AGRICULTURE AND FOOD CONSULTING

FINAL REPORT
on
TURKISH AGRICULTURAL SECTOR MODEL

Consultancy Services under ASAL (2585-TU)

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presented by

AFC Agriculture and Food GmbH
International Consulting & Co. KG
Gluckstrasse 9
D - 5300 Bonn 1
Federal Republic of Germany

Telephone: 0228/63 17 81
Telex: 886 9930 afc d
Telefax: 0228/69 14 46

to

Ministry of Agriculture, Forestry and Rural Affairs
Tarım, Orman Ve Köyisleri Bakanlıgı
Bakanlıklar - Ankara 06100
TURKEY

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For any further information related to this final report, please ask at the office of AFC for:

- Prof. Dr. Otto Strecker
- Gisela Jacobsmeyer

AFC Agriculture and Food GmbH
International Consulting & Co. KG
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D - 5300 Bonn 1
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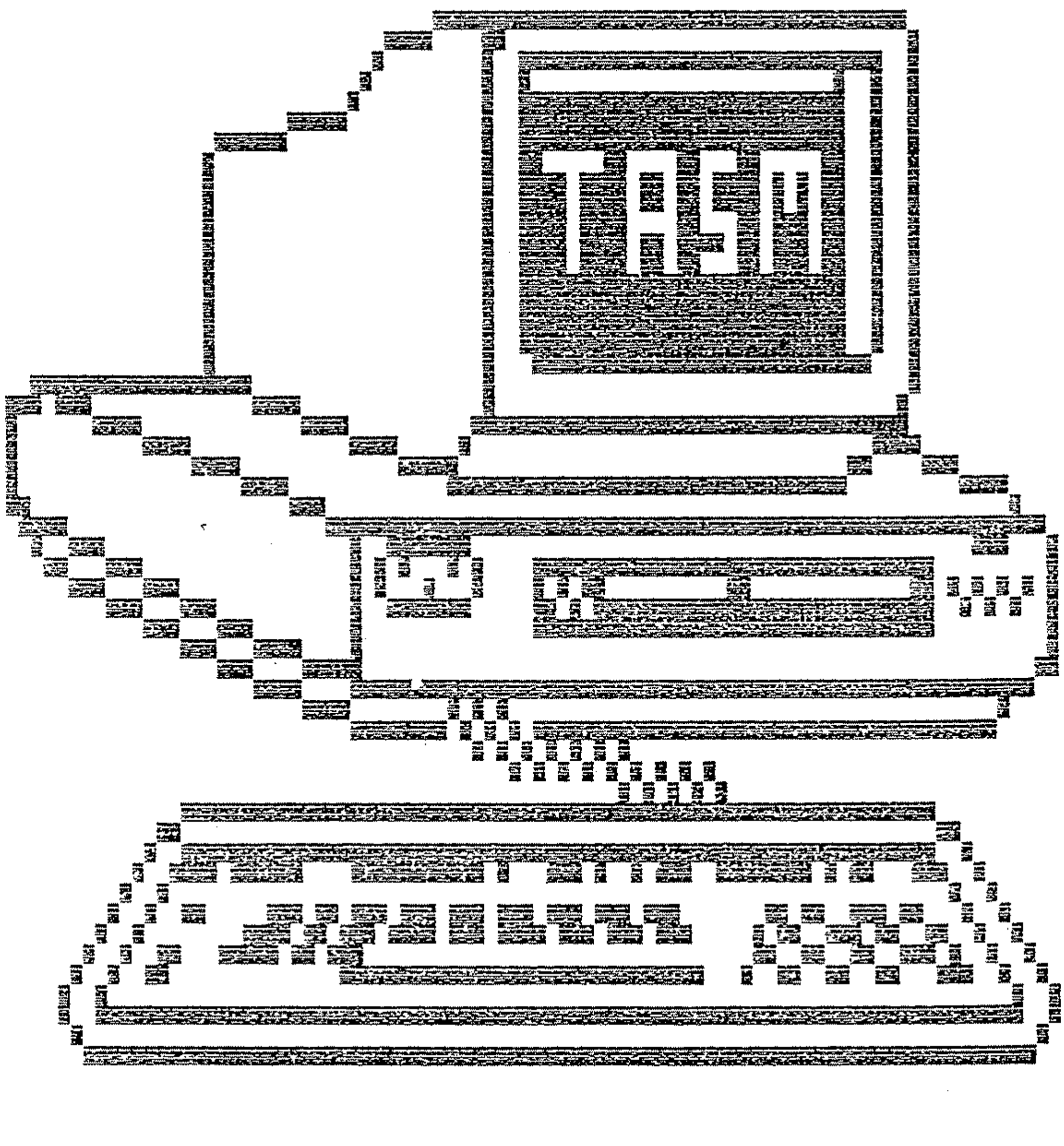
Prepared by:

S. Bauer (Teamleader), Bonn

H. Kasnakoglu, Ankara


TASM

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I. POLICY ORIENTED AGRICULTURAL SECTOR MODELING: AN OVERVIEW

1.1 Need for policy oriented sector modeling

In most countries the agricultural sector is subject to manyfold policy interventions: in the developing countries with the aim of stimulating agricultural and general economic growth, in most developed countries with the intention to support structural change and to mitigate the burdens of structural adjustment. In both cases there exists a basic need for quantitative information on the status of the development process of the agricultural sector, on its potential for growth and structural adjustment, and on the impacts of alternative sets of policy measures on the goals pursued. The specific sectoral conditions, policy goals and applied instruments vary from country to country. But common characteristics are; differentiated agricultural production structures, complex intra- and intersectoral as well as international interrelations, and highly interdependent relations between various political instruments and policy goals.

Under these conditions, the possible contributions to the policy making process of partial market analyses, narrow case studies or highly aggregated sector analyses are limited. Therefore it is necessary to make use of agricultural sector models, which have an adequate degree of differentiation, which incorporate the relevant interdependencies and which contain the most important political goal and instrument variables. As we will see, there does not exist one single (comprehensive) agricultural sector model which could be used for all purposes. But one should aim at a set (or family) of sector models with different degrees of differention and complexity, which can be used in a complementary manner and can shed some light on different aspects of complex problems.

Some important aspects of the specific problems of the agricultural sector and of agricultural policy in Turkey can be sketched as follows:

(1) Despite a steady decline in relative importance over the last decades, the agricultural sector still continues to be of significant importance for the general economy with respect to its contribution to GNP, employment and exports. The agricultural sector is expected to contribute, also in the future, significantly to general economic growth. Large investment projects (irrigation, livestock) are under way and compete for financial resources. Therefore, it is necessary to take into account intersectoral linkages.

(2) In various studies it has been shown that Turkish agriculture

is highly competitive on the world markets and has good chances - if its productivity is strengthened - to expand its production and exports. Therefore, international trade and related policies should be covered by the Turkish agricultural sector model. Emphasis has to be given to the ability of the model to highlight the impacts of alternative trade strategies and liberalization policies.

(3) In Turkish agriculture a wide variety of commodities are produced, which compete for the same resources on the supply side and are interrelated as complements or substitutes on the demand side. It is clear that the use of partial market analyses is limited when so many closely interrelated commodities are considered. Therefore, a differentiated multi-output and multi-input approach is necessary to describe the relevant substitution processes.

(4) Productivity in Turkish agriculture, when compared to EC countries, is still low. Yields in crop production are very different between irrigated and dry farming systems, also they vary significantly regionally. Similar differences are true for livestock production. It follows that the agricultural technology has to be specified carefully.

(5) Goverenment interventions (price stabilization, subidies) have a significant influence on the domestic agricultural output and input markets, as well as on the agricultural credit markets. The agricultural sector model has to contain the relevant policy instrument variables.

(6) Turkey has applied for full membership in the EC. The necessary adjustments of policy measures will have a significant influence on the development process of Turkish agriculture. The sector model should be able to analyze the impacts of those changed conditions. Its structure should be comparable with similar agricultural sector models for EC countries.

All the mentioned reasons underscore the need for the establishment of a powerfull Turkish agricultural sector model. It could be of crucial importance for the elaboration of an effective sectoral development and marketing strategy.

1.2 Short survey of modeling approaches

Applied agricultural sector models can be attributed traditionally to two broad categories: mathematical programming models and econometric models. Both approaches have different roots and characteristics. Programming models have the important advantage of enabling a detailed representation of agricultural technology and an adequate structural differentiation of the production sector. Further it is possible to exploit various sources of statistics and a-priori information for model specification. On the other hand, econometric approaches can make use of well established methods of parameter estimation, are able to test different behavioural assumptions and can apply generally accepted procedures for calibration and validitation.

At the beginning, the development of both approaches followed rather seperate lines. Sectoral programming models could be understood as more or less straight forward extensions of linear programming models for single farms, while econometric sector models were based on traditional supply and demand analysis for agricultural commodities and production factors. But in the course of development elements of both approaches have been combined in various forms, to exploit their respective advantages.

In the following sections, we will sketch the origins and the present the state of agricultural sector models along the lines of the stepwise development of programming approach, because its basic elements are fundamental for most more advanced agricultural sector models. This is true, also, for the Turkish agricultural sector model.

(1) Standard linear programming models for the agricultural sector

The first generation of programming models for the agricultural sector were almost entirely oriented towards the production side: The agricultural sector was subdivided in different production sectors, regions and/or groups of farms, for which usual linear programming models were established which were linked by factor constraints and exchange activities. The technological parameters were based mainly on representative farm-level data. Usually, objective functions were introduced which implied profit maximization of farmers and traders under the conditions of perfect competition. The demand side was represented - strongly simplifying - either by fixed prices or quantities, depending on the prevailing demand conditions and political market interventions. Characteristic examples for this type of models are the programming models for the United States, Sweden and Germany.

Programming models of this type can help to understand the competitive positions of different production sectors, groups of farms and regions within the sectoral context, and the complex interdependencies which exist between them. Also, they are being used as base models for sectoral projections and the analysis of the impact of alternative policy scenarios whithin a comparative static framework. An advantage of this simple linear programming approach - in comparison to more sophisticated models - is that, given computer capacities it enables a more problem adequate differentiation of the farming sector.

Beyond the applications for projections and policy simulations, interregional programming models have been used successfully in the field of food security planning for situations of political or military crises. This approach has been persued in many countries, among others in Switzerland, Norway and Germany.

In the course of time, the standard type of static sectoral programming models has been widened and generalized in different directions. One line has been the linking of agricultural sector models with models for the general economy, which has been most extensively studied in the case of Mexican CHAC model.

Other extensions include:
- the introduction of price elastic product demand and factor supply functions,
- the consideration of risk and modeling of price expectations,
- some modifications in the profit maximization assumption for farmers,
- the introduction of non-linear yield and cost functions, and
- the consideration of dynamic interdependences in the process of sectoral adjustment.

In the following sections we will consider some aspects of these further developments as far as they are relevant for the present Turkish agricultural sector model or for its possible future extensions.

(2) <u>Price endogeneous sector models</u>

A more general approach to agricultural sector modeling has to take into account the fact that commodity demand and factor supply are price-dependent which implies that downward sloping demand curves (and upward sloping factor supply curves) have to be incorporated into the programming model. This approach rests on the assumption that producers are profit maximizers and that consumers are utility maximizers as described by linear demand functions. Such equilibrium problems can be solved simultaneously by a quadratic programming model.

For some time the applications of quadratic programming models have been limited to rather small test cases. In many studies the sectoral equilibrium problem has been reduced to a partial equilibrium problem on a single market, to make it computable. But during the last decade the possibilities for practical applications of non-linear programming models have increased considerably, since more powerful software-packages became available. Experience shows that non-linear programming alogorithms can now be applied to solve full-sized agricultural sector models, at least on the non-regionalized level.

An alternative to the simultaneous solution of sectoral equilibrium problems is the iterative procedures which have often been applied in connection with the linear programming models mentioned in (1). Iterative procedures can be applied relatively easily if most prices are fixed by government interventions or determined by the world market, as it is the case for many markets in the EC. But they become complicated and time consuming when the prices are endogeneous on more than a few markets. Therefore, it is preferable to apply a non-linear programming algorithm whenever the model size does enable such an approach.

(3) Incorporation of risk and other behavioural aspects

Risk-aversion is an important characteristic of farmers' behaviour, who are confronted with manifold uncertainties, especially with respect to wheater conditions. Therefore it is not surprising that many agricultural economists have dealt with the problem of incorporating risk components into farm models and agricultural sector models. Despite numerous efforts so far only little progress has been made to estimate the risk factors and to develop operational procedures for the incorporation of risk into agricultural sectoral models.

Therefore, often only rather general restrictions on the speed of change of variables and on the degree of specialization are introduced which comprise the influence of many other factors, and are not very satisfying from a theoretical point of view. A first attempt for formalizing such an approach has been the introduction of "flexibility constraints" in agricultural sector models which restrict the maximal change the production and factor input levels from year to year The recursive coupling of a sequence of periodic production models leads to the concept of Recusive Programming as will be dealt with in the next section.

(4) Dynamic aspects of agricultural sector modeling

The sectoral development process is characterized by several intertemporal interdependences. The major line of linkages can be sketched as follows: The production decisions in period t depend on the present situation in the farming sector (factor capacities, technical know-how etc.) and on the expectations about future economic and technical developments, especially price expectations. Agricultural supply, determined as such is assumed to be given in the next period. Actual prices are formed according to the supply/demand interactions in this period and determine the resulting agricultural income and factor returns. The main determinants for factor adjustments: labour mobility, investment and changes of land capacity, which again determine together with possibly changed expectations the production decisions for the next period etc.

Several approaches have been persued to model at least some aspects of this dynamic process. The major efforts are concerned with the dynamic interdependencies within the agricultural production sector, where two alternative modeling concepts can be distinguished: dynamic and recursive programming models.

Dynamic programming models, aim at the determination of the optimal time paths of factor allocation. They are appropriate - in principal - if a political institution has to decide on investment and production down to the farm level. In market economies this is sometimes the case for limited investment and development projects, e.g. irrigation projects, but usually not for the whole agricultural sector. Successful applications can be found therefore only for the first category of projects .

Recursive programming models, aim at the explanation of the stepwise sectoral development and decision process, as it has been sketched above. After the pioneering works in the 60's, many agricultural economists have tried to explore the possibilities of this approach in different directions. The general approach incorporates components for the explanation of (price) expectations, intertemporal physical and monetary balances, and - as a characteristic feature - the concept of flexibility constraints. These can be used in a "naive" or in a more sophisticated manner. In the first case the flexibility coefficients are determined by rather simple assumptions (e.g. according to maximal or minimal yearly changes in the past), in the second case those changes are explained by economic variables (e.g. regressions between yearly changes of variables and shadow prices). In a similar approach a linear programming model has been used to generate a time series of shadow prices which serve as explanatory variables for the estimation of behaviour functions (supply, investment, factor demand).

Supply and demand components can also be coupled in an iterative procedure which is governed by the sequence of price expectations, supply response, price formation ("dynamic coupling of market linkages"). Such an approach can be rather flexible and is able to explain sectoral developments which are characterized by lagged adjustments and states of disequilibrium. But,so far experience with "dynamic coupling" procedures of this type is rather limited, since this approach requires the empirical specification and linking of supply, demand, stockholding and international trade components which can be done by rather large research groups.

1.3 Experiences with policy oriented agricultural sector modeling

The following types of agricultural sector modeling can be distinguished according to their use for policy making:

(1) "Academic modeling", which aims at the development and testing of methodological concepts, and the explanation of principal features of socio-economic adjustment processes. The empirical applications serve often only the purpose of methodological demonstration.

(2) Modeling of policy relevant issues by research groups outside

the administration. The results of such analyses are usually transmitted to policy makers in the form of expertises.

(3) Modeling work in close mutual contact with policy makers. This approach has to be based on modeling concepts which enable a dialogue between model builders and policy makers, at least with key experts of the administration, with respect to data base, model mechanism and interpretation of model results.

The state of methodlogical research in the field of agricultural sector modeling has been sketched in the preceeding section. In the following section we will comment on the situation of policy oriented modeling in some developed and developing countries.

The use of quantitative sector models as a base for the evaluation of political alternatives and policy advice has been emphasized differently during the last decades. In the 60's and beginning of 70's when new methods and larger computer capacities became available, the expectations - by model builders and politicans - were often exaggarated. In a number of countries big and ambitions projects have been started but many of them faced difficulties and the results could not catch up with the high expectations. The difficulties were caused by a number of factors such as limited methodological and empirical experiencies of the research staff, shortcomings of the data bases, deficiencies in the communication process between model builders and politicans. As a reaction to this experience less credit was given for some time to large scale agricultural sector modeling, instead different types of case studies and partial analyses were the favoured approach. But after some time it became obvious that the evaluation of the more fundamental policy alternatives calls for the use of more comprehensive agricultural sector models. The understanding that partial analyses and comprehensive sectoral modeling need not be seen as alternatives but rather as complementary approaches, has started to dominate.

At present the situation might be sketched as follows:By far the most intensive modeling work is being done in the United States. This is true not only for research work at the universities and other research institutions, but also for the modeling work in the administration itself. This is performed mainly in the "Economic Research Service" (ERS) which constitutes a large research unit within the ministry of agriculture. The modeling work is concerned with different policy questions: short- and long term forcasting work for national and international agricultural commodity markets; medium - and longer - term models for the analysis of the internal impacts of alternative agricultural policies; international trade models for the analysis of the impacts of national policies on other countries, and of the policies of other countries on the domestic agricultural sector. In sumarizing, a whole set of models has been developed and is being applied in a complementary manner.Further, important modeling work is being done in other export oriented developed countries, such as Australia, New Zealand and Canada. Naturally, here world wide outlook work and the analysis of the impacts of alternative export-strategies are in the foreground. In the European Community a more reluctant approach to agricultural sector modeling has been followed. In the EC member states agricultural sector modeling playes a different role. In most cases little modeling work is being done within the national ministries. The EC Commission has stepwise increased its interest in agricultural sector modeling. During the seventies, market forecasts and analyes of the agricultural income situation have been the major activities. During the last decade more comprehensive modeling work for the whole agricultural sector gained importance. In this context, the creation of a systematically structured and comparable "basic data system" for the EC countries and the EC as a whole has been a major undertaking.In many developing countries agricultural sector modeling gained great importance, since agricultural development strategies have to be evaluated within a general economic context. In most cases the modeling work is financed by donar countries or international institutions. Often economic modeling constitutes the basis for the elaboration of development plans and strategies. The sector modeling in Portugal, Spain, Mexico, Italy, Brazil, Thailand, Korea, Phillipines can be sited as some examples.

1.4 Conceptual requirements for agricultural sector models

Based on the assessment of literature and own experience the following requirements with respect to the conceptual design of agricultural sector models can be formulated:

(1) The description of agricultural technology should be based on an activity concept, which enables a representation of both, yields per unit and activity levels (acreage, number of livestock) and the flows between the different branches of production. This is of importance since the determinants of the input mix and yields are different from those which govern acreage allocation and the development of livestock numbers. Further, different sources of statistical data and a priori knowledge about technical relations can be exploited.

(2) The model should contain the relevant physical and monetary balances and should be consistent with the national and sectoral accounting framework. This is a prerequisite for an adequate representation of intersectoral linkages.

(3) The model should permit an appropriate degree of differentiation which can differ according to the specific type of policy question addressed. Since the model size increases exponentially with the number of commodities and activities distinguished, it has advantages to conduct parallel studies at different levels of disaggregation. In any case flexible possibilities for aggregation v.s disaggregation should be

foreseen in the modeling concept.

(4) Intersectoral linkages concern mainly the demand for agricultural products and the factor markets. The modeling approach should include the relevant feedbacks between the agricultural sector and the general economy. If the agricultural sector has large general economic importance, a general equilibrium approach has many advantages. In any case, a careful specification of general economic scenario conditions and the use of more general functional relationships (price dependant product demand and factor supply functions) is advisable.

(5) The same is true with respect to the modeling of international trade. In many cases the "small country assumption" will not be appropriate so that price dependant export and import functions will have to be included.

(6) A central decision for the modeling concept concerns the consideration of the time dimension. In ,principal, dynamic interdependencies and time lags are of large importance, for the agricultural adjustment process so that recursive coupling procedures are adequate. This is especially true for medium- and longer-term projections and policy simulations. But the empirical specification of dynamic models needs an elaborated data base (time series) and is rather time consuming. Therefore, it is often advisable to persue comparative static approaches as complementary analytical concepts.

1.5 Need for a basic data system

One important experience of the last decade has been that policy oriented modeling should be seen in close connection with systematic work on the data base. The development of a basic data system has to be oriented at the modeling concept and its elaboration has to be understood as a continuous task. The basic data system has to contain, besides the original statistical data various categories of information from occasional surveys and case studies as well as engineering and farm accounting data. Especially the last categories are of importance for the specification of the agricultural technology component. These data should be integrated into a data system which is more than a "data bank". The structured "integrated data system" can be understood itself as a "model", designed to describe the production structure and intra- and intersectoral flows of the agricultural sector. It is a result of a first phase of modeling work and subject to continous further development and revision.

1.6 Requirements for policy oriented applications

If agricultural sector modeling shall be used in the process of policy making some requirements with respect to the institutional setting have to be fulfilled. Of central importance is a continuous dialogue between policy makers on the one hand and model builders on the other hand. The modeling group can be created either within or outside of the administration. In the first case it has to be guaranted that the necessary continous process of methodological improvement can take place, in the second case an organisational scheme for mutual dialogue has to be defined. Both procedures have advantages and disadvantages; e.g. the EC Commission has decided for its own modeling work to pursue the second alternative.

The experience shows that the following steps in the communication process between policy makers and model builders are useful:

(1) Presentation of the "working of the model" on the basis of ex-post analyses and status-quo forecasts ("base run"). This exercise includes a diagnosis of the present situation and some indication of future problems and conflicts.

(2) Presentation of policy goals and scenario conditions, as invisaged by the policy makers; specification of policy goals and scenarios in a first round of discussion.

(3) Computation of a first series of policy runs; discussion on the plausibility of results and trade-offs between different policy goals; revision of modeling assumptions.

(4) Further rounds of computation, discussion of results and revisions, depending on the complexity of problems.

(5) Final interpretation of the impacts of policy alternatives on sectoral developments and policy goals by the group of model builders.

(6) Evaluation of the analyzed policy alternatives by the policy makers.

In this way, continuous work on the basis of agricultural sector models can be understood as a mutual learning process. It is indispensable for the understanding of model mechanism, for the understanding of the potentials and limitations of specific models and for an adequate interpretation of modeling results.

II. METHODOLOGICAL APPROACH AND BASIC STRUCTURE OF TASM

2.1 Historical development and characteristics of TASM-MAFRA

A systematic and comprehensive analysis of the agricultural sector and the agricultural policies have for a long time been far beyond the relative importance of this sector within Turkey's economy. Despite the availability of relatively rich sources of data, when compared to other countries, even today there does not exist an integrated data system, which covers the agricultural sector as a whole and integrates the sector with the rest of the economy and with foreign countries (agricultural accounting system). While the lack of information and appropriate tools for policy analysis has long been acknowledged by policy makers and related agencies such as the Ministry of Agriculture, State Planning Organization, or World Bank, for a long time not much distance was traveled towards its elimination. The search for the "best" agricultural sector model on the one hand, and futile efforts to form a "perfect, all comprehensive" data base before any formal analysis on the other, has continued for years by different agencies. The realization of the importance of appropriate information and policy tools and the accentuation of the interactions between these tools and the databases, has resulted recently in a shift from the search for a "perfect model and all data" to the emphasis on an "operational model and relevant data". In these lines, more systematic agricultural sector and policy analysis have been initiated by the Ministry of Agriculture and the World Bank as a first step towards the development of operational tools, which can be used for policy analysis purposes in the Ministry.

The general necessity for employing sector modelling as a tool for current policy decisions has been already outlined in Chapter 1. Compared to other countries, there are a number of special reasons for intensified sector modelling and analysis investigation in Turkey. Among others, one can point out the following:

a) The agricultural sector as well as the Turkish economy is claimed to be in a take-off development stage with enormous implications concerning structural adjustments. Large investment projects (such as large irrigation projects, improvement in livestock production) are under way. The impact of such policies on the agricultural sector and the economy in general can not easily be foreseen without formal modelling tools.

b) The economic policies of the recent years are oriented towards liberalization and free markets on the international and domestic fronts. This includes also the tendency to a more free and market oriented exchange rate regime. Since the relative importance of tradeable and non-tradeable goods differs in the various sectors and even within the agricultural sector, a more liberalized trade policy will lead to different impacts on various production sectors. A systematic analysis is needed in order to asses various direct and indirect structural adjustments of the economy.

c) Turkey has applied for full membership in EC. In this process, several adjustments need to take place regarding the structure of the Turkish economy and the domestic and foreign trade flows, both prior and after the entry to EC.

d) Finally, one characteristic is the wide variety of commodities, which are produced in Turkish agriculture. These commodities compete for the same resources and are interrelated as complements or substitutes on the demand side. Of the approximately 125 crops, excluding livestock, 40 major ones constituting over 95 percent of the agricultrual crop value or area are incorporated in TASM. It is clear that, with so many closely interrelated commodities to be considered, partial market and policy analysis are bound to have significant limitations.

The Turkish Agricultural Sector Model (TASM-MAFRA), which is presented in this report, relies on earlier versions of TASM. At the same time, the present version differs in many respects from earlier ones. Therefore, in the following a short summary of the historical development of the TASM modelling activities and the main characteristics of TASM-MAFRA shall be introduced.

The work on TASM has been initiated in 1981 in connection with the World Bank mission to Turkey. At this time, the transmission process of the Turkish economy was studied and questions concerning industrialization and growth with different trade strategies have been pointed out. In order to analyse and answer these types of questions, a linear programming model has been developed for the base year 1979. This model has been utilized in several World Bank reports on Turkey. It has latter been updated and modified in several directions, particularly the following two are worth mentioning:

a) The national version of TASM has been improved and modified, especially with respect to the livestock sector. At the same time, the problems of linear programming models at the national level have become obvious (see chapter 1) and the emphasis was shifted to the introduction of non-linear relations in order to overcome some of the problems. The model was still national and specified for the base year 1979.

b) Since the natural and economic differences within Turkish agriculture and the related policy problems were increasingly exposed, a regional version of TASM was constructed. This regional version was specified for the base year 1982 and devided the available Turkish data into 5 regions. This model has been running on the mainframe computer at the World Bank in a linearized form (segmented demand functions) and has also been used for several World Bank reports.

In the beginning of the consultancy services on the "Turkish Agricultural Sector Model" under ASAL (2585-TU) the question arose and was discussed with the Agricultural Ministry, whether we should rely on the structure of the national or regional model. Since the purpose of the project was to develop, update and implement an Agricultural Sector Model at the Ministry for their own use, we had to take into account the available computer facilities at the Ministry and the related Department of the Ministry. Additionally one has to consider that a continuous use of quantitative sector models in the policy making process requires a fast and easy access to the computer. Given these requirements and the fact that only personal computers are available at MAFRA-APK, our work was, after careful analysis and evaluation of several versions of TASM and of the principal requirements of the Ministry (see progress report I), focused on developing an operational PC-version of TASM, which can be implemented at MAFRA and used for practical policy analysis.

The arguements for not considering the regional version of TASM in this study are not limited to the hardware problems mentioned above:

a) The consideration of the regional impact of agricultural policies and the modelling of the adjustment process of the agricultural sector on the basis of region specific natural and economic conditions requires a much more detailed regional disaggregation (for Turkey about 30 to 50 regions). If only five regions are considered for Turkey, the natural and economic conditions within the single regions may still be very different; in some cases the intraregional differences may exceed the interregional variations, which is an insufficient aggregation condition.

b) The interregional trade flows, the transportation costs and the flows and costs for trade from a certain region to the main harbour points (international trade) seem very important for a number of policy purposes, especially for a large country like Turkey. But again a more detailed regional disaggregation and a consideration of the diverse trade flows and the existing transportation facilities seems necessary to address policy questions of this type. The modelling of agricultural trade between five points in Turkey, which cover geographically large areas, seems not only problematic, but may even lead to some misleading model results and unrealistic interregional price structures.

c) On regional level, the available data base is in general more scarce and poorer than on sectoral or on single farm level. The poor regional data base involves particular problems, if one wants to consider sectoral consistency, e.g. consistent trade and commodity balances, including international trade. These regional data problems involve enormous difficulties, if a continuous updating of the model is intended and if the model shall be used for policy analysis under future economic scenarios (evaluation of policy impacts under future conditions for present decisions).

d) On the other hand, because of the poor regional data availability and the limited knowledge of the regional production techniques, a large number of sectoral relations and coefficients has to be used in all regions. As far as we have experienced this is also, to a large extent, the case for the regional version of TASM. It is obvious that such a (more or less necessary) practice reduces the value and the additional information to be obtained from a regional model.

e) A special problem of regional model, as it has been presented by the World Bank, concerns the fact that no description and explanation of the model structure and the sources of data has been delivered. Also no information is given about how they have derived various parameters, and if coefficients are based on expert knowledge or just on "guestimates". Due to this missing information it is very difficult to evaluate the empirical content as well as the "power" of the model and especially to work out an appropriate updating system. This can lead to serious problems concerning the policy applications, because fundamental questions about the reliability of the data, the model parameters and the implicit model assumptions may arise.

f) As a final point we may mention the general difficulty of updating and working with a "large scale" agricultural sector model, especially in a small (MAFRA) working group with little modeling experience. In order to get familiarity with the model, which is a precondition for successful model application, it is important to know about the influence and the sensibility of the various model parameters and model assumptions. It is a difficult job to keep this up continuously (year by year) for about 10.000 parameters of a large scale model. As far as we are concerned, this is the main reason, why all over the world there are only very few places, where large scale regional sector models are continuously updated and currently used for policy purposes (see Chapter 1).

For these reasons it is in our experience more fruitful to start with a "smaller" version of an agricultural sector model. This allows an easier understanding of the essential structure, the assumptions and the economic mechanisms of the model and to gain experience in technical handling on a PC. Such a model can and should be used in an interactive way, by carrying out several simulation runs ("playing with the model"), rather than solving a big model once for answering a certain policy question. This is the way we interprete the main scope of this study to "improve the analytical capacities of MAFRA". Only after considerable experience with the application of this PC model and after the construction of a better and more consistent data base, (recommondation on the establishment of a consistent agricultural information system will be made in this study) it then might be fruitful to work with an enlarged (regional) version of an agricultural sector model for Turkey.

