the economy in period (t).

Agricultural production and food processing are modelled by two separate linear programming models (module P-3 and P-5) determining first the agricultural production. As it was mentioned weather random effects are not considered.

In P-3 module the production of the five agricultural commodities are represented by two or three production technologies (see Figure 3) and a relatively wide range of input factors are considered as is shown in Table 2. The module P-3 contains 22 columns and 31 rows including the objective function (in Appendix 3 the whole model is presented). Obviously the P-3 model parameters are subject to annual updating according to the trends of biological and technical development as well as domestic price changes.

Model P-5 is used to describe the production decision of the food processing industry. The relatively small case linear programming model has 15 columns and 19 rows as can be seen in Appendix 4 and the results are, to a large extent, determined by available raw materials and processing capacities.

As can be seen from the description of P-3 and P-5 modules the investment decisions are included in production decision models in both cases and most of the investments have no time lag.

2.2.3 Consumption and Trade Block

The Consumption and Trade Block of HAM-1 plays a very important role in the operation of the whole system. Some reformation of the original structure of this model block was required during the work on it, but the basic content of this block has not been changed compared to the general model outline. In HAM-1 the private and government consumption and the country's reaction to world market changes are modelled by three modules.

First in module CT-1 those equations are handled which can be solved based on former model elements. Practically simple calculation takes place to determine:

- the income and income utilization of producing enterprises socialist agriculture, food processing, rest of the economy) including the total demands of producing sectors;
- the earnings and committed expenditures, including savings, of the population (private consumers);
- the government income from population and production sector and the committed expenditures of the government.

The savings of the population is calculated based on a savings function determined empirically by S. Meszaros as follows:

$$SAP^{(t)} = (0.0175 + 0.005t)\ INCPO^{(t)} + 0.007\ SAT^{(t-1)}$$

where:

$SAP^{(t)}$ are the new savings of population in period (t);

$SAT^{(t-1)}$ are the total income of population in period (t);

$INCOP^{(t)}$ are the total savings at the end of period (t-1).

2.2.3.1 Modelling of Consumer's Demands

Module CT-2 is an important part of this model block and the whole model as well, describing the private consumption. The role of Module CT-2 is to determine the per capita consumer demands assuming that the endowment of consumers after deduction of savings is spent for buying various commodities.

The consumer demands toward a specific commodity are influenced by the prices and the level of endowment. In HAM-1 the demand for commodity i is described as follows:

$$CP_i^{(t)} = \frac{\rho_i^{(t)}\ CPE^{(t)}}{p_i^{c(t)}}$$

$$\rho_i^{(t)} > 0 \text{ and } \sum_i \rho_i^{(t)} = 1$$

where:

$CP_i^{(t)}$ = per capita demand for commodity i in period (t);

$CPE^{(t)}$ = per capita endowment of consumers in period (t);

$p_i^{c(t)}$ = consumer price of commodity i in period (t).

The $\rho_i^{(t)}$ parameters are determined in the model for each simulated year by using C.E.V. Leser's nonlinear demand model.

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* C.E.V. Leser: "A method for estimating price and income elasticities from the series and its application to consumers' expenditures in the Netherlands 1949-1959." Statischtischen Studien vom 13 October 1962, des Statischtisches Centralbüros Den Haag.

We assume that consumer expenditures on commodity i can be described as:

$$CP_i^{(t)} \; p_i^{c(t)} = \frac{c_i \left(\frac{p_i^{c(t)}}{CPE^{(t)}} \right)^{\alpha_i} CPE^{(t)}}{\sum_j c_k \left(\frac{p_j^{c(t)}}{CPE^{(t)}} \right)^{\alpha_j}}$$

where:

c_i, α_i are parameters related to commodity i

and therefore

$$CP_i^{(t)} = \frac{c_i p_i^{c(t)(\alpha_i - 1)} CPE^{(t)(1 - \alpha_i)}}{\sum_j c_j p_j^{c(t)\alpha_j CPE^{(t) - \alpha_j}}}$$

Based on time series of $CP_i^{(t)}$, $p_i^{c(t)}$ and $CPE^{(t)}$ (Appendix 1) the α_i and c_i parameters have been estimated using the least square method on the data showed in Appendix 1. The $\rho_i(t)$ coefficients are calculated in HAM-1 as follows:

Table No 3

Parameters of demand system used in HAM-1

Commodity	c_i	α_i
1. Wheat	465,570	0,47800
2. Sugar	2,929	0,00535
3. Pork	240,550	0,57560
4. Processed meat	191,000	0,62140
5. Beef	19,463	0,13200
6. Nth Product	6,138	-0,24500

$$\rho_i^{(t)} = \frac{c_i \left(\frac{p_i^{c(t)}}{CPE^{(t)}} \right)^{\alpha_i}}{\sum_j c_j \left(\frac{p_j^{c(t)}}{CPE^{(t)}} \right)^{\alpha_j}}$$

and

$\rho_i^{(t)}$ is expressing the share of commodity i in total consumer expenditures in period (t).

Table No. 3 shows the estimated values of c_i and α_i.

2.2.3.2 Exchange Module

Module CT-3 is a crucial part of the whole model, where the final level of private and government consumption as well as stocks satisfying balance of trade equilibrium conditions are determined. It is very important to underline that the reaction mechanism of domestic demands to new world market conditions (prices) is described here.

After some unsuccessful attempts with linear programming, based on Michiel Keyzer's suggestion, a relatively simple method has been developed to solve module CT-3.

In this module the so-called non-committed demands are determined which can be the subjects of further adjustment. The non-committed demand for a specific commodity consists of various elements; therefore let q_{ih} express the h-th type of demand for commodity i. To reach a solution first we define a target level of the h-th demand of commodity i ($q_{ih}^{(t)}$) and introduce a vector λ which indicates the extent to which the target ($q_{ih}^{(t)}$) is realized. Obviously the realization levels are constrained between two bounds:

$$\lambda^* \leq \lambda \leq \lambda^{**}$$

Let us assume, that

y = vector of supply after the deduction of committed expenditures;

p_i^w = world market price of commodity i;

k = preliminary fixed balance of foreign trade.

The solution of module CT-3 is equal to the determination of such values of vector λ which satisfy:

$$p^w Q \lambda = p^w y + k$$

and

$$\lambda^* \leq \lambda \leq \lambda^{**}$$

and

Q is a matrix of non-committed demands.

During the solution procedure a strict preference ordering of various types of demands is followed. In case of changes in the world market prices a new λ vector has to be calculated. If no solution can be obtained the λ^* and λ^{**} vectors have to be adjusted so that a solution can be reached. The calculation of vector λ is easily programmed. It is worthwhile to consider 1 as initial value of λ_i. It is obvious that in case the target is realised, $\lambda_i \equiv 1$ and always $\lambda_i^* < 1$, $\lambda_i^{**} > 1$.

The module CT-3 of HAM-1 is based on this method, but of course the vector λ is related to a relatively large system of equations and constraints and the whole matter is more complicated.

The supply after the deduction of demands related to committed expenditures which cannot be subjects of any further adjustment is given by former model modules. Using the symbols of the general model outline, the y vector related to HAM-1 can be formulated as follows:

$\underline{y}^{(t)}$ = supply after deduction of demand related to committed expenditures.

$$y_i^{(t)} = S_i^{(t-1)} + SPA_i^{(t)} - \sum_f \alpha_{fi}^{p(t)} PF_{fi}^{(t)}$$

$$y_f^{(t)} = S_f^{(t-1)} + PFP_f^{(t)}$$

$$y_n^{(t)} = S_n^{(t-1)} + P_n^{(t)} - \alpha_{nn}^{n\ (t)} P_n^{(t)} - \Pi(MESI^{(t)} +$$

$$+ MEPI^{(t)} + TINS^{(t)} + TINP^{(t)} + TINN^{(t)})$$

where:

$SPA_i^{(t)}$ is the output of socialist agriculture from commodity i in period (t);

$PF_{fi}^{(t)}$ is the production of processed food commodity f from commodity i in period (t);

$PFP_f^{(t)}$ is the output of food processing from commodity f in period (t);

$P_n^{(t)}$ is the production of the rest of the economy in period (t);

$\alpha_{fi}^{p(t)}$ is a coefficient expressing the use of the i-th commodity in food processing;

$\alpha_{nn}^{n(t)}$ is a coefficient expressing the use of the products of the rest of the economy within the rest of the economy;

$MESI^{(t)}$, $MEPI^{(t)}$ are the total use of the nth commodity in agriculture and food processing in period (t);

$TINS^{(t)}$, $TINP^{(t)}$, $TINN^{(t)}$ are the amounts of investments assuming that only the n-th commodity is used in the major producing areas in period (t).

and:

$$\Pi = \frac{1}{p_n^{\rho r(t)}}$$

As we mentioned, the endowments of population is calculated in module CT-1. The demands related to non-committed expenditures (q_{ih}) are formulated in matrix $\underline{Q}$ as follows:

$\underline{Q}$ = non-committed demand

i (agricultural commodities)	0	$S_i^{(t)}$	0	0	0	0	$TC_i^{(t)}$
f (processed food commodities)	0	$S_f^{(t)}$	0	0	0	0	$TC_f^{(t)}$
n (rest of the economy)	$S_n^{(t)}$	0	$\Pi GPE^{(t)}$	$\Pi DGINA^{(t)}$	$\Pi GINN$	$TC_n^{(t)}$	0

$S_i^{(t)}$, , are stocks in period (t);

$TC_i^{(t)}$, $TC_f^{(t)}$, $TC_n^{(t)}$ = total consumption of population from the various commodities;

$GPE^{(t)}$ are government public expenditures in period (t);

$DGINA^{(t)}$ are direct government investments in food and agriculture in period (t);

$GINN^{(t)}$ are government investments in the rest of the economy;

$p_n^{pr(t)}$ is the producer price of the nth commodity in period (t).

The structure of matrix Q expresses the preference ordering of adjustment as it is stated in the model outline, namely:

- adjustment of stocks of nth commodity;
- stock adjustment of agricultural and processed food commodities;
- modification of government public expenditures;
- adjustment of direct government investments in food and agriculture;
- modification of government investments in the rest of the economy;
- adjustment of private consumption of nth product;
- modification of private consumption of food and agricultural commodities

are the order of demand adjustments.

The target values of $\underline{Q}$ matrix elements are as follows:

- in case of stocks the government plan targets calculated in GM-P-3 Module are used as targets in Module CT-3

$$S_n^{(t)'}(\text{target}) = PS^{(t)}$$

$$S_i^{(t)'}(\text{target}) = PS_i^{(t)}$$

$$S_f^{(t)'}(\text{target}) = PS_f^{(t)}$$

- the target value of $GPE^{(t)}$ is calculated in CT-1 Module as:

$$GPE^{(t)'} = ep^{g(t)} GPE^{(t-1)}$$

where:

$ep^{g(t)}$ is the coefficient of the trend of desired increase in public expenditures.

- as the target value of direct government investments in food and agriculture the value of $PDGINA^{(t)}$ (planned direct government investments in food and agriculture) as determined in Module GM-P-3 is used. The target value of $GINN^{(t)}$ is calculated based on the value of $PAFN^{(t)}$ (planned capital accumulation of the rest of the economy) determined in Module GM-P-1 and $IFEAN^{(t)}$ (firm's investment fund in the rest of the economy) in module CT-1 as:

$$GINN^{(t)'} = PAFN^{(t)} - IFEAN^{(t)}$$

- as targets on private consumption, the values of $TC_n^{(t)}$, $TC_i^{(t)}$, $TC_f^{(t)}$ related to consumer prices fixed for the given period are used.

λ^* and λ^{**} express the extent of allowed deviation from target levels. For the various elements of $\underline{Q}$ different λ^* λ^{**} are given, expressing the government objectives and policies in demand adjustment. Table 4 contains λ^* and λ^{**} vectors of HAM-1. Actually three sets of λ^* and λ^{**} are used in HAM-1 when the extent of possible adjustment is increased continuously going from the first set to the third one. Using the algorithm mentioned above, vector $\underline{\lambda}$ is determined and we get the final values of variables included in matrix Q as:

Table 4

λ^* and λ^{**} used in HAM-1

λ^* and λ^{**} related to	λ^*			λ^{**}		
	3	2	1	1	2	3
$S_n^{(t)}$	0	0.3	0.5	2	5	10
$S_i^{(t)}$, $S_f^{(t)}$	0.4	0.5	0.6	2	3	4
$GPE^{(t)}$	0.6	0.7	0.8	1.2	1.3	1.5
$DGINA^{(t)}$	0	0.3	0.5	1.2	1.5	2
$GINN^{(t)}$	0	0.3	0.5	3	4	5
$TC_n^{(t)}$	0.85	0.9	0.95	1.05	1.15	1.25
$TC_i^{(t)}$, TC_f	0.95	1.0	1.0	1	1.05	1.05

$$S_n^{(t)} = \lambda_1 PS_n^{(t)}$$

$$S_i^{(t)} = \lambda_2 PS_n^{(t)}$$

$$S_f^{(t)} = \lambda_2 PS_f^{(t)}$$

$$GPE^{(t)} = \lambda_3 GPE^{(t)'}$$

$$DGINA^{(t)} = \lambda_4 PDGINA^{(t)}$$

$$GINN^{(t)} = \lambda_5 GINN^{(t)'}$$

$$TC_n^{(t)} = \lambda_6 TC_n^{(t)'}$$

$$TC_i^{(t)} = \lambda_7 TC_i^{(t)'}$$

$$TC_f^{(t)} = \lambda_7 TC_f^{(t)'}$$

If λ_6 and $\lambda_7 \neq 1$ to satisfy our condition that consumption is equal to the endowments of population, either consumer prices are adjusted or keeping the original prices the excess endowment is considered as forced savings of the population.

2.2.4 Economic Analysis of Government

The revision of the government policy instruments in HAM-1 is based fully on procedures outlined in the general model outline. The actual values of government policy instruments are determined in this module. These values have a great impact upon the performance and operation of the whole system.

- First the desired share of investment accumulation in net national product is updated for the next period. The procedure is based on the comparison of the actual growth of gross national product and those exogenous coefficients expressing the bounds of desired growth as it is shown in Figure No. 6.

- The annual increase of unit wages is calculated based on the growth of net national product and the desired share of investment accumulation in net national product as one can see on Figure No. 6.

- The desired share of food and agriculture in total investment accumulation is revised based on the actual growth of gross production value of food and agriculture (see Figure No. 7).

- The income tax rates are changed if the actual income rates are above or below certain given bounds as it is shown by Figure No. 7.

- Finally, the producer and consumer prices are also revised. In HAM-1 this procedure is based on the comparison of target and actual figures of production as Figure No. 8 shows it.

2.2.5 Updating Parameters

The last block of HAM-1 is devoted to the updating of parameters of other model blocks. The demographic changes are given exogenously based on a prognosis elaborated by the Hungarian Central Statistical Bureau. In HAM-1 only plowland is considered and some annual decrease of total land is projected as:

$$LS^{(t)} = 0.9995 \cdot LS^{(t-1)}$$

$LS^{(t)}$ is the total available plowland in period (t).

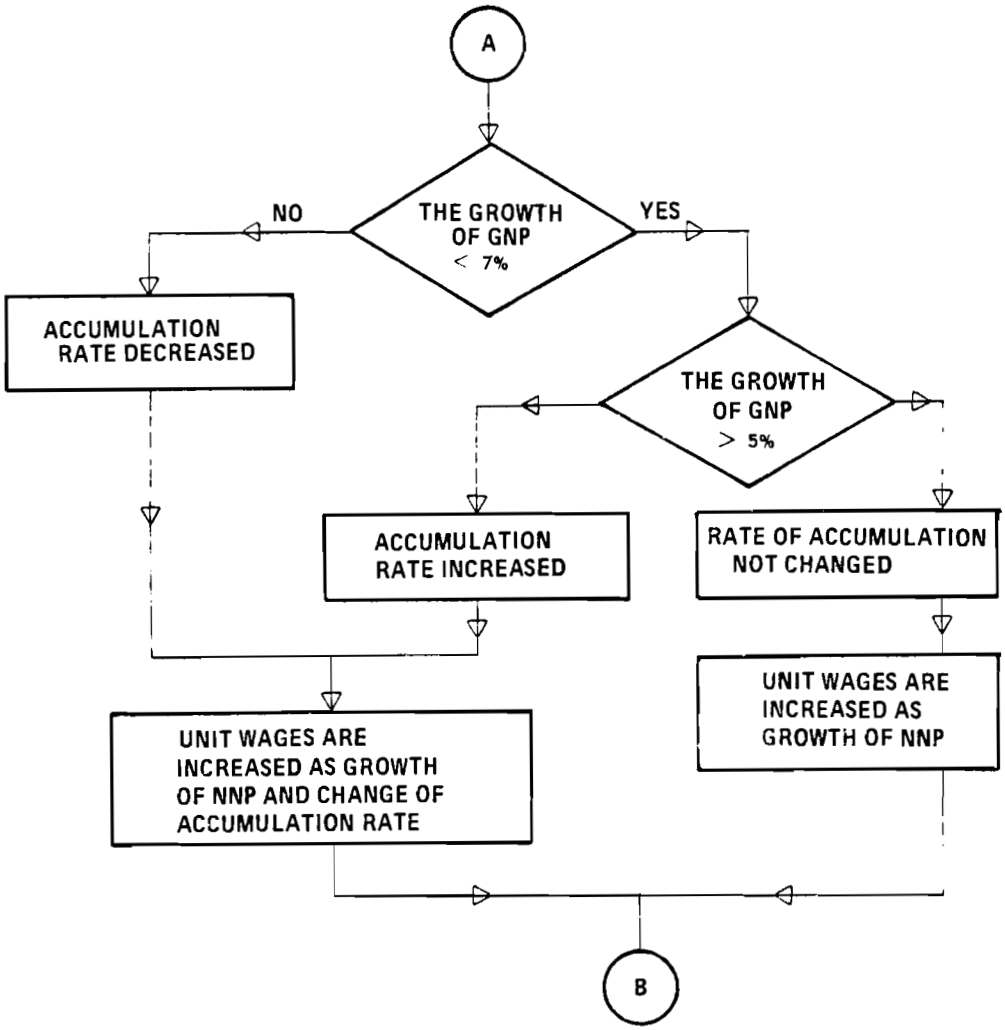

FIGURE 6

Revision of Basic Policy Variables

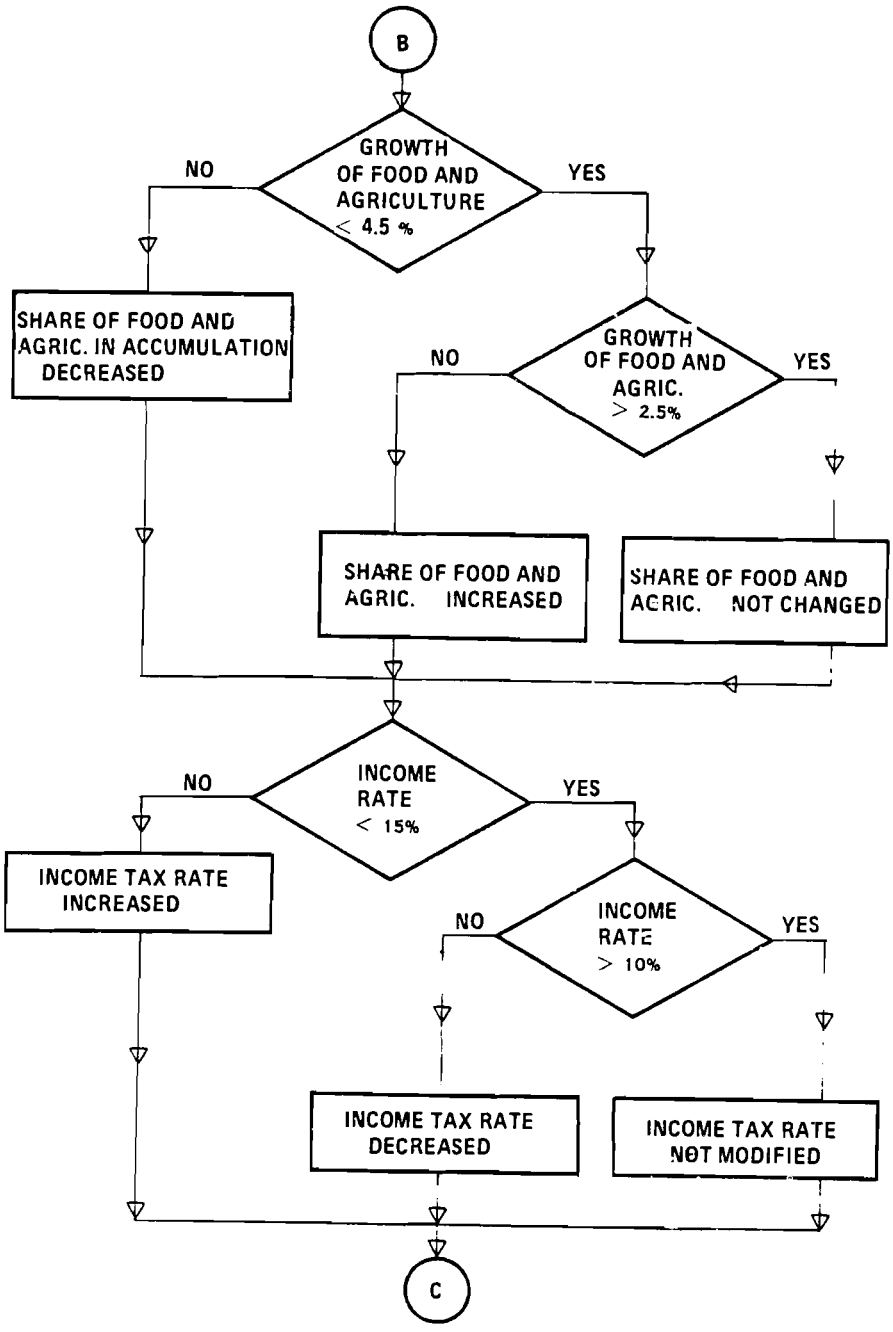

FIGURE 7

Revision of the Desired Share of Food and Agriculture in Total Investment and Income Tax Rate