In the light of the points raised above we have focused our work for a policy oriented agricultural sector model for Turkey on the available national versions of TASM. The model developed within this study differs, however, in many respects from earlier national versions:

a) The model is not only specified for a single base year, but for eight base periods from 1979-1986. This allows a more realistic model calibration and validation as well as a consolidated forecasting and policy simulation approach.

b) The conceptual framework and the data base system are developed to permit continuous updating. Instead of a one time exercise, a continuouse model application following the well known rolling plan principle is intended.

c) The present version of TASM relies rather heavily on non-linear relations within a mathematical programming approach. Particularly, three kinds of non-linearities were incorporated: price-responsive demand for agricultural commodities, price-responsive factor supply functions and non-linear cost functions as means for model calibration.

d) The new version of the model contains a more flexible and realistic structure for the feed-livestock sector.

e) The model has been developed is such a way, that it can be run on a PC. The software, necessary for the operation of the model, has been tested and made available for the Ministry. This is not only the first time for a version of TASM to be run on PC's, but in general, there is only very little experiences in simulating a comrehensive agricultural sector model like TASM-MAFRA on a PC.

The present version of TASM-MAFRA can be directly addressed to a number of policy questions, in particular the following can be pointed out:

- Influence of changes in trade policy and world market conditions on the agricultural sector (including domestic demand),
- Impact of changed input price policies,
- Impact of changing agricultural technologies,

- Sectoral and crop specific effects of changes in the general economic conditions (e.g. influence of population and income growth on agriculture),

- Impact of changed resource availabilities,

- Impact of quotas and taxes for output and inputs.

Policy decisions should, in principle, always be oriented on future developments. This means that one should always apply a forecasting/simulation version of model for the preparation and evaluation of policy alternatives. Therefore, we have emphasized the development of updating and forecasting systems, which can continuously be used for policy purposes following the "rolling plan" principles. In order to realize a real sound basis for such a forecasting/simulation system, past time series data, to the extent available, have to be introduced within the system and used for the prediction of the model parameters and the values of the exogenous variables.

The main methodological feature of this PC version include a number of non-linear relations at the demand and production cost sides. This leads, in principle, to a more continuous response of the model even to small changes of exogenous variables. In our experience this is a very important improvement of agricultural programming models, especially for their application to policy analysis.

In the developed model version of TASM-MAFRA, agricultural output prices are modeled as endogenous depending on the slope and intercept of the demand and the implicit supply curve. This means that the designed model can be used in order to derive a guideline for agricultural price policy, which is in line with the economic conditions of domestic producers, consumers and also with the conditions in international markets. But it is also possible to introduce governmental demand in order to influence (stabilize) the domestic price level, or to consider agricultural prices explicitly as an exogenous policy variable.

Further modifications are required, if the governmental budgetary effects are to be modeled explicitly or introduced as constraints to policy interventions, or if the current agricultural price policy systems is to be introduced in an explicit form.

To supplement this brief characterization of TASM-MAFRA and of the regional model TASM2 a more systematic comparison of the two model versions is illustrated in Figure II.1. In Figure II.1 the main features of the two model versions are reported as far as the model size, the hard- and software aspects, the output and input specification and the main methodological characteristics are concerned. In the following chapters the structure and methodology of TASM-MAFRA, the data base system and the programming system is described in more detail.

FIGURE II.1 BASIC FEATURES OF TASM2 AND TASM-MAFRA

FEATURES	TASM2	TASM-MAFRA
MODEL SIZE		
No of Variables	2500	350
No of Constraints	1000	250
COMPUTER HARDWARE	MAIN-FRAME	PC
COMPUTER SOFTWARE	TEMPO	GAMS-MINOS-SYMPHONY
SOLUTION TIME		
Base Run	30-60 minutes	20-30 minutes
Policy Runs	5-10 minutes Approx. on Main Frame	15-20 minutes Approx. on PC
OBJECTIVE FUNTION	LINEARIZED	NON-LINEAR
BASE YEAR/PERIOD	1982	1979 - 1986
REGIONAL SPECIFICATION	YES (5 REGIONS)	NO (6 REGION SPECIFIC LAND CONSTRAINTS)
NO OF PRODUCTS	43	55
INPUTS	LAND(4), LABOR(2Q) FERTILIZER(2), SEEDS TRACTOR(Q), ANIMAL(Q) FEED(32), CREDIT(2), OTHER COSTS	LAND(10), LABOR(2Q) FERTILIZER(2), SEEDS TRACTOR(Q), ANIMAL(Q) FEED(42)
CROP ACTIVITIES	SINGLE	SINGLE
LIVESTOCK ACTIVITIES	VARIABLE FEED RATION	VARIABLE FEED RATION

FIGURE II.1 BASIC FEATURES OF TASM2 AND TASM-MAFRA(Cont.)

FEATURES	TASM2	TASM-MAFRA
CROP TECHNOLOGY	EXOGENOUS ANIMAL-TRACTOR FERTILIZER	ENDOGENOUS ANIMAL TRACTOR
LIVESTOCK TECHNOL.	TRADITIONAL-MODERN-IMPROVED	SINGLE
DOMESTIC DEMAND	ALL PRIVATE	ALL PRIVATE
FOREIGN DEMAND	ALL PRIVATE	ALL PRIVATE
RISK SPECIFICATION	NONE	NONE
DOEMSTIC DEMAND FUNCTION	LINEAR	LINEAR
FOREIGN TRADE FUNCTIONS	LINEAR	LINEAR
DOMESTIC PRICES	ENDOGENOUS	ENDOGENOUS
FACTOR PRICES	EXOGENOUS	EXOGENOUS, PARTLY ENDOGENOUS
EXCHANGE RATE	EXOGENOUS	EXOGENOUS
RESOURCE AVAIL.	EXEGONOUS	EXOGENOUS
COST FUNCTIONS	LINEAR	QUADRATIC
VALIDATION AND CALIBIRATION	TRADITIONAL DATA AND PARAMETER ADJUSTMENTS	POSITIV QUADRATIC PROGRAMMING APPROACH

Note: TASM-MAFRA specifications are as of May 1988 and subject to change

Q means quarterly (4 quarters a year)

At the end of this chapter some more general comments on TASM-MAFRA from the methodological and policy point of view shall be added.

a) The fact that the PC version of TASM-MAFRA is smaller than the main-frame version, should not give the impression that it is a "small" and "simplified" model. Indeed, the TASM-MAFRA is a large model, and it allows one to focus on the crucial parts of the model. It is smaller in the sense that a 1000 x 2500 matrix is replaced by an approximately 250 x 350 system of the focal model. This is achieved by replacing linear approximations by true non-linear functions, by throwing out redundant constraints and variables, which can easily be calculated outside the model. Therefore, as far as, for example the number of commodities or inputs are concerned, the model is more detailed than TASM2. With the exception of the interregional inderdependences our version represents in fact more of the characteristic interrelations and linkages within agriculture. We believe therefore, with very few minor exceptions, that TASM-MAFRA can produce almost every detail, which is available by TASM2.

b) It is evident that, there is a trade-off between easy model handling and application on the one hand and the potential detail in representing the agricultural sector and the applied policy on the other. But the more interesting question is, whether the potential of a large scale model can really be fully exploited with sound empirical informations. Working with a PC version of a model with the mentioned size, one is almost reaching the limits of the computer memory. One therefore does not have the luxury of incorporating every detail, or policy set-up in one model, as it might be possible with the main-frame version. The PC version has been developed and submitted to the Ministry, therefore, cannot directly address all possible policy questions at the desired detail levels. It will require some preliminary work before it can be employed for simulations, which are not formally presented in the submitted model version.

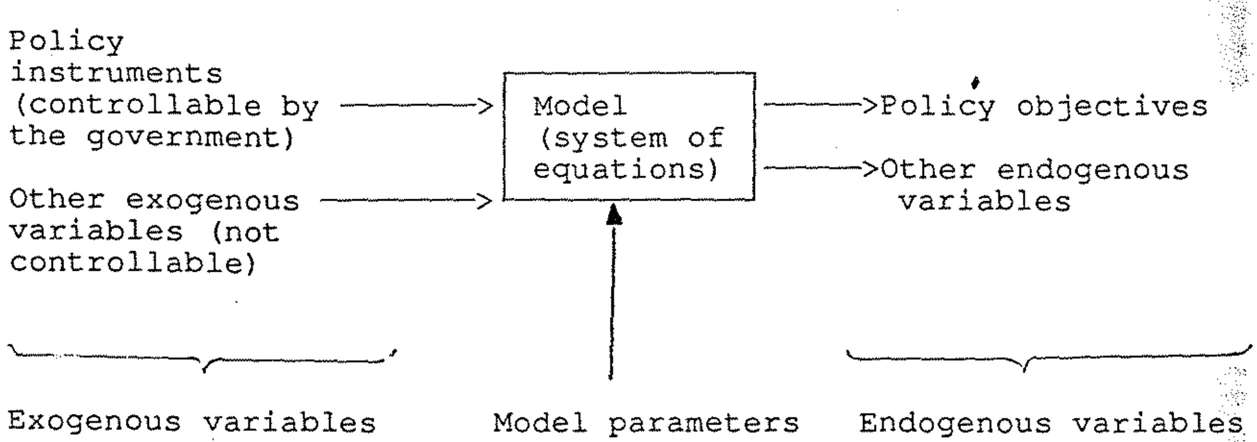
However, we have tried to secure and provide the Ministry with the necessary tool for policy analysis and prognosis through this study, tested in several ways (including policy simulation runs), which is relatively easy to handle and which meets, in our understanding, the requirements of the Ministry at the present stage. In our view, it is more important to provide an outcome from this study, which will really be used in the Ministry on a regular basis, rather than utilizing a formal model in its "raw" form, which is necessarily less user friendly and less flexible.

2.2 Basic elements of models in general and of TASM-MAFRA

2.2.1 Basic structure of sector models

Every quantitative model consists basically of a system of equations, which describe the relation of the variables considered in the model. Therefore, one can characterize each model by the kinds and types of equations, the parameters of the equations and the exogenous and endogenous variables. The principal feature of a quantitative agricultural sector model associates the following elements (Fig. II. 2):

FIGURE II. 2: PRINCIPAL STRUCTURE OF A QUANTITATIVE SECTOR MODEL



Based on this characterization of a model, first the meaning of the different model elements and the vocabulary, which is used throughout this report and also in practical model application, will be defined more precisely and second, the basic structure of TASM-MAFRA will be explained.

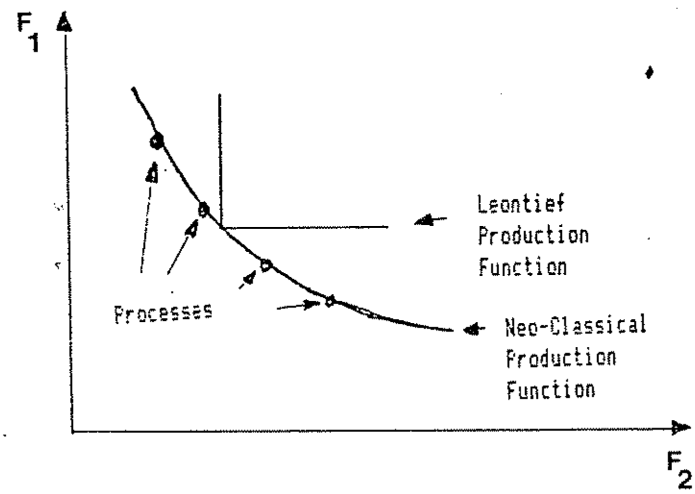
This basic terminology is also used in the GAMS-MINOS-Software package which is employed in TASM-MAFRA. For practical applications it is very important to have an easy translation between the economic and programming terminology.

2.2.2 Equations

Depending on the various types of economic relations in a model, different kinds of equations are considered The following types are basically distinghished: production functions, behavioural functions, institutional functions and definitional equations.

(a) **Production functions**: These functions describe the technogical relations between physical inputs and outputs. In principal two types of production functions can be considered: Leontief production functions, which assume fixed input and output coefficients (no factor substitution), and Neo - Classical production functions with assumed continuous input-output relations (perfect factor substitution). The formulation of production processes, on which TASM-MAFRA is based, can be characterized as a mixture of both concepts: For each production process fixed input and output coefficients are assumed according to each time period. Due to the formulation of a number of production processes (activities), it is, however, possible to approximate neo-classical production relations (Fig. II.3).

FIGURE II.3: ILLUSTRATION OF VARIOUS TECHNOLOGY CONCEPTS (At a given level of Output)



In the case of TASM-MAFRA different production processes (each with fixed coefficients in a given year) are considered:

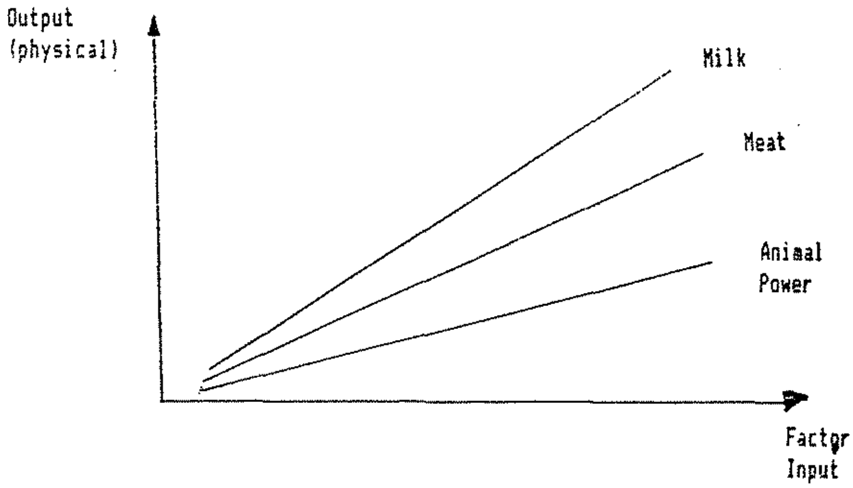
- In relation to the level of mechanization, an animal power activity (with high labour and low capital input) and a tractor based production activity (relatively low labour input and high capital input) is formulated for every single crop activity.

- Different production activities are defined in relation to irrigated and non-irrigated land.

- Finally, different processes are defined for crop production with respect to fallow

The activity based approach offers a user friendly formulation of processes with more than only one output. In TASM-MAFRA this has been the case for animal production activites. In this sense the complementary technical relations between milk, meat,wool and hide are assumed on the production side (Fig.II.4).

FIGURE II.4: ILLUSTRATION OF COMPLEMENTARY OUTPUT REALATIONS
(Example of Cattle Production)



In order to allow for substitution between some of these commodities, it would be necessary to consider different livestock activities.

The present persion of TASM-MAFRA includes also some neo-classical production elements through the incorporated non-linear cost functions (for more details see section 2.2.3).

(b) **Behavioural functions**: are used to describe the reaction of actors or groups of actors to changed economic conditions. Two broad groups of behavioural functions can be distinghished:

- Direct behavioural functions express the relationship between a decision variable and the economic indicators:

$$X = f(P1 \ldots\ldots Pn)$$

For example conventional demand functions characterize directly the reaction of consumers to a changed price element.

- Indirect behavioural functions are based on an objective function, which is maximized or minimized under certain constraints, such as the profit of farmers, maximized under the given constraints of certain production functions and resource availabilities.

TASM-MAFRA is based on both types of behavioural functions. Firstly, the overall objective function is maximized over the sum of the producer and consumer surplus on each of the agricultural commodity markets. This formulation ensures that a competitive market equilibrium is modeled. Secondly, there is also a number of direct behavioural functions incorporated, like the domestic demand function, or various factor supply functions. Since these functions can implicitly express other behavioural roles as well, the model does not necessarily present pure profit maximization of the farmers or utility maximization of consumers. This has always been the basic assumption and general opinion about the maximimazation of the producer and consumer surplus. The overall objective function is, however, convenient, since it ensures that the model solution is consistent in economic terms.

(c) **Institutional equations**: These equations express relations between economic variables, which are determined by public and social institutions, e.g. by the government or by semi-public agencies. Typical examples are:

- Tax functions, which describe e.g. the amount of income (value added) tax in relation to the taxable income (value added),
- Social security payment functions,
- Subsidy or income transfer functions.

A common characteristic of these functions is that the parameters are determined by public decisions.

The present version of TASM-MAFRA does not include institutional functions explicitly. A more detailed consideration of the price policy system in Turkey or the agricultural income structure would, however, require the incorporation of appropriate institutional functions.

(d) **Definition equations**: These equations are used in order to consider physical and monetary consistency between variables. Typical examples of such equations are (as in the case of TASM-MAFRA):

- commodity balances, which ensure that total supply (the sum of all supply components) is equal to total demand (the sum of all demand components),
- factor supply and use balances,
- balances for intermediate products, which are produced and used within agriculture.

Definitional equations are also employed in the aggregation of detailed model results, or in order to transform model results into policy relevant variables.

2.2.3 Variables

Economic variables of a sector model are either factors, which influence the economic situation and development of the agricultural sector (exogenous variables), or they present the outcome (result) of a model (endogenous variables).

(a) **Exogenous variables**: The exogenous variables of an agricultural sector model can either be controlled by the public decision maker (instrument variables), or they have to be taken as given to the sector (the farmers) as well as to the policy maker.

(aa) **Uncontrolable exogenous variables**: The following groups of variables can not - or at least not directly - be influenced by the agricultural policy makers (in brackets: relevance with TASM-MAFRA):

- World market prices (foreign trade, export earnings),
- General income level (demand for agricultural products),
- Population development (demand for agricultural product, labour supply),
- Factor prices (production costs),
- Exchange rate (Foreign trade in agricultural commodities and inputs),
- Inflation rate (Several model components).

These variables are given for the expost period and they have to be projected for model runs and policy simulations in future periods. Since there is no single best method for projecting these variables, alternative projections, based on a more optimistic or pessimistic view, should be made. If possible, results from macro economic forecasting should be used in order to derive consistent general economic scenarios.

The need for an explicit formulaton of future economic scenarios should not only be seen as a burden of the sector modelling activities. Instead, one should realize the fact that the effectiveness and the evaluation of future policies depends to a large extent on the expected economic scenarios. The sector model can help to expose these interrelations explicitly. The model cannot however,forecast the "best" future policy. In an uncertain world, final policy decisions have to be based among others on the expectations about future economic conditions.

(ab) **Policy variables**: The value of policy variables is determined by policy decisions, either in their absolute value or in their relation to other variables (e.g. tax rates). In TASM-MAFRA, there are different categories of policy variables directly considered, such as

- agricultural input prices, determined or effected by government decisions (e.g. fertilizer),

- export and import quantitates, as far as export and import quotas are employed,

- export and import tariffs,

- irrigated area, as a result of government irrigation projects.

There is a number of other policy activities, which are not directly incorporated in the model. It is, however, possible to introduce such additional policy variables or to modify other exogenous variables, if they are influenced by policy actions. For example government intervention programs can easily by introduced as an additional element in the commodity balance.

In practical model applications, policy variables are the main subjects of simulation runs. Through a systematic variation of the different policy variables it is possible to model the trade-offs betweeen various goal variables. This type of policy simulation may particularly be employed for the evaluation of future policy options.

(b) **Enodogenous variables**: The endogenous variables present the outcome of an agricultural sector model. From a formal point of view, it is a common practice to distinguish between policy objective or goal variables and other endogenous variables (sometimes named as irrelevant variables). We will not follow this differentiation, since most of the endogenous variables are directly or indirectly relevant for analyzing and evaluating agricultural sector development and policy questions. The main model results of TASM-MAFRA include the following categories of endogenous variables:

- volume of production at commodity level,

- volume of domestic demand for human consumption, exports, imports and internal demand of the agricultural sector,

- farm gate prices for agricultural commodities (equilibrium prices),

- use of production factors, e.g. total land use, allocation of land to crops, total labour use, purchased inputs,

- shadow prices for fixed factors and intermediate inputs, like feed.

Based on the direct model results, a number of other policy relevant variables can be calculated:

- value of production, value of purchased inputs and various farm income measures,

- distribution of income to the production factors,
- foreign exchange earnings,
- expenses for food consumption,
- cost structure of production in the total sector and for each commodity,
- various measures for the evaluation of international competitiveness, like domestic resource cost indicators.

The values of the different endogenous variables in the ex-post period, in principle, are derived from the available statistics. In the process of model specification these variables can be used in connection with the exogenous variables, for the estimation of the model coefficients and parameters. To test a model against reality means to compare the endogenous variables (the outcome of a model) with the values provided by the statistics.

In forecasting and policy simulations, the endogenous variables are unknown, their values are determined by the model mechanisms (the system of equations) and the exogenous variables, including the policy variables.

2.2.4 Parameters

Parameters represent quantitative relationships between the variables in equations, especially concerning technological and behavioural equations. The meaning of parameters depends very much on the functional form of the equation (e.g. linear, exponential, quadratic). In any case a parameter expresses the influence of one variable onto another. For example:

Linear equation: $Y = a * X$

Exponential equation: $Y = X^b$

Y = endogenous variable
X = predeterminated variable (exogenous or endogenous within the model)
a = absolute influence of the change of X by one unit on Y
b = relative (percentage) influence of the relative change of X on Y

The parameters of a model can either connect exogenous variables with endogenous variables or two endogenous variables.

In TASM-MAFRA the most important groups of parameters are (parameters and coefficients are used here as synonyms):

- output coefficients (yields per ha or animal),

- input coefficients (factor requirements per ha or animal),

- parameters of the demand function,

- parameters of the factor supply functions,

- parameters of the non-linear cost functions.

The parameters of a model are in principle exogenous, which means that certain sets of parameters have to be specified outside the model. In the case of TASM-MAFRA we use, however, the model itself for specifying certain parameters in order to receive consistency and to calibrate the model in the base period. This procedure is based on certain assumptions, which can be modified, if more precise information is available.

Concerning the application of the model, the parameters have to be forecasted. With the implemented version of TASM-MAFRA base forecasts are realized by using the trend of past developments. In practical application the forecasted parameters should, however be subjected to evaluation and to modifications by the model user.

Systematic variations of the model parameters may be desired mainly for two purposes:

- Firstly, through solving the model at different parameter values the sensitivity and responsiveness of the model mechanisms can be tested. Such a test may help to clarify the stability of the model solution in relation to the parameters. Based on such a systematic sensitivity analysis one can gain precise information about the most critical parameters, which have to be specified carefully and interpreted along with relatively less important parameters.

- Secondly, for policy simulation purposes certain parameters of the model may be changed. This is obvious in the case of institutional equations (see above). Furthermore also other model coefficients like for example livestock yield coefficients may be changed as a result of a successful government breeding programme. If the agricultural producer prices for instance are completely determined by government intervention progammes, the parameters of the demand functions can easily be changed in such a way that this policy instrument dominates. These examples show that a number of agricultural policy measures can directly or indirectly be incorporated and studied in TASM-MAFRA.

In the GAMS-MINOS Package, as will be discussed in later chapters parameters and exogenous variables are programmed and handled in a similar way.

2.3 Structure and methodology of TASM-MAFRA

2.3.1 Overview

The basic structure of TASM, which is basically a mathematical programming model for the Turkish agricultural sector, is summarized in Figure II.5. A more detailed formulation of the model will be given in the following chapters.

The model incorporates production activities, which account more than 90 % of the value of agricultural production in Turkey. Agricultural supply and the domestic and international demand components are represented within the commodity balances of the model. The most important factor markets and linkages with the commodity markets are explicitly taken into account. Additionally, various intermediate flows, e.g. between crop and animal production, are incorporated. The objective function maximizes the sum of consumer and producer surplyses, plus net exports as defined by the model. The core of TASM-MAFRA consists of production activities, resource constraints and a matrix of input-output coefficients. As far as possible the data base has been constructed from published and unpublished official statistics in order to permit easy updating for future policy simulations. But the data employed was subjected to a critical consistency check prior to base runs and during the base calibration runs.

As mentioned earlier, TASM-MAFRA is a non-linear mathematical programming model. However, most parts of the model are linear. Therefore we will begin in what follows with the linear model part and explain the structure of the total model. Then we will discuss the question of why non-linear relationships should be introduced into a sector model like TASM-MAFRA. Finally, the non-linear equations in TASM-MAFRA will be explained in detail and the procedure used for estimating the parameters will be outlined.

2.3.2 The linear model part

The overall structure of the mathematical programming model is illustrated in the core matrix presented in Figure II.6. It is apparent from the matrix that the main body of the model is characterized by linear relations. The non-linear relations only appear in some parts of the objective function. However, this should not be taken as a ign to diminish the importance of the non-linear part. Also the size and relative importance of various row and column sections can not be concluded out of the presented core matrix.

In the following section, the main activity blocks (columns) and of the main constraint blocks (rows) of Figure II.6 will be explained.

FIGURE II.5: BASIC STRUCTURE OF TASM-MAFRA

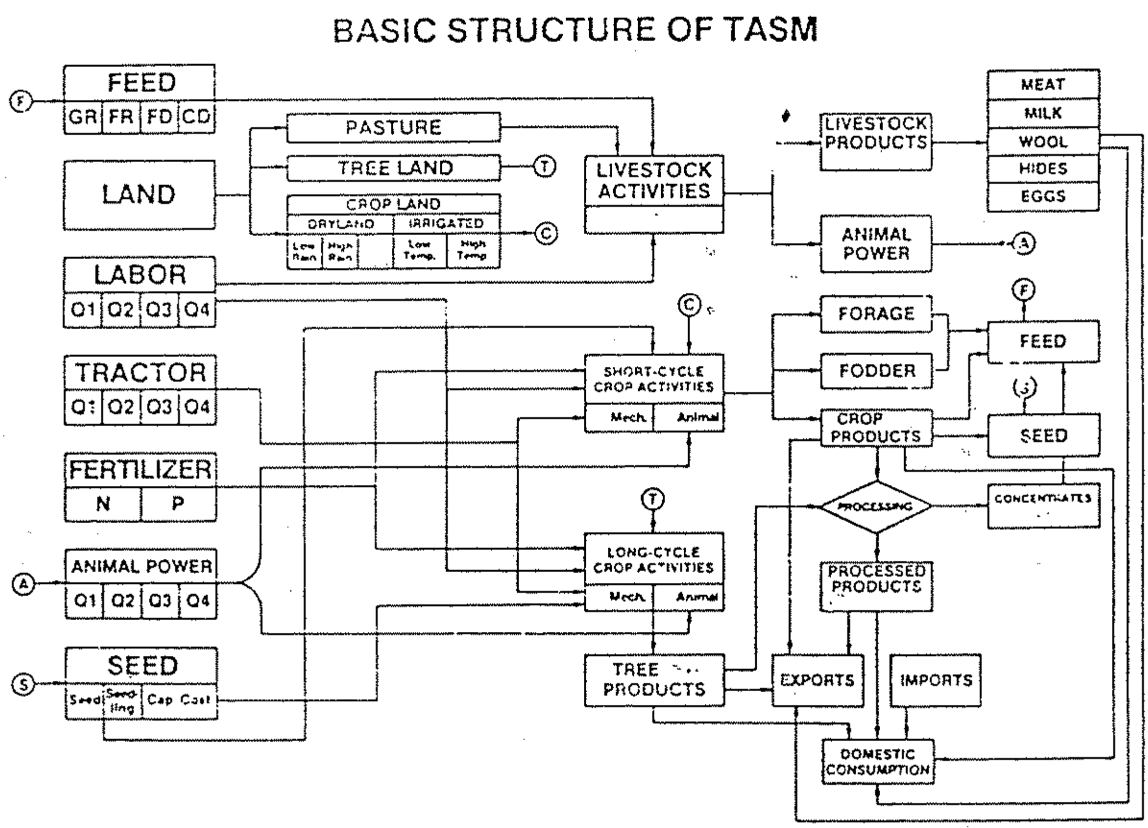


FIGURE II.6: THE CORE MATRIX OF TASM-MAFRA

Constraint Block	Crop Production	Livestock Production	Feed Supply	Fert Use	Produ Costs	Labor Supply	Tractor Service Supply	Import	Export	Processed Product Trade	Domestic Consumption	RHS
	Activity Block											
(0) Objective Function	+ ... +	+ ... +			-1 ... -1	+ ... +	+ ... +	- ... -	+ ... +	- + + +	+ ... +	
(1) Dry Total Pasture Dry Good Irrigated Total Irrigated Good Tree Area	1111 11 1111 -11 ... 1											≤ Land Availability
(2) Fallow Rotations	- + + - +											= 0
(3) Labor Requirements (Demand)	+ ++ + + + + ++	+ ... + + ... +	+ ... + + ... +			-1 ... -1						≤ 0
(4) Tractor Requirements (Demand)	+ + + ++						-1 ... -1					≤ 0
(5) Animal Power Balance	+ + + + + + + +	- ... - - ... -										≤ 0
(6) Fertilizer Requirements	++ + + ++			-1 ... -1								= 0
(7) Production Costs	+ + + + + + + + + +	+ ... +			-1 ... -1							= 0
(8) Commodity Balance	+ + + ++	+ + + + + +	-1 ... -1					1 ... 1	-1 ... -1	+ - - -	-1 ... -1	= 0
(9) Total Labor Availability						1 ... 1						≤ Labor Availability
(10) Tractor Stock							1 ... 1					≤ Tractor Availability
(11) Feed Supply Balances	+ + + +		-1 +1 -1 +1							+ + + +		≥ 0
(12) Feed Demand Balances		- - - - - - - - -	+ ... +									≤ 0
(13) Trade Limits								1 ... 1	1 ... 1	1 ... 1		≤ Maximum Trade Quantities

Note: (⋰⋱) indicates non-linear relationships.

2.3.2.1 Activity blocks

Agricultural production in the model is represented by 120 production activities, of which 113 account for crop production. The crop production activities are specified in relation to typical input requirements concerning quantity and quality of the different input types under Turkish production conditions. The main input categories are land, labor, tractor and machinery services as well as purchased inputs like fertilizer, seed etc. These production activities produce 35 different crop commodities, which can be sold on the market (commodity balance), and several intermediate commodities, mainly fodder crops. Each commodity can be produced by at least two activities. For some commodities further disaggregation of activities has been made according to

- the land type : * dry land,
  * dry land, good quality,
  * irrigated land,
  * irrigated land, good quality;
- the mechanization: * animal intensive
  * capital intensive
- the rotations : * with fallow
  * without fallow

For all crop production activities two levels of mechanization are considered. Other kinds of differentiation are applied in a flexible manner according to the crop and production characteristics. For example 6 wheat production activities are incorporated.
- wheat, dry land, without fallow, animal power;
- wheat, dry land, without fallow, tractor power;
- wheat, dry land, with fallow, animal power;
- wheat, dry land, with fallow, tractor power;
- wheat, irrigated land, without fallow, animal power;
- wheat, irrigated land, without fallow, tractor power.

By this way of formulation certain regional characteristics, like availability of irrigated land, are implicitly considered.

Concerning livestock production only seven production activities are incorporated, due to the poor available data base, namely: sheeps, goats, cattle, buffalo, mule and poultry. These seven activities produce 20 marketable livestock commodities and provide additonally animal power for crop production. In contrast to crop production, in which several activities produce the same output and allow therefore factor substitution, each livestock activity is characterized by complementary outputs with fixed ratios(e.g. sheep activity: milk, meat, wool, hide).

The main input categories for livestock production activities are labor and feed. Both input types are evaluated at internal shadow prices as explained below:

- The feed supply activities transfer either marketable commodities, like grain and fodder crops such as alfalfa, or by-products, like concentrates, to the feed demand balances. These feed supply activites admit substitution to a certain degree in the feed ration. However, specific minimum requirements for the main feed categories are considered Certain feed supply activities, like pasture use or straw harvesting, require labour input.

- Activities concerning fertilizer use and production costs are mainly accounted for balancing or technical purposes.

- The labour and tractor service supply activities have been incorporated in order to model the price responsive supply of these factors with the given availabilities. In a pure linear model version with given factor prices (completely elastic supply curve) or given factor stocks (completely inelastic factor supply) these activities could be neglected.

- The export and import activity block includes foreign trade at given world market prices, corrected by transportation costs as well as export and import tariffs. The possibility of foreign trade activity needs to be considered for certain commodities in raw and in processed form. The levels of the foreign trade activities are restricted in accordance with the directly or indirectly government managed foreign trade regime.

- The final block of activities describes domestic demand for human consumption and for industrial use for each of the 55 commodities. The basic assumption of price responsive domestic demand leads to non-linear values in the objective function, as will be explained in detail in the later sections.

2.3.2.2 Constraints blocks

(1) The land constraint block differentiates between six different land types. The amount of available dry good and irrigated good land is in each time period a sub-set of the total land. Therefore, activities, which require good land, also need to be characterized by a land input coefficient for the associated total land. The available tree area and also the pasture area is completely seperated from arable land. Therefore, according to projections and policy simulations, one has to have in mind that land can, at least to a certain extend, be transferred between these categories, e.g. the total area used for tree crops may increase or decrease. Within certain limits total agricultural area may also expand, if there are appropriate economic incentives.

Since, for certain policy simulation versions, agricultural land is the only explicit absolute restriction with a right hand side value, the land availabilities need to be estimated carefully.

(2) The crop-fallow rotation block ensures that fallow is utilized with certain relation to land use for cereal production in dry areas. This means that the fallow activities have to be realized in proportion to single crop activities. These constraints have been introduced in order to ensure that agricultural land in dry areas can recover and accumulate water during the fallow year. The present version employs a limit of 30 % of cereal area to be left as fallow. This parameter may be changed if production techniques improve or if irrigation increases.

(3) The labour equations, balance total labour demand of the crop and livestock activities with total labour supply. Total labour demand is given by the sum of labour requirement coefficients multiplied with the levels of the production activities. Labour supply and effective labour use is modeled by a supply function, which is responsive to the internal returns to labour (non-linear element). In general, only part of the availably labour endowment in farm households is effectively used in agricultural production, due to a number of reasons (aggregation error, unit problems, seasonal labour shortages, dificulties to find jobs outside of agriculture in rural areas).

The labour requirement block is differentiated for four quarters a year. This allows for an endogenous quarterly differentiation of the internal wage rate (shadow price) and the associated labour costs.

(4;5) The tractor and animal power requirements and associated balances are also quarterly. The two mechanization levels for each crop activity, mentioned above, have to be defined by the associated labour (block 3), tractor (block 4) and animal power (block 5) requirement coefficients. In the present version global relations between these coefficients are assumed, but for an accurate empirical verification of typical agricultural technology in the model, more basic research has to be done.

Total tractor and animal power demand is given by the activity levels (model internal choice of the production and technology levels) and the associated coefficients. While supply of tractor services from the given tractor stock is assumed to be price elastic (see non-linear tractor supply function), animal power supply is assumed to be a complementarity to livestock production.

The internal (shadow) price of tractor and animal power use is determined by the interaction of quarterly supply and demand and the economic mechanism behind it.

(6;7) The fertilizer and production cost equations describe inputs, which are bought at given prices (completely price elastic supply). The fertilizer block is presented in order to account for the fertilizer use. The cost block is employed for summarizing the variable production costs, which enter the objective function. The variable costs include at present: seed costs, fertilizer costs and capital costs.

(8) The commodity balance equations ensure for each of the 55 agricultural commodities that total supply matches total demand. Agricultural supply is composed of domestic supply (given by the sum of the levels of the different production activities multiplied with the given yield coefficients) and by imports. On the demand side domestic consumption, exports in raw or processed form and sector internal use of agricultural commodities (e.g. feed grain) are icluded.

Government intervention and purchase of products by sales cooperatives, TMO, etc. is either included in domestic consumption or in exports (e.g. domestic price stabilization by government, managed foreign trade). In an improved version of TASM-MAFRA an explicit consideration of the various government intervention practices on agricultural markets should be included more explicitly.

In the solution, the dual values of the commodity balance block presents the agricultural product prices at farm gate level.

(9;10) This block represents the total labour and tractor availability. Since in the base period runs these restrictions have never been binding, they can be removed from the model without any influence on the model solution (however, projection and policy simulation runs have to be checked for consistency in this respect).

The non-linear labour and tractor supply functions are, however, formulated in relative terms and they take the labour and tractor availabilities into account.

(11;12) Feed supply and demand balances constitute the major linkages between crop and livestock production. On the supply side several supply components are considered, in particular:

- straw,as a by product from cereals,
- oil-seeds, as a by-product from sunflower, groundnut, cotton and soyabeans,
- concentrates, as a by-product from cereals and sugarbeet,
- feedgrains, as a major commodity (feeding grain competes with the use for domestic consumption and exports). In order to ensure that not only the cheapest cereal component is used, minimum constraints on the composition of feedgrains are used,

- feed equivalent from pasture use,

- fodder, as a major crop, competing with marketable crops (alfalfa and other fodder crops).

The by-products are direved from the yields of the major products assuming a fixed relation (complementarity) for each of the commodities. All feed commodities are evaluated by a set of energy-equivalent coefficients. Total feed supply in energy units is obtained by summing up the various components, mentioned above.

Feed demand of livestock production is disaggregated into several components in order to ensure balanced feed rations. Also feed demand is measured in energy units. The subgroups are formulated in such a way that certain minimum needs of protein, raw fibre etc. are considered. The hierarchical system of total and sub-groups of feed demand for all livestock activities is arranged in following ranks:

Grade I: Total Feed Demand

Grade II: a) High energy feed (concentrates, grain,oilseeds),
b) Straw,
c) Fodder,
d) Pasture.

Following Grade II a) only:

Grade III: grain, oilseeds

Grade IV: oilseeds

Since all subgroups are considered as minimum constraints, there are certain possibilities for substitution between the subgroups.

Total feed demand per animal is derived from the main yields (meat, milk, eggs). The following technical functions are assumed:

$$TF_j = a_{o,j} + \sum_{k=1}^{n} a_{k,j} \; Y_{j,k}$$

TF_j = total feed demand per animal of the activitiy j

$a_{o,j}$ = absolute or basic feed requirement per activity j (independent from yield)

$a_{k,j}$ = feed requirement per output unit k in the activity j

The coefficients "a" are based on the expert estimates. This functional relationship ensures that yields of the livestock sector and the feed requirements are technically consistent. This is also important for projection and policy simulation runs.

The minimum feed requirements of the subgroup are formulated in relations to the total feed requirements.

The feed costs are accounted on the basis of internal shadow prices for the various feed categories. The shadow prices are generated by variable and opportunity costs of feed supply (in competition with the production of marketable products) and by the technical substitution relation, which by implied with the energy equivalent coefficients.

(13) The last constraint block limits foreign trade as desired by exogenous policy variables.

2.3.2.3 Features of the core matrix and structure of the programming system

The core matrix, as outlined and discussed above, presents the main structure of the programming system.

Firstly, this structure is used for transferring the economic problem into a computer program, which can be solved by applying the GAMS-MINOS Package. For example:

- The different elements of the activity and constraint blocks are defined within the SET statements.

- The constraint blocks as specified in the core matrix are used to formulate the mathematical EQUATIONS of the model.

- The VARIABLES in the GAMS-MINOS input file refer exactly to the activity blocks specified in the core matrix.

- Finally, the main parts of the data and coefficients confirm with the outlined structure. This is true for data entering as well as for data manipulation and consistency checks within the system.

Secondly, the structure of the outlined core matrix is also used in order to organize the solution of the model (outcome, results).

- The solution contains the optimum levels of the activities (in the sense of the constraint objective function), which are listed as VARIABLES in a block by block format. Each block provides the elements as defined in the SET statements.

- The second part of the model solution consists of dual variables of the equations,called MARGINAL (model internal shadow prices), which refer to the constraint blocks and within each block to the elements of the SETs. For equality equation they are always computed as duals. In reference to greater or lower equations (in equalities) duals are generated in the case of binding constraints. If constraints are not binding, the duals equal zero. The positive or negative sign of the duals can not per se be interpreted. A meaningful interpretation is only possible in relation ot the signs of matrix coefficients and to the formulation of the EQUATIONS with "greater than or less than" inequalities.

The structure of the core matrix and the organization of the GAMS-MINOS input and output file are not basically influenced by the introduction of non-linear relations, which will be explained in the next chapter. This is also true as far as the principal interpretation of the model solution mentioned above is concerned. What will be influenced by non-linearities is the responsiveness of the model (the economic model mechanisms), which is of fundamental importance regarding projections and policy simulation runs.

2.3.3 The non-linear model part

2.3.3.1 Problems with linear models and reasons for introducing non-linearities

Along with advances in the computer technology, over the past decades mathematical programming models have become a common instruments in applied economic analysis in general and for farm planning and agricultural sector analysis in particular. Mathematical programming models provide a flexible tool for agricultural sector and policy analysis, since they allow, in principle, an appropriate representation of the multiple input and output relationships of the agricultural sector. In particular, it is possible to introduce complementary relationships (e.g. between milk and meat production) and at the same time competitive relations (e.g. between wheat and barley), which represent an important characteristic of agricultural production. The linkages between crop and animal production through the feed supply and demand relationships, constitute another feature of agriculture, which among all the available methodological approaches, can best be modeled by a programming approach. The representation of agricultural technology with a programming model is additionally supported by the fact that the process specific analysis and description of agriculture plays an important role in agricultural economics and agronomy. Finally, the programming sector modeling approach offers various possibilities for the incorporation of policy instruments like foreign trade policies, domestic agricultural price and intervention policies, quota systems, input subsidies, technology improvement measures in crop and animal production (breeding programms, extension). The results of such a sector model indicate the realization of and the impact (parametric programming) on most of the relevant policy objectives in relation to the policy instrument applied. More insights into and expriences with problem specific applications of such models can be found in a number of applied studies for different countries (some examples are mentioned in chapter 1).

The traditional programming model applied to the agricultural sector and policy analysis involves, however, a number of problems, which are often solved by ad hoc assumptions. These problems are mainly due to the carrying over of the microeconomic and farm based linear programming model onto the sectoral level. The economic conditions, to be faced at the agricultural sector level, differ, however, in many aspects particularly as far as linearity of basic relations is concerned significantly from the farm level conditions:

- While on farm level the input and output prices are normally given (e.g. they can not be influenced by the decisions made by a single farm), at sectoral level prices have to be explained with the operation of the market mechanisms (aggregate supply and demand) and government interventions. This means that on the sectoral level quite a number of model variables (agricultural prices, demand) have to be treated as endogenous.

- On sectoral and even on regional , level serious aggregation problems occur, due to the fact that natural and economic conditions vary from one location to the other and even from one farm to the other. According to the given natural and economic conditions, individual farms specialize their production, consistent with their resource restrictions and their behavioural and risk preferences. On the aggregated regional or sectoral level, production appears to be more diversified and the resource requirements even in small time periods are to some extent compensated. From this general observation it follows that the outcome of a sectoral programming model mismatches the summed up results of individual farm models. From an operational point of view, no applicable and satisfying procedure exists concerning the aggregation problem. Therefore, in practical model application additional restrictions (demand quantities, behavioural constraints, rotation constraints) are introduced on ad hoc basis. In such cases it offen appears that important shadow prices for resources are driven to zero. Both features do not present an appropriate base solution and a suitable starting point for policy analysis and forecasting.

- Finally, the general purposes of a farm model and a sector model are different. The farm model is mainly used for planning purposes; consequently a normative objective function, which expresses the goals of the farm family, is on line with the task. On the other hand the sector model has to describe the actual reactions of the farmers and the expected responses to changing economic and political conditions. In other words, it has to explain the sectoral developments in the sense of positive economics. In conclusion to this, the challenging problem of proper modeling of farmers behaviour in terms of sectoral aggregates has to be solved.

These problems are treated in different ways in the applied sector models. In most of the applied agricultural models ad hoc assumptions are made, like the introduction of flexibility constraints. The implications of such assumptions and the implicit hypothesis are often not very clearly stated (e.g. implicit behavioural values, features of the implicit supply function, variability of factors). The classical linear programming models result in a discontinuous, stepwise supply response function, which is not very suitable for policy analysis on the sectoral level.

Therefore, in order to achieve methodological improvements, and more realistic responsiveness of the model, more thorough investigations and explicit formulations of the theoretical assumptions seem necessary. Below, we attempt to contribute in this respect through the introduction of non-linear relations in order to avoid as far as possible the disturbing discontinuities of applied sector models. Firstly, we may add some additional problems of conventional linear programming models applied at the sector level:

- There exists no formal procedure regarding the estimation of parameters and coefficients within the programming approach. Econometric methods are very rarely applied and can easily lead to consistency problems.

- Furthermore, no generally accepted calibration and validation procedure is available, which can be applied to test the explanation, forecasting and response ability of programming models.

- Due to the linearly limited technology assumption and the linear objective function, the conventional programming models lead to discontinuous responses of output supply and input demand to price variations. This property may imply misleading model results, especially in the case of short and medium term forecasts, of incremental price changes (e.g. impact of yearly support price decisions) and if supply and factor demand elasticities are obtained from the model's results.

- Finally, the conventional programming models tend to simulate a more specialized production structure, than actually observed. This feature mainly results from aggregation errors implied and from the linear technology and linear objective functions. Often several internal relations, like crop rotation constraints derived from the observed production structure, are employed to artificially overcome this problem.

Some of the critical points raised in relation to aggregated sector models above can be overcome or at least be reduced by introducing appropriate non-linear relations. The possibilities for practical applications of non-linear programming models have increased substantially during the last years, since powerful computer-packages have become available, which can even be used on PC's for medium sized problems. The computational aspects will be presented in more detail, below.

There is, however, the additional problem of estimating the non-linear model part. In many occasions some scepticism is raised about the possibilities of estimating meaningful non-linear relations, since the specification of linear relationships (input-output coefficients, model restrictions, objective function) already implies a mdifficult empirical task. We do not fully agree with these arguments. According to our experience with TASM-MAFRA and other agricultural sector models we tend to support the opposite view: A linearized model has to be specified in more detail, because of the discontinuous response feature. A very detailed model specification may result in a number of problems, particularly if the data base is insufficient, which is generally the case. On the other hand, if one accepts some principle theoretical relations (which will be discussed below), it turns out that the incorporation of non-linearities may help to overcome at least some of the problems, especially if the data base is poor and insufficient for a detailed representation of a linearized set of coefficients and data.

2.3.3.2 Basic non-linear relations in TASM-MAFRA

As it has already been indicated in the core matrix (Fig. II.6), the implemented version of TASM-MAFRA contains basically three types of non-linearities, namely price-reponsive demand functions, which are used in order to measure the consumer surplus in the objective function, price responsive factor supply functions for labour and tractor services as well as non-linear cost functions.

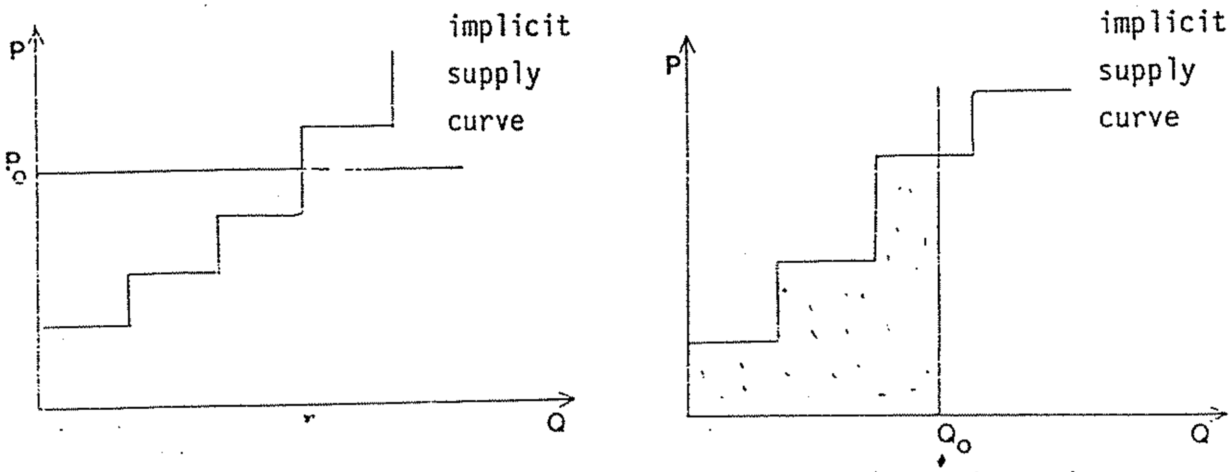
In the following section, the theoretical and methodological background, the specific assumptions and the procedure used for parameter specification will be explained.

2.3.3.2.1 Price responsive demand functions

In standard linear programming models, either demand quantities or product prices are assumed to be given exogenously, which means that a completely elastic or inelastic demand function is assumed. This leads to the following principal price-quantity scheme and market equilibrium for a single product market (Fig. II.7).

The segmented supply curve results from parametrization of a linear programming model. Given an initial equilibrium in the market, it is obvious that supply response to a price change, case a), depends on the initial position on the segment. The corresponding is true for case b) as far as the equilibrium price response to changed demand is concerned. These price-demand interactions can, in fact, highlight the characteristics of certain markets. Case a) is relevant, if the market price is completely determined by government interventions (e.g. sugar

FIGURE II.7: PRICE-QUANTITY RELATIONS IN A STANDARD LP PROBLEM



a) given price (maximizing producer surplus)

b) given demand (minimizing production costs)

beet price). Case b) corresponds to the situation of a strict production quota system. There might also exist markets (e.g. tobacco), in which both regimes are applied at the same time. But even for such markets it is important to model the impact of a policy change (price and/or quota) on domestic demand and market surpluses (intervention, export) as well as on the government budget and even on the world markets.

However, because of the general existence of markets, in which prices are highly determined by demand and supply, an improved sector model should include domestic price-demand relations. As will be demonstrated below, a number of specific government intervention policies can be incorporated in this approach. If there are no specific market intervention mechanisms incorporated, the model solution indicates the equilibrium price, which clears the market at given export and import quantities.

As in many developing countries, in Turkey no farm gate demand data is available. In order to circumvent this problem, the following approach has been employed:

(a) Domestic farmgate demand for domestic consumption has been calculated as a residual as follows:

Domestic Production - Unprocessed Exports - Processed Exports (converted to raw form) + Unprocessed Imports + Processed Imports (converted to raw form) - Internal Use by Agriculture +/- Stocks = Demand at the Farmgate Level for Domestic Consumption

(b) Price-demand elasticities are estimated from income elasticities based on consumption surveys using Frisch method. For a given base year, the parameters of a linear demand curve can then easily be derived. A simple demand function in the inverse form is assumed (cross elasticities are neglected for simplicity):

$$P_{i,t} = a_{i,t} + b_{i,t} \cdot X_{i,t}$$

where,

$P_{i,t}$ = given price for commodity i in period t

$X_{i,t}$ = given (derived) demand for commodity i in period t

A partial differentiation of this function leads to

$$dP_{i,t} / dX_{i,t} = b_{i,t}$$

which represents the absolute price change per unit of additional consumption.

If this equation is multiplied with X/P one obtains the inverse price-demand elasticity expression:

$$1/e_i = dP_{i,t} / dX_{i,t} \cdot X_{i,t} / P_{i,t} = b_{i,t} \cdot X_{i,t} / P_{i,t}$$

where,

e_i = estimated or assumed price elasticity of domestic consumption for commodity i (constant over time).

The parameter b can now easily be calculated from the base year price, the derived consumption volume and from the assumed price elasticity by the formula:

$$b_{i,t} = P_{i,t} / X_{i,t} \cdot 1/e_i$$

And for the constant $a_{i,t}$:

$$a_{i,t} = P_{i,t} - b_{i,t} \cdot X_{i,t}$$

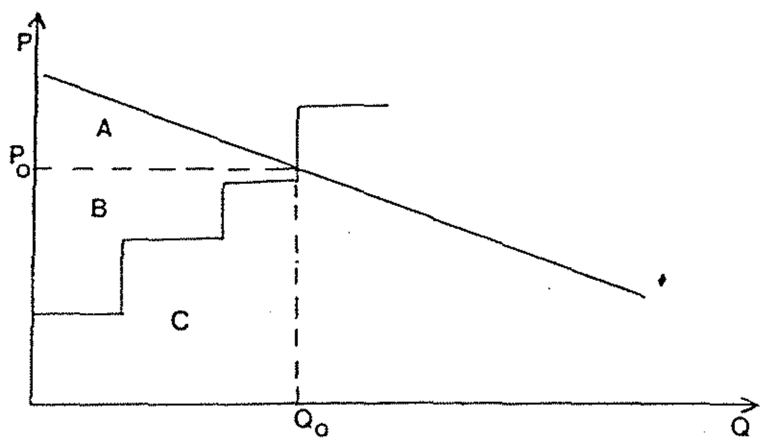
Since the price-demand elasticity to have a negative sign, therefore also $b_{i,t}$ will be negative.

(c) In the case of competitive equilibrium it has been shown that the maximum of the consumer and producer surplus leads to a market equilibrium. In our case the sum of the producer and consumer surplus is equal to the area under the demand curve minus the production costs implied by the programming model. For each domestic demand activity the integral over the inverse demand curve, which equals the area under the demand curve,

$$a_i - 0.5\ b_i X_i^2$$

enters therefore into the objective function. The production costs in a commodity market are registered by the cost activities (see core matrix), the internal opportunity costs for fixed or price reponsive supplied factors and by the non-linear cost term (see below). As long as the area beneath the demand curve is defined, it is also possible to introduce other functional forms, instead of the linear one. Fig. 6. illustrates this approach for a single commodity market.

FIGURE II.8: ILLUSTRATION OF PRICE RESPONSIVE DEMAND FUNCTION IN A PROGRAMMING MODEL



A = Consumer surplus }
B = Producers surplus} to be maximized
C = Production costs
A + B + C = Area under demand curve

(d) For policy analysis and especially for forecasting purposes, the change of the demand curve has to be taken into account. This can either be done by adding additional arguments (such as influence of income and population) to the above mentioned demand function, or by shifting the parameters of the price-demand function directly. For TASM-MAFRA we have chosen the latter method. Having derived the parameters a and b for a time series, the change of these parameters over time can be estimated. Concerning the repositioning of the demand curve the following hypothesis can be tested:

- An increase in income leads to a shift of the demand curve, e.g. influence on the intercept term "a". Additionally, also preferences may vary, which are simply approximated by a trend variable. The relation to be tested is therefore:

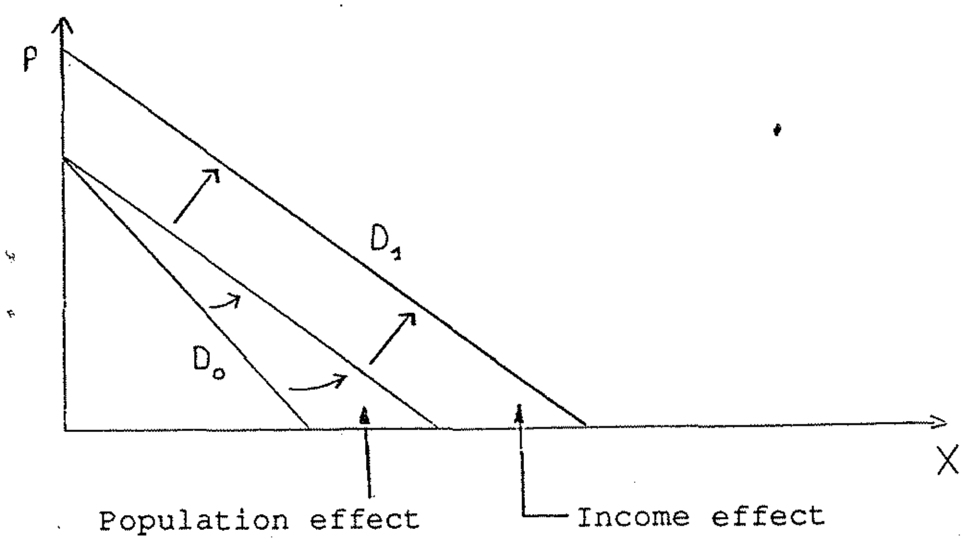
$a_{i,t} = f_i (I_t , t)$
where,
I = Income
t = Trend.

- A changing population may mainly influence the slope of the demand curve. If also a trend variable is considered, the following relation is obtained:

$b_{i,t} = f_{i,t}(P_t, t)$
where,
P = Population
t = Trend.

The assumptions underlaying this approach can be graphically illustrated (Fig. II.9).

FIGURE II.9: REPOSITIONING OF DEMAND OVER TIME



Do = demand curve in period 0
D1 = demand curve in period 1.

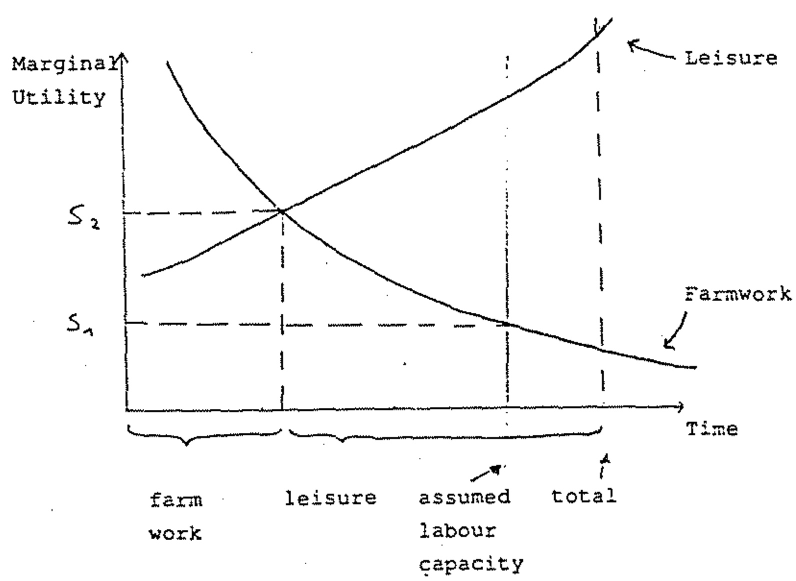
If the econometric estimations of the above mentioned functions lead to reasonable results, they can be used for the projection of the demand curves as a function of future population and income.

2.3.3.2.2 Price responsive factor supply

Factor supply in conventional programming models -analogous to domestic demand - is assumed to be fixed or variable, e.g. completely elastic or inelastic in relation to factor prices. Depending on the time period considered (short or long term), the composition of fix and variable factors change. Certain factors, like available agricultural land, are in fact nearly fixed at the sectoral level; the prices of some variable factors, which are demanded in only small shares by the agricultural sector, such as fuel, can be assumed to be basically exogenous. Special agricultural inputs, like fertilizer, may however be characterized by a price responsive supply function; at least, if there are no market interventions. If it is possible to estimate such a supply function, there is no complication in introducing it into a non-linear programming model of the agricultural sector.

A critical point in most aggregate programming models is related to factors, which are in principle fixed (in the short term), but not fully employed and hence not restricted by the corresponding resource constraints. In this case, their shadow prices equal zero and factor costs are not computed by the model. This occurs often with respect to labour and machinary inputs. In this case, the model might lead to quite misleading results and responses. The main reason leading to a model outcome of underemployment can be traced to the aggregation error mentioned above. Disguised unemployment, especially of labour, might also occur at farm level, if the traditional firm model is applied. However the assumption of a farm family, willing to work at a zero level or for very low return to labour, seems unrealistic. A theoretical explanation is suggested by the household-firm model, which assumes a given amount of disposable time for the farm family. This time endowment can be spent on farm work and leisure. The maximized utility is a function of leisure and income (demand for goods and services). The optimal allocation of labour use to farming and leisure is achieved, if the marginal utilities of leisure and farm work are equal. According to this broader view of the household-firm model, it is possible that the optimal labour use is quite below the capacity assumed in the traditional firm model. As the following figure demonstrates, under a realistic leisure utility relation the shadow price can hardly equal zero.