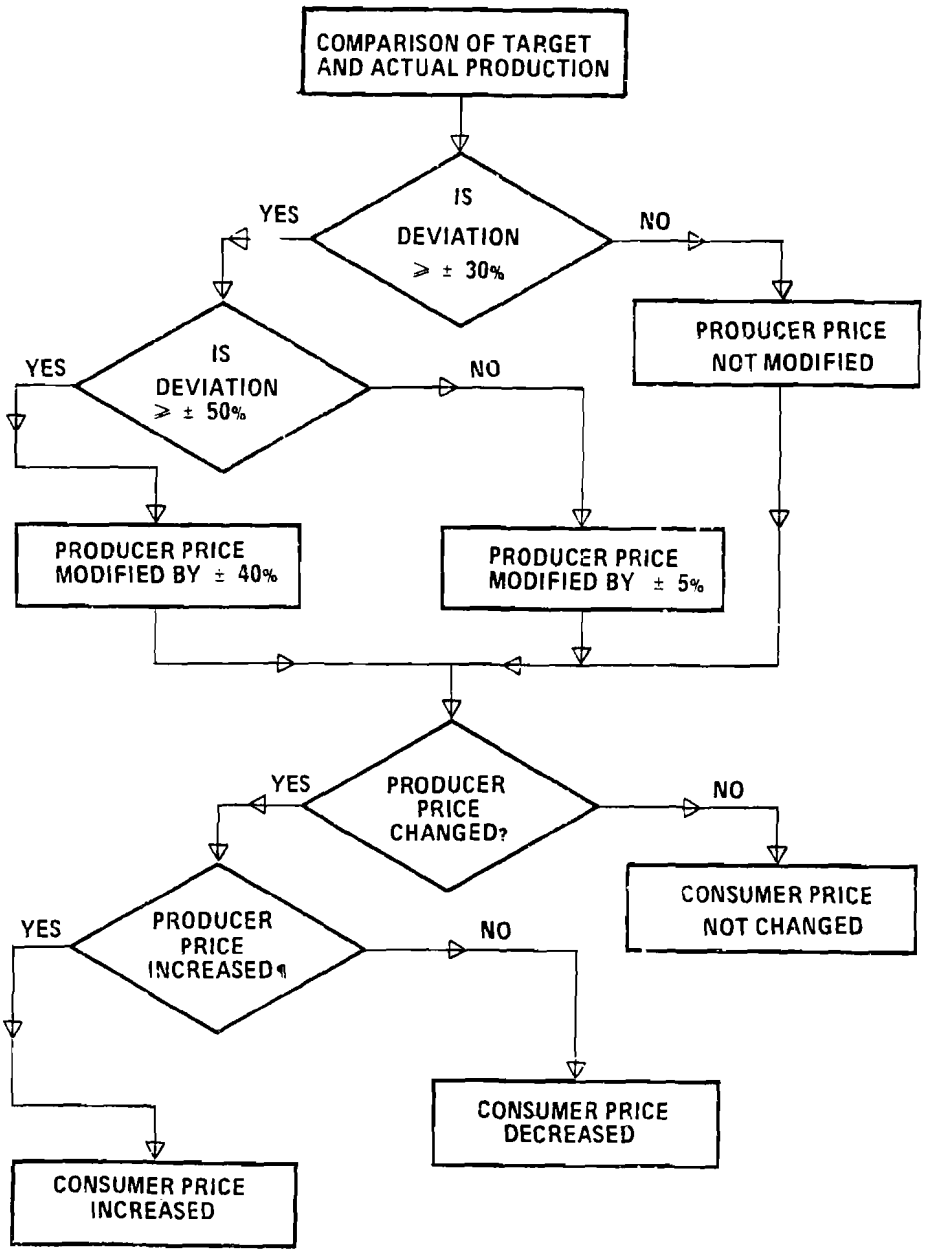

FIGURE 8

Revision of Domestic Prices

Table 5

Initial Values and Updating of Physical Resources*

Resource	Unit	Initial value ($RS_i^{(0)}$ RP_i^0)	Updating
Tractors	1000 head	440	$RS_1^{(t)} = 0.86RS_1^{(t-1)} + RIS_1^{(t-1)}$
Additional Equipment	1 mill. pieces H.Ft	30000	$RS_2^{(t)} = 0.87RS_2^{(t-1)} + RIS_2^{(t-1)}$
Pig barns	1000 head	9000	$RS_3^{(t)} = 0.95RS_3^{(t-1)} + RIS_3^{(t-1)}$
Cattle barns	1000 head	3000	$RS_4^{(t)} = 0.97RS_4^{(t-1)} + RIS_4^{(t-1)}$
Other fixed assets	1 mill. pieces H.Ft	50000	$RS_5^{(t)} = 0.95RS_5^{(t-1)} + RIS_5^{(t-1)}$
Sugar processing plants	1000 m.t.	3600	$RP_1^{(t)} = 0.95RP_1^{(t-1)} + RIP^{(t-1)}$
Slaughtering capacity	1000 m.t.	2000	$RP_2^{(t)} = 0.95RP_2^{(t-1)} + RIP_2^{(t-1)}$
Meat processing plants	1000 m.t.	300	$RP_3^{(t)} = 0.95RP_3^{(t-1)} + RIP_3^{(t-1)}$

In agricultural production the fixed assets are represented by five types. In food processing three basic production resources are considered. Table 5 shows the method of updating and the initial stocks of these resources.

The coefficients of Module GM-P-3 are calculcated based on P-3 and P-5 modules. If only one production technology is considered in food processing, simply the parameters of P-5 are used in GM-P-3 module. In case of agricultural production the GP-P-3 linear programming model parameters are determined based on the previous year P-3 module. Table 6 contains a section

* $RIS_i^{(t)}$, $RIP_i^{(t)}$ are increase of physical resources by new investments in period (t).

of GM-P-3 model and in Table 7, the related part of the previous year's P-3 module is shown. The GM-P-3 module's parameters are calculated as:

$$e_{42} = \frac{\alpha_{20.2}\ SP_{11}^{(t-1)} + \alpha_{20.3}\ SP_{12}^{(t-1)} + \alpha_{20.4}\ SP_{13}^{(t-1)}}{\gamma_{11}\ SP_{11}^{(t-1)} + \gamma_{12}\ SP_{12}^{(t-1)} + \gamma_{13}\ SP_{13}^{(t-1)}}$$

$$e_{43} = \frac{\alpha_{20.5}\ SP_{21}^{(t-1)} + \alpha_{20.6}\ SP_{22}^{(t-1)}}{\gamma_{21}\ SP_{21}^{(t-1)} + \gamma_{22}\ SP_{22}^{(t-1)}}$$

$$e_{44} = \frac{\alpha_{20.7}\ SP_{31}^{(t-1)} + \alpha_{20.8}\ SP_{32}^{(t-1)}}{\gamma_{31}\ SP_{31}^{(t-1)} + \gamma_{32}\ SP_{32}^{(t-1)}}$$

e_{52}, e_{53}, e_{54},
e_{65}, e_{76}
e_{82}, e_{83}, e_{84}
$e_{12.2}$, $e_{12,3}$, $e_{12.4}$, $e_{12.5}$, $e_{12.6}$
$e_{14.2}$, $e_{14.3}$, $e_{14.4}$
E_4, E_5

are similarly calculated

Table 6

GM-P-3 Module Coefficients Determined Based on P-3 Module

Columns / Rows	Sugar-beet prod.	Corn Production	Wheat Production	Pig Product.	Cattle Production
	PP_1	PP_2	PP_3	PP_4	PP_5
	2	3	4	5	6
4 Tractor	e_{42}	e_{43}	e_{44}		
5 Other Equipment	e_{52}	e_{53}	e_{54}		
6 Pig barns				e_{65}	
7 Cattle barns					e_{76}
8 Other fixed assets	e_{82}	e_{83}	e_{84}		
12 Labour	$e_{12.2}$	$e_{12.3}$	$e_{12.4}$	$e_{12.5}$	$e_{12.6}$
14 Land	$e_{14.2}$	$e_{14.3}$	$e_{14.4}$		
30 Corn		1		$-E_4$	$-E_5$

Table 7

P-3 Module's Coefficients Used To calculate Module GM-P-3 Coefficients

Columns / Rows	Sugarbeet			Corn		Wheat		Pork		Cattle	
	SP_{11}	SP_{12}	SP_{13}	SP_{21}	SP_{22}	SP_{31}	SP_{32}	SP_{41}	SP_{42}	SP_{51}	SP_{52}
	2	3	4	5	6	7	8	9	10	11	12
20 Tractors	$\alpha_{20.2}$	$\alpha_{20.3}$	$\alpha_{20.4}$	$\alpha_{20.5}$	$\alpha_{20.6}$	$\alpha_{20.7}$	$\alpha_{20.8}$				
21 Other Equipment	$\alpha_{21.2}$	$\alpha_{21.3}$	$\alpha_{21.4}$	$\alpha_{21.5}$	$\alpha_{21.6}$	$\alpha_{21.7}$	$\alpha_{21.8}$				
22 Pig barns								0.7	0.55		
23 Cattle barns										1	1
24 Other fixed assets	$\alpha_{24.2}$	$\alpha_{24.3}$	$\alpha_{24.4}$	$\alpha_{24.5}$	$\alpha_{24.6}$	$\alpha_{24.7}$	$\alpha_{24.8}$				
25 Labour	$\alpha_{25.2}$	$\alpha_{25.3}$	$\alpha_{25.4}$	$\alpha_{25.5}$	$\alpha_{25.6}$	$\alpha_{25.7}$	$\alpha_{25.8}$	$\alpha_{25.9}$	$\alpha_{25.10}$	$\alpha_{25.11}$	$\alpha_{25.12}$
28 Corn utilization balance				γ_{21}	γ_{22}			$-E_{41}^{(t)}$	$-E_{42}^{(t)}$	$-E_{51}$	$-E_{52}$
Yields	γ_{11}	γ_{12}	γ_{13}	γ_{21}	γ_{22}	γ_{31}	γ_{32}	γ_{41}	γ_{42}	γ_{51}	γ_{52}

In the objective function of GM-P-3 module, the balance of payment of food and agriculture is maximized using the previous year's world market prices.

In modelling of agricultural producer's decisions of HAM-1 the following coefficients are updated during the simulated time horizons:

- yields, expressing the trends of biological development;
- fertilizer usage, related to yields;
- feed input coefficients in pork production;
- upper limits of future technologies in production of agricultural commodities;
- prices and unit wages.

Functions used to update yields and fertilizer inputs are shown in Table 8. The unit pork feed input coefficients are calculated as:

- present technology:

$$E_{41}^{(t)} = E_{41}^{(t-1)} - 0.00333 \quad (E_{41}^{(0)} = 0.32)$$

- future technology:

$$E_{42}^{(t)} = E_{42}^{(t-1)} - 0.003 \quad (E_{42}^{(0)} = 0.30)$$

The upper limit of future technology ($z_i^{(t)}$) is updated as follows:

$$Z_1^{(t)} \text{ (sugarbeet)} = Z_1^{(t-1)} + 0,0375 \quad (Z_1^{(0)} = 0,25)$$

$$Z_2^{(t)} \text{ (corn)} = Z_2^{(t-1)} + 0,01875 \quad (Z_2^{(0)} = 0,4)$$

$$Z_3^{(t)} \text{ (wheat)} = Z_3^{(t-1)} + 0,01875 \quad (Z_3^{(0)} = 0,3)$$

$$Z_4^{(t)} \text{ (pork)} = Z_4^{(t-1)} + 0,035 \quad (Z_4^{(0)} = 0,3)$$

$$Z_5^{(t)} \text{ (cattle)} = Z_5^{(t-1)} + 0,040 \quad (Z_5^{(0)} = 0,2)$$

In Module P-5 of HAM-1 from model coefficients (food processing) only prices and the wage rate are updated.

3. COMPUTATION OF HAM-1

The computer program of HAM-1 has been developed in Hungary by the Computer Center of the Hungarian National Planning Bureau under the leadership of Laszlo Zeöld. At present two program versions exist allowing us to execute runs both on IIASA's PDP 11/45 and the Hungarian Planning Bureau's ICL - System 4/70 computers.

Table 8

Yield and Fertilizer Response Functions in HAM-1*

Crop	Sym-bol	Yield Function	Initl. Yield Mt/ha	Fertilizer Response Function
Sugarbeet				
- present technol.	γ_{11}	$\gamma_{11}^{(t)} = \gamma_{11}^{(t-1)} + 0.547$	31.8	$\alpha_{41.11}^{(t)} = 0.01365 \gamma_{11}^{(t)} - 0.01607$
- future technol.	γ_{12}	$\gamma_{12}^{(t)} = \gamma_{12}^{(t-1)} + 0.533$	42.0	$\alpha_{41.12}^{(t)} = 0.01587 \gamma_{12}^{(t)} - 0.0635$
- irrigated prod.	$\gamma_{13}^{(t)}$	$\gamma_{13}^{(t)} = \gamma_{13}^{(t-1)} + 0.60$	44.0	$\alpha_{41,13}^{(t)} = 0.01875 \gamma_{13}^{(t)} - 0.205$
Corn				
- present technol.	γ_{21}	$\gamma_{21}^{(t)} = \gamma_{21}^{(t-1)} + 0.132$	4.5	$\alpha_{41.21}^{(t)} = 0.0625 \gamma_{21}^{(t)} - 0.08375$
- future technol.	γ_{22}	$\gamma_{22}^{(t)} = \gamma_{21}^{(t-1)} + 0.152$	5.5	$\alpha_{41.22}^{(t)} = 0.05782 \gamma_{22}^{(t)} - 0.149$
Wheat				
- present technol.	γ_{31}	$\gamma_{31}^{(t)} = \gamma_{31}^{(t-1)} + 0.073$	3.3	$\alpha_{41\ 31}^{(t)} = 0.0909 \gamma_{31}^{(t)} - 0.04997$
- future technol.	γ_{32}	$\gamma_{32}^{(t)} \quad \gamma_{32}^{(t-1)} + 0.087$	4.2	$\alpha_{41.32}^{(t)} = 0.08461 \gamma_{32}^{(t)} - 0.05536$

* $\alpha_{41,ij}^{(t)}$ = unit fertilizer input coefficient in period (t).

The computer program of HAM-1 consists of four subprograms:

- LOAD: is used to change model parameters, to determine the length of runs and to start with the program.

- MAIN: executes the solution of GM-P, GM-A, P, and UD Blocks of model.

- CONSUM: is devoted to the solution of Consumption and Trade Block.

- TAB: role is to store selected variables after each simulated year and to prepare the outputs including time series for the whole simulated period.

At the end of computation different types of output can be printed out. The output system of HAM-1 consists of three major elements:

1. Annual Results which serve the analysis of time periods containing very detailed results on each simulated year and on each module of the model including the updated model coefficients.

2. Summary of Results covers time series of the most important indicators making the global analysis of the various runs possible.

3. Plotter Output can be prepared on the most important time series visualizing trends, tendencies projected by HAM-1, and helping in the comparison of various runs.

The Summary of Results is the most useful type of output, and in most cases the information needs on the individual runs can be satisfied based on it. Of course the more detailed analysis or debugging can not be done without the Annual Results. The Summary of Results is structured according to 8 tables, namely:

1. Commodity Coverage: list of commodities

2. General Indicators: general indicators of production, foreign trade, investment, income development on current and fixed prices for the whole simulated period and indexes of the development.

3. Dynamics of Production and Trade: planned and actual production, export or import of individual commodities in physical units.

4. Dynamics of per Capita Consumption: private consumption by commodities in value.

5. Dynamics of Investments: investments in physical units by types of investments and share of the rest of the economy in total investment fund for each year.

6. Dynamics of Prices: producer consumer and world market prices of commodities, producer and consumer price indexes.

7. Resources and Production Structure: main physical resources, production structure in physical units and structure of the gross production value of food and agriculture for each or for the desired - e.g. first and last - simulated years.

One complete set of Summary of Results tables can be seen in Appendix 5. Figure 9 shows the structure of HAM-1's output system.

4. EXPERIMENTS WITH HAM-1

To realize our objectives with HAM-1 as they are stated under point 1, numerous runs of HAM-1 have been executed. These runs represent three types of investigations, namely:

- testing the operation of the whole system, investigation of the model's relation to reality;
- studying the impacts of changes in external conditions;
- investigating how the system reacts on modifications within the model.

The larger number of runs belong to the first type of the above mentioned three points. Some of them served simply debugging purposes. In other cases the sensitivity of the crucial parameters have been investigated. Finally several runs have been required to test our assumptions on various decision making procedures. These runs led us to the so-called basic variant of HAM-1, which can be considered as the most appropriate description of the present Hungarian food and agricultural system obviously on the aggregation level and accepting the methodological framework of HAM-1. The Summary of Results of the basic variant is shown in Appendix 5.

Now we present some of the results of the computation, first of all to realize our third objectives - to prove that the HAM model structure is suitable for providing useful information for decision making and policy analysis. In our analysis the results of twelve independent runs are used and compared. These model variants are as follows:

Basic model variant, as explained above.

1. Variant: we assume a three year price cycle of corn on the world market.

2. Variant: we assume a two year price cycle of corn on the world market.

3. Variant: the world market prices of all food and agricultural commodities of HAM-1 are changing year by year.

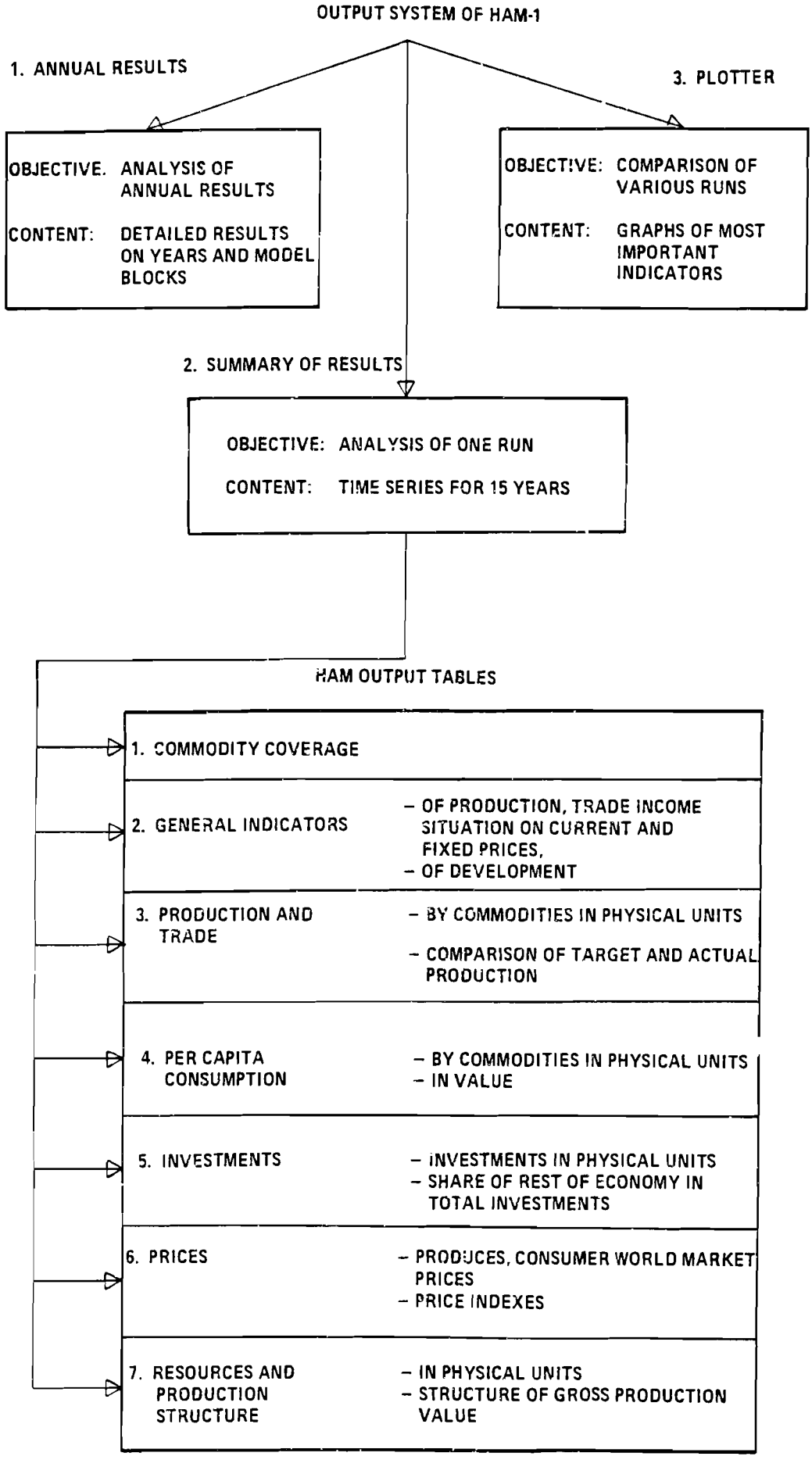
OUTPUT SYSTEM OF HAM-1
1. ANNUAL RESULTS
OBJECTIVE. ANALYSIS OF ANNUAL RESULTS
CONTENT: DETAILED RESULTS ON YEARS AND MODEL BLOCKS
3. PLOTTER
OBJECTIVE: COMPARISON OF VARIOUS RUNS
CONTENT: GRAPHS OF MOST IMPORTANT INDICATORS
2. SUMMARY OF RESULTS
OBJECTIVE: ANALYSIS OF ONE RUN
CONTENT: TIME SERIES FOR 15 YEARS
HAM OUTPUT TABLES
1. COMMODITY COVERAGE
2. GENERAL INDICATORS
– OF PRODUCTION, TRADE INCOME SITUATION ON CURRENT AND FIXED PRICES,
– OF DEVELOPMENT
3. PRODUCTION AND TRADE
– BY COMMODITIES IN PHYSICAL UNITS
– COMPARISON OF TARGET AND ACTUAL PRODUCTION
4. PER CAPITA CONSUMPTION
– BY COMMODITIES IN PHYSICAL UNITS
– IN VALUE
5. INVESTMENTS
– INVESTMENTS IN PHYSICAL UNITS
– SHARE OF REST OF ECONOMY IN TOTAL INVESTMENTS
6. PRICES
– PRODUCES, CONSUMER WORLD MARKET PRICES
– PRICE INDEXES
7. RESOURCES AND PRODUCTION STRUCTURE
– IN PHYSICAL UNITS
– STRUCTURE OF GROSS PRODUCTION VALUE

FIGURE 9

4. Variant: changing world market prices of Variant 3 are used also as domestic producer prices using 1 US$ = 30 H. Ft. exchange rate.

5. Variant: as Variant 4 using 1 US$ = 60 H. Ft. exchange rate.

9. Variant: 40% of amortization funds of enterprises in food and agriculture and 50% of the same funds from the rest of the economy are centralized by the government.