FIGURE II.10: ILLUSTRATION OF A HOUSEHOLD-FIRM MODEL



S1 = shadow price of labour in a firm model
S2 = shadow price of labour in a firm-household model

A direct incorporation of this household-firm approach into an applied sector model fails, due to the difficulties in estimating the utility function. But, if one accepts the underlying basic hypothesis, a simplified relationship between labour supply and the opportunity costs of labour may be used as a proxy. In the case of TASM-MAFRA we have first modeled the labour demand L assuming an exogenous wage rate (derived from the wage rate for hired labour). Additionally we have provided a quadratic cost function:

$$C_t = a_0 + a_{1,t} \; L_t + 0.5 \; a_{2,t} \; L_t^2$$

where,

C_t = Labour cost in period t

L_t = Labour use (modelled) in period t,

which leads to the following wage rate (opportunity cost) and labour use relation:

$$W_t = dC_t / dL_t = a_1 + a_{2,t} \; L_t$$

In the implemented version of TASM-MAFRA we have assumed $a_1 = 0$, so the remaining parameter a_2 can be calculated as

$$a_{2,t} = W_t / L_t$$

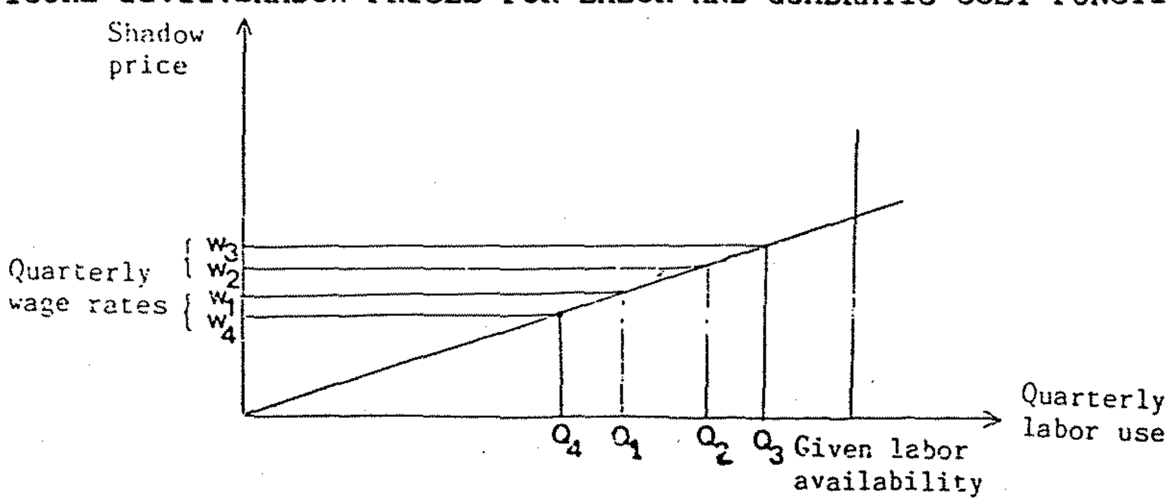
For the estimation of $a_{2,t}$ we have calculated L_t as average quarterly labour use. L_t is derived from the given labour stock LS_t in each period.

$$L_t = a \; . \; LS_t \; / \; 4$$

The parameter a represents the average labour use and has been derived as average over the base period 1979 - 1986.

The same labour supply function in TASM-MAFRA is applied to every quarterly labour restriction. This leads to a shadow price differentiation according to the seasonal labour use.

FIGURE II.11:SHADOW PRICES FOR LABOR AND QUADRATIC COST FUNCTION



These price responsive labour supply relations are incorporated into TASM-MAFRA through the resulting quadratic labour cost functions:

$$0.5 \cdot a_{2,t} \cdot L_t^2 ,$$

which enter into the objective function for the quarterly labour supply activities.

A similar approach has been applied to the costs for using tractor services. This has to be considered, because in addition to some proportional costs, like fuel, there are several cost components, such as costs for repair and maintenance as well as waiting costs, which may increase with the use of a given machinery capacity.

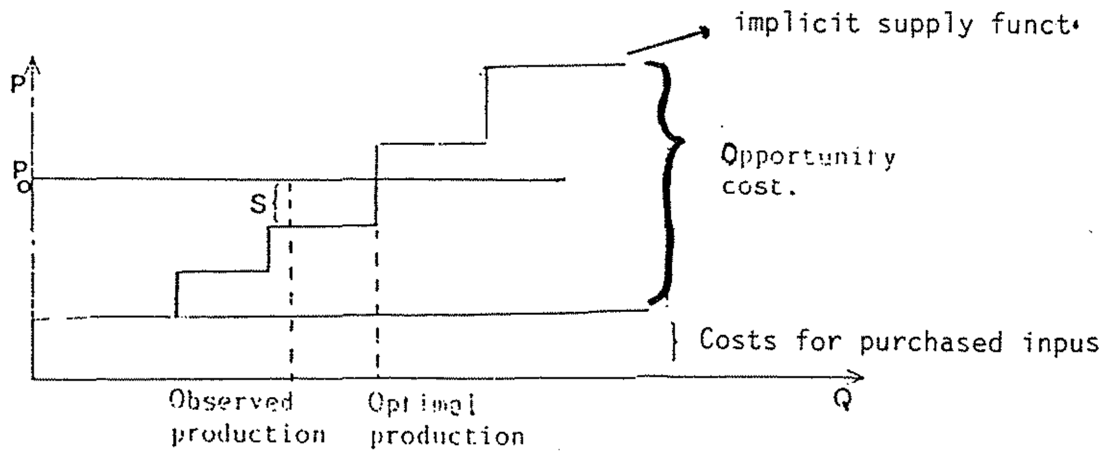
2.3.3.2.3 Non-linear cost functions and calibration of the model

As already mentioned in the previous chapters, programming models are known for their generally poor performance in validation with respect to observed production levels in the base period. In practice a number of ad hoc validation techniques, like modification of constraints, restrictive rotations, modification of the objective function, correction of the demand function and adjustments in the model data itself, are applied. Most of these reformulations, however, have no sound theoretical and methodological basis. Another critical point is that the linear programming model may react too rigorously, because of the segmented (stepwise) implied cost function. In practice, however, a more continuous cost increase on the sectoral level is expected. For example the expansion of a specific crop may require the cultivation of more marginal land, which is less suitable for this specific crop, and a change in the crop rotation may imply additional costs and finally lower yields or higher inputs can be expected. Additionally, a significant change may introduce some adjustment costs, which are not covered by linear input-output coefficients.

If we take the simple case of a linear programming model with given prices, the principal problem may be outlined as follows (see Figure II. 12):

The cost structure for a certain commodity implied in the programming model contains the costs for purchased inputs with given prices (sum of the corresponding input coefficients multiplied with the given prices) and the opportunity costs of the fixed factors (input coefficients multiplied with the associated internal shadow prices). Given a certain commodity price, the optimal production level can easily be drived . In many cases, the optimal production level may, however, exceed the observed level in the base year. On the observed level it is obvious that - keeping up the assumption of profit maximizing - the costs S are not covered by the model. These costs can exactly

FIGURE II. 12 PRINCIPAL PROBLEM OF LINEAR PROGRAMMING



be covered either by manipulations mentioned above or by defining an additional cost component, which leads to the costs S at the observed production level. If one takes into account the reasons mentioned above, it has to be concluded that the additional cost function should be non-linear. In the present version of TASM-MAFRA a quadratic cost function is assumed.

Summarizing, the farmer's aggregate crop allocation decisions are used to calculate additonal non-linear cost terms, which would cause the observed allocations, rather than adding constraints to the linear system, which would disable the allocation process.

(a) The principal approach : Using this approach, the linear model can be exactly calibrated to observed outputs for a single year or calibrated with a least-squares criterium, if actual production levels for several years are known. The resulting optimization problem incorporates a quadratic cost term for each commodity and is restricted only by those constraints, which can be empirically justified. The problem is solved as a non-linear programming problem.

The additional non-linear cost component is termed as the implicit cost, since it is implied in a positive sense in the farmer's crop allocations.

The application and implementation of this approach requires a two step procedure:

- In the first stage a conventional linear or non-linear programming model is extended by a set of calibration constraints, which serve as upper bound, inequality contraints for the observed production level X. If only one production activity per output commodity is considered, a small perturbation of the given production level (say 0.0001.X) may be necessary in order to ensure that the relevant resource constraints are binding. The shadow prices for these additional constraints reflect the costs S, mentioned in Fig II.12.

- In the second step the shadow prices of the calibration constraints are used to derive the non-linear cost function part, which enters into the objective function. The calibration constraints of the first step are removed and it turns out that the model calibrates exactly with the given production levels.The estimation of the non-linear cost function part is based on the following quadratic function:

$C_n = 0.5\ b\ S^2$
where,
Cn = non-linear part of total production costs.

The first derivate of this function leads to marginal costs:

$\delta C_n / \delta X = b\ X$

which must be equal to S in the point of the observed production levels. The parameter b can then easily be derived from the shadow price of the additional calibration constraints S and the observed production levels X.

$b = S\ /\ \bar{X}$

If the programming model is applied to time series or cross section data, the parameter b can be subjected to an econometric analysis in order to explain changes of the cost structure over time and space. The application of such an approach allows also to specify and test various functional forms in order to receive a stable relationship for the non-linear cost term. Such an analysis provides a base for carrying out projections and policy simulation runs for future scenarios.

However, it has to be noted that such a non-linear programming model still follows the normative assumption of maximizing the profits or in case of an integrated demand function - the sum of the producer and consumer surpluses. Additionally, we have to point out that this approach also requires a careful specification of the input and output coefficients in the linear part. Otherwise all "errors" appear as residuals in the non-linear cost function part. Finally, the approach includes the weak point that the costs implied in the non-linear part can not explicitly be attributed to certain production factors. Nevertheless, this approach allows an operational calibration method, which has proved to be useful in the application of TASM, with a relatively large number of commodities, to practical policy analysis.

(b) Application of TASM-MAFRA: This principal approach is incorporated in TASM-MAFRA in order to calibrate the model and to get a better performance as far as the continuous response is concerned. Note that, with the implementation of non-linearities via price-responsive demand (chapter 2.3.3.2.1) and factor supply functions (chapter 2.3.3.2.2), the model is already improved with respect to its relative responsiveness (compared to the assumptions in the last chapter). However, the principal calibration problem still exists.

Starting with the core matrix of the linear model part and from the available statistical information, different categories of model variables are calibrated by applying the non-linear cost function approach, namely:

- the production volumes of the 35 marketable crop commodities,

- the quantities of fodder production (alfalfa, other fodder crops),

- the activity levels (number of animals, average stock) of the 7 livestock production activities. Since fixed output coefficients are assumed, the 20 output commodities are automatically calibrated,

- the fallow and cereal area (fallow constraints),

- and the relation between animal and tractor based technology (technology constraints).

In order to solve the first stage problem of TASM-MAFRA (calibration run), the core matrix (Fig. 2. 2) is enlarged by the blocks of additional constraints. In the RHS section of these additional constraints either statistical data (number of animals,total crop production) or derived values (fallow and technology constraints) are used as upper bounds.

The shadow prices (duals) of these additoinal calibration constraints have then to be analysed and evaluated in detail (plausible relations between them, changes over the ex-post period), before they are used to solve the second stage problem.

The first stage run, described above, does not only provide duals to be employed in the second stage, but also identifies possible inconsistencies, which might be inherent in the model specification. This is very important in sector models, where interrelated quantities, which enter the model, such as area, production, consumption and trade, have different data sources.

Therefore, exact calibration for example with respect to the production level, does not guarantee exact calibration with respect to acreages. Before one can proceed with the second stage based on the results of the first stage, it may be necessary to perform minor consistency or calibration adjustments in the model data and specification. This should not be confused, however, with the calibration adjustments for both structural inconsistencies and base year erros in conventional validation approaches.

The second step problem (base run) is then exactly based on the structure of the core matrix. In order to run the second stage problem, the coefficients of the non-linear cost function have to be calculated. This is realized in the output file of the first stage run by utililizing the DISPLAY possibilities of the GAMS-MINOS Package. Consequently, the calculated coefficients have to be transferred from the output file of the calibration run to the input file of the base run. Finally, the objective function has to be modified and the calibration constraints of the first stage run have to be removed.

Since the base solution, obtained from the second stage, calibrates exactly with the base year vector of the variables, for which non-linear cost functions are incorporated, the conventional validation procedure of comparing the observed and simulated base year quantities becomes irrelevant in this case. At this point it is necessary to define the terms "calibration" and "validation" as used in this paper. By calibration we understand the ability of the model to reproduce the actual base year quantities and prices, and informally test the interal consistency of the model data and structure. We define validation as the ability of the model to be systematically updated and hence employed as a short- and medium run policy instrument in the years beyond the base year, but still in the base (ex post) period. In other words, one should be able to predict with the model in the short- and medium run after systematically updating resource constraints and non-linear cost coefficients.

Regarding real projection and policy simulation runs, one has also to forecast the coefficients of the non-linear cost function. In the present version of TASM-MAFRA single trend functions based on the base period coefficients are employed.

Concerning the improvement of the present version, it seems adviceable to analyze these coefficients in more detail and to employ econometric estimates for forecasting the model coefficients.

TASM DICTIONARY

III. TASM DICTIONARY

3.1. Model Statistics:

In this section we provide a summary of the size of TASM. We should however point out that these statistics are only for illustrative purposes. They may vary from one version to the other and also between the base, calibration, policy and projection runs. Model statistics are summarized in Table III.1.

TABLE III.1. : SUMMARY STATISTICS ON TASM

FEATURES			*SIZE* *
Model Size			200x300
Number of Variables	300		
Number of Equations	200		
Number of Products			70
Final Products	55		
Annual and Perennial		35	
Livestock		20	
Intermediate Products	15		
Number of Activities			120
Number of Inputs			65
Labor	4		
Tractor	4		
Animal Power	4		
Feed	6		
Seed	24		
Capital	15		
Land	6		
Fertilizer	2		
Number of Processed Products			7
Number of Traded Products			57
Unprocessed	50		
Processed	7		

3.2. Algebraic Statement of TASM

3.2.1 INDICES

s **Basic Land Types**

Dry Land with High or Low Rainfall
Dry Land with High Rainfall
Irrigated Land with High or Low Temperature
Irrigated Land with High Temperature
Tree Area
Pasture Land

l **Labor (divided into 4 quarters per year)**

Labor-1q Labor-2q Labor-3q Labor-4q

a **Animal Power (divided into 4 quarters per year)**

Animal-1q Animal-2q Animal-3q Animal-4q

m **Tractor Power (divided into 4 quarters per year)**

Tractor-1q Tractor-2q Tractor-3q Tractor-4q

f **Fertilizers**

Nitrogen Phosphate

d **Seeds**

Wheat	Corn	Rye	Barley	Soybean
Chick Pea	Dry Bean	Lentil	Potato,	Onion
Tomato	Green Pepper	Cucumber	Sunflower	Groundnut
Cotton	Tobacco	Sugar-beet	Melon	Pistachio
Rice	Sesame,	Alfalfa	Fodder	

ol **Crop Outputs**

Wheat	Corn	Rye	Barley	Rice
Chick Pea	Dry Bean	Lentil	Potato	Onion
Green Pepper	Tomato	Cucumber	Sunflower	Olive
Groundnut	Soybean	Sesame,	Cotton	Sugar Beet
Tobacco	Tea	Citrus	Grape	Apple
Peach	Apricot	Cherry	Wild Cherry	Melon
Strawberry	Banana	Quince	Pistachio	Hazelnut

o2 Livestock Outputs

Sheep-meat	Sheep-milk	Sheep-wool	Sheep-hide
Goat-meat	Goat-milk	Goat-wool	Goat-hide,
Angora-meat	Angora-milk	Angora-wool	Angora-hide
Beef	Cow-milk		Cow-hide
Bufallo-meat	Bufallo-milk		Bufallo-hide
Poultry-meat	Eggs		

g1 Feed (straw and hay)

Wheat	Corn	Rye	Barley
Pulses	Alfalfa	Fodder	

g2 Feed (concentrates)

Wheat	Rye	Barley	Sugar Beet

g3 Feed (grains)

Wheat	Corn	Rye	Barley

g4 Feed (oil-cakes)

Sunflower	Groundnut	Cotton	Soybean

g5 Feed (green fodder and high quality hay)

Fodder	Alfalfa

tf Total Feed Supply in Energy Values

Total Straw	Total Concentrate	Total Grain
Total Fodder	Total Oil-cakes	Total Pasture

ts Subgroups of Energy Requirements of the Livestock Sector

Total Grain, Concentrate and Oil-cakes
Total Grain and Oil-cakes
Total Pasture

te Total Energy

t Production Techniques

Animal	Mechanized

i Crop Activities

Wheat--d	Wheat-fd	Wheat--i	Corn--d
Corn-fd	Corn--i	Rye--d	Rye-fd
Rice--i	Rice-fi	Barley--d	Barley-fd
Cheakpea--d	Cheakpea--i	Drybean--i	Lentld
Potato--ii	Onion--d	Onion--i	Greenpepper--i
Tomato--i	Cucumber--i	Sunflower--d	Sunflower--i
Groundnut--i	Soyabean--i	Sesame--i	Cotton--i
Tobacco--d	Melon--d	Melon--i	Sugarbeet--i
Alfalfa--i	Fodder--d	Pasture	
Olive--d	Tea--d	Citrus--i	Grape--d
Grape--i	Apple--i	Peach--i	Apricot--i
Cherry--i	Wildcherry--i	Strawberry--i	Banana--i
Quince--i	Pistachio--d	Hazelnut--d	

j Livestock Production Activities

Sheep	Goat	Angora	Cattle
Buffalo	Mule	Poultry	

jc Livestock Activity and Commodity Correspondence

Sheep-meat	Goat-meat	Angora-meat	Beef
Bufallo-meat	Poultry-meat	Mule	

b Area

Wheat	Corn	Rye	Barley	Rice
Chick Pea	Dry Bean	Lentil	Potato	Onion
Green Pepper	Tomato	Cucumber	Sunflower	Olive
Groundnut	Soybean	Sesame,	Cotton	Sugar Beet
Tobacco	Tea	Citrus	Grape	Apple
Peach	Apricot	Cherry	Wild Cherry	Melon
Strawberry	Banana	Quince	Pistachio	Hazelnut
Alfalfa	Fodder			

B.C. Cereal Area

Wheat	Corn	Rye	Rice	Barley

bf Fallow Area

b1 Fodder Production

Fodder	Alfalfa

b2 Fodder Area

Alfalfa Fodder

e *Production Costs*

Seed Fertilizer Capital

3.2.2 PARAMETERS (DATA)

Macro	Macroeconomic variables and relations
Concent	Concentrate by product coeff(per output unit)
Conoil	Oil seed by product coefficient
Enec	Energy equivalent by products per by product unit
Labfed	Labor for harvesting and feeding straw
Feedreq	Feed requirements (energy per yield unit)
PqpIt	Quadratic labor and tractor costs
Runemp	Relative unemployment of labor and tractors
P	Crop production coefficients
Q	Livestock production coefficients
Qq	Index of livestock grain consumption
Pcost	Crop production costs
Qcost	Livestock production costs
Imprice	Import price
Exprice	Export price
Tcon	Consumption of raw products
Dpri	Demand curve prices
Alpha	Demand curve intercept
Beta	Demand curve slope
Impppind	Imported processed product index
Expppind	Exported processed product index
Expindex	Export index
Impindex	Import index

3.2.3 ACTIVITIES (VARIABLES)

PROFIT	Objective function
RELFAL	Relative fallow
PPTRADE	Trade of processed commodities
CROPS	Production of crop

3.2.4 LIST OF EQUATIONS

Basic Land Constraints

$$(1)\quad \sum_{tr}\sum_{t}(P_{s,tr,t} * CROPS_{tr,t}) \leq Res_{s,quant}$$

for all s

Labor and Tractor Constraints

$$(2)\quad \sum_{tr}\sum_{t}(P_{lm,tr,t} * CROPS_{tr,t}) + \sum_{j}(Q_{lm,j} * PRODUCT_j) + Tabfed_{lm} * FEED_{tstraw} = LATRUSE_{lm}$$

for all lm

Animal Power Balances

$$(3)\quad \sum_{tr}\sum_{t}(P_{a,tr,t} * CROPS_{tr,t}) \leq \sum_{j}(Q_{a,j} * PRODUCT_j)$$

for all a

Feed Supply (Straw)

$$(4)\quad \sum_{tr}\sum_{t}\sum_{g1}(P_{g1,tr,t} * CROPS_{tr,t} * Enec_{g1}) \geq FEED_{tstraw}$$

Feed Supply (Concentrates)

$$(5)\quad \sum_{tr}\sum_{t}\sum_{g2}(P_{g2,tr,t} * CROPS_{tr,t} * Enec_{g2}) * Concent_{g2} \geq FEED_{tconcen}$$

Feed Supply (Cereals)

$$(6)\quad \sum_{g3}\left(FGRAIN_{g3} * Feedgrain_{g3,enegr}\right) \geq FEED_{tgrain}$$

Feed Supply (Pasture)

$$(7)\quad \sum_{t}\left(CROPS_{pasture,t} * P_{pastfeed,pasture,t}\right) \geq FEED_{tpast}$$

Feed Supply (Oil Cakes)

$$(8)\quad \sum_{tr}\sum_{t}\sum_{g4}\left(P_{g4,tr,t} * CROPS_{tr,t} * Enec_{g4}\right)$$

$$* Conoil_{g4} \geq FEED_{toil}$$

Feed Supply (Alfalfa and Fodder)

$$(9)\quad \sum_{tr}\sum_{t}\sum_{g5}\left(P_{g5,tr,t} * CROPS_{tr,t} * Enec_{g5}\right) \geq FEED_{tfodd}$$

Total Feed Balance

$$(10)\quad \sum_{tf}\left(FEED_{tf}\right) \geq \sum_{l}\left(Q_{tene,l} * PRODUCT_{l}\right)$$

Minimum Feed Requirements by Components

$$(11)\quad FEED_{tf} \geq \sum_{l}\left(Q_{tf,l} * PRODUCT_{l}\right)$$

Minimum Grain Concentrate and Oil Cake Requirements

$$(12)\quad FEED_{tgrain} + FEED_{tconcen} + FEED_{toil} \geq \sum_{j}\left(Q_{tgrconoil,j} * PRODUCT_{j}\right)$$

Minimum Grain and Oil Cake Requirement

$$(13)\quad FEED_{tgrain} + FEED_{toil} \geq \sum_{j}\left(Q_{tgroil,j} * PRODUCT_{j}\right)$$

Minimum Shares of Individual Grains in Feed

$$(14)\quad FGRAIN_{g3} * Feedgrain_{g3,maxgr} \geq FEED_{tgrain} * Feedgrain_{g3,mingr}$$

for all $g3$

Purchased Fertilizers

$$(15)\quad \sum_{lr}\sum_{t}\left(P_{f,lr,t} * CROPS_{lr,t}\right) = PFERT_{f}$$

for all f

Production Costs

$$(16)\quad \sum_{lr}\sum_{t}\left(Pcost_{e,lr,t} * CROPS_{lr,t}\right) + \sum_{j}\left(Qcost_{e,j} * PRODUCT_{j}\right) = PROCOST_{e}$$

for all e

Commodity Balances

$$(17)\quad \sum_{lr}\sum_{t}\left(P_{o,lr,t} * CROPS_{lr,t}\right) * \left(1 - Concent_{o}\right) * \left(1 - Conoil_{o}\right) + \sum_{j}\left(Q_{o,j} * PRODUCT_{j}\right) + IMPORT_{o} * Impindex_{o}$$

$$= TOTALCONS_{o} + EXPORT_{o} * Expindex_{o} + Proctrade_{factor,o} * PPTRADE_{o}$$

for all o

Cereal Area

$$(18)\quad \sum_{bc}\sum_{tr}\sum_{t}\left(P_{bc,tr,t} * CROPS_{tr,t}\right) = CERAREA$$

Fallow Area

$$(19)\quad \sum_{tr}\sum_{t}\left(P_{fallow,tr,t} * CROPS_{tr,t}\right) = FALAREA$$

Technology

$$(20)\quad \sum_{b}\sum_{tr}\left(P_{b,tr,t} * CROPS_{tr,t}\right) = TECH_t$$

for all t

Objective Function

$$(21)\quad \sum_{o}\left(Alpha_o * TOTALCONS_o + 0.5 * Beta_o * TOTALCONS_o^2\right)$$

$$+ \sum_{o}\left(Exprice_o * EXPORT_o\right) - \sum_{o}\left(Imprice_o * IMPORT_o\right)$$

$$+ \sum_{o}\left(Proctrade_{tprice,o} * PPTRADE_o\right) - \sum_{t} PRCOST_t$$

$$- 0.5 * \sum_{lm}\left(Pqplt_{lm} * LATRUSE_{lm}^2\right)$$

$$- 0.5 * \sum_{oal} Par_{oal,pqp1} * \sum_{tr}\sum_{t}\left(P_{oal,tr,t} * CROPS_{tr,t}\right)^2$$

$$- 0.5 * \sum_{j}\left(Res_{j,pqp3} * PRODUCT_j^2\right) - 0.5 * \sum_{t}\left(Macro_t * TECH_t^2\right)$$

$$- 0.5 * Macro_{pqpcer} * CERAREA^2 - 0.5 * Macro_{pqpfal} * FALAREA^2 = PROFIT$$

Calibration and Base Solution Constraints Only

Animal Inventory

(22) $PRODUCT_j \leq Res_{j,quant}$

for all *j*

Import of Crops and Livestock

(23) $Impindex_o * IMPORT_o = Trade_{o,imp-q}$

for all *o*

Export of Crops and Livestock

(24) $Expindex_o * EXPORT_o = Trade_{o,exp-q}$

for all *o*

Trade of Processed Products

(25) $Exppplnd_o * PPTRADE_o = Proctrade_{tradeg,o}$

for all *o*

Production Calibration

(26) $\sum_{tr}\sum_{t}(P_{oal,tr,t} * CROPS_{tr,t}) = Dom_{oal,dprod}$

for all *oal*

Fodder Area Calibration

(27) $\sum_{tr}\sum_{t}(P_{b2,tr,t} * CROPS_{tr,t}) = Res_{b2,area}$

for all *b2*

Fallow in Cereal Area Calibration

(28) $FALAREA - CERAREA \, 8 \, Macro_{fcoef} = RELFAL$

(29) $RELFAL \leq 0$

Technology Calibration

(30) $TECH_{animal} - TECH_{mechanized} * Macro_{tcoef} = TECHNOL$

(31) $TECHNOL \leq 0$

IV. THE DATA BASE SYSTEM

The data base of TASM can be viewed from two different perspectives: i. Functional and ii. Operational. In this section we attempt to provide a general outline of the data base system from these two perspectives.

Then, following an overview of the sources of data employed in TASM we present the actual processed data from 1979-1986 employed in model simulations.

As we will demonstrate in the following two sections, the raw data passes through various stages of aggregation, estimation, classification and calibration before it becomes the final data set. Finally,in the last part of this chapter, we present the computer software developed to take the TASM modeller from the raw data to the final model data in a systematic way, and which explicitly records every step in data manupulation.

We believe that the final part itself is an important contribution towards the formation of an operational data base system at the ministry for future works on TASM as well as for addressing policy issues using other analytical techniques.

4.1. Functional View of TASM Data Base:

Since TASM is an optimization model, it requires the specification of an objective function and constraints which restrict the choice set. The objective function in TASM can be summarized as the maximization of producer and consumer welfare in Turkish agriculture. The constraints of the model on the other hand, summarize the state of technology and resource availability in addition to the restrictions imposed by the world outside agriculture on agricultural production. Therefore the data base requirements of TASM can be viewed from this perspective as providing the parameters of the objective function and the constraint set.

4.1.1 The Objective Function:

As we have explained in the previous sections, the maximization of the producer's and consumer's welfares can be translated into the maximization of the sum of consumer and producer surplus, and which in turn can be formulated as maximization of the areas under the consumer demand and producer supply functions. This requires the specification of the consumer demand functions and producer supply functions which in TASM are formulated at the farm-gate level.

4.1.2 Demand Functions:

In TASM, the consumer demands fall into three categories: 1. Final domestic demand, 2. Final foreign demand and 3. Intermediate demand by crop and livestock production activities.

The intermediate demand is endogenously determined in the model and hence does not require any explicit formulation in the objective function.

The domestic and foreign demand functions on the other hand are exogenous and need to be specified. One alternative is to estimate domestic and foreign demand functions outside the model or incorporate those estimated elsewhere. Since such estimated demand functions do not exist for Turkish agriculture, an indirect second best approach is employed in TASM. The foreign demand (or export demand) functions are taken as linear step functions, with the step number being 1 in the case of most products for which Turkey does not have a major share in the world trade, and with step number being greater than 1 for few products for which Turkey is the major exporter in the world markets. This kind of an approach, requires as data the prevailing export prices and quantities for each of the traded products in the model.

The domestic demand functions are taken as downward sloping linear functions, and are estimated from the demand price elasticities and observed domestic consumption and farm- gate price series in the base year. Furthermore, the repositioning of these demand functions for future policy simulations, require, information on income and population elasticities. Therefore, if we summarize, the specification of the demand in the objective function in TASM requires:

-Demand price elasticities
-Demand income and population elasticities
-Consumption
-Farm-gate prices
-Export quantities
-Export prices

4.1.3 *Supply Functions:*

In TASM, supply also has two components: 1. Domestic supply and 2. Foreign supply.

Foreign supply is assumed to be exogenously determined and as in foreign demand, specified as step functions. This in turn necessitates data on import quantities and prices.

Domestic supply functions are endogenously determined by the model and hence do not require an explicit specification in the objective function except for the prices of the traded inputs and the reservation costs. Therefore the explicit data requirements of the supply side in the objective function can be summarized as:

-Factor prices
-Import quantities
-Import prices

4.1.4 *Domestic and Foreign Trade:*

Both the demand and supply sides of the objective function involve domestic as well as international prices and quantities. While domestic prices and cost are in domestic currency units, the international trade prices are in dollars. Similarly, while the domestic prices are farm-gate prices, trade prices are border prices. Furthermore, the agricultural products at the farm-gate in most of the cases differ in form from the respective traded products due to processing. Therefore, the specification of the objective function requires in addition to the specification of demand and supply functions discussed above, the following additional information to obtain a consistent data set:

-Exchange rate
-Processing factors, costs and margins

4.1.5 The Constraint Set:

The constraint set of TASM essentially contains three types of information, namely: 1. The technology or input-output relationships, ii. Resource availability and iii. The policy environment and has the function of specifying the choice set.