10. Variant: the initial value of z_i (upper limit of the application of the advanced technology) is increased.

11. Variant: as Variant 10 allowing also a faster full substitution of traditional technologies.

12. Variant: as Basic Variant assuming that domestic prices remain unchanged for the whole covered time horizon.

13. Variant: as Variant 3 assuming that domestic prices remain unchanged for the whole covered time horizon.

14. Variant: instead of 100% only 70% is the required level of self-sufficiency from food and agricultural commodities.

15. Variant: instead of 100% there is no required level of self-sufficiency from food and agricultural commodities.

As one can notice in the case of Variants 1,2,3, the external conditions are modified, on the other hand in Variants 4-15, our assumptions on the system are changed (model structure is modified).

4.1

In Figures 10,11 and 12, the impacts of various government policies and external conditions on the development of the whole Hungarian food and agricultural production are shown as computed by HAM-1. As we can see in Figure 10 where the results of the Basic Variant are compared with the results of Variant 2, the cyclical change of corn world market prices does not influence significantly the basic trend of production growth. However the changes in basic government policies -- modification of producer price system, the desired level of self-sufficiency -- have a significant impact on projected production growth. In Figure 11, the Basic Variant is compared with Variants 4 and 14. The decrease of the desired level of self-sufficiency (Variant 14) makes a faster production growth possible allowing a higher level of specialization to the direction of commodities with most favorable production indicators. The use of world market prices as producer prices (Variant 4) slows down the production development, but it will be shown later on this policy is the most efficient from the point of view of the balance of payments.

In Figure 12 where the Basic Variant is compared with Variant 12, we can see the impacts of the usage of fully fixed domestic prices on the development of food and agriculture.

4.2

The impacts of various government policies on the projected positive balance of payment of food and agriculture and other general performance indicators of the system may also be analysed. Figure 13 shows the balance of payment situation at three model variants - Basic Variant, Variants 4 and 14. It is obvious that Variant 4 is the first from this point of view. But the results also indicates that a basic modification of producer price system -- shift to world market prices -- may cause serious difficulties within the system during the first few years. The same fact is proved by Variant 5, when we were not able to get a feasible solution indicating that a drastic producer price change requires the modifications of other system's elements too. Of course all other performance indicators of the system can be analyzed in a similar way.

4.3

Figure 14 presents the structure of food and agricultural production at the end of modelled planning horizon as computed by various model variants in a comparison with present structure. Obviously the application of different government policies leads us to different production structures and the structure is also influenced by changing external conditions especially by the world market prices. The main conclusion of Figure 14 is that a more specialized structure of food and agriculture is desirable from an economic point of view. With various assumptions a large number of possible structural development can be computed and by using this information there is no doubt that a model like HAM-1 can be a very useful tool in structural decision making.

4.4

The descriptive character of HAM's structure enables the investigation of the efficiency of the whole economic management system as well as the individual instruments. In Figure 15 the example of corn shows how the actual production is related to government plan targets. Figure 16 illustrates very clearly how the world market prices influence the production in the modelled system. There is a two year lag between world market prices and producer's reactions.

4.5

Based on HAM the efficiency of the individual policy instruments of the government may also be analyzed. Variant 4,5 and 12,13 represent such situations where the domestic pricing mechanism is modified. On Figure 11,12 and 13 the impacts of these changes on the overall growth and balance of payment situations are clearly visible.

4.6

Based on the HAM model structure, a wide range of investigations can be done in connection with the individual commodities. Figure 16 shows the corn production in relation to world market and producer prices computed by Variant 2. We can notice that the adjustment mechanism built into HAM-1 is efficient in the case of two-year price cycles (Variant 2). The domestic production goes up when the international market conditions are the most favorable, and down parallel with world market prices. It is also possible to quantify the extent of price reaction of the individual commodities.

4.7

The production module of HAM allows us to carry on various investigations in relation to the technological development of food and agriculture. Variant 12 and 13 represent some examples of these kind of investigations. In Figure 17, the share of advanced technology in total production is shown in the case of sugar beet and corn at the Basic Variant. The investment programs associated with various government policies obviously can also be analyzed.

4.8.

HAM model structure is suitable for various investigations on consumption of population. The aggregated commodity coverage of HAM-1 does not allow us to go into detail in relation to the structure of consumption. However, as Figure 18 shows, the impacts of various government policies on consumption can be analyzed.

4.9.

The interrelation between indirect and drain effects within the system can also be studied. For example in Figures 19 and 20 the wheat and sugarbeet production are shown at basic variant. The sudden increase in year 6 of the wheat production seems to be unexpected, especially because the producer price remained unchanged from year 5 to 6.

РАЗВИТИЕ ПРОИЗВОДСТВА

PRODUCTION DEVELOPEMENT

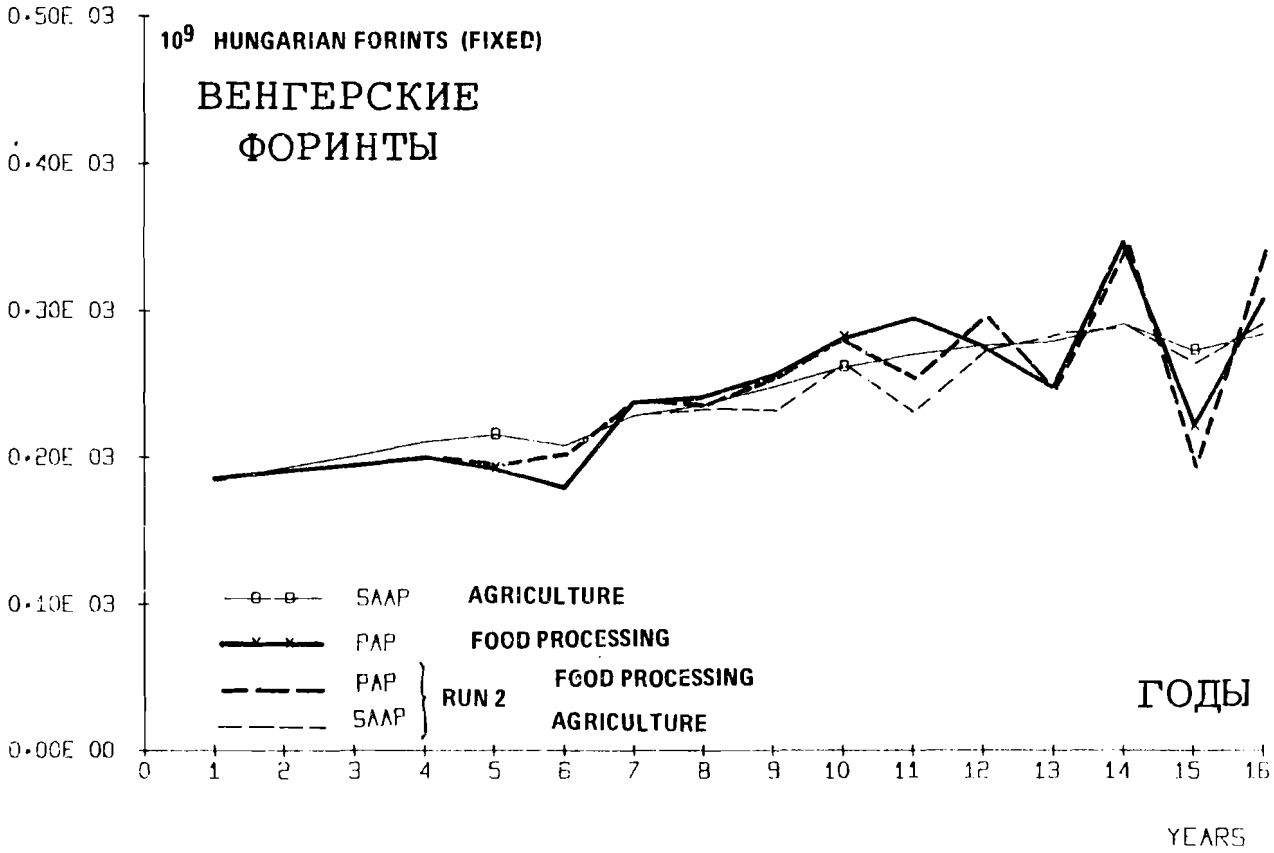

FIGURE 10

ПРОИЗВОДСТВО СОВОКУПНОГО ОБЩЕСТВЕННОГО ПРОДУКТА В СЕЛЬСКОМ ХОЗЯЙСТВЕ

GNP IN FOOD AND AGRICUL··

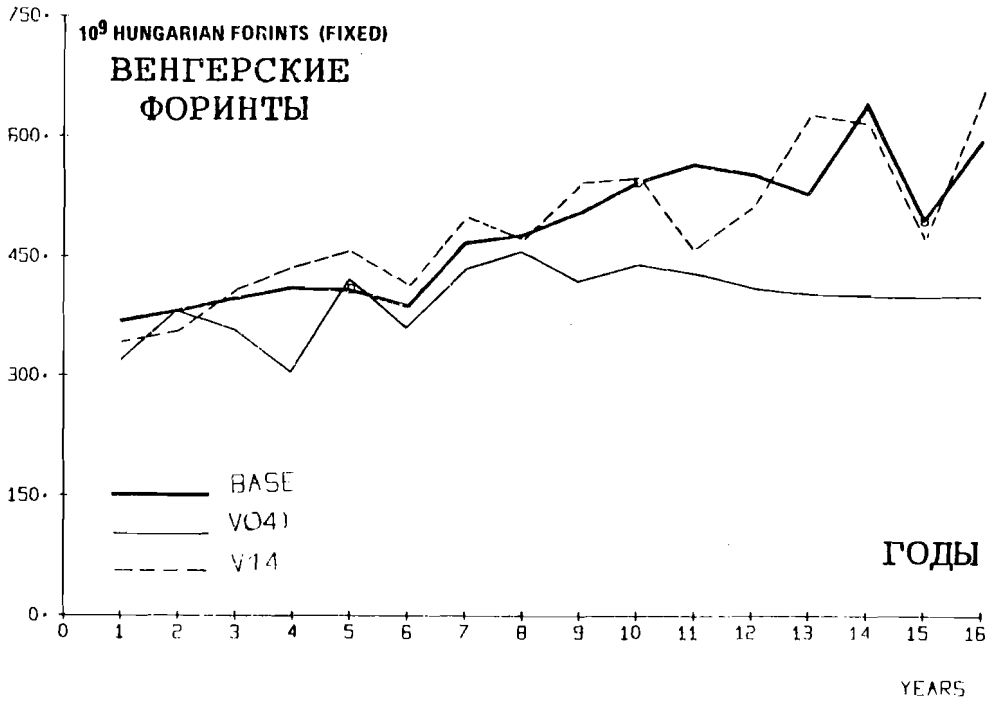

FIGURE 11

ПРОИЗВОДСТВО СОВОКУПНОГО ОБЩЕСТВЕННОГО ПРОДУКТА
В СЕЛЬСКОМ ХОЗЯЙСТВЕ

GNP IN FOOD AND AGRICUL.

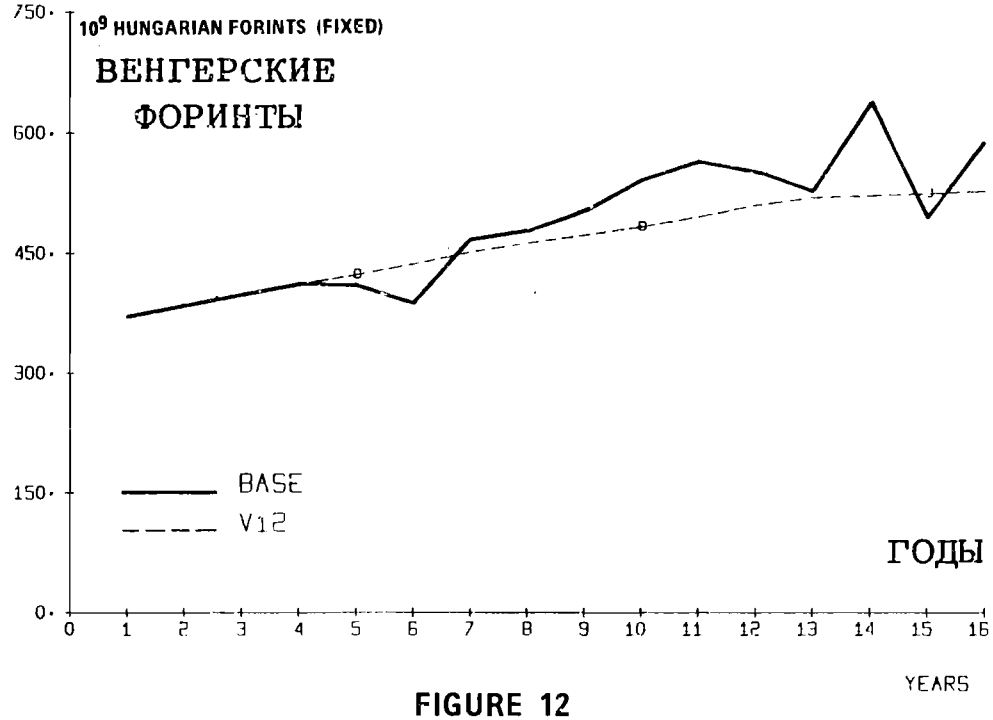

FIGURE 12

ПЛАТЕЖНЫЙ БАЛАНС

BALANCE OF PAYMENT

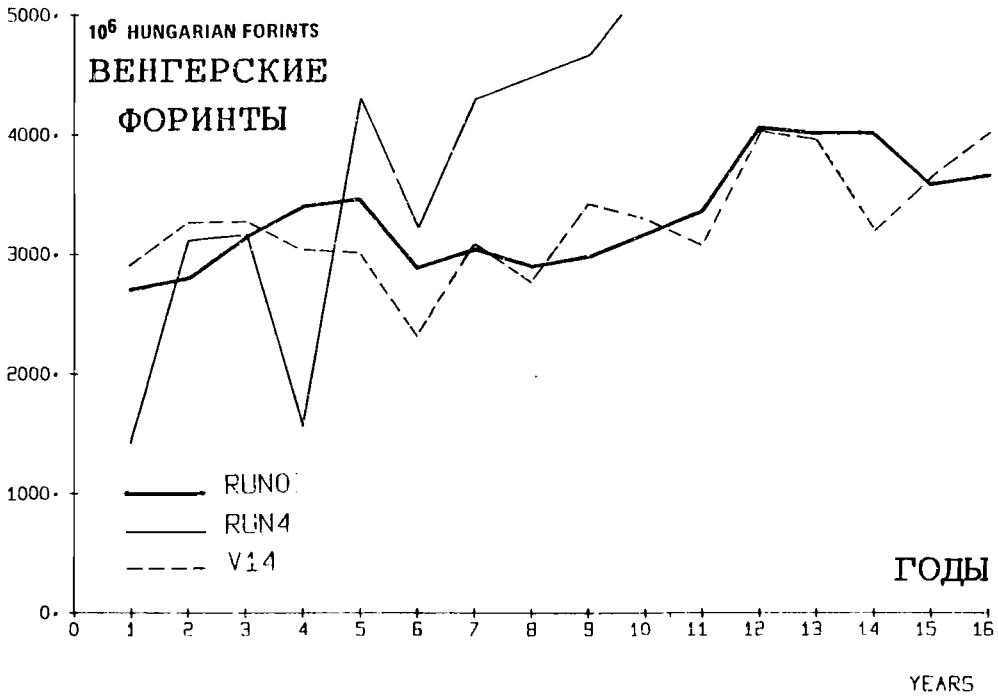

FIGURE 13

STRUCTURE OF FOOD AND AGRICULTURAL PRODUCTION.

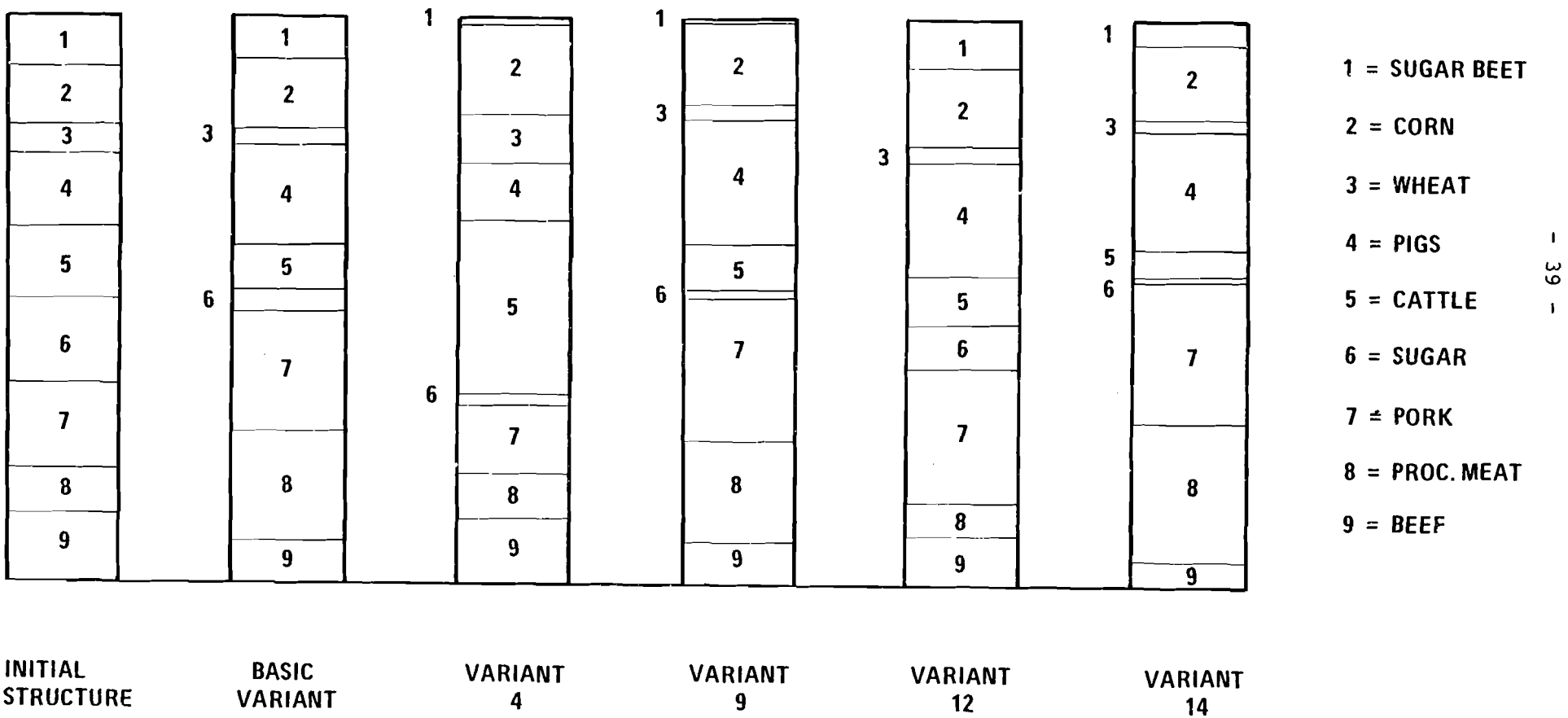

FIGURE 14

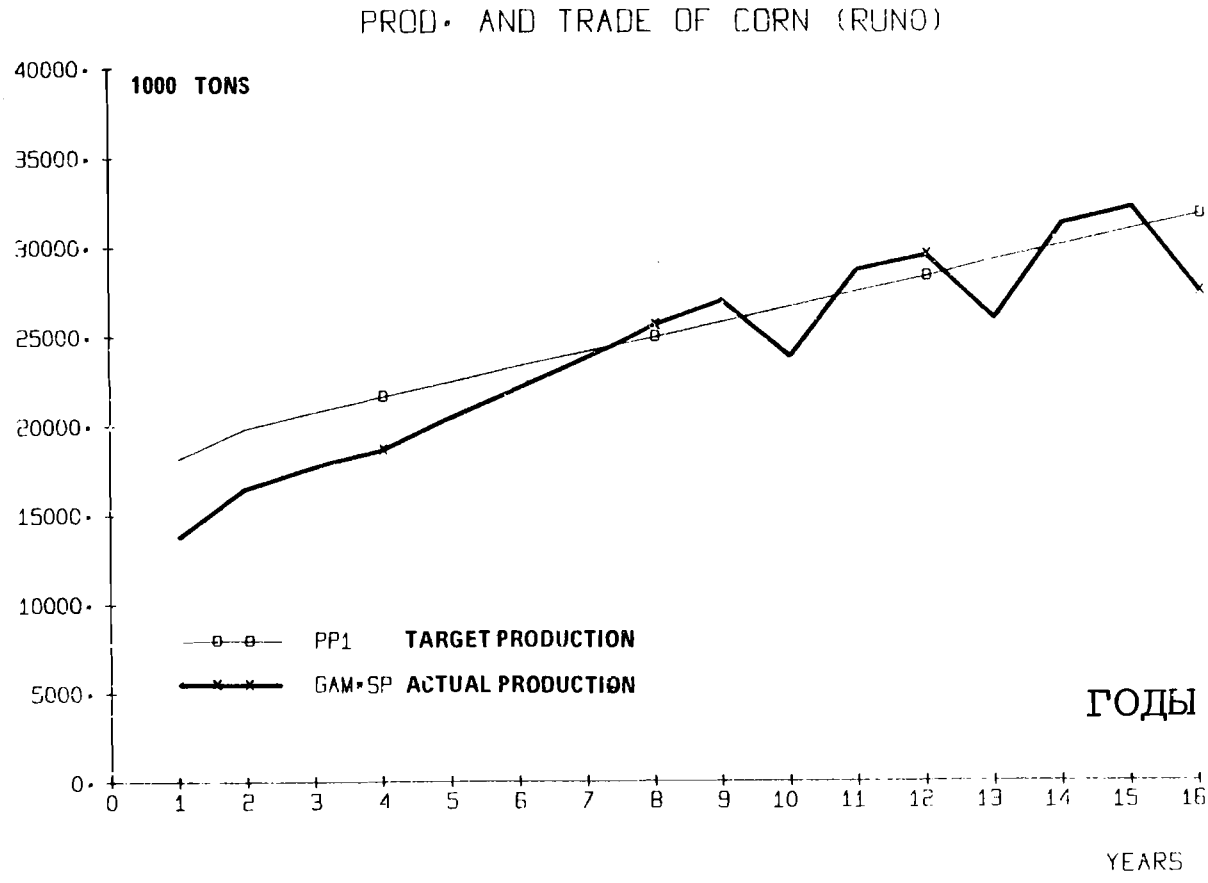

FIGURE 15

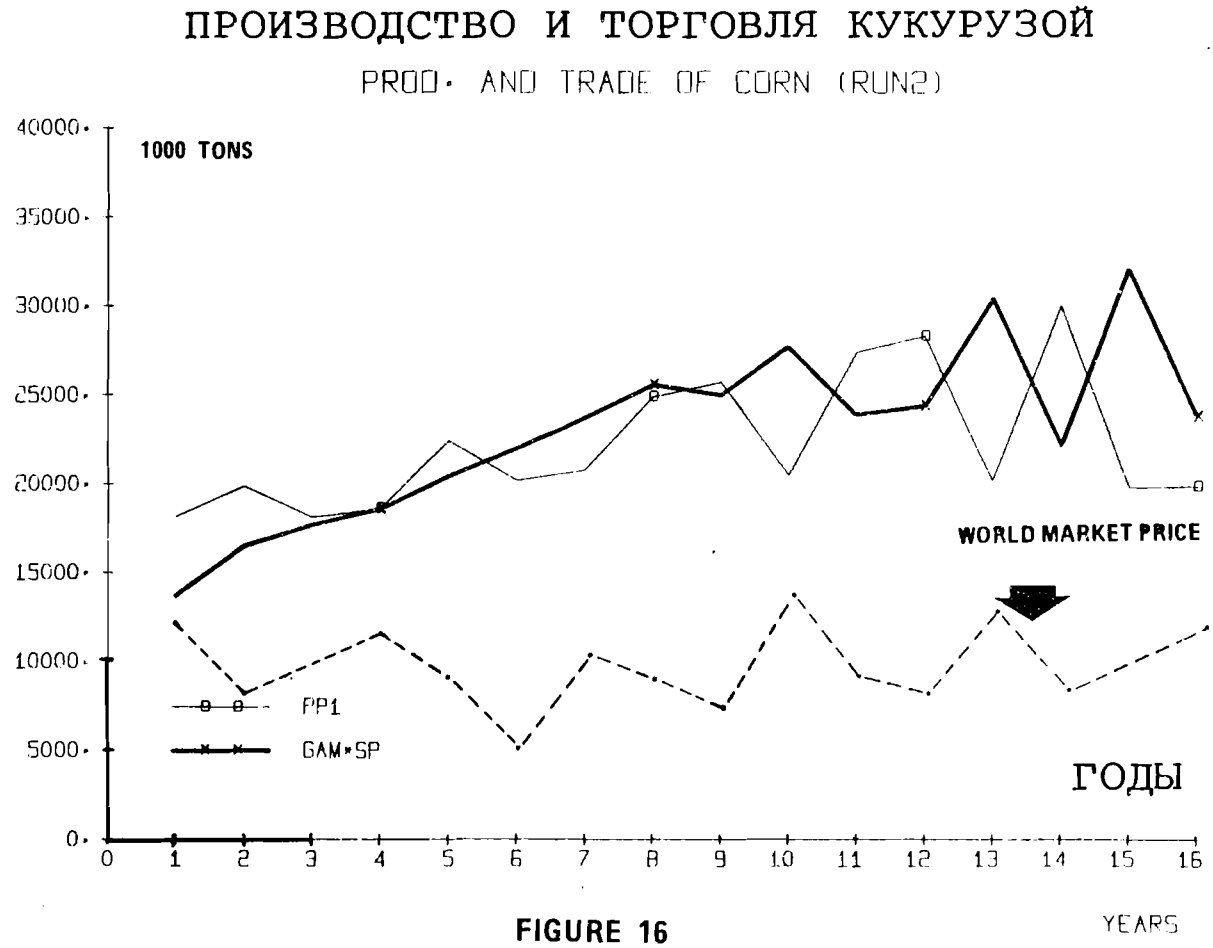

FIGURE 16

СОВРЕМЕННАЯ ТЕХНОЛОГИЯ

ADVANCED TECHNOLOGY (RUNO)