4.1.5.1 The Technology or the Input-Output Matrix:

The Technology or the Input-Output Matrix: The specification of the prevailing technology in agriculture via the input output matrix constitutes the core of the model. This involves the specification of the production activities, the resource requirements of these activities per unit of land, and supply-demand interdependencies between different production activities. Given that land, labor, animal power, machinery, fertilizers, feed and seed are the basic categories of input and, crop and livestock products, animal power, feed and seed are the basic categories of output incorporated in TASM, we can summarize the data requirements of this section as follows:

- specification of production activities (single, fallow, rotation, multiple)
- input requirements per unit of land for each production activity
- crop, livestock yields and by-products.
- processing factors of products for consumption and resulting by-products
- animal-tractor conversion factors
- feed-energy conversion factors
- interdependencies between crop and livestock activities

4.1.5.2 The Resource Availability:

The resource endowment in agriculture, constitutes an upper bound on production and also contributes to the fluctuation of the resource costs around the averages. Furthermore, as in the cases of perennial crops and livestock existing stocks can only be altered in the downward direction (at a cost) but not in the upward direction in the short-run. Here, on must differentiate between tradable inputs like fertilizers, seeds and tractors which essentially are not subject to the short-run fixities like land, labor, animal and tree stocks. The data requirements for the right-hand side of the resource constraints can be summarized as:

- Availability of different land types
- Rain and temperature zones
- Availability of labor and tractors
- Animal stock
- Tree stock

4.1.5.3 Policy Environment:

In addition to the physical constraints imposed by the state of technology and resource limitation, restrictions are in many instances are imposed on the agricultural sector due to the existing policies both in agriculture and outside. For example import and export quantity restrictions, area restrictions on tobacco and sugar beet production can be sited as some examples of such restrictions. Similarly, restrictions can be imposed on agricultural production via international markets, such as the import quotas on Turkish cotton products, trade agreements, world supply and demand conditions. Finally, the policy makers may wish to consider objectives, such as food security, nutrition, etc., which are not incorporated in the objective function of the model. All these additional restrictions can be added to the existing constraint set of the model, to result in a smaller choice set.

4.2. Operational View of TASM Data Base:

The data employed in TASM goes through various stages of processing before it becomes the final data set. Furthermore, some of the data is generated within the model itself. Looking at the data requirements from this perspectives, the requirements of TASM can be categorized as follows:

4.2.1 The Raw Data:

This is the data that is entered in TASM data base as they appear in published statistics and include:

- -production of crop and livestock products
- -area of annual crops(excluding vegetables)
- -number of trees
- -yields
- -farm-gate prices
- -export and import quantities
- -export and import values in TL and $
- -animal stocks
- -number of tractors
- -tree land
- -irrigated land
- -vegetable area

4.2.2 The Processed Data:

In addition to the data that is entered in raw form without processing, some of the data must be processed outside the data base system prior to its entry in the data base. Included in this category one can site :

- -input-output coefficients
- -input prices
- -price elasticities
- -dry land type availability
- -processing factors, costs and margins
- -conversion factors
- -aggregation share factors
- -labor availability

4.2.3 The Aggregated Data:

The raw and processed data are further aggregated and categorized to be consistent with the data requirements of TASM, within the data base system. This step also involves the standardization of the data base in terms of units.

4.2.3.1 Preliminary Base Model Data:

The processed data base is then transformed into a form that can be used in a programming problem. This involves on the one hand the formulating the equations of TASM in matrix form through a matrix generator, and further estimation of parameters and functions from the processed data and parameters.

4.2.3.2 Final Base Model Data:

The preliminary model data above is employed in initial calibration runs of the model and consistency checks are performed. Since the data used comes from different sources, it is natural to expect inconsistencies. The initial model runs indicate clues to such inconsistencies which may result from errors in earlier parts or simply from the incompatibility of the data base parts. The data base corrected for such inconsistencies, becomes the final model data to be employed in policy simulations.

4.2.3.3 Model Generated Data:

Another category of data employed in TASM is the model generated data, based on the Calibrated Base Model Runs using data in e. This data is in principal the coefficients of the non-linear parts of the cost functions and input supply functions and is estimated from the shadow prices of the calibration constraints. The Final Base Model Data is augmented with this Model Generated Data to form the bases for policy simulation runs. A list of model generated data is given below:

- PQP coefficients for output
- PQP coefficients for input costs
- PQP coefficients for technology

4.2.3.4 Projected Data:

The final set of data used in TASM is the projected data for future policy simulations. Since the magnitudes in future years cannot be known at present, they have to be estimated from the past data. The exogenous as well as model generated data must therefore need to be gathered for a sufficient number of previous years to allow for such projections into the future. It is also necessary that, the projected data preserve the consistency requirements of a successful model.

4.3. An Overview of TASM Data Sources:

The sources of data used in TASM can be classified under four. groups: i. Official Published Statistics ii. Official Unpublished Statistics iii. Unofficial Research Findings and iv. Expert Estimates.

i. Official Publications: The majority of the data employed in TASM are based on official data published by various government agencies such as State Institute of Statistics, State Planning Organization, Village Affairs (former TOPRAKSU) and Ministry of Agriculture, Forestry and Rural Affairs.

ii. Official Unpublished Statistics: In Turkey, the publication of official statistics have a lag of about 2-3 years. Therefore, to be able form a recent data base one has to rely on data that is not published for recent years. Furthermore, some data such as the Input-Output coefficients from Production Costs studies of Village Affairs, is based on 2-3 years of data collection and processing, and do not become final until after the process is completed. In many instances, using the non-finalized versions of such data, especialy when they bring in information not available elsewhere or before is the best alternative to guesstimates.

iii. Unofficial Research Findings: The parameters used in the model, in general require some prior analysis on the raw data. Such information is in general not available in official publications, and hence need to be based on the results of other studies performed in the Universities, The World Bank, various Ministries and the State Planning Organization.

iv. Expert Estimates: The data in Turkey and in many other countries, are either not collected with an analytical study in mind or if so not suitable for every analytical study's data requirements. Therefore, no mather how much the available data is stretched, to satisfy the data requirements of a study such as the present one, the dependence on expert guesses cannot be avoided. What is important however, is the explicit statement of such information and the use this deficiency as an input for future data collection efforts.

Finally, we should point out the four specific and important sources of data for this study:

a. The SIS Statistical Yearbook
b. The SIS Agricultural Structure and Production Statistics
c. The SIS The Summary of Agricultural Statistics

d. The SIS Prices Recieved by Farmers Statistics
e. The SIS Foreign Trade Statistics
f. The MAFRA-Village Affairs Production Costs and Inputs Reports

About 90 % of the raw data employed in TASM is contained in these publications and almost all the information contained in these publications on agriculture are employed in TASM and need to be periodically entered in raw form to update the TASM DATA BASE.

4.4. The Model Data

TABLE IV.1: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1979)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000ha)	YIELDS (Kg/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13936.7	6746.627	1867	5.28	1
CORN	1364	290.29	2308	5.91	1
RYE	830	500	1428	4.43	1
RICE	225	43.333	4615	18.92	1
BARLEY	5000	1725	1871	4.78	1
CHICK PEA	285	158.492	1125	22.71	1
DRY BEAN	69	46.046	1500	38.76	1
LENTIL	285	258.285	1046	19.27	1
POTATO	2870	206.681	16982	10.36	1
ONION	1000	53.817	14493	7.17	1
GREEN PEPPER	545	34.097	16000	11.03	1
TOMATO	3500	108.133	32407	8.27	1
CUCUMBER	500	29.97	16667	10.41	1
SUNFLOWER	739	643.643	1326	11.72	1
OLIVE	430	471.963	530	28.04	1
GROUNDNUT	57.5	23.982	2300	28.33	1
SOYBEAN	3.3	2.065	1031	10.34	1
SESAME	26	20.821	578	73.31	1
COTTON	761.9	515.326	778	49.61	1
SUGAR BEET	8760	217.639	36511	1.11	1
TOBACCO	208.7	233.233	929	61.18	1
TEA	555	87.96	10366	14.5	1
CITRUS	1147	50.537	22650	10.05	1
GRAPE	3500	795	4118	19.05	1
APPLE	1350	230.921	5786	13.6	1
PEACH	220	22.449	9843	18.92	1
APRICOT	110	27.255	4015	15.2	1
CHERRY	92	19.594	4694	17.31	1
WILD CHERRY	50	11.506	4348	15.68	1
MELON	5220	285.246	14350	8.47	1
STRAWBERRY	22	4.994	4400	53	1
BANANA	23.3	1.495	15533	80.69	1
QUINCE	45	7.313	6050	14.43	1
PISTACHIO	20	57.2	75	111.52	1
HAZELNUT	300	333.366	784	39.49	1
ALFALFA	1163	129.129	9000	0	1
FODDER	1310.6	364.064	3600	0	1

TABLE IV.2: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1979)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (.000head)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	338	46026	6.93	56.9	1
SHEEP-MILK	1102.2	0	23.9	17.81	1
SHEEP-WOOL	59.3	0	1.3	169.48	1
SHEEP-HIDE	17.9	0	0.4	60.02	1
GOAT-MEAT	103.5	15109	6.85	45.26	1
GOAT-MILK	571.1	0	37.8	12.5	1
GOAT-WOOL	9.2	0	0.6	99.28	1
GOAT-HIDE	4.2	0	0.3	60.02	1
ANGORA-MEAT	6.5	3666	1.77	47.4	1
ANGORA-MILK	54.9	0	15	12.5	1
ANGORA-WOOL	5.8	0	1.4	268.84	1
ANGORA-HIDE	0.3	0	0.1	60.02	1
BEEF	391	15567.1	25.12	62.13	1
COW-MILK	3386.4	0	217.5	14.3	1
COW-HIDE	51.6	0	3.3	2.64	1
BUFALO-MEAT	34	1040.3	32.68	60.46	1
BUFALO-MILK	296.6	0	285.1	12.81	1
BUFALO-HIDE	3.1	0	2.6	2.64	1
POULLTR-MEAT	132	58938.7	2.24	72.1	1
EGGS	265.3	0	4.46	3.3	1
MULE	0	2453	0	0	1

TABLE IV.3: TRADE OF PROCESSED PRODUCTS(1979)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5.0	3.0	5.0	5.25	4.0	2.2
TPRICE	109.85	483.5	463.32	816.02	1057.84	1110.7	1769.3
TRADEQ	107.7	18.5	-13.0	29.6	5.7	75.0	127.0

TABLE IV.4: FOREIGN TRADE QUANTITIES AND PRICES(1979)

PRODUCTS	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	686.0	106.74	0	0
CORN	0	0	0	0
RYE	25.8	101.15	0	0
RICE	0	0	35.0	291.3
BARLEY	16.4	144.5	0	0
CHICK PEA	47.2	603.20	0	0
DRY BEAN	0.27	852.63	0	0
LENTIL	97.4	337.17	0	0
POTATO	12.9	145.73	0	0
ONION	76.5	123.88	0	0
GREEN PEPPER	0.4	553.31	0	0
TOMATO	25.6	126.81	0	0
CUCUMBER	0	0	0	0
SUNFLOWER	0	0	0	0
OLIVE	5.4	552.48	0	0
GROUNDNUT	1.6	756.92	0	0
SOYBEAN	0	0	447.3	547.
SESAME	0.20	1819.17	0	0
COTTON	252.5	1134.45	0	0
SUGAR BEET	0	0	0.7	289.
TOBACCO	69.6	1908.28	0	0
TEA	0	0	0	0
CITRUS	132.2	222.62	0	0
GRAPE	20.1	237.06	0	0
APPLE	29.7	340.79	0	0
PEACH	0.9	280.07	0	0
APRICOT	38.2	282.97	0	0
CHERRY	0	0	0	0
WILD CHERRY	0.56	824.73	0	0
MELON	23.2	86.85	0	0
STRAWBERRY	0.1	996.34	0	0
BANANA	0	0	0	0
QUINCE	0.1	246.46	0	0
PISTACHIO	1.6	3007.92	0	0
HAZELNUT	7.4	1115.91	0	0
SHEEP-MEAT	29.7	1832.02	0	0
SHEEP-MILK	0	0	0	0
SHEEP-WOOL	0	0	5.4	4367.9
SHEEP-HIDE	1.1	382.8	0	0
GOAT-MEAT	8.7	1832.02	0	0
GOAT-MILK	0	0	0	0
GOAT-WOOL	0.9	712.24	0	0
GOAT-HIDE	0	0	0	0
ANGORA-MEAT	0.5	1832.02	0	0
ANGORA-MILK	0	0	0	0
ANGORA-WOOL	1.9	8145.00	0	0
ANGORA-HIDE	0	0	0	0
BEEF	4.0	1140.0	0	0
COW-MILK	0	0	9.0	438.
COW-HIDE	0	0	0.4	2717.
BUFALO-MEAT	3.0	1140.0	0	0
BUFALO-MILK	0	0	0	0
BUFALO-HIDE	0	0	0.4	2717.
POULTRY-MEAT	0	0	0	0
EGGS	0	0	0	0

TABLE IV.5: RESOURCE AVAILABILITY AND PRICES(1979)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	2793.7	
IRR-GOOD	957.7	
TREE	2160.0	
PASTURE	20000.0	
ALFALFA	129.2	
FODDER	364.1	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3088451.	25.0
LABOR-2Q	3088451.	25.0
LABOR-3Q	3088451.	25.0
LABOR-4Q	3088451.	25.0
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	165188.	12.805
TRACTOR-2Q	165188.	12.805
TRACTOR-3Q	165188.	12.805
TRACTOR-4Q	165188.	12.805
FERTILIZERS ($/Kg)		
NITROGEN		0.134146
PHOSPHATE		0.085366
LIVESTOCK (.000 Heads)		
SHEEP	46026.0	
GOAT	15109.0	
ANGORA	3666.0	
CATTLE	15567.1	
BUFFALO	1040.3	
MULE	2453.0	
POULTRY	58938.7	

TABLE IV.5: RESOURCE AVAILABILITY AND PRICES(1979)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		6.5
CORN		8.0
RYE		6.0
RICE		24.0
BARLEY		4.5
CHICK PEA		32.5
DRY BEAN		39.0
LENTIL		18.5
POTATO		10.5
ONION		7.5
GREEN PEPPER		0.2
TOMATO		0.4
CUCUMBER		900.0
SUNFLOWER		20.0
SUGAR BEET		64.0
GROUNDNT		35.0
COTTON		10.0
TOBACCO		0.02
MELON		585.0
ALFALFA		60.0
FOODER		22.5
INVESTMENT COSTS (TL/Ha)		
OLIVE-D		1000.
TEA---D		25000.
CITRUS-I		5000.
GRAPE-D		3820.
GRAPE-I		4310.
APPLE-I		3920.
PEACH-I		10810.
APRICOT-I		5990.
CHERRY-I		7590.
WILD CHERRY-I		6730.
STRAWBERRY-I		46470.
BANANA-I		72980.
QUINCE-I		6380.
PISTACHIO-D		2000.
HAZELNUT-D		2000.

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate= 1US$=41.0 TL.

TABLE IV.6: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1980)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13140.32	6473.89	2.030	10.37	0.9826
CORN	1252.86	289.30	4.331	13.02	0.9210
RYE	731.99	460.60	1.589	8.47	0.9574
BARLEY	5057.25	1725.00	2.932	8.22	1.0115
RICE	143.00	30.04	4.760	25.69	0.9167
CHICK PEA	348.33	190.19	1.831	29.82	1.0185
DRY BEAN	69.00	47.72	1.446	47.46	0.9649
LENTIL	303.69	281.90	1.077	36.22	0.9763
POTATO	3000.00	223.80	13.405	16.52	0.9653
ONION	960.00	54.60	17.583	24.23	0.9463
GREEN PEPPER	580.00	32.93	17.613	22.96	1.1020
TOMATO	3550.00	104.62	33.932	14.76	1.0483
CUCUMBER	500.00	29.00	17.243	17.92	1.0335
SUNFLOWER	939.41	831.67	1.130	19.38	0.9838
OLIVE	1350.00	472.54	2.857	36.84	3.1357
GROUNDNUT	41.00	18.23	2.249	69.87	0.9382
SOYBEAN	2.30	1.94	1.188	23.14	0.7434
SESAME	26.00	20.82	1.249	80.46	1.0000
COTTON	799.97	565.60	1.414	94.19	0.9566
SUGAR BEET	6766.23	217.46	31.115	1.61	0.7730
TOBACCO	220.04	223.70	0.984	77.57	1.0993
TEA	475.96	88.30	5.390	25.00	0.8542
CITRUS	1158.00	50.87	22.764	15.46	1.0030
GRAPE	3600.00	766.94	4.694	36.13	1.0662
APPLE	1430.00	244.45	5.850	17.08	1.0006
PEACH	240.00	23.30	10.299	24.55	1.0509
APRICOT	100.00	28.65	3.491	24.50	0.8649
CHERRY	96.00	20.09	4.779	28.01	1.0179
WILD CHERRY	60.00	13.06	4.595	29.14	1.0575
MELON	4450.00	276.16	16.114	14.33	0.8805
STRAWBERRY	23.00	4.99	4.606	85.76	1.0455
BANANA	30.00	1.59	18.813	130.57	1.2071
QUINCE	50.00	7.89	6.337	18.63	1.0298
PISTACHIO	7.50	60.29	0.124	149.57	0.3558
HAZELNUT	250.00	335.85	0.744	80.56	0.8272
ALFALFA	1233.33	131.13	9.405		0.9671
FODDER	1117.18	358.06	3.100		0.7800

TABLE IV.7: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1980)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (.000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	335.85	48630.00	6.906	112.96	0.9404
SHEEP-MILK	1171.78		24.096	26.23	1.0062
SHEEP-WOOL	61.33		1.261	167.25	0.9788
SHEEP-HIDE	19.35		0.398	124.24	1.0232
GOAT-MEAT	103.03	15385.00	6.697	89.85	0.9776
GOAT-MILK	578.41		37.596	21.79	0.9946
GOAT-WOOL	9.25		0.601	179.91	0.9874
GOAT-HIDE	3.67		0.239	124.24	0.8588
ANGORA-MEAT	6.65	3658.00	1.818	94.10	1.0251
ANGORA-MILK	54.11		14.791	21.79	0.9877
ANGORA-WOOL	5.84	3658.00	1.598	469.98	1.0099
ANGORA-HIDE	0.27		0.075	124.24	0.9144
BEEF	405.83	15894.10	25.533	92.13	1.0166
COW-MILK	3438.89		216.363	26.19	0.9946
COW-HIDE	44.88		2.824	67.66	0.8519
BUFALO-MEAT	35.68	1031.30	34.596	89.66	1.0585
BUFALO-MILK	277.41		268.992	27.28	0.9435
BUFALO-HIDE	2.64		2.564	67.66	0.8604
POULTRY-MEAT	143.78	64200.08	2.240	128.57	1.0000
EGGS	254.26		3.960	96.20	0.8799
MULE					

TABLE IV.8: TRADE OF PROCESSED PRODUCTS(1980)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5.00	3.00	5.00	5.25	4.0	2.2
TPRICE	209.28	559.88	859.58	1351.17	1327.43	631.46	3190.59
TRADEQ	72.42	18.72	-34.55	3.34	5.24	80.25	97.50

TABLE IV.9: FOREIGN TRADE QUANTITIES AND PRICES(1980)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	338.05	130.85	0.00	0.00
CORN	8.82	119.00	0.00	0.00
RYE	0.20	439.45	0.00	0.00
BARLEY	177.92	132.37	14.00	64.78
RICE	0.08	705.19	10.52	356.48
CHICK PEA	91.09	342.95	0.00	0.00
DRY BEAN	7.45	584.24	0.00	0.00
LENTIL	102.75	440.86	0.00	0.00
POTATO	9.72	160.83	0.00	0.00
ONION	32.58	175.86	0.00	0.00
GREEN PEPPER	0.41	553.50	0.00	0.00
TOMATO	26.37	187.79	0.00	0.00
CUCUMBER	0.00	0.00	0.00	0.00
SUNFLOWER	0.00	0.00	0.00	0.00
OLIVE	6.83	318.43	0.00	0.00
GROUNDNUT	3.28	998.81	0.00	0.00
SOYBEAN	0.00	0.00	0.00	0.00
SESAME	0.80	1186.26	0.00	0.00
COTTON	189.07	1334.55	0.00	0.00
SUGAR BEET	283.79	252.86	1494.47	505.83
TOBACCO	83.73	2245.20	0.00	0.00
TEA	0.00	0.00	0.00	0.00
CITRUS	177.73	294.68	0.00	0.00
GRAPE	6.10	261.05	0.00	0.00
APPLE	30.30	291.41	0.00	0.00
PEACH	2.24	306.04	0.00	0.00
APRICOT	63.98	389.26	0.00	0.00
CHERRY	0.000	0.00	0.00	0.00
WILD CHERRY	1.00	488.77	0.00	0.00
MELON	21.08	158.01	0.00	0.00
STRAWBERRY	0.01	625.53	0.00	0.00
BANANA	0.00	0.00	0.00	0.00
QUINCE	0.29	327.42	0.00	0.00
PISTACHIO	1.31	4246.96	0.00	0.00
HAZELNUT	3.43	1393.53	0.00	0.00
SHEEP-MEAT	22.19	1863.08	0.00	0.00
SHEEP-MILK	0.00	0.00	0.00	0.00
SHEEP-WOOL	19.76	2194.19	6.74	5950.75
SHEEP-HIDE	0.58	1487.56	0.06	2975.12
GOAT-MEAT	0.00	0.00	0.00	0.00
GOAT-MILK	0.00	0.00	0.00	0.00
GOAT-WOOL	0.86	719.96	0.00	0.00
GOAT-HIDE	0.47	1487.56	0.00	0.00
ANGORA-MEAT	0.00	0.00	0.00	0.00
ANGORA-MILK	0.00	0.00	0.00	0.00
ANGORA-WOOL	1.04	4388.38	0.00	0.00
ANGORA-HIDE	0.00	0.00	0.00	0.00
BEEF	0.00	0.00	0.00	0.00
COW-MILK	0.00	0.00	0.00	0.00
COW-HIDE	0.00	0.00	2.14	3177.90
BUFALO-MEAT	0.00	0.00	0.00	0.00
BUFALO-MILK	0.00	0.00	0.00	0.00
BUFALO-HIDE	0.00	0.00	0.00	0.00
POULTRY-MEAT	0.00	0.00	0.00	0.00
EGGS	0.00	0.00	0.00	0.00

TABLE IV.10: RESOURCE AVAILABILITY AND PRICES(1980)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	2907.5	
IRR-GOOD	1014.6	
TREE	2160	
PASTURE	20000	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3085000	50.
LABOR-2Q	3085000	50.
LABOR-3Q	3085000	50.
LABOR-4Q	3085000	50.
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	178965	9.854
TRACTOR-2Q	178965	9.854
TRACTOR-3Q	178965	9.854
TRACTOR-4Q	178965	9.854
FERTILIZERS (Ton/$/Kg)		
NITROGEN	648599	0.36130
PHOSPHATE	482790	0.34817
LIVESTOCK (.000 Heads)		
SHEEP	48630	
GOAT	15385	
ANGORA	3658	
CATTLE	15894.1	
BUFFALO	1031.3	
MULE	2444	
POULTRY	64200	

TABLE IV.10: RESOURCE AVAILABILITY AND PRICES(1980)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		16.
CORN		20.
RYE		15.
BARLEY		14.75
RICE		35.
CHICK PEA		43.25
DRY BEAN		51.55
LENTIL		38.7
POTATO		16.85
ONION		17.2
GREEN PEPPER		0.4
TOMATO		0.45
CUCUMBER		1500.
SUNFLOWER		32.
SUGAR BEET		120.
GROUNDNUT		70.6
SOYBEAN		29.7
SESAME		105.4
COTTON		17.5
TOBACCO		0.03
MELON		1010.5
ALFALFA		127.5
FODDER		25.
INVESTMENT COSTS (TL/Ha)		
OLIVE-D		2000.
TEA---D		50000.
CITRUS-I		10000.
GRAPE-D		7640.
GRAPE-I		8620.
APPLE-I		7840.
PEACH-I		21620.
APRICOT-I		11980.
CHERRY-I		15180.
WILD CHERRY-I		13460.
STRAWBERRY-I		92940.
BANANA-I		145960.
QUINCE-I		12760.
PISTACHIO-D		4000.
HAZELNUT-D		4000.

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=76.11301 TL

TABLE IV.11: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1981)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13538.51	6638.97	2.039	18.03	0.9872
CORN	1212.44	287.81	4.213	22.45	0.8966
RYE	704.81	423.51	1.664	14.11	1.0025
BARLEY	5629.77	1826.65	3.082	14.72	1.0633
RICE	198	42.18	4.694	54.38	0.9041
CHICK PEA	297.67	158.49	1.878	35.07	1.0444
DRY BEAN	66.91	43.95	1.522	61.25	1.0159
LENTIL	436.07	376.36	1.159	55.45	1.05
POTATO	3000	220.13	13.628	21.25	0.9814
ONION	1090	58.5	18.634	24.33	1.0028
GREEN PEPPER	600	31.38	19.119	28.27	1.1961
TOMATO	3600	99.71	36.106	21.58	1.1155
CUCUMBER	510	27.64	18.455	27.02	1.1062
SUNFLOWER	720.21	723.19	0.996	31.34	0.8674
OLIVE	400	484.47	0.826	43.55	0.9062
GROUNDNUT	57	23.98	2.377	76.38	0.9913
SOYBEAN	15	10.97	1.367	36.79	0.8556
SESAME	25	18.51	1.351	90.59	1.0817
COTTON	780.77	550.35	1.419	149.72	0.9595
SUGAR BEET	11165.45	290.89	38.384	3.91	0.9536
TOBACCO	161.91	177.72	0.911	137.03	1.0181
TEA	192.26	87.25	2.204	41	0.3492
CITRUS	958	53.72	17.833	23.28	0.7857
GRAPE	3700	748.24	4.945	42.91	1.1232
APPLE	1450	247.42	5.861	21.32	1.0025
PEACH	265	23.69	11.185	41.52	1.1413
APRICOT	105	29.59	3.548	52.67	0.8791
CHERRY	95	20.52	4.629	48.36	0.9859
WILD CHERRY	60	13.67	4.388	41.05	1.0098
MELON	4500	263.19	17.098	18.95	0.9343
STRAWBERRY	23	4.99	4.606	148.07	1.0455
BANANA	30	1.59	18.813	225.43	1.2071
QUINCE	56	7.94	7.053	29.64	1.1462
PISTACHIO	25	74.74	0.334	350.93	0.9566
HAZELNUT	350	333.99	1.048	110.48	1.1645
ALFALFA	1323	143.14	9.243	0	0.9729
FODDER	1108.05	358.89	3.087	0	0.7719

TABLE IV.12: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1981)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (.000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	377.7	49598	7.615	137.05	1.037
SHEEP-MILK	1196.59	49598	24.126	35.67	1.0074
SHEEP-WOOL	62.35	49598	1.257	262.92	0.9757
SHEEP-HIDE	28.71	49598	0.579	182.83	1.4885
GOAT-MEAT	103.36	15070	6.859	109.01	1.0012
GOAT-MILK	565.46	15070	37.522	35.06	0.9927
GOAT-WOOL	8.94	15070	0.593	198.28	0.9738
GOAT-HIDE	5.68	15070	0.377	182.83	1.3561
ANGORA-MEAT	6.9	3856	1.791	114.17	1.0099
ANGORA-MILK	57.76	3856	14.98	35.06	1.0003
ANGORA-WOOL	6.05	3856	1.57	477.62	0.9923
ANGORA-HIDE	0.5	3856	0.128	182.83	1.5688
BEEF	371.4	15981.1	23.24	110.42	0.9253
COW-MILK	3486.09	15981.1	218.138	35.91	1.0028
COW-HIDE	53.86	15981.1	3.37	87.89	1.0167
BUFALO-MEAT	32.21	1002.29	32.141	107.45	0.9834
BUFALO-MILK	283.58	1002.29	282.928	38.54	0.9923
BUFALO-HIDE	2.44	1002.29	2.433	87.89	0.8166
POULTRY-MEAT	139.59	62328.92	2.24	155.8	1
EGGS	281.7	62328.92	4.52	169.6	1.0041

TABLE IV.13: TRADE OF PROCESSED PRODUCTS(1981)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	305.57	554.08	813.18	1358.87	1944.05	687.32	2390.52
TRADEQ	111.56	26.72	-8.87	43.45	3.32	99.69	92.35

TABLE IV.14: FOREIGN TRADE QUANTITIES AND PRICES(1981)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	315.5	144.9	272.3	205.7
CORN	0.0	0.0	0.0	0.0
RYE	0.2	254.4	0.0	0.0
BARLEY	372.0	156.0	0.0	0.0
RICE	0.0	0.0	40.4	353.5
CHICK PEA	175.7	333.1	0.0	0.0
DRY BEAN	28.1	551.0	0.0	0.0
LENTIL	228.4	459.2	0.0	0.0
POTATO	17.7	197.9	0.0	0.0
ONION	98.7	168.2	0.0	0.0
GREEN PEPPER	0.6	491.8	0.0	0.0
TOMATO	75.4	178.5	0.0	0.0
CUCUMBER	0.0	0.0	0.0	0.0
SUNFLOWER	0.0	767.7	0.0	0.0
OLIVE	1.4	402.6	0.0	0.0
GROUNDNUT	5.4	1149.0	0.0	0.0
SOYBEAN	0.0	0.0	752.9	427.4
SESAME	0.9	826.0	0.0	0.0
COTTON	241.0	1268.0	0.0	0.0
SUGAR BEET	201.6	168.5	619.4	493.2
TOBACCO	131.0	2328.1	0.0	0.0
TEA	0.0	0.0	0.0	0.0
CITRUS	279.9	271.2	0.0	0.0
GRAPE	9.8	233.3	0.0	0.0
APPLE	127.7	277.8	0.0	0.0
PEACH	5.5	321.6	0.0	0.0
APRICOT	50.4	485.1	0.0	0.0
CHERRY	0.0	0.0	0.0	0.0
WILD CHERRY	0.9	510.9	0.0	0.0
MELON	18.2	139.3	0.0	0.0
STRAWBERRY	0.1	702.2	0.0	0.0
BANANA	0.0	834.0	0.0	0.0
QUINCE	1.0	229.6	0.0	0.0
PISTACHIO	4.0	4020.3	0.0	0.0
HAZELNUT	12.9	1599.1	0.0	0.0
SHEEP-MEAT	56.9	1849.6	0.0	0.0
SHEEP-MILK	0.0	0.0	0.0	0.0
SHEEP-WOOL	22.2	1799.0	13.3	6381.0
SHEEP-HIDE	0.9	1041.0	0.1	2481.0
GOAT-MEAT	0.3	952.4	0.0	0.0
GOAT-MILK	0.0	0.0	0.0	0.0
GOAT-WOOL	1.5	704.5	0.0	0.0
GOAT-HIDE	0.9	1041.0	0.0	0.0
ANGORA-MEAT	0.0	0.0	0.0	0.0
ANGORA-MILK	0.0	0.0	0.0	0.0
ANGORA-WOOL	2.8	3598.1	0.0	0.0
ANGORA-HIDE	0.0	0.0	0.0	0.0
BEEF	12.8	1572.1	0.0	0.0
COW-MILK	46.3	242.0	47.8	483.9
COW-HIDE	0.0	0.0	3.3	2259.7
BUFALO-MEAT	0.0	1572.1	0.3	4716.4
BUFALO-MILK	0.0	0.0	0.0	0.0
BUFALO-HIDE	0.0	0.0	0.0	0.0
POULTRY-MEAT	0.7	1007.0	0.0	0.0
EGGS	3.1	766.7	0.0	0.0