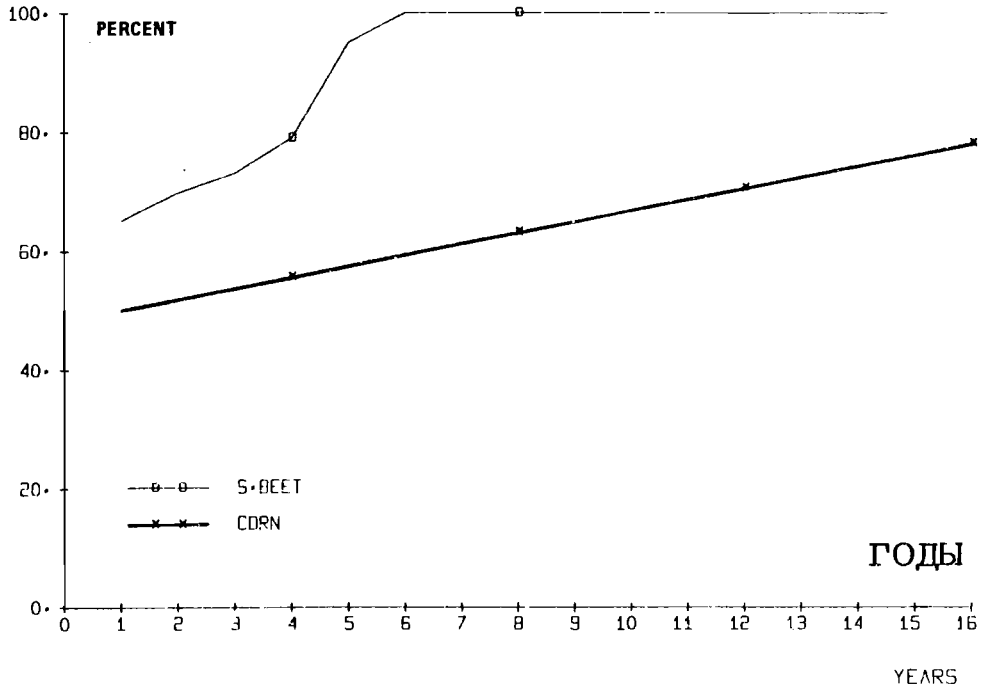

FIGURE 17

ДИНАМИКА ПОТРЕБЛЕНИЯ

DYNAMICS OF CONSUMPTION

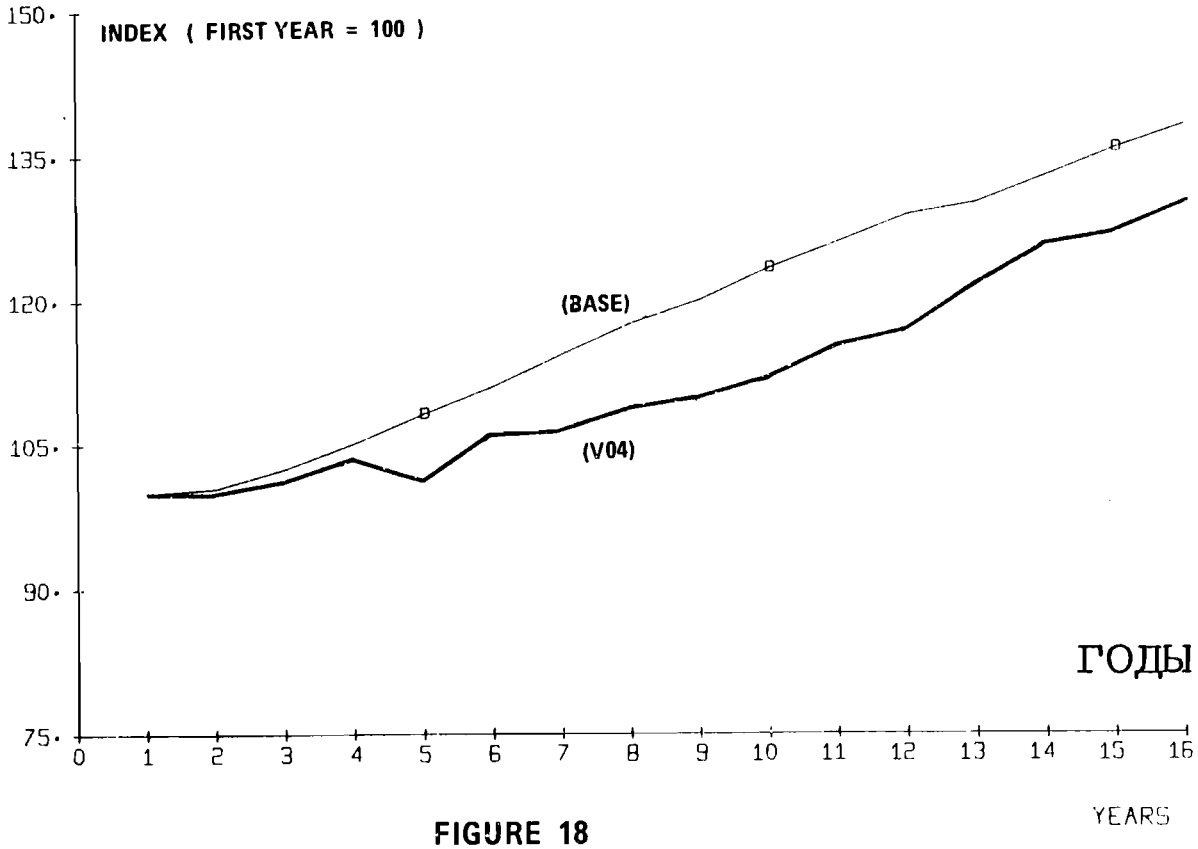

FIGURE 18

ПРОИЗВОДСТВО И ТОРГОВЛЯ ПШЕНИЦЕЙ

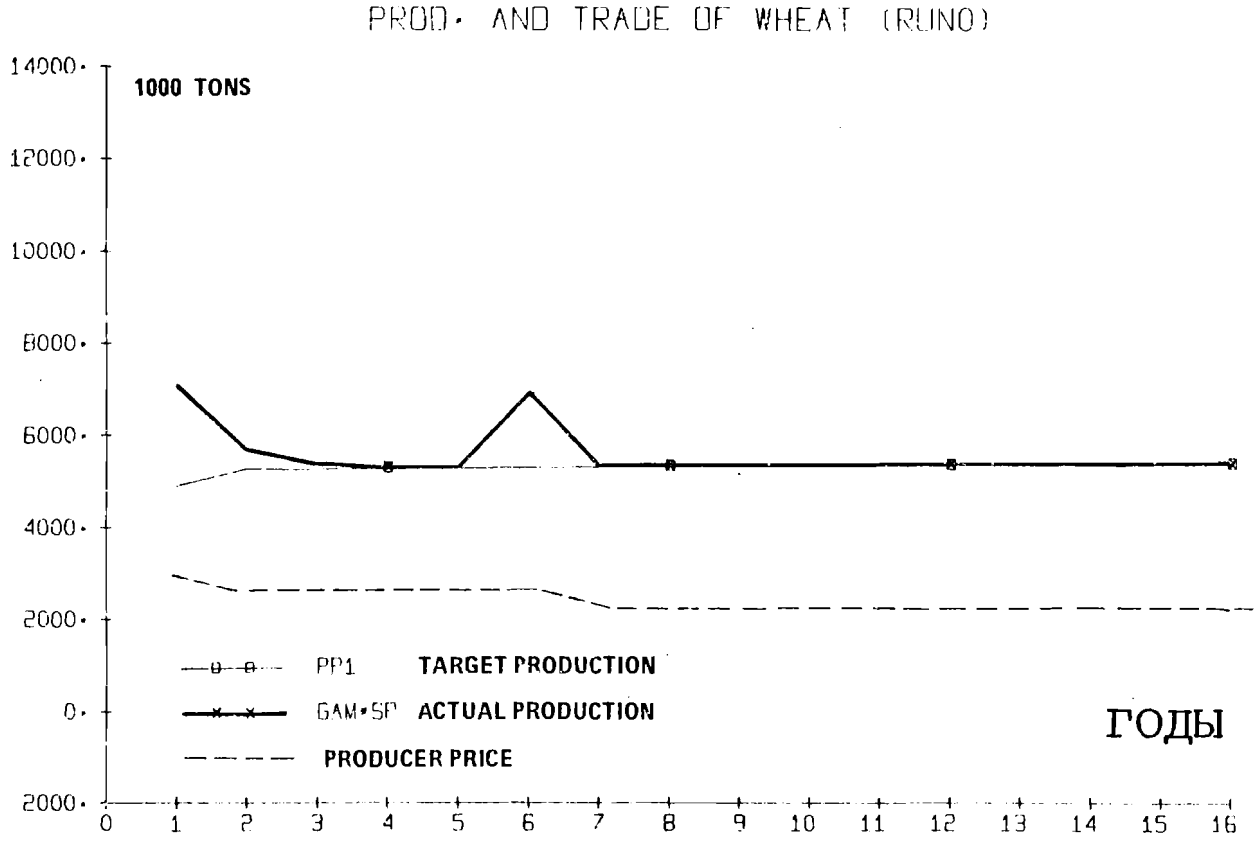

FIGURE 19

YEARS

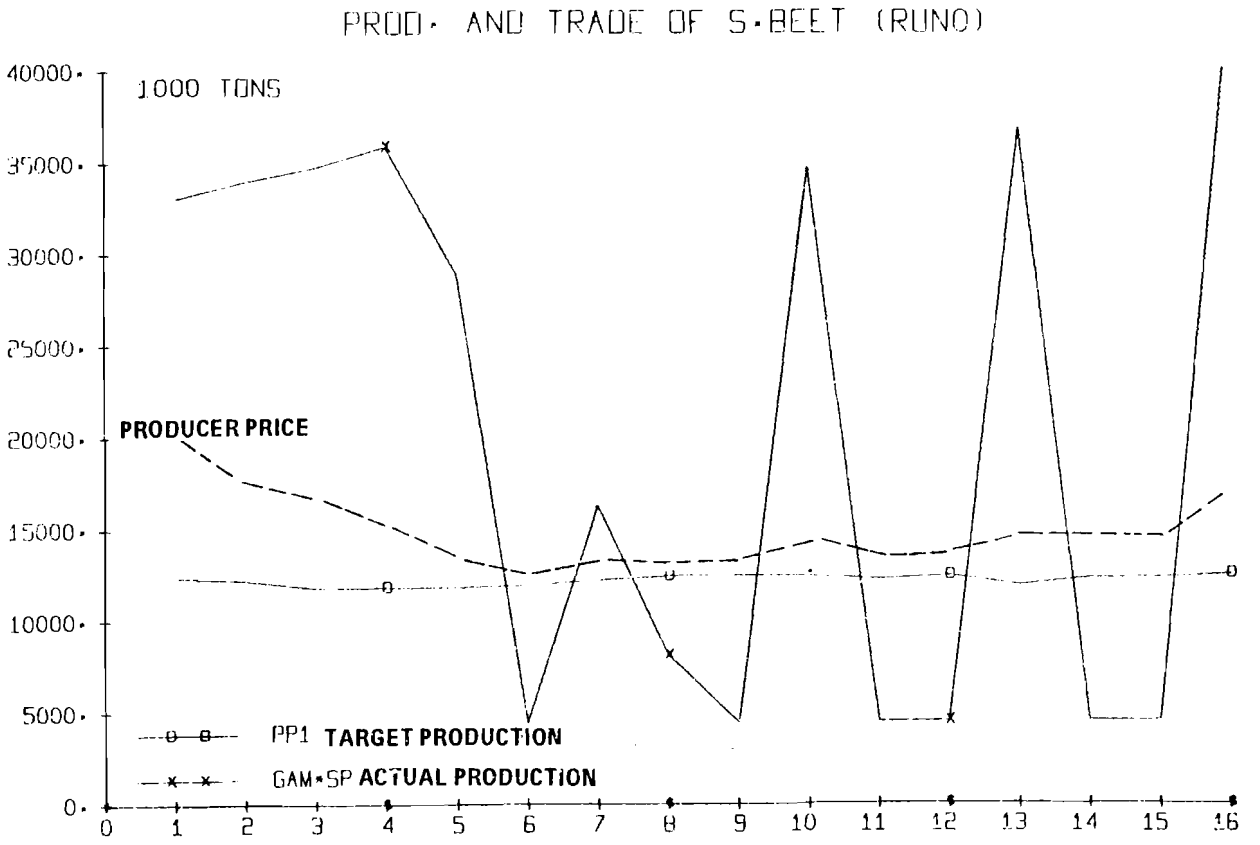

FIGURE 20

This event can be explained based on comparisons with the developments in sugarbeet production. The sugarbeet production decreased very sharply from year 5 to 6 and this crop is partly replaced by the more profitable wheat. This increase is not desired by the national plan, therefore producer prices are modified and wheat loses its competitiveness.

5. CONCLUSIONS

On the whole we feel that the development of HAM-1 has been a very useful step in our work towards the final version of HAM. We believe that the results of various runs of HAM-1 are rather promising. They have supported the appropriateness of our approach and prove that the HAM model structure really can contribute to the further development of planning techniques and actual decision making as well. HAM-1 has also led us to several methodological conclusions that are very important for the further refinement of the model. The most important ones are as follow:

- A relatively aggregated commodity coverage as in the case of HAM-1, is also suitable for very valuable investigations, and above a relatively moderate level, the disaggregation does not improve the quantity of information generated by macro-models. Therefore contrary to our original plans, the commodity aggregation of the final version of HAM will follow the commodity list of FAP at IIASA having not more than 10 - 15 additional commodities.

- The GM-A model describing the policy instrument revising activity of the government is the crucial part of the model from the point ov view of further refinement. Further investigations are required to analyse the present practice and especially the pricing mechanism built in the model has to be revised.

- The use of linear programming in three modules has caused less difficulties than we expected. In spite of this fact we will try to substitute the linear programming model of agricultural producer decisions with a more sophisticated nonlinear programming approach. The structure of the remaining L-P's will also be further developed based on the HAM-1.

- More attention has to be given to the dynamic features of agricultural investments. The approach of HAM-1, including these decisions in production models is not fully satisfactory for some of the investments (e.g. development of animal husbandry). The application of a separate multi-stage model for investment decisions seems to be the desired solution.

- The enlargement of the model size requires a well designed data collecting system, but we have to be aware of the fact that because of insufficient information some of the parameters cannot

be estimated by statistical methods. In these cases we intend to use the estimations of experts of various Hungarian research institutions.

- The elaboration of further methods of validization for HAM-1 has to be one of our most important tasks in the future.

Based on the above mentioned experiments with HAM-1, a presentation of the results in Hungary in the second half of April, 1978, a model presentation at IIASA and probably also in the Soviet Union, further development of HAM will take place later this year. The final model version (HAM-2) with more disaggregated commodity coverage(about 25 food and agricultural commodities) is expected to be completed by the end of 1978.

APPENDIX

Appendix 1

Per Capita Consumption (x_1) and Consumer Prices (p_1^c) of commodities used to estimate the utility function of HAM-1

Year	Wheat			Sugar			Beef		
	p_1^c, x_1	x_1	p_1^c	p_2^c, x_2	x_2	p_2^c	p_3^c, x_3	x_3	p_3^c
1960	1295.46	279.19	4.64	359.94	33.73	10.67	1126.45	42.97	21.61
1961	1341.57	286.66	4.68	384.98	36.05	10.68	1134.68	52.29	21.70
1962	1405.17	299.61	4.69	397.73	37.21	10.69	1126.64	52.60	21.42
1963	1388.56	295.44	4.70	415.11	38.79	10.70	1167.32	54.50	21.42
1964	1399.06	302.17	4.63	427.65	39.93	10.71	1211.65	56.75	21.35
1965	1459.87	307.34	4.75	421.28	39.34	10.71	1193.54	55.92	21.34
1966	1515.45	319.04	4.75	441.77	41.25	10.71	1390.35	47.20	29.45
1967	1540.66	325.03	4.74	466.48	43.56	10.71	1496.59	48.92	30.59
1968	1629.24	342.28	4.76	468.13	47.82	9.79	1512.05	50.31	30.05
1969	1640.38	347.54	4.72	498.98	50.81	9.82	1589.21	53.31	29.81
1970	1691.92	357.70	4.73	531.68	53.81	9.88	1672.29	56.27	29.72
1971	1786.48	378.49	4.72	566.48	57.22	9.90	1677.63	56.47	29.71
1972	1817.75	384.30	4.73	602.37	60.30	9.99	1683.87	56.45	29.83
1973	1947.03	407.32	4.78	654.96	65.37	10.02	1903.90	62.28	30.57
1974	1967.48	410.65	4.79	681.59	68.09	10.01	1957.73	65.28	29.99
1975	1976.05	412.54	4.79	743.20	72.37	10.27	2049.93	67.19	30.51

Year	Pork			Processed Meat			Rest of the economy		
	p_4^c, x_4	x_4	p_4^c	p_5^c, x_5	x_5	p_5^c	p_6^c, x_6	x_6	p_6
1960	885.39	34.07	25.94	628.32	13.6	46.2	7271.44	7271.44	1000.0
1961	909.32	34.29	26.52	643.90	13.7	47.0	7321.55	7304.75	1002.3
1962	907.22	32.39	28.01	702.26	14.6	48.1	7705.98	7372.07	1004.6
1963	938.29	33.08	28.36	683.02	14.2	48.1	8140.90	8058.70	1010.2
1964	969.83	34.10	28.44	728.16	14.8	49.2	8733.65	8577.54	1018.2
1965	1012.68	35.40	28.61	775.71	15.3	50.7	8948.92	8729.80	1025.1
1966	1061.64	29.17	36.40	774.04	14.8	82.3	9668.75	9386.224	1030.1
1967	1096.46	29.28	37.44	824.40	15.2	54.5	10349.41	9975.33	1037.5
1968	1150.72	30.43	37.81	933.90	16.5	56.6	10925.96	10505.73	1040.0
1969	1177.19	30.94	38.05	941.22	16.2	58.1	11793.02	11244.30	1048.8
1970	1198.48	31.35	38.23	1031.90	17.0	60.7	12994.75	12351.25	1052.1
1971	1241.39	32.52	38.17	1124.01	18.1	62.1	14157.01	12961.92	1092.2
1972	1297.66	33.93	38.36	1242.01	20.0	62.1	15176.35	13604.98	1115.5
1973	1320.43	33.83	39.03	1326.64	20.6	64.4	16418.04	13953.80	1176.6
1974	1378.52	35.50	38.83	1449.70	21.8	66.5	17974.95	14834.50	1211.7
1975	1465.39	37.45	39.13	1603.20	24.0	66.8	19558.13	15522.32	1260.0

Appendix 2

Linear Programming Model for Fixing Government Targets for Food and Agriculture (GM-P-3) Module.