TABLE IV.15: RESOURCE AVAILABILITY AND PRICES(1981)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3021.15	
IRR-GOOD	1035.67	
TREE	2160	
PASTURE	20000	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3082941	62.5
LABOR-2Q	3082941	62.5
LABOR-3Q	3082941	62.5
LABOR-4Q	3082941	62.5
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	188129	10.08
TRACTOR-2Q	188129	10.08
TRACTOR-3Q	188129	10.08
TRACTOR-4Q	188129	10.08
FERTILIZERS (Ton/$/Kg)		
NITROGEN	776408	0.4218
PHOSPHATE	532984	0.41205
LIVESTOCK (.000 Heads)		
SHEEP	49598	
GOAT	15070	
ANGORA	3856	
CATTLE	15981	
BUFFALO	1002	
MULE	2353	
POULTRY	62329	

TABLE IV.15: RESOURCE AVAILABILITY AND PRICES(1981)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		22.8
CORN		30.3
RYE		20.3
BARLEY		24
RICE		70.3
CHICK PEA		54
DRY BEAN		64.1
LENTIL		58.9
POTATO		23.2
ONION		26.9
GREEN PEPPER		0.6
TOMATO		0.5
CUCUMBER		2390.5
SUNFLOWER		56.9
SUGAR BEET		230.1
GROUNDNUT		106.1
SOYBEAN		46.4
SESAME		119.1
COTTON		29.8
TOBACCO		0.04
MELON		1435.9
ALFALFA		195
FODDER		40
INVESTMENT COSTS (TL/Ha)		
OLIVE-D		3000
TEA---D		75000
CITRUS-I		15000
GRAPE-D		11460
GRAPE-I		12930
APPLE-I		11760
PEACH-I		32430
APRICOT-I		17970
CHERRY-I		22770
WILD CHERRY-I		20190
STRAWBERRY-I		139410
BANANA-I		218940
QUINCE-I		19140
PISTACHIO-D		6000
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=112.8478 TL

TABLE IV.16: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1982)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13936.7	6459.54	2.158	22.6	1.0444
CORN	1374.1	287.81	4.774	27.9	1.0161
RYE	625.56	350.7	1.784	16.85	1.0746
BARLEY	6106.87	1932.62	3.16	17.17	1.0902
RICE	210	44.69	4.699	57.72	0.905
CHICK PEA	354.67	194.15	1.827	55.79	1.0159
DRY BEAN	69	44.37	1.555	103.28	1.0377
LENTIL	856.56	919.13	0.932	58.33	0.8446
POTATO	3000	220.13	13.628	22.88	0.9814
ONION	1025	55.38	18.51	17.98	0.9961
GREEN PEPPER	600	34.14	17.572	27.9	1.0994
TOMATO	3700	108.48	34.107	17.15	1.0537
CUCUMBER	550	30.07	18.292	30.7	1.0964
SUNFLOWER	663.85	766.59	0.866	40.15	0.7542
OLIVE	1320	471.67	2.799	52.56	3.0717
GROUNDNUT	50	23.02	2.172	86.01	0.9058
SOYBEAN	24.39	15.74	1.55	47.91	0.9697
SESAME	44.25	20.47	2.161	170.17	1.7308
COTTON	594.98	501.01	1.188	192.02	0.8032
SUGAR BEET	12732.86	300.57	42.362	4.99	1.0525
TOBACCO	200.17	206.76	0.968	191.29	1.082
TEA	303.25	105.84	2.865	55	0.4541
CITRUS	1203	56.19	21.408	29.35	0.9432
GRAPE	3650	612.62	5.958	47.67	1.3533
APPLE	1600	252.03	6.348	29.59	1.0859
PEACH	265	23.94	11.068	51.31	1.1294
APRICOT	140	30.59	4.577	60.1	1.1341
CHERRY	105	20.63	5.089	90.67	1.0838
WILD CHERRY	62	14.01	4.426	65.42	1.0186
MELON	4500	286.36	15.715	19.78	0.8587
STRAWBERRY	22	4	5.507	277.61	1.25
BANANA	30	1.59	18.813	422.66	1.2071
QUINCE	62	7.69	8.058	39.2	1.3095
PISTACHIO	13	64.96	0.2	414.56	0.5724
HAZELNUT	220	333.8	0.659	134.18	0.7324
ALFALFA	1340.3	141.05	9.502	0	1.0002
FODDER	1218.17	447.63	2.721	0	0.6803

TABLE IV.17: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1982)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (.000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	379.91	49636	7.654	178.93	1.0423
SHEEP-MILK	1201.62	49636	24.209	47.03	1.0109
SHEEP-WOOL	62.12	49636	1.251	314.48	0.9713
SHEEP-HIDE	32.18	49636	0.648	254.99	1.6669
GOAT-MEAT	101.35	14655	6.916	142.32	1.0096
GOAT-MILK	552.43	14655	37.696	37.72	0.9973
GOAT-WOOL	9.31	14655	0.635	198.72	1.0433
GOAT-HIDE	6.79	14655	0.463	254.99	1.6661
ANGORA-MEAT	6.47	3558	1.82	149.05	1.0264
ANGORA-MILK	54.25	3558	15.247	37.72	1.0182
ANGORA-WOOL	5.59	3558	1.571	516.46	0.9932
ANGORA-HIDE	0.7	3558	0.196	254.99	2.3994
BEEF	331.99	14484.09	22.921	145.44	0.9126
COW-MILK	3156.06	14484.09	217.899	43.37	1.0017
COW-HIDE	61.18	14484.09	4.224	143.55	1.2742
BUFALO-MEAT	23.98	808.23	29.664	141.53	0.9076
BUFALO-MILK	232.15	808.23	287.237	46.16	1.0075
BUFALO-HIDE	2.38	808.23	2.944	143.55	0.9879
POULTRY-MEAT	146.75	65524.82	2.24	181.7	1
EGGS	307.07	65524.82	4.686	217.6	1.0411

TABLE IV.18: TRADE OF PROCESSED PRODUCTS(1982)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	305.57	554.08	813.18	1358.87	1944.05	687.32	2390.52
TRADEQ	111.56	26.72	-8.87	43.45	3.32	99.69	92.35

TABLE IV.19: FOREIGN TRADE QUANTITIES AND PRICES(1982)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	296.21	146.00	525.28	205.83
CORN	0.05	336.04	19.55	221.53
RYE	2.04	235.07	0.00	0.00
BARLEY	482.71	144.81	0.00	0.00
RICE	0.00	0.00	31.58	414.70
CHICK PEA	161.07	354.50	0.00	0.00
DRY BEAN	7.63	656.14	0.00	0.00
LENTIL	312.23	345.05	0.00	0.00
POTATO	54.39	126.15	0.00	0.00
ONION	176.56	126.27	0.00	0.00
GREEN PEPPER	0.73	403.19	0.00	0.00
TOMATO	108.58	125.91	0.00	0.00
CUCUMBER	0.00	0.00	0.00	0.00
SUNFLOWER	0.01	754.12	0.00	0.00
OLIVE	0.71	504.73	0.00	0.00
GROUNDNUT	10.52	742.94	0.00	0.00
SOYBEAN	7.03	167.21	757.70	760.95
SESAME	1.22	1214.53	0.17	1123.70
COTTON	378.74	1025.65	28.78	3734.79
SUGAR BEET	1937.82	212.11	4.18	115.46
TOBACCO	104.92	2644.88	0.00	0.00
TEA	0.00	0.00	0.00	0.00
CITRUS	230.87	205.69	0.00	0.00
GRAPE	12.11	173.38	0.00	0.00
APPLE	104.54	231.33	0.00	0.00
PEACH	5.10	279.16	0.00	0.00
APRICOT	82.67	314.91	0.00	0.00
CHERRY	0.00	0.00	0.00	0.00
WILD CHERRY	0.45	388.31	0.00	0.00
MELON	31.71	120.45	0.00	0.00
STRAWBERRY	0.18	564.62	0.00	0.00
BANANA	0.01	1014.37	0.00	0.00
QUINCE	1.40	224.38	0.00	0.00
PISTACHIO	4.00	3120.97	0.00	0.00
HAZELNUT	8.21	1090.07	0.00	0.00
SHEEP-MEAT	84.56	1584.90	0.00	0.00
SHEEP-MILK	0.01	2429.06	0.00	0.00
SHEEP-WOOL	32.86	5000.00	10.90	7019.69
SHEEP-HIDE	1.67	1500.00	0.64	2483.07
GOAT-MEAT	0.49	1540.06	0.00	0.00
GOAT-MILK	0.01	2429.06	0.00	0.00
GOAT-WOOL	1.45	907.78	0.00	0.00
GOAT-HIDE	1.67	1500.00	0.00	0.00
ANGORA-MEAT	0.00	0.00	0.00	0.00
ANGORA-MILK	0.01	2429.06	0.00	0.00
ANGORA-WOOL	3.70	2786.98	0.00	0.00
ANGORA-HIDE	0.00	0.00	0.00	0.00
BEEF	46.86	1433.25	0.00	0.00
COW-MILK	5.29	2429.06	3.63	800.00
COW-HIDE	0.00	0.00	2.81	2569.57
BUFALO-MEAT	0.25	1433.25	0.00	0.00
BUFALO-MILK	1.00	2429.06	0.00	0.00
BUFALO-HIDE	0.00	0.00	0.00	0.00
POULTRY-MEAT	0.80	1032.85	0.00	0.00
EGGS	10.29	778.78	0.00	0.00

TABLE IV.20: RESOURCE AVAILABILITY AND PRICES(1982)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3080	
IRR-GOOD	1065.1	
TREE	2205	
PASTURE	20500	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3085000	75
LABOR-2Q	3085000	75
LABOR-3Q	3085000	75
LABOR-4Q	3085000	75
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	201371	7.356
TRACTOR-2Q	201371	7.356
TRACTOR-3Q	201371	7.356
TRACTOR-4Q	201371	7.356
FERTILIZERS (Ton/$/Kg)		
NITROGEN	847241	0.28506
PHOSPHATE	569624	0.27035
LIVESTOCK (.000 Heads)		
SHEEP	48630	
GOAT	15385	
ANGORA	3658	
CATTLE	15894.1	
BUFFALO	1031.3	
MULE	2444	
POULTRY	64200	

TABLE IV.20: RESOURCE AVAILABILITY AND PRICES(1982)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		35
CORN		44
RYE		31
BARLEY		29.5
RICE		94
CHICK PEA		86
DRY BEAN		118.55
LENTIL		66.6
POTATO		30
ONION		35
GREEN PEPPER		1.1
TOMATO		1
CUCUMBER		2656.1
SUNFLOWER		60
SUGAR BEET		293.7
GROUNDNUT		120.1
SOYBEAN		70
SESAME		234.6
COTTON		35
TOBACCO		0.06
MELON		1548.7
ALFALFA		350
FODDER		42.5
INVESTMENT COSTS (TL/Ha)		3600
OLIVE-D		90000
TEA---D		18000
CITRUS-I		13752
GRAPE-D		15516
GRAPE-I		14112
APPLE-I		38916
PEACH-I		21564
APRICOT-I		27324
CHERRY-I		24228
WILD CHERRY-I		167292
STRAWBERRY-I		262728
BANANA-I		22968
QUINCE-I		7200
PISTACHIO-D		7200
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=163.125 TL

TABLE IV.21: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1983)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13060.68	6624.61	1.972	26.93	0.9544
CORN	1495.35	272.92	5.479	28.23	1.1661
RYE	575.03	319.61	1.799	20.36	1.0838
BARLEY	5176.53	1786.61	2.897	21.17	0.9996
RICE	189	40.44	4.673	63.25	0.9
CHICK PEA	367.33	265.08	1.386	77.85	0.7706
DRY BEAN	73.18	50.23	1.457	128.24	0.9722
LENTIL	1012.3	959.34	1.055	65.51	0.9563
POTATO	3050	226.25	13.481	29.81	0.9708
ONION	1000	54.6	18.316	26.43	0.9857
GREEN PEPPER	640	37.46	17.085	34.27	1.0689
TOMATO	3700	119.02	31.089	28.81	0.9605
CUCUMBER	600	32.99	18.189	38.65	1.0902
SUNFLOWER	895.57	795.51	1.126	52.18	0.9805
OLIVE	400	473.33	0.845	68.54	0.9275
GROUNDNUT	50.4	23.02	2.189	121.08	0.913
SOYBEAN	46	15.65	2.94	55.85	1.8394
SESAME	38	27.76	1.369	233.08	1.0962
COTTON	835.17	509.43	1.639	275.84	1.1088
SUGAR BEET	12769.97	290.89	43.9	5.94	1.0907
TOBACCO	225.33	230.26	0.979	227.51	1.0936
TEA	435.94	106.01	4.112	72.5	0.6517
CITRUS	1299	57.97	22.407	33.21	0.9873
GRAPE	3400	612.62	5.55	66.94	1.2606
APPLE	1750	255.33	6.854	33.72	1.1724
PEACH	270	25.74	10.49	50.74	1.0704
APRICOT	170	37.3	4.557	58.28	1.1292
CHERRY	110	21.19	5.19	111.94	1.1054
WILD CHERRY	66	14.31	4.613	49.95	1.0615
MELON	4610	314.16	14.674	24.72	0.8019
STRAWBERRY	22	4.49	4.895	342.74	1.1111
BANANA	24	1.5	16.054	521.8	1.03
QUINCE	63	7.68	8.201	47.17	1.3328
PISTACHIO	25	64.74	0.386	645.24	1.1044
HAZELNUT	395	337.1	1.172	158.28	1.3021
ALFALFA	1295.51	144.06	8.993	0	0.9466
FODDER	1268.64	502.25	2.526	0	0.6315

TABLE IV.22: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1983)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (.000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	378.2	48707	7.765	241.26	1.0573
SHEEP-MILK	1187.52	48707	24.381	59.99	1.0181
SHEEP-WOOL	62.3	48707	1.279	395.8	0.9928
SHEEP-HIDE	32.95	48707	0.676	558.43	1.7394
GOAT-MEAT	93.36	13615	6.857	191.91	1.001
GOAT-MILK	511.62	13615	37.578	54.07	0.9942
GOAT-WOOL	8.6	13615	0.632	260.73	1.0376
GOAT-HIDE	6.59	13615	0.484	558.43	1.7425
ANGORA-MEAT	5.77	3117	1.852	200.98	1.0445
ANGORA-MILK	47.31	3117	15.177	54.07	1.0135
ANGORA-WOOL	4.56	3117	1.462	755.66	0.924
ANGORA-HIDE	0.54	3117	0.173	558.43	2.1149
BEEF	339.86	14099.09	24.105	207.94	0.9597
COW-MILK	3074.05	14099.09	218.032	54.8	1.0023
COW-HIDE	58.51	14099.09	4.15	178.67	1.252
BUFALO-MEAT	24.81	758.22	32.724	202.35	1.0012
BUFALO-MILK	219.1	758.22	288.969	58.76	1.0135
BUFALO-HIDE	2.67	758.22	3.521	178.67	1.1815
POULTRY-MEAT	148.81	66443.16	2.24	229.46	1
EGGS	309.43	66443.16	4.657	247.6	1.0346

TABLE IV.23: TRADE OF PROCESSED PRODUCTS(1983)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	140.4	497.61	589.71	1010.02	2653.93	614.97	1713
TRADEQ	301.53	50.58	-19.83	63.75	0.56	80.69	114.34

TABLE IV.24: FOREIGN TRADE QUANTITIES AND PRICES(1983)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	609.90	138.47	12.91	182.59
CORN	4.52	264.56	0.00	0.00
RYE	5.35	150.45	0.00	0.00
BARLEY	635.08	124.40	159.49	192.57
RICE	0.03	468.41	15.38	413.70
CHICK PEA	168.74	315.62	0.00	0.00
DRY BEAN	29.15	530.95	0.00	0.00
LENTIL	370.98	225.58	0.00	0.00
POTATO	36.65	110.63	0.00	0.00
ONION	133.93	102.97	0.00	0.00
GREEN PEPPER	1.04	358.89	0.00	0.00
TOMATO	120.09	139.12	0.00	0.00
CUCUMBER	0.00	0.00	0.00	0.00
SUNFLOWER	0.00	0.00	0.00	0.00
OLIVE	1.40	559.54	0.00	0.00
GROUNDNUT	4.60	816.06	0.00	0.00
SOYBEAN	12.49	720.88	502.27	743.44
SESAME	1.41	1142.78	0.35	814.24
COTTON	308.05	1159.17	25.67	3478.65
SUGAR BEET	2859.83	203.96	2.79	212.19
TOBACCO	69.55	2668.65	0.00	0.00
TEA	0.00	0.00	0.00	0.00
CITRUS	246.00	176.64	0.00	0.00
GRAPE	10.96	182.64	0.00	0.00
APPLE	101.17	173.18	0.00	0.00
PEACH	7.50	239.68	0.00	0.00
APRICOT	123.20	292.89	0.00	0.00
CHERRY	0.00	0.00	0.00	0.00
WILD CHERRY	0.66	359.82	0.00	0.00
MELON	40.92	108.68	0.00	0.00
STRAWBERRY	0.33	516.65	0.00	0.00
BANANA	0.01	1029.22	0.00	0.00
QUINCE	2.97	181.57	0.00	0.00
PISTACHIO	2.32	3781.82	0.00	0.00
HAZELNUT	0.91	1027.34	0.00	0.00
SHEEP-MEAT	86.09	1407.95	0.00	0.00
SHEEP-MILK	0.02	241.15	0.00	0.00
SHEEP-WOOL	39.35	1470.51	16.07	6456.65
SHEEP-HIDE	0.00	0.00	1.00	2653.84
GOAT-MEAT	0.52	1423.79	0.00	0.00
GOAT-MILK	1.00	241.15	0.00	0.00
GOAT-WOOL	1.48	591.60	0.00	0.00
GOAT-HIDE	0.00	0.00	0.00	0.00
ANGORA-MEAT	0.00	0.00	0.00	0.00
ANGORA-MILK	0.01	241.15	0.00	0.00
ANGORA-WOOL	2.62	2941.03	0.00	0.00
ANGORA-HIDE	0.00	0.00	0.00	0.00
BEEF	32.79	1358.71	0.00	0.00
COW-MILK	0.12	241.15	0.00	0.00
COW-HIDE	0.21	957.78	4.60	1764.14
BUFALO-MEAT	0.00	0.00	0.00	0.00
BUFALO-MILK	0.01	241.15	0.00	0.00
BUFALO-HIDE	0.14	957.78	0.00	0.00
POULTRY-MEAT	1.52	701.02	0.00	0.00
EGGS	24.87	553.86	1.52	1167.81

TABLE IV.25: RESOURCE AVAILABILITY AND PRICES(1983)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3138.7	
IRR-GOOD	1094.4	
TREE	2247	
PASTURE	20500	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3085000	100
LABOR-2Q	3085000	100
LABOR-3Q	3085000	100
LABOR-4Q	3085000	100
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	210605	6.175
TRACTOR-2Q	210605	6.175
TRACTOR-3Q	210605	6.175
TRACTOR-4Q	210605	6.175
FERTILIZERS (Ton/$/Kg)		
NITROGEN	990805	0.205
PHOSPHATE	617975	0.195
LIVESTOCK (.000 Heads)		
SHEEP	48707	
GOAT	13615	
ANGORA	3117	
CATTLE	14099	
BUFFALO	758	
MULE	2180	
POULTRY	60435	

TABLE IV.25: RESOURCE AVAILABILITY AND PRICES(1983)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		42.5
CORN		60
RYE		38
BARLEY		35.5
RICE		110
CHICK PEA		134
DRY BEAN		173
LENTIL		72
POTATO		32
ONION		37
GREEN PEPPER		1.6
TOMATO		1.6
CUCUMBER		3255.9
SUNFLOWER		73
SUGAR BEET		349.6
GROUNDNUT		168.9
SOYBEAN		105
SESAME		350
COTTON		45
TOBACCO		0.07
MELON		1661.5
ALFALFA		500
FODDER		60
INVESTMENT COSTS (TL/Ha)		4320
OLIVE-D		108000
TEA---D		21600
CITRUS-I		16502
GRAPE-D		18619
GRAPE-I		16934
APPLE-I		46699
PEACH-I		25877
APRICOT-I		32789
CHERRY-I		29074
WILD CHERRY-I		200750
STRAWBERRY-I		315274
BANANA-I		27562
QUINCE-I		8640
PISTACHIO-D		8640
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=226.708 TL

TABLE IV.26: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1984)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13697.79	6459.54	2.121	43.08	1.0265
CORN	1515.56	272.92	5.553	46.79	1.1818
RYE	555.89	303.97	1.829	35.69	1.1016
BARLEY	6202.29	2002.23	3.098	39.25	1.0687
RICE	168	36.98	4.543	108.49	0.875
CHICK PEA	424.33	273.4	1.552	121.37	0.8631
DRY BEAN	68.58	46.88	1.463	148.48	0.9762
LENTIL	887.7	915.07	0.97	118.51	0.8792
POTATO	3200	232.36	13.772	62.19	0.9917
ONION	1100	58.5	18.804	66.52	1.012
GREEN PEPPER	665	34.7	19.166	63.28	1.1991
TOMATO	4000	110.24	36.285	49.68	1.121
CUCUMBER	675	30.55	22.092	61.16	1.3242
SUNFLOWER	889.31	817.21	1.088	90.84	0.9478
OLIVE	800	474.58	1.686	135.37	1.8502
GROUNDNUT	47.5	22.06	2.153	254.9	0.8979
SOYBEAN	60	18.07	3.321	76.67	2.0779
SESAME	45	41.64	1.081	291.46	0.8654
COTTON	927.96	639.95	1.45	426.48	0.9808
SUGAR BEET	11108.72	285.25	38.944	7.52	0.9676
TOBACCO	171.07	189.08	0.905	296.95	1.0111
TEA	568.93	105.62	5.387	101	0.8537
CITRUS	1334.3	58.36	22.864	37.97	1.0074
GRAPE	3300	584.56	5.645	98.99	1.2823
APPLE	1900	260.81	7.285	49.56	1.2461
PEACH	235	26.12	8.999	131.38	0.9182
APRICOT	200	41.28	4.845	145.88	1.2004
CHERRY	105	21.79	4.818	216.71	1.0261
WILD CHERRY	65	14.67	4.43	142.86	1.0193
MELON	4800	290.99	16.495	47.87	0.9014
STRAWBERRY	25	5.29	4.723	663.53	1.072
BANANA	35	1.4	25.084	1010.19	1.6094
QUINCE	59	7.79	7.572	75.8	1.2305
PISTACHIO	23	65.54	0.351	805.96	1.0037
HAZELNUT	300	337.72	0.888	196.41	0.9871
ALFALFA	1417.45	166.47	8.515	0	0.8963
FODDER	1408.07	521.56	2.7	0	0.6749

TABLE IV.27: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1984)

PRODUCTS	PRODUCTION (.000 Tons)	STOCK (000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	304.55	40391	7.54	324.62	1.0267
SHEEP-MILK	984.03	40391	24.362	86.01	1.0173
SHEEP-WOOL	50.87	40391	1.259	540.23	0.9775
SHEEP-HIDE	37.92	40391	0.939	678.64	2.4141
GOAT-MEAT	74.47	11127	6.693	258.22	0.977
GOAT-MILK	420.04	11127	37.749	73.68	0.9987
GOAT-WOOL	6.58	11127	0.592	336.94	0.9715
GOAT-HIDE	4.75	11127	0.427	678.64	1.5349
ANGORA-MEAT	3.56	1973	1.805	270.42	1.018
ANGORA-MILK	27.71	1973	14.043	73.68	0.9377
ANGORA-WOOL	3.22	1973	1.631	910.88	1.031
ANGORA-HIDE	0.25	1973	0.124	678.64	1.5188
BEEF	309.67	12410.08	24.953	281.33	0.9935
COW-MILK	2727.25	12410.08	219.761	80.75	1.0102
COW-HIDE	63.25	12410.08	5.097	254.91	1.5376
BUFALO-MEAT	19.73	544.16	36.255	273.77	1.1093
BUFALO-MILK	156.01	544.16	286.697	83.12	1.0056
BUFALO-HIDE	2.86	544.16	5.247	254.91	1.7609
POULTRY-MEAT	149.19	66613.46	2.24	312.5	1
EGGS	348.02	66613.46	5.224	370.8	1.1607

TABLE IV.28: TRADE OF PROCESSED PRODUCTS(1984)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	147.26	486.91	1115.13	1009.97	2504.94	522.04	1757.47
TRADEQ	428.27	67.79	-77.29	17.99	0.58	82.4	50

TABLE IV.29: FOREIGN TRADE QUANTITIES AND PRICES(1984)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	291.96	131.94	835.99	203.82
CORN	3.05	240.33	135.31	193.59
RYE	25.62	108.86	0	0
BARLEY	425.43	116.25	571.22	184.8
RICE	0.06	518.49	130.84	298.39
CHICK PEA	164.24	338	0	0
DRY BEAN	39.45	409.18	0	0
LENTIL	292.81	251.05	0	0
POTATO	72.96	126.89	1.73	232.22
ONION	109.45	121.72	0	0
GREEN PEPPER	1.77	276.84	0	0
TOMATO	132.2	145.9	0	0
CUCUMBER	0	0	0	0
SUNFLOWER	0	0	0	0
OLIVE	6.17	248.82	0	0
GROUNDNUT	6.78	821.95	0	0
SOYBEAN	0	0	745.23	959.02
SESAME	1.44	964.98	0	0
COTTON	336.59	1253.79	8.84	4275.33
SUGAR BEET	5311.6	158.14	4.58	181.33
TOBACCO	64.51	2407.39	0	0
TEA	0	0	0	0
CITRUS	246.27	148.09	0	0
GRAPE	12.9	199.12	0	0
APPLE	71.06	151.55	0	0
PEACH	5.61	251.05	0	0
APRICOT	132.29	327.32	0	0
CHERRY	0	0	0	0
WILD CHERRY	0.49	526.76	0	0
MELON	39.79	130.02	0	0
STRAWBERRY	0.47	286.03	0	0
BANANA	0	0	0	0
QUINCE	0.88	206.13	0	0
PISTACHIO	3.27	2987.84	0	0
HAZELNUT	5.83	965.29	0	0
SHEEP-MEAT	80	1265.18	0	0
SHEEP-MILK	0.01	295.71	0	0
SHEEP-WOOL	35.77	2545.74	20.22	6253.15
SHEEP-HIDE	0	0	8.5	1737.29
GOAT-MEAT	20.17	1176.28	0.09	1601.47
GOAT-MILK	0.01	295.71	0	0
GOAT-WOOL	1.1	574.51	0	0
GOAT-HIDE	3.93	1000	0.16	1372.13
ANGORA-MEAT	0	0	0	0
ANGORA-MILK	0.01	295.71	0	0
ANGORA-WOOL	2.3	5091.48	0	0
ANGORA-HIDE	0	0	0	0
BEEF	26.62	1117.73	0.76	1594.12
COW-MILK	5.78	295.71	35.29	1005.86
COW-HIDE	0.72	1139.99	3.52	2794.23
BUFALO-MEAT	0	0	0	0
BUFALO-MILK	0.01	295.71	0	0
BUFALO-HIDE	0.26	1075.17	0	0
POULTRY-MEAT	4.45	677.96	0	0
EGGS	54.61	521.25	1.22	602.34

TABLE IV.30: RESOURCE AVAILABILITY AND PRICES(1984)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3197.4	
IRR-GOOD	1123.8	
TREE	2273	
PASTURE	21000	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3082941	175
LABOR-2Q	3082941	175
LABOR-3Q	3082941	175
LABOR-4Q	3082941	175
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	228348	5.196
TRACTOR-2Q	228348	5.196
TRACTOR-3Q	228348	5.196
TRACTOR-4Q	228348	5.196
FERTILIZERS (Ton/$/Kg)		
NITROGEN	998384	0.19801
PHOSPHATE	574728	0.20348
LIVESTOCK (.000 Heads)		
SHEEP	40391	
GOAT	11127	
ANGORA	1973	
CATTLE	12410	
BUFFALO	544	
MULE	2062	
POULTRY	60472	

TABLE IV.30: RESOURCE AVAILABILITY AND PRICES(1984)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		69
CORN		100
RYE		61
BARLEY		65
RICE		160
CHICK PEA		150
DRY BEAN		194
LENTIL		82
POTATO		100
ONION		116
GREEN PEPPER		2
TOMATO		5
CUCUMBER		5092.5
SUNFLOWER		95
SUGAR BEET		442.5
GROUNDNUT		356
SOYBEAN		140
SESAME		240
COTTON		85
TOBACCO		0.09
MELON		1774.4
ALFALFA		700
FODDER		160
INVESTMENT COSTS (TL/Ha)		5184
OLIVE-D		129600
TEA---D		25920
CITRUS-I		19803
GRAPE-D		22343
GRAPE-I		20321
APPLE-I		56039
PEACH-I		31052
APRICOT-I		39347
CHERRY-I		34888
WILD CHERRY-I		240900
STRAWBERRY-I		378328
BANANA-I		33074
QUINCE-I		10368
PISTACHIO-D		10368
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=365.65 TL

TABLE IV.31: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1985)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	13538.51	6710.74	2.017	62.25	0.9766
CORN	1919.7	281.36	6.823	66	1.4521
RYE	552.06	291.06	1.897	52.62	1.1426
BARLEY	6202.29	2063.84	3.005	51.1	1.0368
RICE	162	35.82	4.522	156.22	0.871
CHICK PEA	506.67	316.19	1.602	232.67	0.8911
DRY BEAN	71.09	62.79	1.132	244.5	0.7556
LENTIL	962.46	881.12	1.092	236.5	0.9899
POTATO	4100	253.15	16.196	97	1.1663
ONION	1270	65.91	19.27	87	1.037
GREEN PEPPER	725	36.58	19.822	102.26	1.2401
TOMATO	4900	116.21	42.166	94	1.3027
CUCUMBER	780	32.21	24.217	90	1.4516
SUNFLOWER	1002.03	930.03	1.077	151	0.9384
OLIVE	600	477.26	1.257	232	1.3799
GROUNDNUT	59	20.34	2.901	290	1.21
SOYBEAN	125	38.89	3.214	121	2.0115
SESAME	45	40.72	1.105	426	0.8851
COTTON	828.77	555.74	1.491	466.86	1.0087
SUGAR BEET	9830.37	260.32	37.763	11	0.9382
TOBACCO	164.28	177.4	0.926	453.38	1.0349
TEA	624.08	109.86	5.681	140	0.9003
CITRUS	982.5	58.27	16.862	112.35	0.743
GRAPE	3300	584.56	5.645	144	1.2823
APPLE	1900	261.44	7.268	84	1.2431
PEACH	200	26.45	7.562	165	0.7716
APRICOT	170	44.76	3.798	178	0.941
CHERRY	130	22.41	5.8	161	1.2353
WILD CHERRY	85	15.2	5.593	144	1.287
MELON	5500	306.75	17.93	51.6	0.9798
STRAWBERRY	33.5	4.99	6.708	492.95	1.5227
BANANA	36	1.45	24.808	750.5	1.5918
QUINCE	68	7.86	8.647	141	1.4053
PISTACHIO	35	67.45	0.519	1060	1.484
HAZELNUT	180	344.56	0.522	458.6	0.5805
ALFALFA	1573.58	169.19	9.301	0	0.979
FODDER	1376.53	565.34	2.435	0	0.6087

TABLE IV.32: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1985)

PRODUCTS	PRODUCTION (000 Tons)	STOCK (000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	304.55	40391	7.54	441.49	1.0267
SHEEP-MILK	984.03	40391	24.362	156	1.0173
SHEEP-WOOL	50.87	40391	1.259	802	0.9775
SHEEP-HIDE	37.92	40391	0.939	989.64	2.4141
GOAT-MEAT	74.47	11127	6.693	351.17	0.977
GOAT-MILK	420.04	11127	37.749	156	0.9987
GOAT-WOOL	6.58	11127	0.592	491	0.9715
GOAT-HIDE	4.75	11127	0.427	333.88	1.5349
ANGORA-MEAT	3.56	1973	1.805	367.78	1.018
ANGORA-MILK	27.71	1973	14.043	156	0.9377
ANGORA-WOOL	3.22	1973	1.631	3357	1.031
ANGORA-HIDE	0.25	1973	0.124	989.64	1.5188
BEEF	309.67	12410.08	24.953	381.81	0.9935
COW-MILK	2727.25	12410.08	219.761	135	1.0102
COW-HIDE	63.25	12410.08	5.097	260.73	1.5376
BUFALO-MEAT	19.73	544.16	36.255	371.55	1.1093
BUFALO-MILK	156.01	544.16	286.697	135	1.0056
BUFALO-HIDE	2.86	544.16	5.247	260.73	1.7609
POULTRY-MEAT	149.19	66613.46	2.24	476.34	1
EGGS	358.99	66613.46	5.389	480	1.1972

TABLE IV.33: TRADE OF PROCESSED PRODUCTS(1985)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	141.57	443.36	812.66	1106.39	2311.29	572.74	2293.93
TRADEQ	259.33	73.71	-66.61	-3.03	1.83	90.73	70

TABLE IV.34: FOREIGN TRADE QUANTITIES AND PRICES(1985)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	268.92	151.96	731.43	180.84
CORN	10.51	111.83	102.56	216.68
RYE	1.74	185.78	0	0
BARLEY	243.76	119.52	111.96	175.34
RICE	0.09	352.69	131.35	271.36
CHICK PEA	194.62	378.59	0	0
DRY BEAN	19.62	494.98	0	0
LENTIL	125.7	464.38	0	0
POTATO	11.19	130.64	8.69	208.61
ONION	131.31	95.62	0.4	100.47
GREEN PEPPER	2.08	297.3	0	0
TOMATO	158.82	133.36	0	0
CUCUMBER	0	0	0	0
SUNFLOWER	0.03	477.13	1.29	6559.68
OLIVE	1.05	531.28	0	0
GROUNDNUT	5.06	717.82	0	0
SOYBEAN	0	0	669.7	352.52
SESAME	0	0	0	0
COTTON	390.26	1020.47	15.38	4451.31
SUGAR BEET	2803.88	183.85	12.42	224.59
TOBACCO	90.87	2523.59	0	0
TEA	0	0	0	0
CITRUS	201.73	184.01	0	0
GRAPE	14.99	192.26	1.01	300.3
APPLE	69.93	143.31	0	0
PEACH	5.64	227.8	0	0
APRICOT	77.15	234.85	0	0
CHERRY	0	0	0	0
WILD CHERRY	0.35	594.83	0	0
MELON	52.16	93.31	0	0
STRAWBERRY	0.39	239.22	0	0
BANANA	0.02	875.53	0	0
QUINCE	0.98	221.16	0	0
PISTACHIO	8.16	2174.95	0	0
HAZELNUT	0.72	1131.79	0	0
SHEEP-MEAT	80	1205.39	1.06	1522.3
SHEEP-MILK	0.03	432.86	0	0
SHEEP-WOOL	45.3	2577.37	20.46	5362.2
SHEEP-HIDE	0	0	8.84	1613.24
GOAT-MEAT	17.21	1187.82	0	0
GOAT-MILK	0.01	432.86	0	0
GOAT-WOOL	1.19	588.26	0	0
GOAT-HIDE	4.66	1174.73	0.57	1423.34
ANGORA-MEAT	0	0	0	0
ANGORA-MILK	0.01	432.86	0	0
ANGORA-WOOL	1.98	4684.21	0	0
ANGORA-HIDE	0	0	0	0
BEEF	6.87	1091.08	37.71	1586.41
COW-MILK	7.63	432.86	98.83	836.98
COW-HIDE	0	0	4.71	2792.05
BUFALO-MEAT	0.03	1091.08	0.05	1552.97
BUFALO-MILK	0.02	432.86	0	0
BUFALO-HIDE	0.84	1174.73	2.4	1423.34
POULTRY-MEAT	2.05	1171.64	0	0
EGGS	42.78	471.75	2.22	889.42

TABLE IV.35: RESOURCE AVAILABILITY AND PRICES(1985)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3256.2	
IRR-GOOD	1153.2	
TREE	2302	
PASTURE	21500	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3085000	250
LABOR-2Q	3085000	250
LABOR-3Q	3085000	250
LABOR-4Q	3085000	250
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	239501	5.174
TRACTOR-2Q	239501	5.174
TRACTOR-3Q	239501	5.174
TRACTOR-4Q	239501	5.174
FERTILIZERS (Ton/$/Kg)		
NITROGEN	920568	0.23455
PHOSPHATE	476013	0.23627
LIVESTOCK (.000 Heads)		
SHEEP	40391	
GOAT	11127	
ANGORA	1973	
CATTLE	12410	
BUFFALO	544	
MULE	2062	
POULTRY	60472	

TABLE IV.35: RESOURCE AVAILABILITY AND PRICES(1985)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		91
CORN		700
RYE		81
BARLEY		87
RICE		250
CHICK PEA		350
DRY BEAN		452
LENTIL		316
POTATO		150
ONION		174
GREEN PEPPER		2.5
TOMATO		6
CUCUMBER		7513.6
SUNFLOWER		195
SUGAR BEET		647.3
GROUNDNUT		404.9
SOYBEAN		200
SESAME		420
COTTON		110
TOBACCO		0.13
MELON		1887.2
ALFALFA		1325
FODDER		200
INVESTMENT COSTS (TL/Ha)		6221
OLIVE-D		155520
TEA---D		31104
CITRUS-I		23763
GRAPE-D		26812
GRAPE-I		24386
APPLE-I		67247
PEACH-I		37263
APRICOT-I		47216
CHERRY-I		41866
WILD CHERRY-I		289081
STRAWBERRY-I		453994
BANANA-I		36689
QUINCE-I		12442
PISTACHIO-D		12442
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=521.86 TL

TABLE IV.36: DOMESTIC AREA, YIELDS, PRODUCTION AND FARMGATE PRICES(1986)

PRODUCTS	PRODUCTION (.000 Tons)	AREA (.000Ha)	YIELDS (Ton/Ha)	PRICES (TL/Kg)	RYIELD 1979=1
WHEAT	15131.27	6710.74	2.255	79.5	1.0915
CORN	2323.85	277.88	8.363	81	1.7798
RYE	533.68	272.19	1.961	65.24	1.1812
BARLEY	6679.39	2059.53	3.243	64	1.1189
RICE	165	31.78	5.192	339	1
CHICK PEA	798	423.17	1.886	284	1.0487
DRY BEAN	71.09	64.05	1.11	465.9	0.7407
LENTIL	1323.77	1106.94	1.196	354	1.0838
POTATO	4000	239.7	16.687	85	1.2017
ONION	1300	56.94	22.832	64	1.2288
GREEN PEPPER	738	36.02	20.487	248.35	1.2817
TOMATO	5000	114.45	43.687	140	1.3497
CUCUMBER	750	31.72	23.643	198	1.4171
SUNFLOWER	1177.39	996.56	1.181	175	1.029
OLIVE	1010	485.63	2.08	287	2.2827
GROUNDNUT	50	21.1	2.369	414	0.9881
SOYBEAN	200	58.08	3.444	161	2.1549
SESAME	45	46.27	0.973	704	0.7788
COTTON	828.77	492.59	1.682	641.94	1.138
SUGAR BEET	10662.68	281.9	37.825	16	0.9397
TOBACCO	163.81	189.24	0.866	915.83	0.9674
TEA	689.05	136.98	5.03	461.61	0.7973
CITRUS	1396	60.75	22.978	150.14	1.0124
GRAPE	3000	561.18	5.346	209	1.2143
APPLE	1865	260.15	7.169	122	1.2263
PEACH	275	27.04	10.169	208	1.0377
APRICOT	300	44.76	6.702	245	1.6606
CHERRY	140	22.95	6.099	248	1.299
WILD CHERRY	80	14.84	5.39	188	1.2404
MELON	5000	302.11	16.55	109.4	0.9044
STRAWBERRY	35	4.99	7.008	759.33	1.5909
BANANA	35	1.45	24.219	1156.04	1.5539
QUINCE	75	7.87	9.535	160	1.5495
PISTACHIO	30	67.06	0.447	1488	1.2795
HAZELNUT	300	341.45	0.879	677.8	0.9763
ALFALFA	1726.29	184.07	9.378	0	0.9872
FODDER	1372.88	558.07	2.46	0	0.615

TABLE IV.37: ANIMAL STOCK, YIELDS, PRODUCTION AND FARMGATE PRICES(1986)

PRODUCTS	PRODUCTION (000 Tons)	STOCK (000 Heads)	YIELDS (Kg/Head)	PRICES (TL/Kg)	RYIELD 1979=1
SHEEP-MEAT	378.2	48707	7.765	509.12	1.0573
SHEEP-MILK	1187.52	48707	24.381	181	1.0181
SHEEP-WOOL	62.3	48707	1.279	1045	0.9928
SHEEP-HIDE	32.95	48707	0.676	1745.13	1.7394
GOAT-MEAT	93.36	13615	6.857	404.97	1.001
GOAT-MILK	511.62	13615	37.578	181	0.9942
GOAT-WOOL	8.6	13615	0.632	584	1.0376
GOAT-HIDE	6.59	13615	0.484	1745.13	1.7425
ANGORA-MEAT	5.77	3117	1.852	424.12	1.0445
ANGORA-MILK	47.31	3117	15.177	181	1.0135
ANGORA-WOOL	4.56	3117	1.462	3336	0.924
ANGORA-HIDE	0.54	3117	0.173	1745.13	2.1149
BEEF	339.86	14099.09	24.105	489.54	0.9597
COW-MILK	3074.05	14099.09	218.032	156	1.0023
COW-HIDE	58.51	14099.09	4.15	461.61	1.252
BUFALO-MEAT	24.81	758.22	32.724	476.38	1.0012
BUFALO-MILK	219.1	758.22	288.969	156	1.0135
BUFALO-HIDE	2.67	758.22	3.521	461.61	1.1815
POULTRY-MEAT	143.31	63986.95	2.24	605.36	1
EGGS	335.07	63986.95	5.236	620	1.1633

TABLE IV.38: TRADE OF PROCESSED PRODUCTS(1986)

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5	3	5	5.25	4	2.2
TPRICE	153.94	413.92	556.34	858.07	1927.28	728.18	2619.34
TRADEQ	178.27	100.83	-29.15	16.31	0.76	108.16	120

TABLE IV.39: FOREIGN TRADE QUANTITIES AND PRICES(1986)

	EXP-Q (.000 Ton)	EXP-P ($/Ton)	IMP-Q (.000 Ton)	IMP-P ($/Ton)
WHEAT	16.17	96.18	788.17	146.57
CORN	7.27	101.43	190.61	183.4
RYE	1.33	178.28	0	0
BARLEY	64.6	92.69	0	0
RICE	0	0	141.14	205.57
CHICK PEA	253.75	336.4	0	0
DRY BEAN	10.85	507.03	0	0
LENTIL	251.84	446.26	0	0
POTATO	8.42	120.97	0.37	297.36
ONION	164.5	64.44	0	0
GREEN PEPPER	2.86	357.63	0	0
TOMATO	165.75	140.57	0	0
CUCUMBER	0	0	0	0
SUNFLOWER	0	0	0	0
OLIVE	1.21	517.82	0	0
GROUNDNUT	2.22	701.25	0.02	893.84
SOYBEAN	0	0	413.36	931.69
SESAME	0	0	7.63	910.64
COTTON	594.26	739.89	104.53	1286.05
SUGAR BEET	82.29	108.07	13.64	95.49
TOBACCO	60.27	2594.09	0	0
TEA	0	0	0	0
CITRUS	201.04	175.21	14.77	174.18
GRAPE	15.45	192.51	6.24	322.59
APPLE	54.99	139.78	0	0
PEACH	5.27	196.93	0	0
APRICOT	116.02	282.75	0	0
CHERRY	0	0	0	0
WILD CHERRY	0.45	459.39	0	0
MELON	37.95	157.01	0	0
STRAWBERRY	0.51	442.1	0	0
BANANA	0	0	0	0
QUINCE	1.28	218.09	0	0
PISTACHIO	6.61	2557.08	0	0
HAZELNUT	0.25	1880.64	0	0
SHEEP-MEAT	164.81	1063.33	9.99	1434.39
SHEEP-MILK	0.02	434.07	0	0
SHEEP-WOOL	34	1723.37	24.04	5142.67
SHEEP-HIDE	0	0	28.45	1912.68
GOAT-MEAT	16.12	1207.68	0	0
GOAT-MILK	0.01	434.07	0	0
GOAT-WOOL	2.05	666.55	0	0
GOAT-HIDE	0	0	0	0
ANGORA-MEAT	0	0	0	0
ANGORA-MILK	0.01	434.07	0	0
ANGORA-WOOL	2.03	3446.74	0	0
ANGORA-HIDE	0	0	0	0
BEEF	3.52	1439.05	29.51	1435.82
COW-MILK	7.29	434.07	67.59	1273.48
COW-HIDE	0	0	6.83	3093.1
BUFALO-MEAT	0	0	0	0
BUFALO-MILK	0.01	434.07	0	0
BUFALO-HIDE	0	0	3.46	2185.22
POULTRY-MEAT	2.36	1124.41	0	0
EGGS	21.44	415.78	0	0

TABLE IV.40: RESOURCE AVAILABILITY AND PRICES(1986)

	QUANTITY	PRICE
LAND (.000 Hectars)		
DRY-EITH	16955.56	
DRY-GOOD	11812.02	
IRR-EITH	3315	
IRR-GOOD	1182.6	
TREE	2304	
PASTURE	21746	
LABOR (.000 Hours/TL/Hour)		
LABOR-1Q	3085000	312.5
LABOR-2Q	3085000	312.5
LABOR-3Q	3085000	312.5
LABOR-4Q	3085000	312.5
TRACTOR (.000 Hours/$/Hour)		
TRACTOR-1Q	251295	6.248
TRACTOR-2Q	251295	6.248
TRACTOR-3Q	251295	6.248
TRACTOR-4Q	251295	6.248
FERTILIZERS (Ton/$/Kg)		
NITROGEN	953181	0.25424
PHOSPHATE	519677	0.24219
LIVESTOCK (.000 Heads)		
SHEEP	48707	
GOAT	13615	
ANGORA	3117	
CATTLE	14099	
BUFFALO	758	
MULE	2062	
POULTRY	63987	

TABLE IV.40: RESOURCE AVAILABILITY AND PRICES(1986)

	QUANTITY	PRICE
SEED (TL/Kg)		
WHEAT		122
CORN		800
RYE		109
BARLEY		113
RICE		275
CHICK PEA		400
DRY BEAN		516
LENTIL		550
POTATO		200
ONION		232
GREEN PEPPER		3
TOMATO		8
CUCUMBER		16529.8
SUNFLOWER		250
SUGAR BEET		941.6
GROUNDNUT		578
SOYBEAN		280
SESAME		600
COTTON		180
TOBACCO		0.26
MELON		2000
ALFALFA		1400
FODDER		250
INVESTMENT COSTS (TL/Ha)		7465
OLIVE-D		186624
TEA---D		37325
CITRUS-I		28516
GRAPE-D		32174
GRAPE-I		29263
APPLE-I		80696
PEACH-I		44715
APRICOT-I		56659
CHERRY-I		501239
WILD CHERRY-I		346897
STRAWBERRY-I		544793
BANANA-I		47626
QUINCE-I		14930
PISTACHIO-D		14930
HAZELNUT-D		6000

Note: I=Irrigated, D=Dry
Seed prices for cucumbers and melons are TL/.000 seedlings
Exchange Rate is 1US$=672.19 TL

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986)

INPUT\ACTIVITY	SWHEATD	FWHEATD	SWHEATI	SCORN-D	FCORN-D
DRY-GOOD	1	0	0	1	1
DRY-EITH	1	2	0	1	2
IRR-EITH	0	0	1	0	0
A-WHEAT-	1	1	1	0	0
A-CORN--	0	0	0	1	1
FALLOW	0	1	0	0	1
LABOR-1Q	0.8	18	1.4	14	42
LABOR-2Q	4	27.4	28.9	87.4	53.7
LABOR-3Q	28.3	25.2	45.9	75.6	75.6
LABOR-4Q	46.4	31.2	52.8	0	5.7
ANIMAL-1Q	0	14	0	14	28
ANIMAL-2Q	2	26	4	19.2	19.6
ANIMAL-3Q	27	24	43	3.6	13.6
ANIMAL-4Q	43	30	49	0	0
NITROGEN	75	48.4	60.8	48	41
PHOSPHATE	56.7	62.2	67	60	70
S-WHEAT	193.3	186.8	188	0	0
WHEAT	1.55	2	3.4	0	0
F-WHEAT	1.85	2.4	4.1	0	0
S-CORN	0	0	0	60	54
CORN	0	0	0	2.5	3.3
F-CORN	0	0	0	3.4	4.4

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SCORN-I	SRYE--D	FRYE--D	SRICE-I	FRICE-I
DRY-GOOD	0	1	0	0	0
DRY-EITH	0	1	2	0	0
IRR-EITH	1	0	0	1	1.33
IRR-GOOD	0	0	0	1	0
A-CORN--	1	0	0	0	0
A-RYE---	0	1	1	0	0
A-RICE--	0	0	0	1	1
FALLOW	0	0	1	0	0.33
LABOR-1Q	88	11.2	22.4	0	0
LABOR-2Q	258.3	32.7	64.7	360	400
LABOR-3Q	177.6	22.3	11.3	95	105
LABOR-4Q	64.9	29.2	36.2	0	0
ANIMAL-1Q	88	11	22	0	0
ANIMAL-2Q	17	32	64	90	100
ANIMAL-3Q	0	21	10	23	25
ANIMAL-4Q	35	28	35	0	0
NITROGEN	66	40	38.5	115	100
PHOSPHATE	32.5	50	55	45	50
S-CORN	60	0	0	0	0
CORN	5.4	0	0	0	0
F-CORN	9.4	0	0	0	0
S-RYE	0	175.4	136.5	0	0
RYE	0	1.66	2	0	0
F-RYE	0	1.8	2.3	0	0
S-RICE	0	0	0	110	120
RICE	0	0	0	4	5.2

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SBARLYD	FBARLYD	SCKPEAD	SCKPEAI	SDBEANI
DRY-GOOD	1	0	1	0	0
DRY-EITH	1	2	1	0	0
IRR-EITH	0	0	0	1	1
A-BARLEY	1	1	0	0	0
FALLOW	0	1	0	0	0
A-CHKPEA	0	0	1	1	0
A-DRBEAN	0	0	0	0	1
LABOR-1Q	2.5	8	27	14	19
LABOR-2Q	1	38.2	56.4	289	223.7
LABOR-3Q	168.1	19.4	88.1	165.2	238.8
LABOR-4Q	20.1	27.2	28	14	57.7
ANIMAL-1Q	0	8	27	14	19
ANIMAL-2Q	0	38	15	30	44
ANIMAL-3Q	95	18	4	15	31
ANIMAL-4Q	17	26	28	14	40
NITROGEN	42	40.4	20	27	30
PHOSPHATE	50	55	50	69	62.5
S-BARLEY	250	184	0	0	0
BARLEY	2.5	2.9	0	0	0
F-BARLEY	2.8	3.4	0	0	0
S-CHICKPEA	0	0	140	100	0
CHICK-PEA	0	0	1.2	2.5	0
F-PULSES	0	0	1.1	2.16	2.7
S-DRY-BEAN	0	0	0	0	110
DRY-BEAN	0	0	0	0	1.498

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SLENTLD	SPOTATI	SONIOND	SONIONI	SGPEPPI
DRY-GOOD	1	0	1	0	0
IRR-EITH	0	1	0	1	1
DRY-EITH	1	0	1	0	0
A-LENTIL	1	0	0	0	0
A-POTATO	0	1	0	0	0
A-ONION-	0	0	1	1	0
A-GRPEPR	0	0	0	0	1
LABOR-1Q	5	16	197	197.6	33
LABOR-2Q	67.7	315.7	205.6	416.7	331.4
LABOR-3Q	143.8	324.4	527.2	565.3	1040.2
LABOR-4Q	10.4	176.2	0	48.6	0
ANIMAL-1Q	5	16	57	87	33
ANIMAL-2Q	33	53	0	10	68
ANIMAL-3Q	52	47	33	44	56
ANIMAL-4Q	10	101	0	27	0
NITROGEN	21.3	70.6	60	88.5	110
PHOSPHATE	8.3	84	80	102	110
S-LENTIL	99	0	0	0	0
LENTIL	1.103	0	0	0	0
F-PULSES	1.1	0	0	0	0
S-POTATO	0	1555	0	0	0
POTATO	0	13.886	0	0	0
S-ONOIN	0	0	31	22	0
ONION	0	0	9.2	18.6	0
S-GR-PEPPR	0	0	0	0	36000
GR-PEPPER	0	0	0	0	15.983

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	STOMATI	SCUCUMI	SSUNFLD	SSUNFLI	SGRNUTI
IRR-EITH	1	1	0	1	1
DRY-EITH	0	0	1	0	0
DRY-GOOD	0	0	1	0	0
IRR-GOOD	0	0	0	0	1
A-TOMATO	1	0	0	0	0
A-CUCUMB	0	1	0	0	0
A-SUNFLR	0	0	1	1	0
A-GRDNUT	0	0	0	0	1
LABOR-1Q	126.9	41	35.2	41.8	59
LABOR-2Q	728.8	262.9	132.1	104.7	304
LABOR-3Q	1067.4	948.4	21.3	21.9	353.3
LABOR-4Q	105.3	34	0	8	371.5
ANIMAL-1Q	57	41	34	38	57
ANIMAL-2Q	54	19	17	10	75
ANIMAL-3Q	122	95	19	0	6
ANIMAL-4Q	42	34	0	6	39
NITROGEN	118	80	30	40	50
PHOSPHATE	75.5	90	30	40	50
S-TOMATO	2667	0	0	0	0
TOMATO	32.367	0	0	0	0
S-CUCUMBER	0	5.5	0	0	0
CUCUMBER	0	16.687	0	0	0
S-SUNFLWER	0	0	10	11.5	0
SUNFLOWER	0	0	1.148	1.7	0
S-GROUNDNT	0	0	0	0	100
GROUNDNUT	0	0	0	0	2.397

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SSBEANI	SSESAMI	SCOTTNI	STOBACD	SMELOND
IRR-EITH	1	1	1	0	0
IRR-GOOD	0	0	1	0	0
DRY-GOOD	0	0	0	1	0
DRY-EITH	0	0	0	1	1
A-SBEAN-	1	0	0	0	0
A-SESAME	0	1	0	0	0
A-COTTON	0	0	1	0	0
A-TOBACO	0	0	0	1	0
A-MELON-	0	0	0	0	1
LABOR-1Q	0	0	41	26	11.7
LABOR-2Q	0	188.3	317.8	476.5	28.5
LABOR-3Q	142.3	111.8	421.6	662.2	353.8
LABOR-4Q	257.7	58.9	403.7	378.2	83.5
ANIMAL-1Q	0	0	41	26	10
ANIMAL-2Q	0	54.5	121	90	26
ANIMAL-3Q	50.2	21.5	64	15	96
ANIMAL-4Q	61.8	42	41	20	0
NITROGEN	60	120	160	28	30
PHOSPHATE	0	40	100	21	20
S-SOYABEAN	15	0	0	0	0
SOYABEAN	2.1	0	0	0	0
S-SESAME	0	70	0	0	0
SESAME	0	1.248	0	0	0
S-COTTON	0	0	75	0	0
COTTON	0	0	1.479	0	0
S-TOBACCO	0	0	0	200000	0
TOBACCO	0	0	0	0.8948	0
S-MELON	0	0	0	0	6.9
MELON	0	0	0	0	10.4

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SMELONI	SALFALI	SFODDRD	SSBEETI	PASTURE
IRR-EITH	1	1	0	1	0
DRY-GOOD	0	0	1	0	0
DRY-EITH	0	0	1	0	0
A-MELON-	1	0	0	0	0
A-ALFALF	0	1	0	0	0
A-FODDER	0	0	1	0	0
A-SRBEET	0	0	0	1	0
PASTURE	0	0	0	0	1
LABOR-1Q	42	0	15	43.4	3
LABOR-2Q	173.7	85	40.5	470.6	6
LABOR-3Q	320.3	185.5	68.5	184.6	4
LABOR-4Q	16	0	0	362.9	2
ANIMAL-1Q	42	0	15	41.7	0
ANIMAL-2Q	58	50	35	28.9	0
ANIMAL-3Q	98	33	20	58.7	0
ANIMAL-4Q	16	0	0	89.3	0
NITROGEN	54	10	30	153.4	0
PHOSPHATE	63	10	0	144.9	0
S-MELON	4.5	0	0	0	0
MELON	18.3	0	0	0	0
S-ALFALFA	0	15	0	0	0
F-ALFALFA	0	5	0	0	0
ALFALFA	0	9.5	0	0	0
S-FODDER	0	0	30	0	0
FODDER	0	0	4	0	0
F-FODDER	0	0	1.5	0	0
S-SUG-BEET	0	0	0	10	0
SUG-BEET	0	0	0	40.25	0
PASTFEED	0	0	0	0	0.22

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	OLIVE-D	TEA---D	CITRS-I	GRAPE-D	GRAPE-I
TREE	1	1	1	1	1
A-OLIVE-	1	0	0	0	0
A-TEA---	0	1	0	0	0
A-CITRUS	0	0	1	0	0
A-GRAPE-	0	0	0	1	1
LABOR-1Q	42.8	12	711.7	158.7	203.9
LABOR-2Q	36.1	74	368.6	185.5	279.2
LABOR-3Q	1.9	55	190	347	417.3
LABOR-4Q	139.6	15	515.3	77.9	162.4
ANIMAL-1Q	30.4	0	45.6	0	39
ANIMAL-2Q	30.4	2	0	55	79
ANIMAL-3Q	0	0	0	44	37
ANIMAL-4Q	19	0	45.6	28	52
NITROGEN	7.6	25.9	152	25	50
PHOSPHATE	5.7	7.5	152	40	80
OLIVE	0.911	0	0	0	0
TEA	0	6.309	0	0	0
CITRUS	0	0	22.696	0	0
GRAPE	0	0	0	3.829	4.98

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	APPLE-I	PEACH-I	APRIC-I	CHERR-I	WCHER-I
TREE	1	1	1	1	1
A-APPLE-	1	0	0	0	0
A-PEACH-	0	1	0	0	0
A-APRICO	0	0	1	0	0
A-CHERRY	0	0	0	1	0
A-WDCHER	0	0	0	0	1
LABOR-1Q	69.9	103.9	107.2	256.5	85.1
LABOR-2Q	101.2	63.4	419.3	1365.7	340
LABOR-3Q	220.6	632.5	234.1	58	1151.3
LABOR-4Q	112.6	101.9	40	30	30
ANIMAL-1Q	0	0	0	137	0
ANIMAL-2Q	61.6	0	181	172	244
ANIMAL-3Q	74.8	77	9	0	28
ANIMAL-4Q	23.8	39.3	0	0	0
NITROGEN	15.8	6.2	40	50	50
PHOSPHATE	30.8	23.1	50	40	80
APPLE	5.846	0	0	0	0
PEACH	0	9.799	0	0	0
APRICOT	0	0	4.035	0	0
CHERRY	0	0	0	4.695	0
WILDCHERRY	0	0	0	0	4.345

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	STBER-I	BANAN-I	QUINC-I	PISTA-D	HAZEL-D
TREE	1	1	1	1	1
A-SBERRY	1	0	0	0	0
A-BANANA	0	1	0	0	0
A-QUINCE	0	0	1	0	0
A-PISTAC	0	0	0	1	0
A-HAZELN	0	0	0	0	1
LABOR-1Q	102.4	86	66.8	159	113
LABOR-2Q	1580.6	894	161.5	18	113
LABOR-3Q	77.5	285	159.4	170	591
LABOR-4Q	281	972.5	165.4	154.4	113
ANIMAL-1Q	0	0	0	120	0
ANIMAL-2Q	8.6	0	93.5	18	0
ANIMAL-3Q	8.1	0	0	10	10
ANIMAL-4Q	31.5	127	22.6	0	0
NITROGEN	24.8	400	27.5	0	130
PHOSPHATE	0	240	55	20	1.7
STRAWBERRY	4.405	0	0	0	0
BANANA	0	15.585	0	0	0
QUINCE	0	0	6.153	0	0
S-PISTACHI	0	0	0	15	0
PISTACHIO	0	0	0	0.3496	0
HAZELNUT	0	0	0	0	0.9

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
LABOR	11.53	10.53	10.2	120	120
ANIMAL	0	0	0	38	52
TENE	115.6	119.5	147.7	436.2	549.7
TPAST	8	8	8	8	8
TGRCONOIL	32	30	30	40	40
TGROIL	26	26	26	32	35
TOIL	1	1	1	1	1
TSTRAW	10	10	8	12	12
TFODD	4	4	2	6	5
SHEEP-MEAT	7.34	0	0	0	0
SHEEP-MILK	23.95	0	0	0	0
SHEEP-WOOL	1.29	0	0	0	0
SHEEP-HIDE	0.389	0	0	0	0
GOAT-MEAT	0	6.85	0	0	0
GOAT-MILK	0	37.8	0	0	0
GOAT-WOOL	0	0.609	0	0	0
GOAT-HIDE	0	0.278	0	0	0
ANGOR-MEAT	0	0	1.773	0	0
ANGOR-MILK	0	0	14.975	0	0
ANGOR-WOOL	0	0	1.582	0	0
ANGOR-HIDE	0	0	0.0826	0	0
BEEF	0	0	0	25.11	0
COW-MILK	0	0	0	217.54	0
COW-HIDE	0	0	0	3.315	0
BUFAL-MEAT	0	0	0	0	32.68
BUFAL-MILK	0	0	0	0	285.2
BUFAL-HIDE	0	0	0	0	2.98

TABLE IV.41: BASIC PRODUCTION COEFFICIENTS (1979-1986) (cont.)