(A) List of Columns	Unit
1. Right hand side	
2. Production of sugarbeet	1000 m.t.
3. Production of corn	1000 m.t.
4. Production of wheat	1000 m.t.
5. Pig production	1000 m.t.
6. Cattle production	1000 m.t.
7. Sugar production	1000 m.t.
8. Pork production	1000 m.t.
9. Processed meat production	1000 m.t.
10. Beef production	1000 m.t.
11. Export of corn	1000 m.t.
12. Export of wheat	1000 m.t.
13. Export of cattle	1000 m.t.
14. Export of sugar	1000 m.t.
15. Export of pork	1000 m.t.
16. Export of processed meat	1000 m.t.
17. Export of beef	1000 m.t.
18. Import of sugar	1000 m.t.
19. Import of pork	1000 m.t.
20. Import of beef	1000 m.t.
21. Closing stock of corn	1000 m.t.
22. Closing stock of wheat	1000 m.t.
23. Closing stock of sugar	1000 m.t.
24. Closing stock of pork	1000 m.t.
25. Closing stock of processed meat	1000 m.t.
26. Closing stock of beef	1000 m.t.
27. New investment in tractors	1000 pieces
28. New investment in additional equipment	1000 Hung. Ft.
29. New investment in pig barns	1000 pieces
30. New investment in cattle barns	1000 pieces

(Appendix 2 cont.)

31.	New investment in other fixed assets		1000 Hung. Ft.
32.	New investment in sugar plants		1000 Hung. Ft.
33.	New investment in slaughter-houses		1000 Hung. Ft.
34.	New investment in meat processing plants		1000 Hung. Ft.

(B)	List of Rows	Relation	Unit
1.	Objective function: Max of balance of payment		$ 1000.--
2.	Investment funds of enterprises	≤	1000 Hung. Ft.
3.	Total government investment subsidy	≤	1000 Hung. Ft.
4.	Available tractors	≤	1000 pieces
5.	Available additional agricultural equipment	≤	1000 Hung. Ft.
6.	Available pig barns	≤	1000 pieces
7.	Available cattle barns	≤	1000 pieces
8.	Available other fixed assets	≤	1000 Hung. Ft.
9.	Available sugar plant capacity	≤	1000 m.t.
10.	Available slaughter-house capacity	≤	1000 m.t.
11.	Available meat processing plant capacity	≤	1000 m.t.
12.	Upper limit of labor use in agriculture	≤	1000 heads
13.	Upper limit in labor use of food processing	≤	1000 heads
14.	Available land	≤	1000 hectares
15.	Upper limit of corn export	≤	1000 m.t.
16.	Upper limit of wheat export	≤	1000 m.t.
17.	Upper limit of cattle export	≤	1000 m.t.
18.	Upper limit of sugar export	≤	1000 m.t.
19.	Upper limit of pork export	≤	1000 m.t.
20.	Upper limit of processed meat export	≤	1000 m.t.
21.	Upper limit of beef export	≤	1000 m.t.
22.	Upper limit of corn stocks	≤	1000 m.t.
23.	Upper limit of wheat stocks	≤	1000 m.t.
24.	Upper limit of sugar stocks	≤	1000 m.t.
25.	Upper limit of pork stocks	≤	1000 m.t.
26.	Upper limit of processed meat stocks	≤	1000 m.t.
27.	Upper limit of beef stocks	≤	1000 m.t.
28.	Lower bound of corn stocks	≥	1000 m.t
29.	Lower bound of wheat stocks	≥	1000 m.t.
30.	Lower bound of sugar stocks	≥	1000 m.t.
31.	Lower bound of pork stocks	≥	1000 m.t.

(Appendix 2 cont.)

32.	Lower bound of processed meat stocks	$\geq$	1000 m.t.
33.	Lower bound of beef stocks	$\geq$	1000 m.t.
34.	Agricultural labor requirements	$\geq$	1000 head
35.	Labor requirement of food processing	$\geq$	1000 head
36.	Lower bound of gross national product of food and agriculture	$\geq$	1000 m.t.
37.	Production utilization balance of sugarbeet	=	1000 m.t.
38.	Production utilization balance of corn	=	1000 m.t.
39.	Production utilization balance of wheat	=	1000 m.t.
40.	Production utilization balance of pig	=	1000 m.t.
41.	Production utilization balance of cattle	=	1000 m.t.
42.	Production utilization balance of sugar	=	1000 m.t.
43.	Production utilization balance of pork	=	1000 m.t.
44.	Production utilization balance of processed meat	=	1000 m.t.
45.	Production utilization balance of beef	=	1000 m.t.

(C) GM-P-3 Model Tables

	1	2	3	4	5	6	7	8	9	10	11	
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	1
2	15000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2
3	15444.907	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3
4	440.000	0.002	0.012	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4
5	30000.000	0.139	0.981	1.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5
6	9040.000	0.000	0.000	0.000	5.897	0.000	0.000	0.000	0.000	0.000	0.000	6
7	3000.000	0.000	0.000	0.000	0.000	1.873	0.000	0.000	0.000	0.000	0.000	7
8	50000.000	0.025	0.163	0.178	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8
9	3600.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	9
10	2000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000	1.000	0.000	10
11	300.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	11
12	987.000	0.006	0.010	0.017	0.084	0.164	0.000	0.000	0.000	0.000	0.000	12
13	250.000	0.000	0.000	0.000	0.000	0.000	0.034	0.044	0.052	0.045	0.000	13
14	5497.250	0.029	0.203	0.297	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14
15	99000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	15
16	99000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	16
17	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17
18	1000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18
19	80.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	19
20	400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	20
21	400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21
22	500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22
23	400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23
24	100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24
25	50.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	25
26	50.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	26
27	50.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27
28	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	28
29	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	29
30	50.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30
31	20.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	31
32	5.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32
33	20.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33
34	0.000	0.006	0.010	0.017	0.084	0.164	0.000	0.000	0.000	0.000	0.000	34
35	0.000	0.000	0.000	0.000	0.000	0.000	0.034	0.044	0.052	0.045	0.000	35
36	297568.781	1.000	2.700	2.900	25.600	30.180	14.000	55.000	102.000	60.000	0.000	36
37	0.000	1.000	0.000	0.000	0.000	0.000	-8.000	0.000	0.000	0.000	0.000	37
38	-10.000	0.000	1.000	0.000	-3.397	-4.870	0.000	0.000	0.000	0.000	-1.000	38
39	4892.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	39
40	0.000	0.000	0.000	0.000	1.000	0.000	0.000	-1.800	0.000	0.000	0.000	40
41	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	-1.900	0.000	41
42	497.200	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	42
43	303.196	0.000	0.000	0.000	0.000	0.000	0.000	1.000	-1.780	0.000	0.000	43
44	262.196	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	44
45	736.680	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.030	45
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	46
	1	2	3	4	5	6	7	8	9	10	11	

	12	13	14	15	16	17	18	19	20	21	22	
1	0.130	1.400	0.380	1.200	2.100	1.500	-0.380	-1.200	-1.500	0.000	0.000	1
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15
16	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	16
17	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17
18	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18
19	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	19
20	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	20
21	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	21
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	22
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	23
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	25
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	26
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	28
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	29
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	30
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	31
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32
33	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	34
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35
36	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	36
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	37
38	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-1.000	0.000	38
39	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-1.000	39
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	40
41	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	41
42	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	42
43	0.000	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	43
44	0.000	0.000	0.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	44
45	0.000	0.000	0.000	0.000	0.000	-1.000	0.000	0.000	1.000	0.000	0.000	45
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	46
	12	13	14	15	16	17	18	19	20	21	22	

	23	24	25	26	27	28	29	30	31	32	33	34	
1	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1
2	0,000	0,000	0,000	0,000	51,650	0,900	10,740	18,000	0,900	0,700	0,820	100,000	2
3	0,000	0,000	0,000	0,000	5,680	0,100	2,680	12,000	0,100	1,050	1,640	60,000	3
4	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	4
5	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	5
6	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	6
7	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	7
8	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	8
9	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	0,000	9
10	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	0,000	10
11	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-1,000	11
12	0,000	0,000	0,000	0,000	0,000	2,000	0,000	0,000	0,000	0,000	0,000	0,000	12
13	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	13
14	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	14
15	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	15
16	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	16
17	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	17
18	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	18
19	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	19
20	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	20
21	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	21
22	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	22
23	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	23
24	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	24
25	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	25
26	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	26
27	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	27
28	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	28
29	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	29
30	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	30
31	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	31
32	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	32
33	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	33
34	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	2,000	34
35	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	35
36	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	36
37	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	37
38	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	38
39	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	39
40	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	40
41	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	41
42	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	42
43	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	43
44	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	44
45	0,000	0,000	0,000	-1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	45
46	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	46
	23	24	25	26	27	28	29	30	31	32	33	34	

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Appendix 3

Linear Programming Model for Determining Agricultural Production (P-3) Module.

(A) List of Columns	Units
1. Right hand side	
2. Sugarbeet production, traditional technology	1000 hectares
3. Sugarbeet production, advanced technology	1000 hectares
4. Sugarbeet production, irrigated technology	1000 hectares
5. Corn production, traditional technology	1000 hectares
6. Corn production, advanced technology	1000 hectares
7. Wheat production, traditional technology	1000 hectares
8. Wheat production, advanced technology	1000 hectares
9. Pig production, traditional technology	1000 heads
10. Pig production, advanced technology	1000 heads
11. Cattle production, traditional technology	1000 heads
12. Cattle production, advanced technology	1000 heads
13. New investment in tractors using government subsidies	1000 pieces
14. New investment in other equipment using government subsidies	1000 Hung. Ft.
15. New investment in pig barns using government subsidies	1000 heads
16. New investment in cattle barns using government subsidies	1000 heads
17. New investment in other fixed assets using government subsidies	1000 Hung. Ft.
18. New investment in tractors only by enterprise's own resources	1000 pieces
19. New investment in other equipment by enterprise's own resources	1000 Hung. Ft.
20. New investment in pig barns by enterprise's own resources	1000 head
21. New investment in cattle barns by enterprise's own resources	1000 head
22. New investment in other fixed assets by enterprise's own resources	1000 Hung. Ft.

(Appendix 3 cont.)

(B)	List of Rows	Relation	Unit
1.	Objective function: enterprise's net income	max	1000 Hung. Ft.
2.	Irrigated land	$\leq$	1000 hectares
3.	Plowland	$\leq$	1000 hectares
4.	Upper limit of sugarbeet production	$\leq$	1000 hectares
5.	Upper limit of corn production	$\leq$	1000 hectares
6.	Upper limit of wheat production	$\leq$	1000 hectares
7.	Upper limit for sugarbeet, traditional technology	$\leq$	1000 hectares
8.	Upper limit for corn, traditional technology	$\leq$	1000 hectares
9.	Upper limit for wheat, traditional technology	$\leq$	1000 hectares
10.	Upper limit for pigs, traditional technology	$\leq$	1000 heads
11.	Upper limit for cattle, traditional technology	$\leq$	1000 heads
12.	Upper limit for sugarbeet, advanced technology	$\leq$	1000 hectares
13.	Upper limit for corn,advanced technology	$\leq$	1000 hectares
14.	Upper limit for wheat, advanced technology	$\leq$	1000 hectares
15.	Upper limit for pigs,advanced technology	$\leq$	1000 heads
16.	Upper limit for cattle, advanced technology	$\leq$	1000 heads
17.	Use of enterprise's investment funds	$\leq$	1000 Hung. Ft.
18.	Use of government subsidies for investment in farm machinery	$\leq$	1000 Hung. Ft.
19.	Use of government subsidies for investment in animal husbandry	$\leq$	1000 Hung. Ft.
20.	Tractor utilization	$\leq$	1000 pieces
21.	Other equipment utilization	$\leq$	1000 pieces
22.	Pig barn utilization	$\leq$	1000 head
23.	Cattle barn utilization	$\leq$	1000 head
24.	Other fixed asset utilization	$\leq$	1000 Hung. Ft.
25.	Upper limit of labor use	$\leq$	1000 heads
26.	Total labor requirements	=	1000 heads
27.	Sugarbeet utilization balance	=	1000 m.t.

(Appendix 3 cont.)

28.	Corn utilization balance	=	1000 m.t.
29.	Wheat utilization balance	=	1000 m.t.
30.	Pig utilization balance	=	1000 m.t.
31.	Cattle utilization balance	=	1000 m.t.

(C) P-3 Model Tables

	1	2	3	4	5	6	7	8	9	10	
1	0.0000	10.4695	13.9625	15.2970	0.6627	1.7575	0.9470	1.8554	0.6863	1.0652	1
2	500.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0300	0.0300	0.0000	0.0000	2
3	5497.2500	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	3
4	824.5875	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4
5	5497.2500	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	5
6	3573.2124	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	6
7	625.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7
8	1500.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8
9	1900.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	9
10	8700.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	10
11	2400.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	11
12	0.0000	-0.2500	0.7500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	12
13	0.0000	0.0000	0.0000	0.0000	-0.5000	0.5000	0.0000	0.0000	0.0000	0.0000	13
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.5000	0.5000	0.0000	0.0000	14
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.3000	0.7000	15
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	16
17	10000.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	17
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18
19	10000.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	19
20	440.0000	0.0535	0.1300	0.1355	0.0438	0.0905	0.0340	0.0687	0.0000	0.0000	20
21	30000.0000	2.8700	11.6470	12.1070	2.7250	10.0960	2.1120	7.6650	0.0000	0.0000	21
22	9040.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7000	0.5500	22
23	3000.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	23
24	50000.0000	7.7931	11.6589	12.4190	3.2729	5.0866	2.3938	3.8891	0.8064	0.8928	24
25	987.0000	0.2200	0.1800	0.2000	0.0560	0.0400	0.0600	0.0480	0.0128	0.0088	25
26	0.0000	0.2200	0.1800	0.2000	0.0560	0.0400	0.0600	0.0480	0.0128	0.0088	26
27	4420.0801	32.3470	42.5330	44.6000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	27
28	0.0000	0.0000	0.0000	0.0000	4.6320	5.6520	0.0000	0.0000	-0.4967	-0.4470	28
29	5262.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1230	4.0370	0.0000	0.0000	29
30	1603.5607	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1400	0.1550	30
31	1469.6765	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	31
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	32
	1	2	3	4	5	6	7	8	9	10	

	11	12	13	14	15	16	17	
1	0.2482	1.0161	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	1
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	9
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10
11	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	11
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	12
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	14
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	15
16	-0.2000	0.8000	0.0000	0.0000	0.0000	0.0000	0.0000	16
17	0.0000	0.0000	51.6500	0.9000	10.7400	18.0000	0.9000	17
18	0.0000	0.0000	5.6800	0.1000	0.0000	0.0000	0.1000	18
19	0.0000	0.0000	0.0000	0.0000	2.6800	12.0000	0.0000	19
20	0.0000	0.0000	-1.0000	0.0000	0.0000	0.0000	0.0000	20
21	0.0000	0.0000	0.0000	-1.0000	0.0000	0.0000	0.0000	21
22	0.0000	0.0000	0.0000	0.0000	-1.0000	0.0000	0.0000	22
23	1.0000	1.0000	0.0000	0.0000	0.0000	-1.0000	0.0000	23
24	3.6058	3.7212	0.0000	0.0000	0.0000	0.0000	-1.0000	24
25	0.0960	0.0480	0.0000	0.0000	0.0000	0.0000	0.0000	25
26	0.0960	0.0480	0.0000	0.0000	0.0000	0.0000	0.0000	26
27	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	27
28	-2.6000	-2.6000	0.0000	0.0000	0.2000	0.0000	0.0000	28
29	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	29
30	0.0000	0.0000	0.0000	0.0000	-0.0030	0.0000	0.0000	30
31	0.5310	0.5480	0.0000	0.0000	0.0000	-0.2970	0.0000	31
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	32
	11	12	13	14	15	16	17	

1	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
2	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000
17	57.3300	1.0000	13.4200	30.0000	1.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000
20	-1.0000	0.0000	0.0000	0.0000	0.0000
21	0.0000	-1.0000	0.0000	0.0000	0.0000
22	0.0000	0.0000	-1.0000	0.0000	0.0000
23	0.0000	0.0000	0.0000	-1.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	-1.0000
25	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0000	0.0000	-0.0030	0.0000	0.0000
31	0.0000	0.0000	0.0000	-0.2970	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix 4

Linear Programming Model for Determining Food Processing (P-5) Module.

(A) List of Columns

1.	Right hand side	
2.	Sugar production	1000 m.t.
3.	Processed meat production	1000 m.t.
4.	Beef production	1000 m.t.
5.	New investment in sugar plant using government subsidies	1000 m.t.
6.	New investment in slaughter-houses using government subsidies	1000 m.t.
7.	Pork production	1000 m.t.
8.	New investment in meat processing plants using government subsidies	1000 m.t.
9.	Pork output	1000 m.t.
10.	Production value of food processing	1000 Hung. Ft.
11.	General production expenses of food processing	1000 Hung. Ft.
12.	Labor use in food processing	1000 heads
13.	New investment in sugar plant by enterprise's own resources	1000 m.t.
14.	New investment in slaughter-houses by enterprise's own resources	1000 m.t.
15.	New investment in meat processing plants by enterprise's own resources	1000 m.t.

(B)	List of Rows	Relation	Unit
1.	Objective function: maximum of net income of enterprises		1000 Hung. Ft.
2.	Sugarbeet utilization	$\leq$	1000 m.t.
3.	Cattle utilization	$\leq$	1000 m.t.
4.	Labor utilization	$\leq$	1000 head
5.	Sugar plant capacity	$\leq$	1000 m.t.
6.	Slaughter-house capacity	$\leq$	1000 m.t.
7.	Enterprise's investment funds utilization	$\leq$	1000 m.t.
8.	Available government subsidy for investment in sugar plants	$\leq$	1000 Hung. Ft.

(Appendix 4 cont.)

9.	Available government subsidy for investment in meat industry	$\leq$	1000 Hung. Ft.
10.	Meat processing capacity	$\leq$	1000 m.t.
11.	Lower bound of sugar production	$\geq$	1000 m.t.
12.	Lower bound of pork production	$\geq$	1000 m.t.
13.	Lower bound of processed meat production	$\geq$	1000 m.t.
14.	Lower bound of beef production	$\geq$	1000 m.t.
15.	Pig utilization balance	=	1000 m.t.
16.	Pork utilization balance	=	1000 m.t.
17.	Determination of gross production	=	1000 m.t.
18.	Determination of general management and overhead expenses	=	1000 Hung. Ft.
19.	Total labor use for food processing	=	1000 heads

(C) P-5 Model Tables

	1	2	3	4	5	6	7	8	9	10	11	12	
1	0.000	5.770	2.200	1.318	-0.000	-0.000	7.600	-0.000	0.000	0.000	-1.000	-44.460	1
2	33046.141	8.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2
3	1603.200	0.000	0.000	1.900	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3
4	250.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	4
5	3600.000	1.000	0.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5
6	2000.000	0.000	0.000	1.000	0.000	-1.000	0.500	0.000	0.000	0.000	0.000	0.000	6
7	5000.000	0.000	0.000	0.000	0.700	0.820	0.000	100.000	0.000	0.000	0.000	0.000	7
8	0.000	0.000	0.000	0.000	1.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8
9	0.000	0.000	0.000	0.000	0.000	1.640	0.000	60.000	0.000	0.000	0.000	0.000	9
10	300.000	0.000	1.000	0.000	0.000	0.000	0.000	-1.000	0.000	0.000	0.000	0.000	10
11	526.200	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11
12	305.196	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	12
13	305.196	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13
14	736.680	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	14
15	1795.929	0.000	0.000	0.000	0.000	0.000	1.800	0.000	0.000	0.000	0.000	0.000	15
16	0.000	0.000	-1.780	0.000	0.000	0.000	1.000	0.000	-1.000	0.000	0.000	0.000	16
17	0.000	14.000	102.000	60.000	0.000	0.000	55.000	0.000	0.000	-1.000	0.000	0.000	17
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.150	-1.000	0.000	18
19	0.000	0.034	0.052	0.045	0.000	0.009	0.044	0.000	0.000	0.000	0.000	-1.000	19
	1	2	3	4	5	6	7	8	9	10	11	12	

1	-0.0001	-0.0001	-0.0001
2	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000
5	-1.0000	0.0000	0.0000
6	0.0000	-1.0000	0.0000
7	1.7500	2.4600	160.0000
8	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000
10	0.0000	0.0000	-1.0000
11	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000

Appendix 5

HUNGARIAN AGRICULTURAL MODEL

SUMMARY OF RESULTS

COMMODITY COVERAGE OF THE FIRST VERSION OF HAM

NUMBER	PRODUCT'S NAME	PRODUCT'S CONTENT
1	SUGAR BEET	SUGAR BEET AND OTHER CROP PRODUCTS TO BE PROCESSED
2	CORN	COARSE GRAINS AND OTHER FEED PRODUCTS
3	WHEAT	FOOD GRAINS AND OTHER DIRECTLY CONSUMED CROP PRODUCTS
4	PIG	PIG
5	CATTLE	CATTLE AND OTHER LIVESTOCK PRODUCTS
6	SUGAR	SUGAR AND OTHER PROCESSED CROP PRODUCTS
7	PORK	PORK MEAT
8	PROCESSED MEAT	PROCESSED MEATS
9	BEEF	BEEF AND OTHER MEATS
10	N-TH PRODUCT	PRODUCT OF THE REST OF THE ECONOMY

RUN! 0

GENERAL INDICATORS * 1 *

YEAR	GROSS NATIONAL PRODUCT				GROSS PRODUCTION VALUE OF AGRICULTURE				GROSS PRODUCTION VALUE OF FOOD PROC.			
	CURRENT PRICES		FIXED PRICES		CURRENT PRICES		FIXED PRICES		CURRENT PRICES		FIXED PRICES	
	MILL.FT.	%	MILL.FT.	%	MILL.FT.	%	MILL.FT.	%	MILL.FT.	%	MILL.FT.	%
1	1233251.3	100.0	1233251.3	100.0	183874.9	100.0	183874.9	100.0	186328.2	100.0	186328.2	100.0
2	1262539.6	102.4	1273537.8	103.3	187998.5	102.2	193052.0	105.0	184904.2	99.2	190848.8	102.4
3	1308110.6	106.1	1322916.3	107.3	196134.4	106.7	201601.9	109.6	186094.2	99.9	195432.3	104.9
4	1355492.4	109.9	1374719.5	111.5	202490.0	110.1	210875.7	114.7	189923.6	101.9	200765.2	107.7
5	1401227.1	113.6	1415216.5	114.8	207495.9	112.8	215937.9	117.4	187287.3	100.5	192834.6	103.5
6	1467566.0	119.0	1446530.4	117.3	207620.8	112.9	208202.5	113.2	201056.6	107.9	179439.3	96.3
7	1566374.1	127.0	1544048.4	125.2	224488.4	122.1	228944.5	124.5	265603.1	142.5	238821.2	128.2
8	1621720.9	131.5	1588769.5	128.8	234638.8	127.6	236229.0	128.5	276690.4	148.5	242148.8	130.0
9	1691681.0	137.2	1650436.1	133.8	248510.0	135.2	248248.8	135.0	297289.9	159.6	256306.3	137.6
10	1746543.0	141.6	1723158.9	139.7	252601.9	137.4	261492.7	142.2	313666.8	168.3	281392.0	151.0
11	1835939.8	148.9	1789029.4	145.1	270444.1	147.1	270107.3	146.9	341454.5	183.3	294880.9	158.3
12	1849374.4	150.0	1820020.6	147.6	276853.6	150.6	276526.6	150.4	305258.3	163.8	276231.7	148.3
13	1839551.3	149.2	1853681.5	150.3	264953.9	144.1	278747.6	151.6	248061.8	133.1	248398.4	133.3
14	2030845.8	164.7	2026102.6	164.3	275316.8	149.7	291270.9	158.4	367494.0	197.2	346796.8	186.1
15	1978821.9	160.5	1946188.5	157.8	272289.3	148.1	272542.9	148.2	254612.8	136.6	221725.7	119.0
16	2098979.3	170.2	2117686.3	171.7	258519.8	140.6	284105.9	154.5	314849.5	169.0	307970.2	165.3

RUN: 0

GENERAL INDICATORS * 2 *

YEAR	BALANCE OF FOREIGN TRADE IN FOOD PROD.	INVESTMENTS			NET INCOME OF		
		TOTAL	IN FOOD AND AGRICULTURE	SHARE OF FOOD AND AGRIC.	AGRICULTURAL FIRMS	FOOD PROCESSING FIRMS	REST OF THE ECONOMY
	MILL $	MILL.FT.	MILL.FT.	%	MILL.FT.	MILL.FT.	MILL.FT.
1	2710,59	194488,27	10237,89	5,26	27059,68	0,00	118756,31
2	2803,65	244652,28	31020,84	12,68	25429,90	0,00	127624,79
3	3142,49	258442,27	33452,98	12,94	27349,04	0,00	136668,66
4	3394,77	279429,03	40879,77	14,63	26834,65	0,00	143121,38
5	3461,31	293188,53	42298,81	14,43	26404,00	0,00	148241,08
6	2882,98	261813,19	38291,14	14,63	27429,19	0,00	152988,19
7	3038,29	299288,19	56535,59	18,89	29704,29	3346,22	156461,80
8	2896,65	318000,59	56542,19	17,78	31560,40	2541,72	158120,17
9	2976,59	344675,22	61437,22	17,82	34673,53	2518,56	164951,09
10	3176,66	343554,13	54923,69	15,99	37738,88	3453,56	172098,92
11	3352,32	359559,56	59560,44	16,56	39924,23	2294,50	177075,98
12	4068,35	430913,12	62440,13	14,49	43043,27	0,00	182020,17
13	4020,28	437202,78	58578,94	13,40	44685,73	0,00	200530,84
14	4020,70	446943,69	67591,97	15,12	38969,86	10586,75	213402,27
15	3585,49	561837,25	97931,09	17,43	36110,50	3309,52	217784,02
16	3656,45	417466,72	17018,00	4,08	39992,72	10183,59	240824,94

RUN: 0

GENERAL INDICATORS * 3 *

YEAR	INCOME OF POPULATION	CONSUMPTION			GOVERNMENT BUDGET			
	CURRENT PRICE	FIXED PRICE			INCOME	EXPENDITURES	DEFICIT	SURPLUS
	MILL.FT.	MILL.FT.	MILL.FT.	%	MILL.FT.	MILL.FT.	MILL.FT.	MILL.FT.
1	270902,47	237851,03	226008,17	100,000	238193,81	249573,08	11379,27	0,00
2	273569,50	239323,39	227083,58	100,476	253797,02	266157,69	12360,63	0,00
3	280410,09	244484,70	231651,23	102,497	274835,22	288327,91	13492,69	0,00
4	289140,41	251261,70	237734,59	105,188	292457,06	307204,56	14747,45	0,00
5	298866,25	258838,05	244555,98	108,207	301591,22	317710,09	16118,86	0,00
6	308262,69	266012,41	250978,80	111,049	278531,75	296121,09	17589,36	0,00
7	319129,84	274396,62	258523,30	114,387	265501,75	284704,56	19202,81	0,00
8	329713,81	282402,50	265690,56	117,558	260129,36	281063,59	20934,25	0,00
9	338461,84	288628,00	271164,97	119,980	264048,41	286805,31	22756,91	0,00
10	349811,25	297051,84	278686,41	123,308	283772,47	308546,97	24774,49	0,00
11	359707,78	304019,97	284822,91	126,023	280596,31	307507,53	26911,23	0,00
12	369995,62	311179,34	291121,09	128,810	347274,12	376490,78	29216,65	0,00
13	376386,34	314675,25	293979,09	130,075	359729,34	391329,59	31600,22	0,00
14	387148,75	321912,78	300319,78	132,880	334072,94	368337,06	34264,08	0,00
15	398119,13	329139,22	306632,41	135,673	343963,38	381093,91	37130,50	0,00
16	408426,16	335560,66	312178,50	138,127	373564,28	413755,72	40191,43	0,00

RUN: 0

DYNAMICS OF PRODUCTION AND TRADE * 1 *

UNITS MEASURED: 1000 METRIC TONS

	SUGAR BEET						CORN					
	PRODUCTION		EXPORT	IMPORT	YIELD	ADVANCED TECHNOLOGY	PRODUCTION		EXPORT	IMPORT	YIELD	ADVANCED TECHNOLOGY
YEAR	TARGET	ACTUAL			MT/HA	%	TARGET	ACTUAL		MT/HA	%	
1	12377.6	33046.1	0.0	0.0	40.076	65.04	18145.8	13787.7	0.0	0.0	5.142	50.00
2	12215.6	33969.0	0.0	0.0	41.216	69.74	19837.4	16530.4	2071.9	0.0	5.304	51.87
3	11821.6	34750.1	0.0	0.0	42.185	73.06	20733.6	17726.8	2543.7	0.0	5.466	53.75
4	11827.6	35830.9	0.0	0.0	43.518	78.97	21561.8	18583.2	2578.9	0.0	5.629	55.63
5	11833.6	28923.4	0.0	0.0	46.294	94.97	22407.9	20444.1	3518.3	0.0	5.793	57.50
6	11956.0	4451.6	0.0	0.0	47.600	100.00	23286.9	21995.1	4025.5	0.0	5.957	59.38
7	12245.6	16284.0	0.0	0.0	48.200	100.00	24092.5	23699.0	4529.3	0.0	6.122	61.25
8	12451.6	8122.7	0.0	0.0	48.800	100.00	24892.8	25579.3	5021.8	0.0	6.288	63.13
9	12457.6	4470.5	0.0	0.0	49.400	100.00	25730.4	26904.7	4733.4	0.0	6.455	65.00
10	12463.6	34670.1	0.0	0.0	50.000	100.00	26572.5	23763.8	3308.4	0.0	6.622	66.88
11	12288.4	4483.1	0.0	0.0	50.600	100.00	27450.0	28625.3	4526.1	0.0	6.791	68.75
12	12475.6	4489.4	0.0	0.0	51.200	100.00	28269.9	29491.8	5253.5	0.0	6.960	70.63
13	11881.6	36767.1	0.0	0.0	51.800	100.00	29229.7	25920.8	5599.4	0.0	7.129	72.50
14	12287.6	4502.6	0.0	0.0	52.400	100.00	30019.6	31237.1	6899.9	0.0	7.300	74.38
15	12301.8	4508.3	0.0	0.0	53.000	100.00	30882.1	32115.7	7696.4	0.0	7.471	76.25
16	12499.6	43867.5	0.0	0.0	53.600	100.00	31715.6	27386.6	8162.2	0.0	7.643	78.13

RUN: 0

DYNAMICS OF PRODUCTION AND TRADE * 2 *

UNITS MEASURED: 1000 METRIC TONS

WHEAT

YEAR	PRODUCTION TARGET	PRODUCTION ACTUAL	EXPORT	IMPORT	YIELD MT/HA	ADVANCED TECHNOLOGY %
1	4902.0	7128.8	3437.4	0.0	3.580	50.00
2	5269.5	5712.6	1335.5	0.0	3.677	51.88
3	5267.0	5378.9	956.9	0.0	3.775	53.75
4	5274.5	5284.5	796.3	0.0	3.874	55.63
5	5282.0	5292.0	737.7	0.0	3.973	57.50
6	5292.4	6913.4	2300.4	0.0	4.072	59.38
7	5307.0	5307.0	449.9	0.0	4.172	61.25
8	5319.5	5314.5	367.6	0.0	4.273	63.13
9	5327.0	5322.0	311.6	0.0	4.374	65.00
10	5334.5	5329.5	232.3	0.0	4.475	66.88
11	5337.5	5337.0	172.4	0.0	4.578	68.75
12	5349.5	5344.5	92.4	0.0	4.680	70.63
13	5342.0	5352.0	98.5	0.0	4.783	72.50
14	5359.5	5359.5	38.1	0.0	4.887	74.38
15	5367.2	5367.0	0.0	16.2	4.991	76.25
16	5379.5	5374.5	0.0	51.2	5.096	78.13

RUN1 0

DYNAMICS OF PRODUCTION AND TRADE * 3 *

UNITS MEASURED: 1000 PIECES

	PIG						CATTLE				
	PRODUCTION		EXPORT	IMPORT	UNIT FEED INPUT MT	ADVANCED TECHNOLOGY	PRODUCTION		EXPORT	IMPORT	ADVANCED TECHNOLOGY
YEAR	TARGET	ACTUAL				%	TARGET	ACTUAL			%
1	1892.8	1740.0	0.0	0.0	0.482	30.00	1856.2	1603.2	203.5	0.0	20.00
2	1922.1	1831.6	0.0	0.0	0.477	33.50	2261.7	1689.7	288.0	0.0	24.00
3	2112.3	1933.3	0.0	0.0	0.472	37.00	2225.7	1785.9	382.2	0.0	28.00
4	2316.3	2047.1	0.0	0.0	0.467	40.50	2227.7	1893.3	487.6	0.0	32.00
5	2540.5	2175.0	0.0	0.0	0.462	44.00	2229.7	2014.2	606.5	0.0	36.00
6	2775.4	2320.0	0.0	0.0	0.457	47.50	2242.7	2151.2	741.5	0.0	40.00
7	2965.9	2485.7	0.0	0.0	0.452	51.00	2271.7	2307.8	0.0	0.0	44.00
8	2994.0	2676.9	0.0	0.0	0.448	54.50	2292.7	2488.4	0.0	0.0	48.00
9	2996.2	2900.0	0.0	0.0	0.443	58.00	2294.7	2699.2	0.0	0.0	52.00
10	2998.4	3163.6	0.0	0.0	0.438	61.50	2296.6	2194.0	0.0	0.0	56.00
11	2977.0	3480.0	0.0	0.0	0.433	65.00	2281.4	2775.7	0.0	0.0	60.00
12	3002.8	3866.7	0.0	0.0	0.429	68.50	2300.6	2582.0	1160.3	0.0	64.00
13	2926.9	4350.0	0.0	0.0	0.424	72.00	2245.6	1494.8	71.2	0.0	68.00
14	2981.1	4971.4	0.0	0.0	0.419	75.50	2285.6	1975.4	86.1	0.0	72.00
15	2984.3	1635.6	0.0	0.0	0.414	79.00	2288.4	4105.0	0.0	0.0	76.00
16	3011.5	4117.4	0.0	0.0	0.410	82.50	2308.6	1501.1	71.5	0.0	80.00

RUN: 0

DYNAMICS OF PRODUCTION AND TRADE * 4 *

UNITS MEASURED: 1000 METRIC TONS

YEAR	SUGAR PRODUCTION TARGET	SUGAR PRODUCTION ACTUAL	SUGAR EXPORT	SUGAR IMPORT	PORK PRODUCTION TARGET	PORK PRODUCTION ACTUAL	PORK EXPORT	PORK IMPORT
1	1547.2	4130.8	3535.2	0.0	1051.6	966.7	37.8	0.0
2	1526.9	4246.1	3617.6	0.0	1067.8	1017.5	83.4	0.0
3	1477.7	4343.8	3759.3	0.0	1173.5	1074.1	155.1	0.0
4	1478.4	4468.8	3841.0	0.0	1286.8	1137.3	212.3	0.0
5	1479.2	3615.4	2955.8	0.0	1411.4	1208.3	203.3	0.0
6	1494.5	556.4	0.0	131.1	1541.9	1288.9	0.0	67.6
7	1530.7	2035.5	1364.1	0.0	1647.7	1381.0	0.0	77.8
8	1556.5	1015.3	308.5	0.0	1663.4	1487.2	0.0	93.5
9	1557.2	558.8	0.0	136.7	1664.6	1611.1	0.0	97.8
10	1557.9	2317.0	1625.5	0.0	1665.8	1757.6	0.0	112.4
11	1536.0	560.4	0.0	135.4	1653.9	1933.3	0.0	99.4
12	1559.5	561.2	0.0	202.9	1668.2	2148.1	0.0	143.0
13	1485.2	2775.9	2169.6	0.0	1626.1	2416.7	1459.3	0.0
14	1536.0	536.0	0.0	165.2	1656.2	2761.9	104.4	0.0
15	1537.7	563.5	0.0	85.5	1658.0	908.6	0.0	112.9
16	1562.5	1700.0	1033.8	0.0	1673.0	2287.4	0.0	110.7

RUN: 0

DYNAMICS OF PRODUCTION AND TRADE * 5 *

UNITS MEASURED: 1000 METRIC TONS

YEAR	PROCESSED MEAT PRODUCTION TARGET	PROCESSED MEAT PRODUCTION ACTUAL	PROCESSED MEAT EXPORT	PROCESSED MEAT IMPORT	BEEF PRODUCTION TARGET	BEEF PRODUCTION ACTUAL	BEEF EXPORT	BEEF IMPORT
1	364.2	305.2	156.5	0.0	924.3	736.7	174.2	0.0
2	383.3	305.6	112.8	0.0	1137.7	737.7	171.1	0.0
3	453.6	306.1	116.6	0.0	1118.8	738.8	203.9	0.0
4	517.0	306.5	119.3	0.0	1119.8	739.8	214.5	0.0
5	586.8	306.9	127.6	0.0	1120.9	740.9	230.7	0.0
6	656.6	551.4	380.6	0.0	1127.8	741.9	250.1	0.0
7	707.8	602.9	428.7	0.0	1143.0	1214.6	726.1	0.0
8	710.7	662.3	483.4	0.0	1154.0	1309.7	801.4	0.0
9	711.2	731.7	551.1	0.0	1155.1	1420.6	904.9	0.0
10	711.6	813.7	628.7	0.0	1156.1	1154.7	620.3	0.0
11	709.8	912.2	729.7	0.0	1148.1	1460.9	935.7	0.0
12	712.5	1032.7	838.6	0.0	1158.2	748.2	175.9	0.0
13	705.4	310.4	128.2	0.0	1129.3	749.3	242.8	0.0
14	710.9	1252.2	1072.1	0.0	1150.3	994.4	480.1	0.0
15	711.4	335.6	156.2	0.0	1151.8	2160.5	1648.1	0.0
16	714.2	1110.0	933.2	0.0	1162.4	752.4	216.5	0.0

RUN: 0

DYNAMICS OF PER CAPITA CONSUMPTION

YEAR	WHEAT FT	SUGAR FT	PORK FT	PROC.MEAT FT	BEEF FT	N-TH PROD. FT	SUM(VALUE) FT
1	3849.68	545.95	349.27	177.36	515.48	161328.8	226008.2
2	4143.75	548.90	351.21	178.25	518.69	162730.1	227083.6
3	4187.98	553.79	354.52	179.55	506.79	166436.6	231651.2
4	4246.55	594.01	358.91	177.11	497.04	171400.0	237734.6
5	4305.77	636.99	363.29	170.79	487.56	176754.2	244556.0
6	4359.03	682.16	367.20	164.51	477.41	181735.3	250978.8
7	4580.86	656.13	372.68	166.45	469.66	188083.5	258523.3
8	4654.12	665.02	378.01	168.34	478.27	194241.0	265690.6
9	4707.21	653.45	381.84	169.68	484.55	198866.9	271165.0
10	4777.79	627.54	386.92	171.44	492.95	205177.0	278686.4
11	4842.71	673.10	391.65	173.14	500.56	210690.5	284822.9
12	4899.50	644.64	395.72	174.54	507.36	215966.7	291121.1
13	4917.35	613.11	396.92	174.89	491.86	218022.8	293979.1
14	4964.62	655.07	400.21	168.12	480.13	222944.8	300319.8
15	5019.58	627.02	404.13	169.40	486.29	228233.6	306632.4
16	5042.98	596.53	383.67	162.14	489.30	231767.6	312178.5

RUN: 0

DYNAMICS OF PRICES * 1 *

YEAR	SUGAR BEET			CORN			WHEAT		
	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T
1	1,00	0,00	0,00	2,70	0,00	0,12	2,90	4,80	0,13
2	0,90	0,00	0,00	2,70	0,00	0,12	2,61	4,32	0,13
3	0,81	0,00	0,00	2,70	0,00	0,12	2,61	4,32	0,13
4	0,73	0,00	0,00	2,70	0,00	0,12	2,61	4,32	0,13
5	0,66	0,00	0,00	2,70	0,00	0,12	2,61	4,32	0,13
6	0,59	0,00	0,00	2,70	0,00	0,12	2,61	4,32	0,13
7	0,65	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
8	0,62	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
9	0,65	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
10	0,71	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
11	0,64	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
12	0,71	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
13	0,78	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
14	0,70	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
15	0,77	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13
16	0,85	0,00	0,00	2,70	0,00	0,12	2,48	4,10	0,13

RUN: 0

DYNAMICS OF PRICES * 2 *

YEAR	PIG			CATTLE			SUGAR		
	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T
1	25,60	0,00	0,00	30,18	0,00	1,40	14,00	10,30	0,38
2	25,60	0,00	0,00	30,18	0,00	1,40	12,60	10,30	0,38
3	25,60	0,00	0,00	31,69	0,00	1,40	11,34	10,30	0,38
4	25,60	0,00	0,00	31,69	0,00	1,40	10,21	9,27	0,38
5	25,60	0,00	0,00	31,69	0,00	1,40	9,19	8,34	0,38
6	25,60	0,00	0,00	31,69	0,00	1,40	8,27	7,51	0,38
7	25,60	0,00	0,00	31,69	0,00	1,40	9,09	8,26	0,38
8	25,60	0,00	0,00	31,69	0,00	1,40	8,64	8,26	0,38
9	25,60	0,00	0,00	31,69	0,00	1,40	9,07	8,67	0,38
10	25,60	0,00	0,00	31,69	0,00	1,40	9,98	9,54	0,38
11	25,60	0,00	0,00	31,69	0,00	1,40	8,98	8,59	0,38
12	25,60	0,00	0,00	31,69	0,00	1,40	9,88	9,44	0,38
13	24,32	0,00	0,00	31,69	0,00	1,40	10,87	10,39	0,38
14	21,89	0,00	0,00	33,27	0,00	1,40	9,78	9,35	0,38
15	19,70	0,00	0,00	33,27	0,00	1,40	10,76	10,28	0,38
16	21,67	0,00	0,00	29,95	0,00	1,40	11,83	11,31	0,38

RUN: 0

DYNAMICS OF PRICES * 3 *

YEAR	PORK			PROCESSED MEAT			BEEF		
	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T	PRODUCER 1000 FT/T	CONSUMER 1000 FT/T	WORLD MARKET 1000 $/T
1	55,00	39,00	1,20	102,00	67,00	2,10	60,00	35,50	1,50
2	55,00	39,00	1,20	102,00	67,00	2,10	60,00	35,50	1,50
3	55,00	39,00	1,20	102,00	67,00	2,10	63,00	37,27	1,50
4	55,00	39,00	1,20	107,10	70,35	2,10	66,15	39,14	1,50
5	55,00	39,00	1,20	117,81	77,39	2,10	69,46	41,10	1,50
6	55,00	39,00	1,20	129,59	85,12	2,10	72,93	43,15	1,50
7	55,00	39,00	1,20	129,59	85,12	2,10	76,58	45,31	1,50
8	55,00	39,00	1,20	129,59	85,12	2,10	76,58	45,31	1,50
9	55,00	39,00	1,20	129,59	85,12	2,10	76,58	45,31	1,50
10	55,00	39,00	1,20	129,59	85,12	2,10	76,58	45,31	1,50
11	55,00	39,00	1,20	129,59	85,12	2,10	76,58	45,31	1,50
12	55,00	39,00	1,20	123,11	85,12	2,10	72,75	45,31	1,50
13	52,25	39,00	1,20	110,80	85,12	2,10	76,39	47,57	1,50
14	47,02	39,00	1,20	121,88	93,64	2,10	80,20	49,95	1,50
15	42,32	39,00	1,20	109,69	93,64	2,10	80,20	49,95	1,50
16	46,55	42,90	1,20	120,66	103,00	2,10	72,18	49,95	1,50

RUN: 0

YEAR	PRICE INDEX PRODUCER	CONSUMER
1	100.00	100.00
2	99.14	100.48
3	99.72	102.50
4	99.70	105.19
5	100.00	108.21
6	100.57	111.05
7	100.41	114.39
8	99.96	117.56
9	100.02	119.98
10	100.25	123.31
11	99.95	126.02
12	99.53	128.81
13	99.57	130.07
14	99.67	132.88
15	99.44	135.67
16	101.16	138.13

RUN: 0

DYNAMICS OF INVESTMENTS * 1 *

YEAR	AGRICULTURAL INVESTMENTS: TRACTOR 1000 UNITS	ADDITIONAL EQUIPMENT MILL.FT.	PIG BARN 1000 HEADS	CATTLE BARN 1000 HEADS	OTHER FIXED ASSETS MILL.FT.	AGRICULTURAL INVESTMENTS TOTAL MILL.FT.
1	0.00	4199.95	0.00	-0.00	0.00	4199.95
2	5.08	5495.74	0.00	217.89	907.39	13231.23
3	60.81	4966.18	218.22	234.24	4381.11	22789.02
4	54.86	5269.92	620.42	258.06	3934.50	28417.56
5	51.60	5204.20	677.16	286.02	3676.20	29506.28
6	15.51	2010.60	753.09	319.28	1925.63	24510.06
7	76.41	7079.75	844.34	359.33	6857.41	40428.79
8	38.63	4052.52	955.70	408.20	4706.96	36045.57
9	49.20	4915.91	1093.69	468.76	5878.64	42355.28
10	88.89	7890.73	1267.80	0.00	4545.23	34549.86
11	16.06	2573.15	1492.17	317.60	6431.02	39477.49
12	58.30	5697.88	1788.73	0.00	4617.12	37661.93
13	89.06	7900.95	2192.95	0.00	1326.09	43762.09
14	18.36	3003.72	2765.36	0.00	5084.67	46252.24
15	59.89	5922.45	0.00	2810.38	2633.19	96300.51
16	95.25	8296.68	0.00	0.00	1039.00	14796.45

RUN: 0

DYNAMICS OF INVESTMENTS * 2 *

YEAR	INVESTMENT IN FOOD PROCESSING				DIRECT GOVERNMENT INVESTMENTS IN FOOD AND AGRICULTURE	INVESTMENTS IN THE REST OF THE ECONOMY	TOTAL INVESTMENTS
	SUGAR PLANT	SLOUGHTER HOUSE	MEAT PROCESSING PLANT	TOTAL			
	1000 MT.	1000 MT.	1000 MT.	MILL.FT.	MILL.FT.	MILL.FT.	MILL.FT.
1	530.77	0.00	25.44	5000.00	1037.94	184250.4	194488.3
2	259.36	0.00	103.05	16942.66	846.95	213631.4	244652.3
3	257.11	0.00	46.66	7916.17	2747.78	224989.3	258442.3
4	288.50	0.00	68.59	11479.23	982.97	238549.3	279429.0
5	0.00	0.00	73.36	11738.21	1054.32	250889.7	293188.5
6	0.00	0.00	78.89	12622.27	1158.81	223522.0	261813.2
7	0.00	339.58	87.62	14853.94	1252.88	242752.6	299288.2
8	0.00	210.82	117.71	19352.63	1143.98	261458.4	318000.6
9	0.00	246.60	107.78	17851.19	1230.75	283238.0	344675.2
10	0.00	0.00	119.30	19088.17	1285.64	288630.4	343554.1
11	0.00	366.44	111.19	18692.21	1390.74	299999.1	359559.6
12	0.00	0.00	145.99	23358.73	1419.45	368473.0	430913.1
13	0.00	0.00	82.27	13163.23	1653.63	378623.8	437202.8
14	0.00	214.07	117.11	19264.63	2075.11	379351.7	446943.7
15	0.00	325.95	0.00	801.83	828.78	463906.2	561837.3
16	0.00	0.00	0.00	0.00	2221.55	400448.7	417466.7

YEAR= 1 RUN 0

RESOURCES AND PRODUCTION STRUCTURE

KIND OF RESOURCE	SYMBOLS	AVAILABLE RESOURCES
POPULATION,THOUSANDS	TP	10524,0
LABOR FORCE,THOUSANDS	LA	814,6
	LAF	1039,2
	LAN	4335,8
ARABLE LAND,1000HA	LS	5497,3
TRACTOR,THOUSANDS	RS2	440,0
ADD.MACHINERY,MIL.FT	RS3	30000,0
PIG BARN,THOUSANDS	RS4	9040,0
CATTLE BARN,THOUSANDS	RS5	3000,0
OTH.AGR.ASSETS,MIL.FT	RS6	50000,0
SUGAR PLANT,1000 TONS	RP1	3600,0
SLAUGHTER PLANT,1000 T.	RP2	2000,0
MEAT PROC.PLANT,1000 T.	RP3	300,0

NR	PRODUCT	PRODUCTION STRUCTURE AREA,LIVESTOCK THOUSANDS SP	PRODUCTION 1000 TONS G,SP,SP,PN	STOCKS 1000 TONS S	PRODUCTION STRUCTURE VALUE IN FIXED PRICES	% OF TOTAL VALUE IN FOOD AND AGR.
1	SUGAR BEET	824,6	33046,1	0,0	33046,1	8,9
2	CORN	2681,4	13787,7	10,0	37226,8	10,1
3	WHEAT	1991,3	7128,8	10,0	20673,4	5,6
4	PIG	12428,6	1740,0	0,0	44544,0	12,0
5	CATTLE	3000,0	1603,2	0,0	48384,6	13,1
6	SUGAR	0,0	4130,8	50,0	57830,7	15,6
7	PORK	0,0	966,7	20,0	53166,7	14,4
8	PROC. MEAT	0,0	305,2	5,0	31130,0	8,4
9	BEEF	0,0	736,7	20,0	44200,8	11,9
10	N-TH PRODUCT	0,0	863048,1	60743,4	863048,1	

YEAR=16 RUN1 0

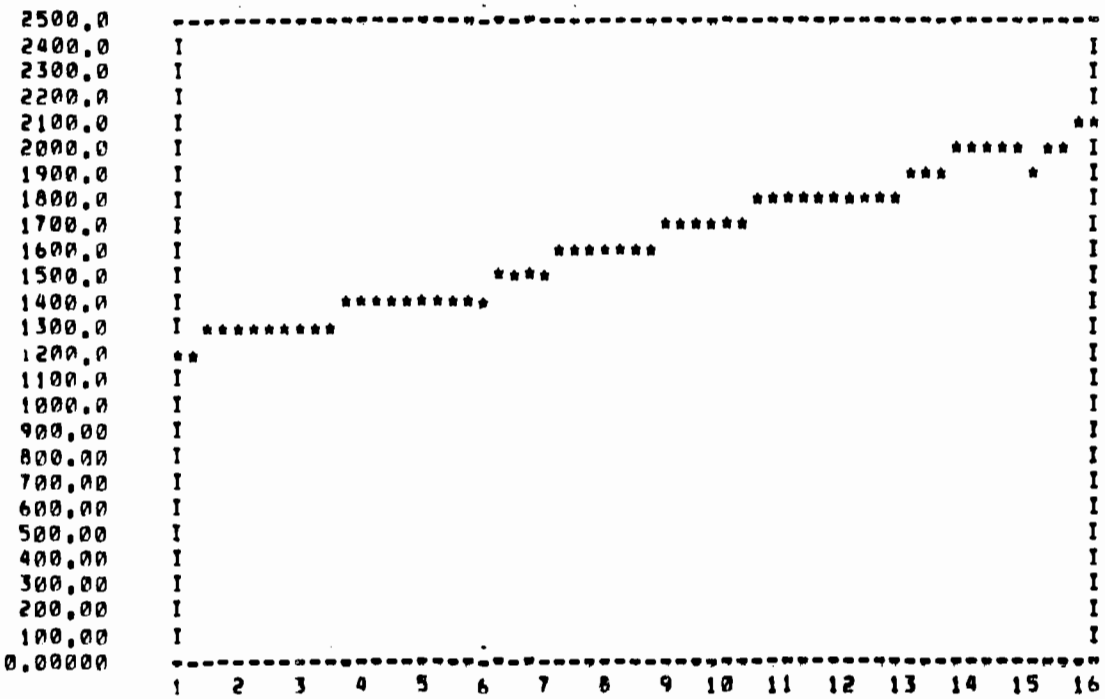
RESOURCES AND PRODUCTION STRUCTURE

KIND OF RESOURCE	SYMBOLS	AVAILABLE RESOURCES
POPULATION,THOUSANDS	TP	10749.0
LABOR FORCE,THOUSANDS	LA	742.9
	LAF	1061.1
	LAN	4291.4
ARABLE LAND,1000HA	LS	5456.2
TRACTOR,THOUSANDS	RS2	367.8
ADD.MACHINERY,MIL.FT	RS3	38812.3
PIG BARN,THOUSANDS	RS4	20064.7
CATTLE BARN,THOUSANDS	RS5	7452.3
OTH.AGR.ASSETS,MIL.FT	RS6	65182.3
SUGAR PLANT,1000 TONS	RP1	2745.4
SLAUGHTER PLANT,1000 T.	RP2	2523.3
MEAT PROC.PLANT,1000 T.	RP3	1158.5

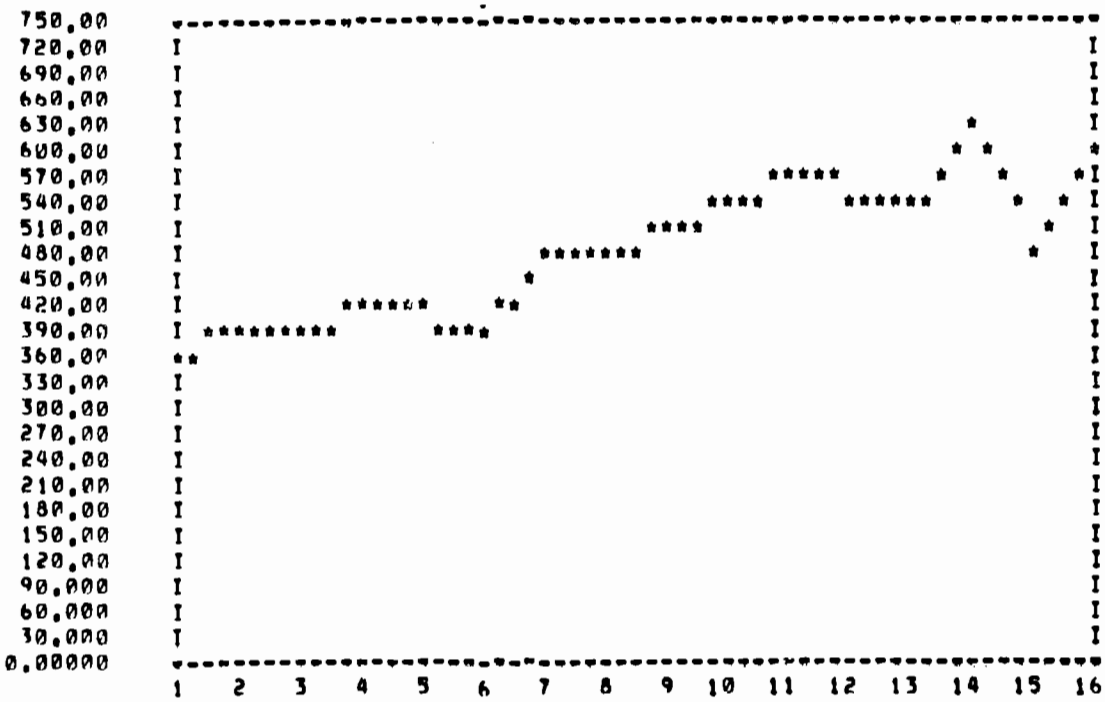
PRODUCTION STRUCTURE

NR	PRODUCT	AREA,LIVESTOCK THOUSANDS SP	PRODUCTION 1000 TONS G.SP,SP,PN	STOCKS 1000 TONS S	VALUE IN FIXED PRICES	% OF TOTAL VALUE IN FOOD AND AGR.
1	SUGAR BEET	818.4	43867.5	0.0	43867.5	7.4
2	CORN	3583.1	27386.6	10.0	73943.9	12.5
3	WHEAT	1054.6	5374.5	10.0	15586.1	2.6
4	PIG	29410.0	4117.4	0.0	105405.3	17.8
5	CATTLE	2756.3	1501.1	0.0	45303.1	7.7
6	SUGAR	0.0	1700.0	50.0	23799.6	4.0
7	PORK	0.0	2287.4	20.0	125809.3	21.2
8	PROC. MEAT	0.0	1110.0	5.0	113215.5	19.1
9	BEEF	0.0	752.4	20.0	45145.8	7.6
10	N-TH PRODUCT	0.0	1525610.0	192764.1	1525610.0	

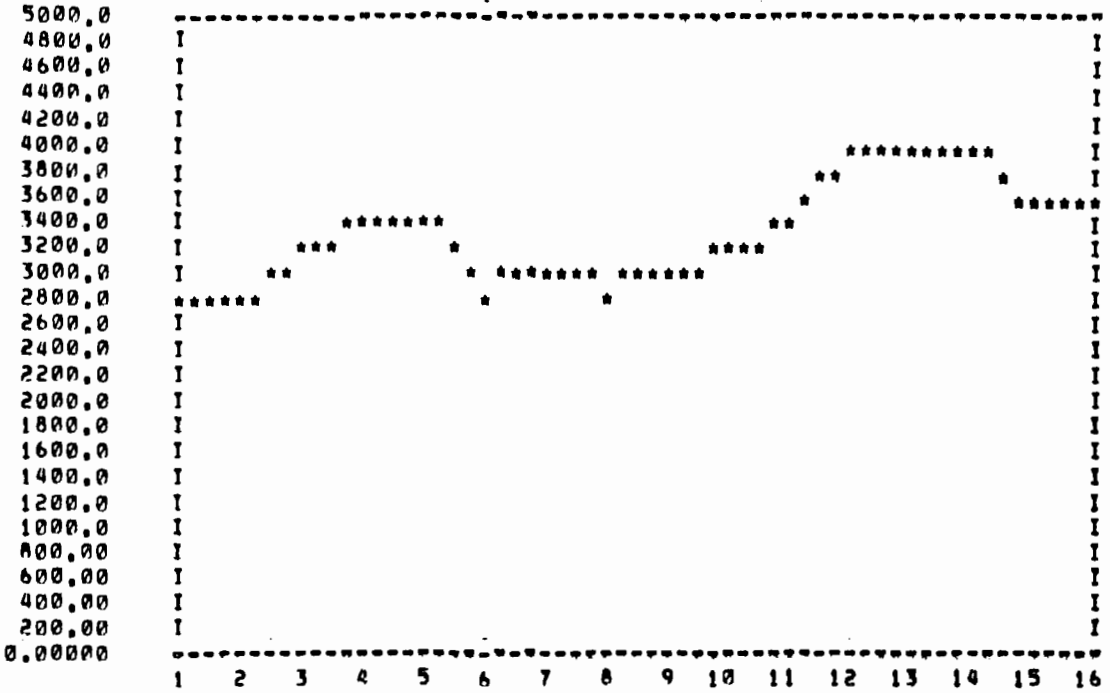
GROSS NATIONAL PRODUCT (BILL,HUNG,FT)



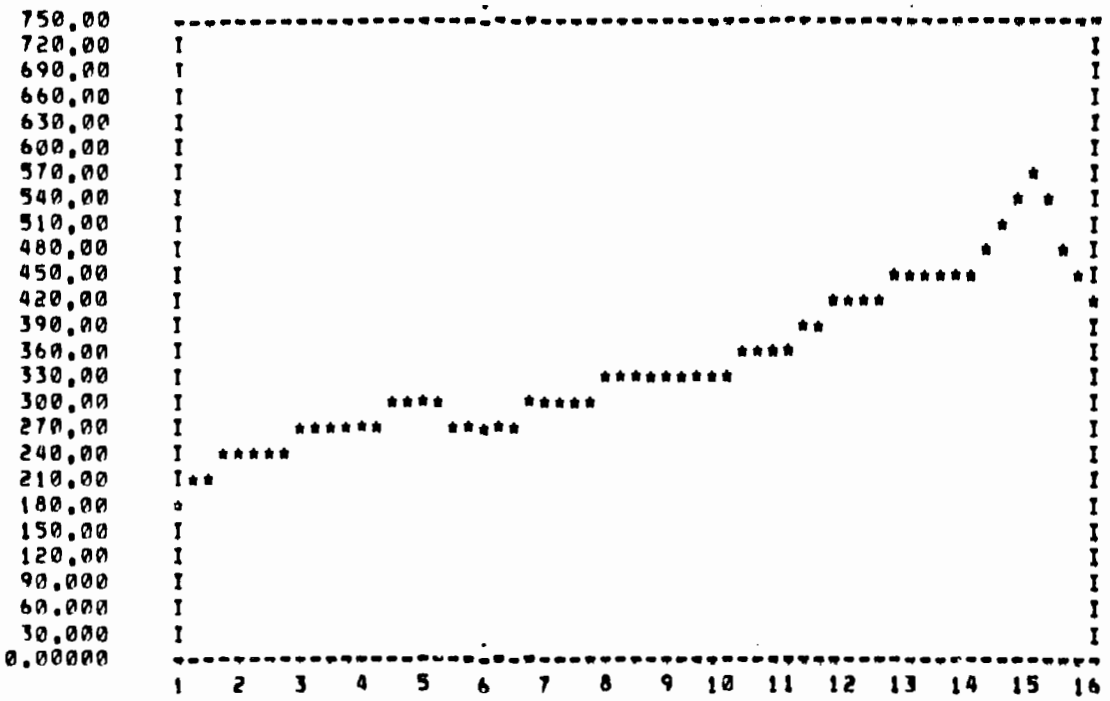
GNP OF FOOD AND AGRICULTURE (BILL,HUNG,FT)



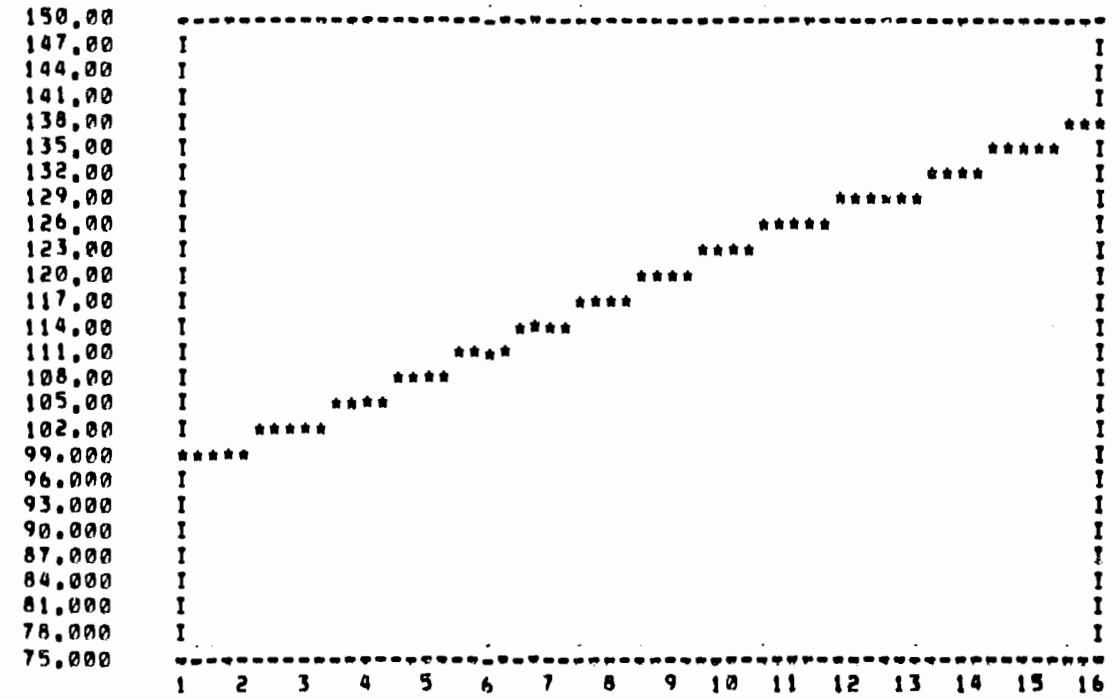
BALANCE OF PAYMENT (MILL,HUNG,FT.)



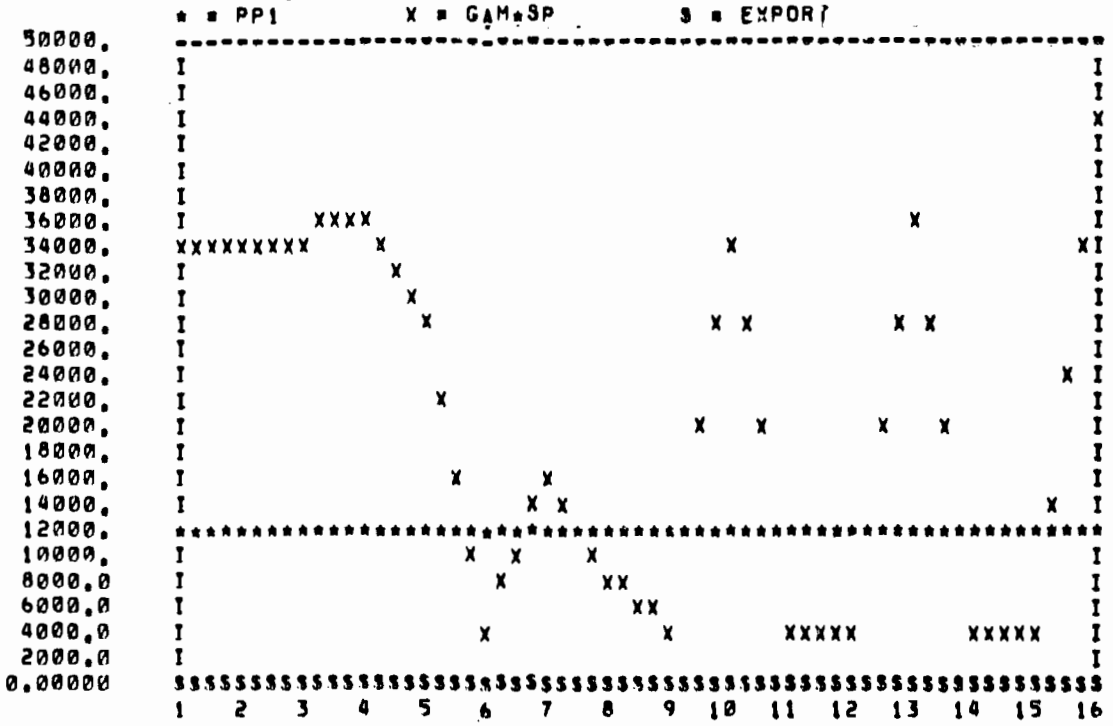
TOTAL INVESTMENTS (BILL,HUNG,FT)

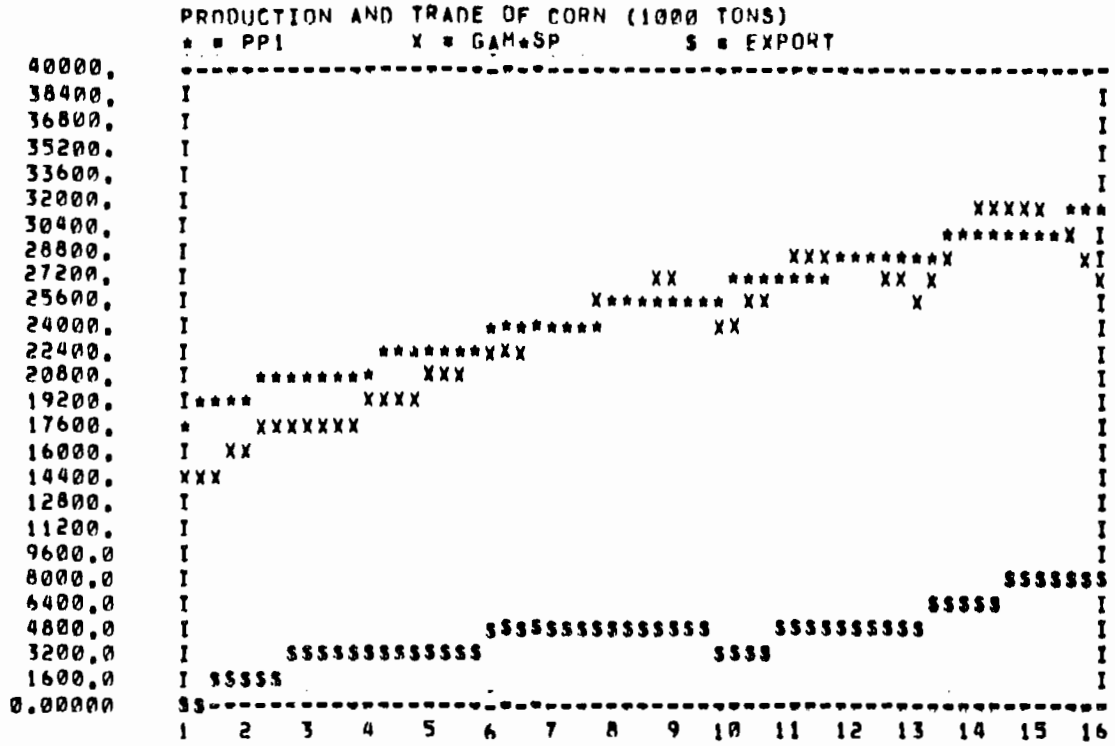


DYNAMICS OF CONSUMPTION (INDEX)



PRODUCTION AND TRADE OF SUGAR BEET (1000 TONS)
* = PP1 X = GAM*SP $ = EXPORT




PRODUCTION AND TRADE OF CORN (1000 TONS)
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22400.
20800.
19200.
17600.
16000.
14400.
12800.
11200.
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1600.0
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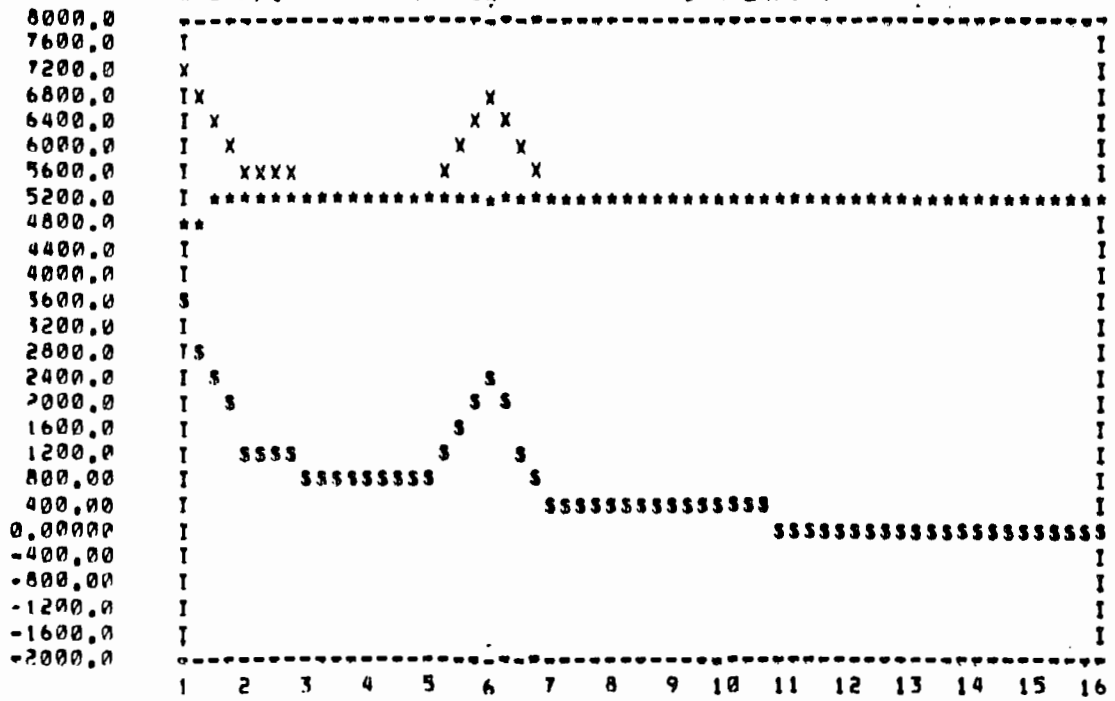
PRODUCTION AND TRADE OF WHEAT (1000 TONS)
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6800.0
6400.0
6000.0
5600.0
5200.0
4800.0
4400.0
4000.0
3600.0
3200.0
2800.0
2400.0
2000.0
1600.0
1200.0
800.00
400.00
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-800.00
-1200.0
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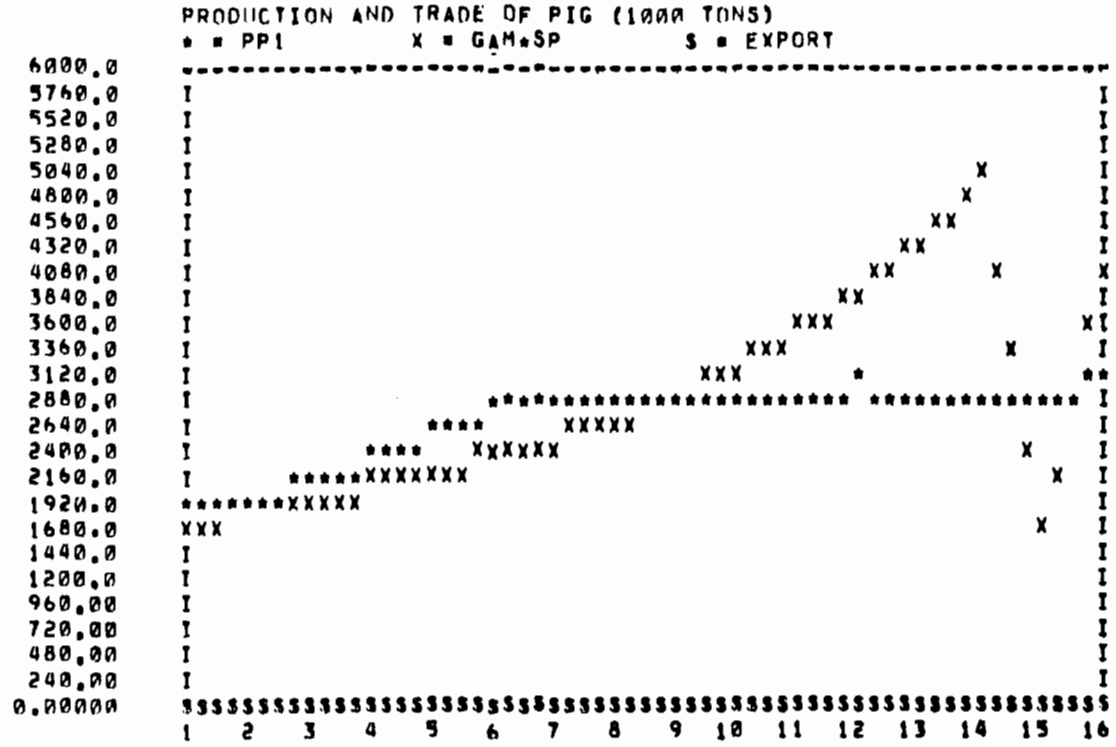
PRODUCTION AND TRADE OF PIG (1000 TONS)
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5520.0
5280.0
5040.0
4800.0
4560.0
4320.0
4080.0
3840.0
3600.0
3360.0
3120.0
2880.0
2640.0
2400.0
2160.0
1920.0
1680.0
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1200.0
960.00
720.00
480.00
240.00
0.00000
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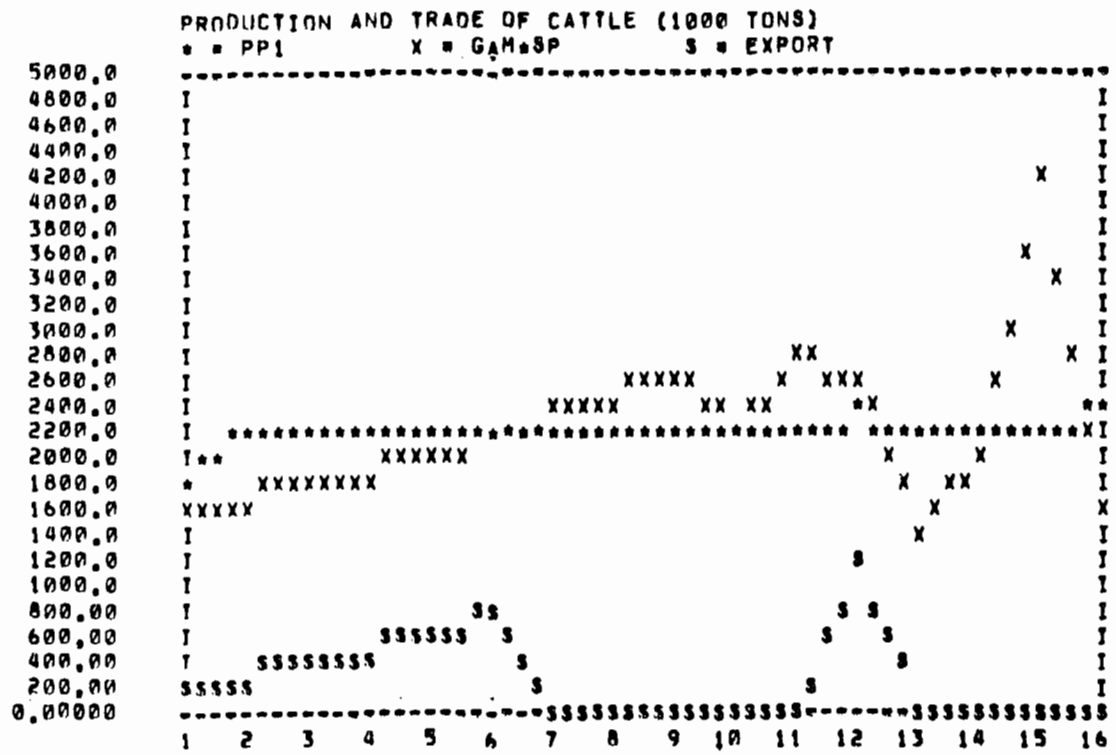
PRODUCTION AND TRADE OF CATTLE (1000 TONS)
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4600.0
4400.0
4200.0
4000.0
3800.0
3600.0
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3200.0
3000.0
2800.0
2600.0
2400.0
2200.0
2000.0
1800.0
1600.0
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800.00
600.00
400.00
200.00
0.00000
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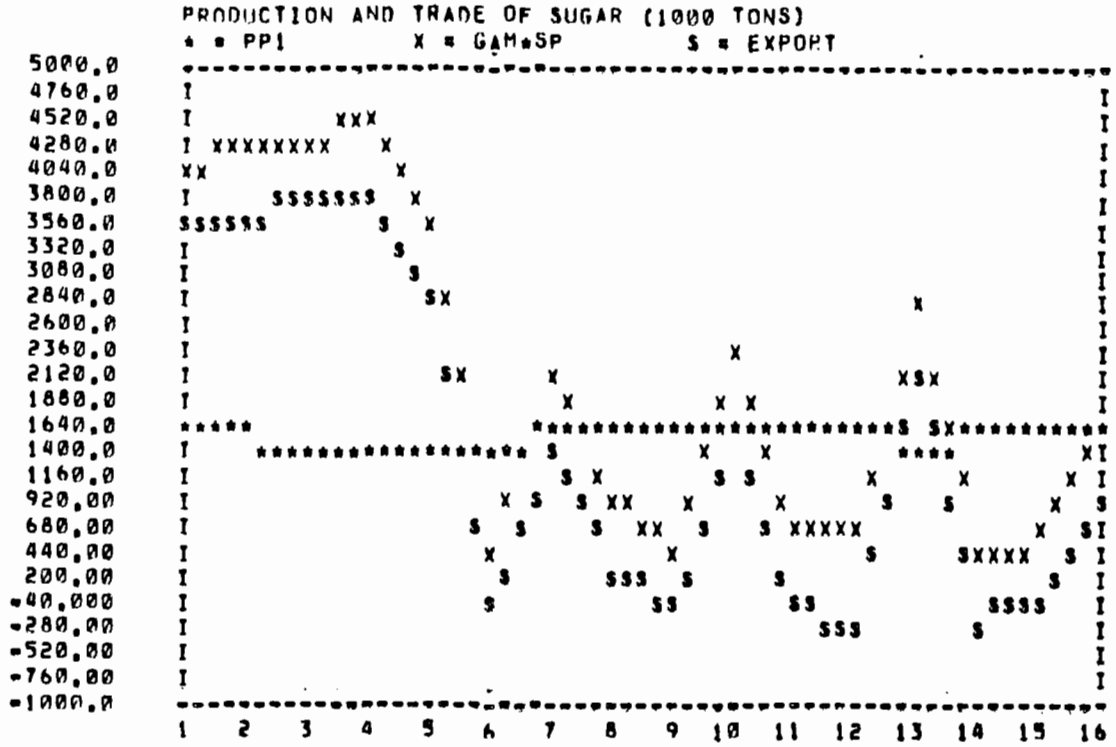
PRODUCTION AND TRADE OF SUGAR (1000 TONS)
* = PP1 X = GAM*SP $ = EXPORT
5000.0
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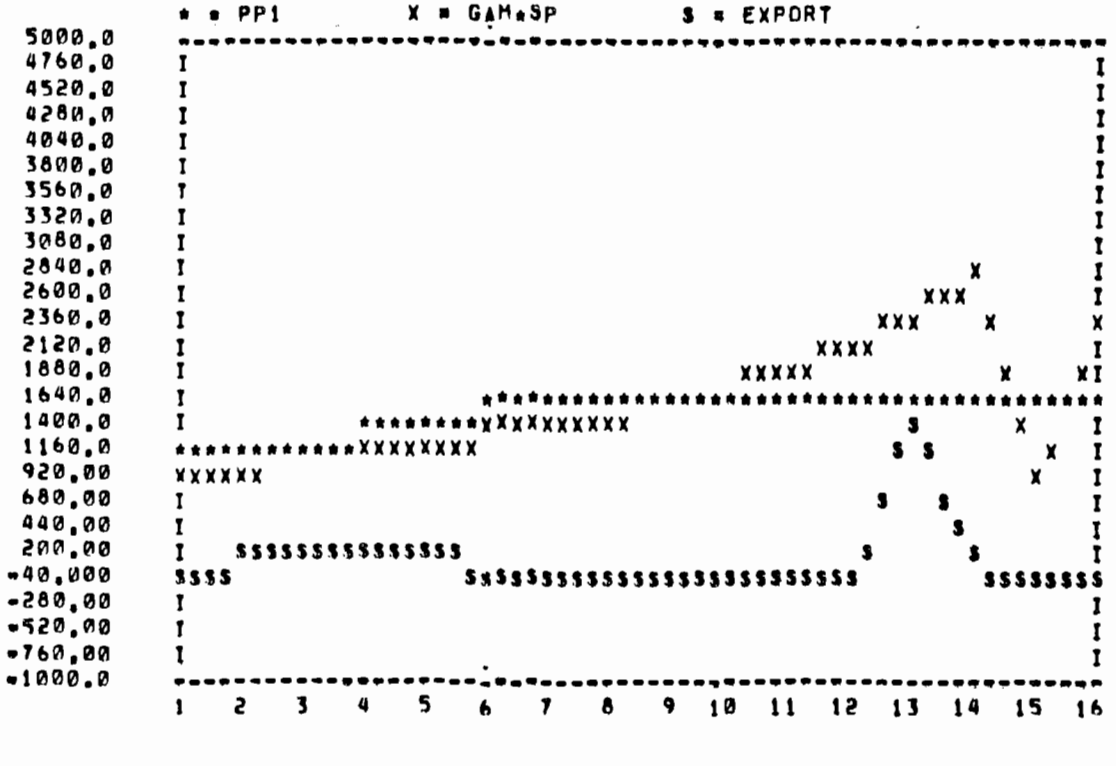
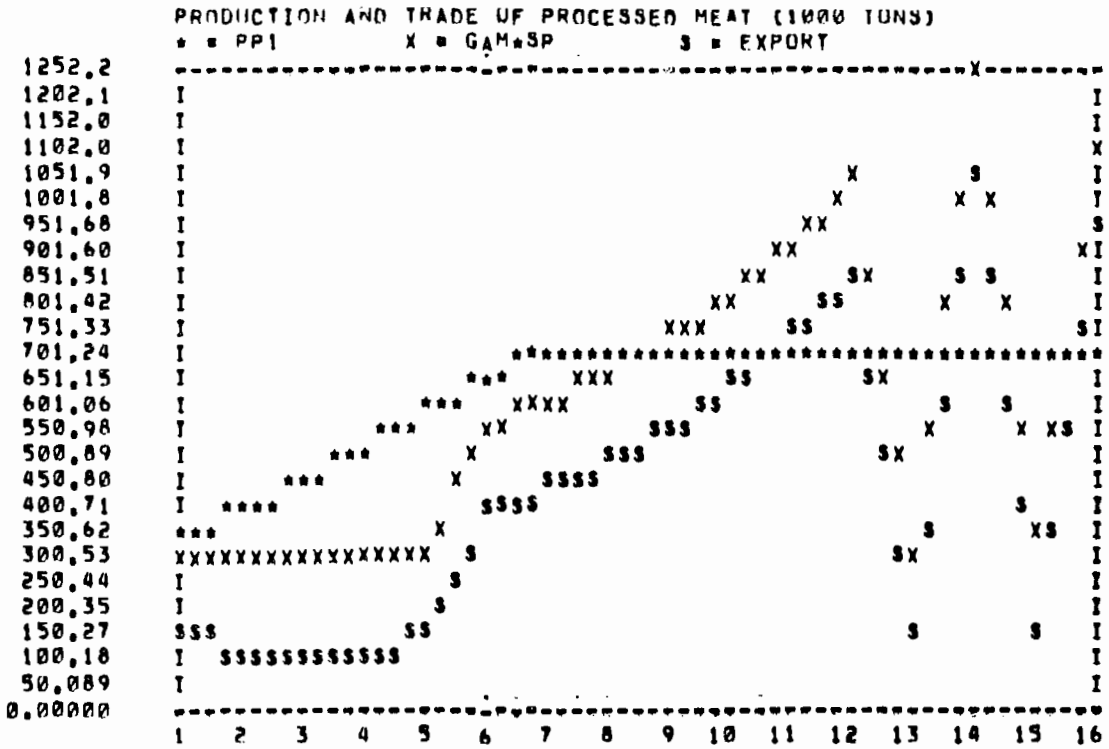
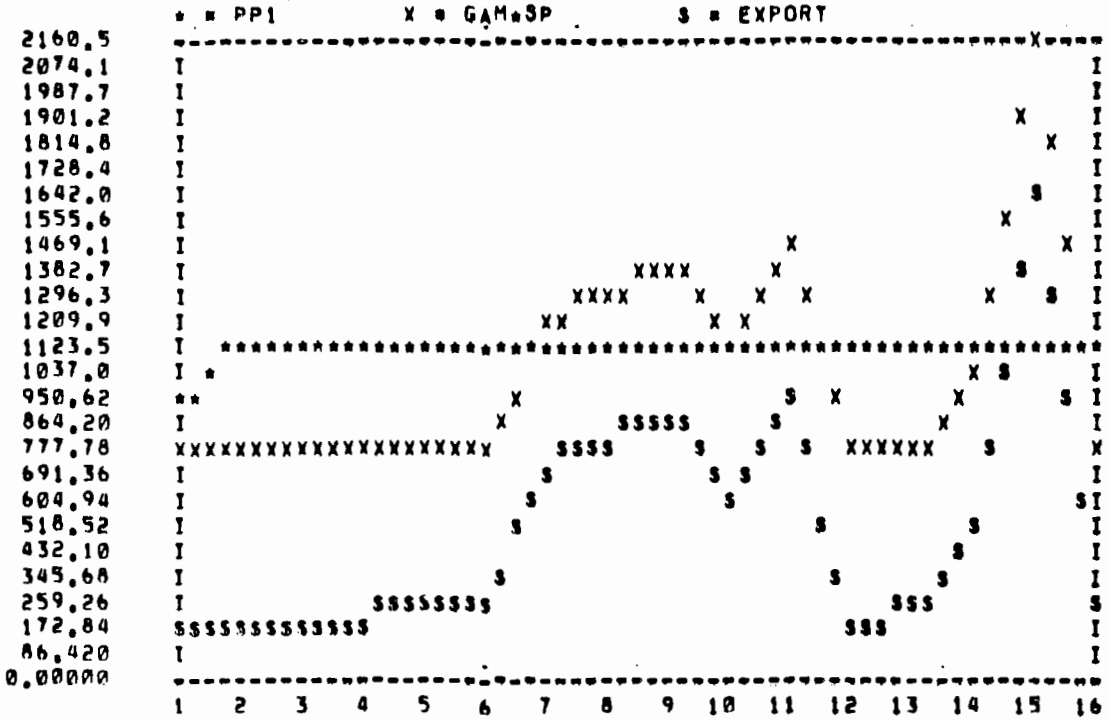
4520.0
4280.0
4040.0
3800.0
3560.0
3320.0
3080.0
2840.0
2600.0
2360.0
2120.0
1880.0
1640.0
1400.0
1160.0
920.00
680.00
440.00
200.00
-40.000
-280.00
-520.00
-760.00
-1000.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16


PRODUCTION AND TRADE OF PORK (1000 TONS)
* = PP1 X = GAM*SP $ = EXPORT
5000.0
4760.0
4520.0
4280.0
4040.0
3800.0
3560.0
3320.0
3080.0
2840.0
2600.0
2360.0
2120.0
1880.0
1640.0
1400.0
1160.0
920.00
680.00
440.00
200.00
-40.000
-280.00
-520.00
-760.00
-1000.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16


PRODUCTION AND TRADE OF PROCESSED MEAT (1000 TONS)
* = PP1 X = GAM*SP $ = EXPORT
1252.2
1202.1
1152.0
1102.0
1051.9
1001.8
951.68
901.60
851.51
801.42
751.33
701.24
651.15
601.06
550.98
500.89
450.80
400.71
350.62
300.53
250.44
200.35
150.27
100.18
50.089
0.00000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16


PRODUCTION AND TRADE OF BEEF (1000 TONS)
* = PP1 X = GAM*SP $ = EXPORT
2160.5
2074.1
1987.7
1901.2
1814.8
1728.4
1642.0
1555.6
1469.1
1382.7
1296.3
1209.9
1123.5
1037.0
950.62
864.20
777.78
691.36
604.94
518.52
432.10
345.68
259.26
172.84
86.420
0.00000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16