INPUT\ACTIVITY	MULE	POULTRY
LABOR	78	5
ANIMAL	120	0
TENE	347.5	25
TPAST	10	4
TGRCONOIL	10	72
TGROIL	5	65
TOIL	1	4
TSTRAW	10	5
TFODD	4.5	0
POLTR-MEAT	0	2.24
EGGS	0	4.501

TABLE IV.42: FEED SUPPLY COEFFICIENTS OF BY-PRODUCTS(1979-1986)

PRODUCT	CONCENTRATE	OIL SEED	ENERGY
WHEAT	0.15		0.50
RYE	0.10		0.24
BARLEY	0.15		0.60
SUG-BEET	0.05		0.60
SUNFLOWER		0.26	0.53
GROUNDNUT		0.10	0.56
COTTON		0.40	0.56
SOYBEAN		0.20	0.68
F-WHEAT			0.13
F-CORN			0.15
F-RYE			0.17
F-BARLEY			0.23
F-PULSES			0.19
F-ALFALFA			0.30
F-FODDER			0.40
ALFALFA			0.30
FODDER			0.40

TABLE IV.43: INPUT REQUIREMENTS FOR HARVESTING AND FEEDING STRAW(1979-1986)

INPUT	HOURS/Ha
LABOR-1Q	8.
LABOR-2Q	3.
LABOR-3Q	25.
LABOR-4Q	5.
TRACTOR-3Q	1.

TABLE IV.44: ENERGY REQUIREMENTS PER YIELD UNIT(1979-1986)

PRODUCT	ENERGY/YIELD
SHEEP-MEAT	1.5
SHEEP-MILK	0.4
GOAT-MEAT	1.6
GOAT-MILK	0.4
ANGOR-MEAT	2.0
ANGOR-MILK	0.5
BEEF	1.8
COW-MILK	0.4
BUFAL-MEAT	2.0
BUFAL-MILK	0.5
POLTR-MEAT	2.5
EGGS	3.5

TABLE IV.45: ABSOLUTE FEED REQUIREMENTS (Kg./Head)(1979-1986)

LIVESTOCK	FEED REQ.
SHEEP	95.
GOAT	94.
ANGORA	102.
CATTLE	290.
BUFFALO	340.
MULE	280.
POULTRY	10.

TABLE IV.46: ENERGY SUPPLY AND MINIMUM SHARES IN FEED OF GRAIN(1979-1986)

GRAINS	ENERGY SUPPLY	MINIMIUM SHARE %
WHEAT	0.72	0.30
CORN	0.78	0.11
RYE	0.65	0.04
BARLEY	0.71	0.51

TABLE I.47: PROCESSING FOR CONSUMPTION (1979-1986)

PRODUCTS	PROCESSING FACTOR(%)	PROCESSING COST($/Ton)
WHEAT	0.85	47.95
CORN	0.90	44.55
RYE	0.90	43.15
BARLEY	0.65	0
RICE	0.90	89.77
SUNFLOWER	0.33	290.18
OLIVE	0.20	290.18
SOYABEAN	0.18	290.18
SESAME	0.40	290.18
SUG-BEET	0.11	98.50
TEA	0.19	241.42

TABLE IV.48 : DEMAND PRICE AND INCOME ELASTICITIES (1979-1986)

PRODUCTS	PRICE ELASTICITY	INCOME ELASTICITY
WHEAT	-0.337	0
CORN	-0.3	0
RYE	-0.2	0
BARLEY	-0.25	0
RICE	-0.2	0.38
CHICK PEA	-0.31	0.6
DRY BEAN	-0.31	0.6
LENTIL	-0.31	0.6
POTATO	-0.2	0.3
ONION	-0.189	0.6
GREEN PEPPER	-0.189	0.6
TOMATO	-0.189	0.6
CUCUMBER	-0.189	0.6
SUNFLOWER	-0.302	0.6
OLIVE	-0.305	0.6
GROUNDNUT	-0.305	0.6
SOYBEAN	-0.305	0.6
SESAME	-0.305	0.6
COTTON	-0.3	0.5
SUGAR BEET	-0.303	0.6
TOBACCO	-0.3	0.5
TEA	-0.5	0.5
CITRUS	-0.197	0.75
GRAPE	-0.13	0.1
APPLE	-0.14	0.8
PEACH	-0.14	0.8
APRICOT	-0.14	0.8
CHERRY	-0.14	0.8
WILD CHERRY	-0.14	0.8
MELON	-0.189	0.6
STRAWBERRY	-0.14	0.8
BANANA	-0.14	0.8
QUINCE	-0.14	0.8
PISTACHIO	-0.4	0.5
HAZELNUT	-0.4	0.5
SHEEP-MEAT	-0.5	1.2
SHEEP-MILK	-0.3	0.95
SHEEP-WOOL	-0.2	1.18
SHEEP-HIDE	-0.365	1.18
GOAT-MEAT	-0.5	1.2
GOAT-MILK	-0.3	0.95
GOAT-WOOL	-0.2	1.18
GOAT-HIDE	-0.365	1.18
ANGORA-MEAT	-0.5	1.2
ANGORA-MILK	-0.3	0.95
ANGORA-WOOL	-0.2	1.18
ANGORA-HIDE	-0.365	1.18
BEEF	-0.365	0.45
COW-MILK	-0.5	1.75
COW-HIDE	-0.365	1.18
BUFALO-MEAT	-0.5	0.45
BUFALO-MILK	-0.5	1.75
BUFALO-HIDE	-0.365	1.18
POULTRY-MEAT	-0.605	0.9
EGGS	-0.6	0.85

TASM DATA PREPARATION MODULES

V. TASM DATA PREPARATION MODULES

This manual provides a description of the various program modules that have been written to facilitate the use of the TASM - **Turkey: Agricultural Model** on IBM-PC Compatible micro-computers. The modules are essentially menu driven programs to be integrated into spread sheets that are commercially available. It is assumed that the user is familiar with the disk operating system and its file management capabilities; therefore, no attempt will be made to provide detailed explanations for saving, retrieving, renaming and deleting data and program files. The descriptions to be provided will be strictly reserved for the four program modules and the menus associated with each.

The four modules are:

1. ***The DATABASE Module:*** This module is designed to allow the user to enter and edit the annual raw data and to transform them into the form required by the nonlinear programming packages used in solving the model. The process of transformation is done automatically by the program: All the user needs to do is to enter the raw data into the appropriate windows.

2. ***The BASEin Module:*** This module is designed to allow the user to enter and edit data directly from the keyboard into the file to be used as input into the programming package for obtaining a base solution and/or incorporate the data prepared in the DATABASE module for this purpose.

3. ***The POLICYin Module:*** This module is designed to allow the user to enter and edit from the keyboard directly into the file to be used as input into the programming package for obtaining solutions for different policy scenarios after obtaining a consistent solution that replicates the observed patterns of resource allocation in the base year.

3. ***The FORECAST Module:*** This module is designed to forecast the future values of selected variables of the programming model, to be used essentially in policy simulation runs and in model evaluation analyses.

The access to all of the modules is achieved by loading the appropriate spread sheet into memory and retrieving a special file named INIT.*. This file has an auto-execute macro program which brings a menu to the screen, allowing the user to choose the appropriate module to be

 TASM DATA PREPARATION MODULES

loaded into the memory. The menu is self-explanatory, containing names consistent with the program modules. The initial screen's representation is presented in Figure IV.1.1.

The manual is divided into four sections; each containing the instructions for using the four modules in the same order as it is listed above.

FIGURE IV.1.1: REPRESENTATION OF THE MODULE SELECTION SCREEN

```
Database   BASEin   POLICYin   Forecast   Exit

Bring the cursor on to the name of the module to be loaded into memory

                    Press the RETURN key and wait
```

5.1.THE DATABASE MODULE

If the **DATABASE** module is selected from the initial menu, a dummy database file (named ***DATAB.****, located in a directory called ***\PROG***) will be loaded into the memory, containing an auto-execute macro. The macro will bring on to the screen a menu that will allow accomplishing all the tasks of entering and editing the raw data. The dummy database file itself does not contain any data. If desired, the user can start entering data by choosing the **EDIT** command from the main menu, and then selecting the type of data to be entered from the sub-menu(s) that will be brought on to the screen. If, on the other hand, a previously saved data file, saved through the **WRITE** command from the same menu, is to be used, the **LOAD** command has to be activated and the appropriate file selected from the list that appears on the screen.

It is possible to obtain a hard copy of ***all*** the data entered, and processed, through the use of the **PRINT** command: A sub-menu will appear, requesting the user to select the appropriate data type. Ensure that a printer is attached and is active before the command is activated.

The command **VIEW** has been included on the menu to allow the user to view the transformed model data that is to be used as input into the programming package. The user will not be allowed to enter any information into this window.

Finally, the **FINISH** command is used either to return the user back to the initial selection menu (INIT) or to exit from the module into the spread sheet.

The main menu and its associated commands are listed below, with the appropriate descriptors.

FIGURE IV.1.2: The MAIN Menu of The DATABASE Module

Load	*Load a previously saved data file into memory*
Edit	*Edit or enter data*
View	*View the transformed data to be input into GAMS*
Print	*Send selected windows to the printer*
Write	*Write the file onto the disk after changing data*
Finish	*Leave module after completing work*

The six commands are activated by either bringing the cursor on to the command to be activated and then pressing the ***RETURN*** key or by pressing the first letter of the appropriate command. Detailed features of each of the commands are provided in the following sub-sections.

5.1.1 The LOAD Command - DATABASE

The **LOAD** command does not have any sub-menus: It simply lists on the screen the files located in a sub-directory of the current hard disk drive named ***DATABASE***. The file(s) to be loaded into the memory must have been saved in the named sub-directory using the **WRITE** command. Otherwise, it will not be possible to use the main menu described above. Once the list is brought on to the screen, use the cursor movement keys (i.e., the ***UPARROW, DOWNARROW, LEFTARROW, RIGHTARROW, PGDOWN, PGUP, HOME*** or ***END*** keys) to move the cursor on to the file desired and press the ***RETURN*** or the ***ENTER*** key. The screen will blank out and remain like that until the file selected is retrieved. The main menu will appear on the screen once again after the retrieval is complete. The user is now ready to enter new data or edit the ones already entered.

5.1.2 The EDIT Command - DATABASE

Once the **EDIT** command is activated, the main menu will be replaced by the edit sub-menu. After selecting the desired data type to be entered or edited, a window will appear on the screen containing the raw data.

It is now possible to move the cursor to the desired cell by means of the cursor movement keys described in Section 5.1.1. Enter the new or corrected values on to the slate and then press any one of the cursor movement keys: The data value will be transferred into the spread sheet window and the cursor will move on in the direction of the movement key pressed. If the *RETURN* key is pressed during data entry, the process of editing data will cease and the **EDIT** sub-menu will appear on the screen once again.

Therefore, the user should not press the *RETURN* or the *ENTER* key until he has completed his task with that particular window.

With the **EDIT** sub-menu on the screen, the user can return to the main menu indicated in Figure IV.1.2, simply by pressing the *ESC* key.

FIGURE IV.1.3: The EDIT Sub-Menu - DATABASE

Exports	*Edit relevant export data*
Imports	*Edit relevant import data*
Output	*Edit production data (output, acreage and animal stocks)*
Prices	*Edit production data*
Convert	*Edit conversion data*

5.1.2.1 The EXPORTS Window

This command has no sub-menu; therefore, the export window is brought on to screen immediately. Two types of data are required: export quantity, in the units specified, and export values, in U. S. Dollars. The aggregation of the individual commodities into those used in non-linear programming package will be done by the module once the *RETURN* or *ENTER* key is pressed and the process of editing the relevant window is finished.

The cursor movements will be restricted to the two columns containing the export quantities and values. The data should be entered using the cursor movement keys. The *RETURN* key should be pressed when work in the **EXPORTS** window is complete.

In order to correct any data values erroneously entered, go to the cell that contains the erroneous value and re-enter the correct value into the same cell. Be sure to use either the *UPARROW* or the *DOWNARROW* keys to enter the correct value if work in the window is not complete.

5.1.2.2 The IMPORTS Window

This command has no sub-menu; therefore, the import window is brought on to screen immediately. Two types of data are required: **import** quantity, in the units specified, and **import** values, in U. S. Dollars. The aggregation of the individual commodities into those used in non-linear programming package will be done by the module once the *RETURN* or *ENTER* key is pressed.

The cursor movements will be restricted to the two columns containing the import quantities and values. The data should be entered using the cursor movement keys. The *RETURN* key should be pressed when work in the **IMPORTS** window is complete.

In order to correct any data values erroneously entered, go to the cell that contains the erroneous value and re-enter the correct value into the same cell. Be sure to use either the *UPARROW* or the *DOWNARROW* keys to enter the correct value if work in the window is not complete.

5.1.2.3 The OUTPUT Windows

There are more than one type of data to enter and/or edit under the **OUTPUT** command. The **OUTPUT** sub-menu is listed in Figure IV.1.4. Choose the type of data to be entered, and follow the rules described in Sections 5.1.2.2 and 5.1.2.1.

FIGURE IV.1.4: The OUTPUT Sub-Menu - DATABASE

Prod	*Edit or enter production data*
Trees	*Edit or enter number of trees for perennials*
Crops	*Edit or enter acreage for field crops*
Animals	*Edit or enter stock numbers for livestock activities*
Return	*Return to the MAIN menu*

Since the **DATABASE** module computes the weighted average yields for the aggregated groups to be used in the modeling runs, the outputs and the production units of each product have to be entered separately. The outputs in appropriate units are entered into a single window, i.e., the **PROD** window. The production units are, however, grouped into three separate windows: one for perennial crops (the **Trees** window), one for field crops (the **Crops** window) and another for livestock (the **Animals** window).

Once the process of editing the desired windows is complete, one can bring up the **EDIT** menu by pressing the *ESC* key. If, however, one wants to bring on to the screen the **MAIN** menu, one has to select the **RETURN** command. If the latter procedure is selected, the data window(s) will disappear and the screen associated with the **MAIN** menu will be displayed.

5.1.2.4 The PRICES Window

If the **PRICES** window is selected from the menu, it is possible to enter and edit the prices of the individual agricultural products. The units are expressed in the column next to the product names. The weighted average prices, aggregated according to the product groups used in the programming model, will be calculated automatically by the program module when the *RETURN* or *ENTER* key is pressed to leave the window.

5.1.2.5 The CONVERT Windows

Like the OUTPUT command, CONVERT has a number of windows for entering and editing. Many of the windows contain the conversion rates used in the data transformation stage of the DATABASE module. The values contained in those tables will usually not change from one year to the next. Most of the conversion rates are best estimates. Change them only when new information is discovered.

There is, however, one table, i.e., the MISC window, which has to be updated every time a new base year is created for the model.
If it is not, the transformed data will not be the appropriate one for the base year contained.

The commands available under the CONVERT sub-menu are listed in Figure IV.1.5.

FIGURE IV.1.5: The CONVERT Sub-Menu

Margins	*Edit or enter trade margin data*
Trees	*Edit or enter tree-to-area conversion rates*
Weights	*Edit or enter price weight used in averaging prices*
Convert	*Edit or enter various conversion rates*
Misc	*Edit or enter miscellaneous data*
Return	*Return to main menu*

Once the process of editing the conversion windows is complete, bring up the EDIT menu by pressing the *ESC* key. If, however, one wants to bring on to the screen the MAIN menu, one has to select the RETURN command. If the latter procedure is selected, the data window(s) will disappear and the screen associated with the MAIN menu will be displayed.

5.1.3 The VIEW Command

The **VIEW** should be used after all the data for a particular year has been entered into the database file. The three windows available for perusal, contain the transformed data to be used as input into the **BASEin** module. Although there are three windows to be perused, only two commands are available in the sub-menu. These are:

FIGURE IV.1.6: The VIEW Sub-Menu

Exim	*View export and import price and quantity data*
Prod	*View production, yield, acreage and price data*

If the **EXIM** command is selected, two windows will appear on the screen: those related to the export and import calculations. The user will not be allowed to enter or change the values being displayed on the screen.

The **PROD** window will contain the aggregated and, where appropriate, averaged values, using the data entered into the **EDIT** windows. Again, you will not be allowed access into the cells in the window.

Once through with viewing the results of the calculations, press the ***RETURN*** or the ***ENTER*** key.
The **VIEW** sub-menu will appear on the top of the screen.
To bring the **MAIN** menu back on to the screen, the ***ESC*** key has to be pressed.

5.1.4 The PRINT Command - DATABASE

If a hard copy of all the data entered into the windows and the results of the transformations performed internally is desired, one has to activate the PRINT command. A sub-menu (Figure IV.1.7) will appear on the screen, prompting you to select the windows to be printed.

Ensure that a printer is attached to your computer, that it contains continuous form paper and that it is turned on, before you activate the PRINT command. Otherwise, an error message to that effect will be displayed and one has to restart all over again by pressing the *RETURN* or the *ENTER* key.

Once the appropriate window(s) is (are) selected, the printing will start immediately. One can stop the printing process by pressing the *Ctrl* and *Break* keys together. An error message will be displayed on the screen, and will prompt you to press the *RETURN* or the *ENTER* key in order to return to the MAIN menu.

When the printing procedure finishes and the PRINT sub-menu reappears on the screen, press the *ESC* key to return back to the MAIN menu.

FIGURE IV.1.7: The PRINT Sub-Menu - DATABASE

Model	*Print transformed model data*
Price	*Print price data*
Convert	*Print conversion tables*
Output	*Print production and area or stock data*

5.1.5 The WRITE Command - DATABASE

The WRITE command has to be used after updating a database file, in order to save the new file on the hard disk. When the command is activated, the top row of the screen will prompt the user to enter the name of the file under which the work sheet is going to be saved. The blinking cursor indicates where one should start keying in the name of the file. Do not erase the directory and the current drive indicators.

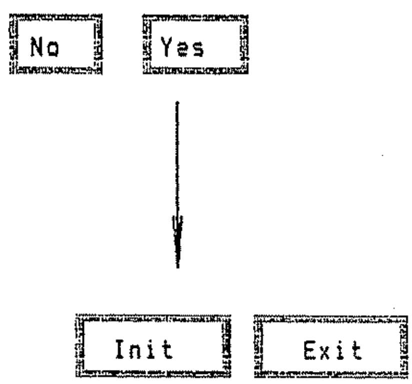
*C:\DATABASE_*

The user has to specify a **unique** name for the database file. otherwise, it will not be saved. Because of this, get a listing of the *\DATABASE* directory before starting an editing session.

5.1.6 The FINISH Command – DATABASE

When work in the **DATABASE** module is finished, select the **FINISH** command from the **MAIN** menu. The sub-menu that will appear on the screen will allow the user to save the work sheet if it has not already been saved. If this is the case, choose the **NO** command from the sub-menu: the **MAIN** menu will reappear on the screen allowing the user to select the **WRITE** command (see, Section 5.1.5). If the work sheet has already been saved, choose the **YES** command. There are two options available for leaving the **DATABASE** module if this is what is desired: one can either exit from the data preparation modules and return to the spread sheet by selecting the **EXIT** command or return to the module selection unit by selecting the **INIT** command.

The representation of the sub-menus under the **FINISH** command is given below.



5.2.THE BASEin MODULE

The **BASEin** module has to be selected from the initial **MODULE SELECTION** unit (see Section IV, Figure IV.1.1). This will load the *BASEIN.** work sheet file located in the *\PROG* directory. This is a dummy file that does not contain any data. A file containing data, which was previously saved using the **BASEin** module, can be loaded, however, after the dummy file is retrieved and the **MAIN** menu appears on the screen.

One can load the initial module selection unit either from within the spread sheet or, as already noted in Section 5.1.6, select it from other modules by choosing the following sequence of commands from the **MAIN** menu of the relevant modules:

FINISH ⇒ YES ⇒ INIT

The commands available on the **MAIN** menu of this module are similar to those of the **DATABASE** module (Section IV.1). There are, however, some differences. These are illustrated in Figure IV.2.1.

As can be seen, the **LOAD**, **EDIT**, **PRINT**, **WRITE** and **FINISH** commands also exist on this **MAIN** menu. Although the **VIEW** command is not included, there are two new ones: The **TRANSFER** and the **SAVE** commands. It must be stated, however, that despite the similarity of the commands, each one performs different tasks.

FIGURE IV.2.1: THE MAIN MENU OF THE BASEin MODULE

Load	*Load a previously saved data file into memory*
Edit	*Edit or enter data*
Transfer	*Transfer the transformed data into BASEin*
Print	*Send selected windows to the printer*
Save	*Save the file to be used as input into GAMS*
Write	*Write the file onto the disk after changing data values*
Finish	*Leave module after completing work*

5.2.1 *The LOAD Command - BASEin*

The **LOAD** command does not have any sub-menus: It simply lists on the screen the files located in a sub-directory of the current hard disk drive named ***GAMSIN***. The file(s) to be loaded into the memory must have been saved in the named sub-directory using the **WRITE** command. Otherwise, it will not be possible to use the main menu described above. Once the list is brought on to the screen, use the cursor movement keys (i.e., the ***UPARROW, DOWNARROW, LEFTARROW, RIGHTARROW, PGDOWN, PGUP, HOME*** or ***END*** keys) to move the cursor on to the file desired and press the ***RETURN*** or the ***ENTER*** key. The screen will blank out and remain like that until the file selected is retrieved. The main menu will appear on the screen once again after the retrieval is complete. The user is now ready to enter new data, transfer certain types of data from the **DATABASE** files created and saved through the **DATABASE** module or edit the ones already entered.

5.2.2 *The EDIT Command - BASEin*

Once the **EDIT** command is activated, the main menu will be replaced by the edit sub-menu. After selecting the desired data type to be entered or edited, a window will appear on the screen containing the raw data. One can, however, transfer some of the data prepared by the **DATABASE** module by selecting the **TRANSFER** command from the **MAIN** menu (see, Section 5.2.3), rather than entering them through the keyboard.

It is now possible to move the cursor to the desired cell by means of the cursor movement keys described in Section 5.1.1. Enter the new or corrected values on to the slate and then press any one of the cursor movement keys: The data value will be transferred into the spread sheet window and the cursor will move on in the direction of the movement key pressed. If the ***RETURN*** key is pressed during data entry, the process of editing data will cease and the **EDIT** sub-menu will appear on the screen once again.

Therefore, the user should not press the *RETURN* or the *ENTER* key until he has completed his task with that particular window.

With the **EDIT** sub-menu on the screen, the user can return to the **MAIN** menu indicated in Figure IV.2.1, simply by pressing the ***ESC*** key.

FIGURE IV.2.2: The EDIT Sub-Menu - BASEin

Dom	*Edit domestic production data*
Resource	*Edit resource availability data*
Trade	*Edit foreign trade data*
Coeff	*Edit technical coefficient data*
Proctrad	*Edit foreign trade data for processed goods*

5.2.2.1 The DOM Command

Selecting the DOM command from the EDIT menu will bring the window that contains the production, yield, area or animal stock, price and relative yields data, appropriately aggregated for input into the non-linear programming package, on to the screen. As already noted in Section 5.1.3, the DATABASE module prepares the annual raw data in this form automatically, therefore, the user should feel no need to actually enter this data into the window. One can use the TRANSFER command (see, Section 5.2.3.1) to combine this portion of the appropriate DATABASE file into the DOM window.

Thus, the primary purpose for including this command on the menu is to allow the editing of individual data values that may be deemed necessary during calibration runs. The editing procedure is the same as that described in Section 5.1.1.

5.2.2.2 The RESOURCE, TRADE, and PROCTRAD Commands

Similar considerations as those expressed in the previous section (Section 5.2.2.1) are applicable for the RESOURCE, TRADE and PROCTRAD commands. All of the relevant data for the windows that appear on the screen when one of these three commands are selected, are prepared in the same format as those of the relevant windows during DATABASE preparation. Therefore, the data for these windows should be transferred using the TRANSFER - RESOURCE, TRADE and PROCTRAD commands (see Sections 5.2.3.2, 5.2.3.3 and 5.2.3.4).

Once transferred, the data can then be edited by selecting the appropriate windows.

A particularly careful attention has to be paid to TRADE window after the transfer process. The transferred export and import quantities will have to be netted out to obtain the values of the net exports for each commodity group. The foreign trade prices will have to be adjusted to reflect this.

If the export quantities are greater than the import quantities, the difference will have to be recorded in the export column and the values appearing in the import quantity and price columns of the relevant groups will have to be replaced by zeros. If, on the other hand, the import quantities are greater than the export quantities, the difference will have to be recorded in the import column and the values appearing in the export quantity and price columns of the relevant groups will have to be replaced by zeros.

Because of the nature of the raw foreign trade data, the data transferred from the base year database files may also contain the value of *ERR.* If some cells contain such an entry, the user should replace these with appropriate values. Otherwise, it will not be possible to run the non-linear programming package to obtain a solution.

5.2.2.3 The COEFF Command

The only windows that cannot be completed by the transfer process on the **EDIT** command, are those containing the technical coefficients of production (i.e., those accessed through the **COEFF** command). These coefficients do not change from one year to the next, therefore they are not entered into the **DATABASE** files. Whenever new information on the technical processes of production is collated, it will be entered directly through the **BASEin** module. This is because, with a new technical coefficient set, the base has to re-calibrated. These coefficients can be transferred into the **POLICYin** module, from within that module, once a consistent base solution is obtained (see Section IV.3).

This means that the dummy *BASEIN.** file will contain the required technical coefficients, so that it is not necessary to enter these data for different base years.

Since there are more than one coefficients window (12 to be exact), when this command is selected all of the windows will be brought on to the screen at the same time. To fit them on a single screen, only the top line of the tables are displayed. The table to be edited is chosen by moving the cursor into the appropriate window and then expanding it.

> **Switch windows by pressing the *F6 function* key (*WINDOW*). The cursor will move from one window to another in the order in which the windows appear on the screen.**

> **Expand the window in which the cursor is located by pressing the *Alt* and *F6 function* keys together (*ZOOM*). Pressing either the *ZOOM* or the *WINDOW* key will cause the window to return to its original size.**

When finished editing the production coefficients press the ***RETURN*** or the ***ENTER*** key in order to bring back the **EDIT** menu on to the screen. The **MAIN** menu, on the other hand, can be brought back by pressing the ***ESC*** key while the **EDIT** menu is on the screen.

5.2.3 The TRANSFER Command

The **TRANSFER** command allows combining certain tables created within the **DATABASE** module into different windows of the **BASEin** module. This makes entering the relevant values from the keyboard redundant and saves a substantial amount of time. The **TRANSFER** sub-menu that will appear when the command is selected, is illustrated in Figure IV.2.3. As can be seen, only the data entered and processed through the **DATABASE** module can be transferred

FIGURE IV.2.3: The TRANSFER Sub-Menu

Dom	*Transfer domestic production data*
Resource	*Transfer resource availability data*
Trade	*Transfer foreign trade data*
Proctrad	*Transfer foreign trade data for processed goods*

When one of the commands is selected from the sub-menu, the program will make the appropriate window current, erase any existing values in the window and bring a list of files located in the *\DATABASE* directory on to the screen. The program will pause in order to allow the user to select the relevant file from the list. Use the cursor movement keys (see Section 5.1.1) to move on to the name of the desired file and then press the *RETURN* or the *ENTER* key in order to make the selection.

Make sure that the same database file is selected each time a different command is selected from the sub-menu; otherwise, the data in different windows will not refer to the same year.

5.2.3.1 The DOM Command

This command transfers the annual raw data for the base year related to the production, yields, acreage or animal stocks, prices and relative yield indices aggregated and appropriately averaged according to requirements of the programming model. The only necessary action to be taken by the user is the selection of the relevant database file from the list to be displayed.

5.2.3.2 The RESOURCE Command

The **RESOURCE** command is slightly more complicated when compared to those that appear on the **TRANSFER** sub-menu. The data are combined into the resource window in three phases; with each phase representing a different set of data. Because of this, the program will pause three different times to allow the user to make three selections from the file list that appears on the screen.

Make sure that the same database file is selected each time; otherwise, the resource data will not refer to the same year.

5.2.3.3 The TRADE Command

This command transfers the annual raw data for the base year related to the export and import quantities and unit dollar prices of unprocessed agricultural commodities, aggregated and appropriately averaged according to requirements of the programming model. The only necessary action to be taken by the user is the selection of the relevant database file from the list to be displayed.

Because of the nature of the raw data, this window requires careful editing through the use of the EDIT - TRADE command (see Section 5.2.2.2), after the transfer process is completed.

5.2.3.4 The PROCTRAD Command

This command transfers the annual raw data for the base year related to the export and import quantities and unit dollar prices of processed agricultural commodities, aggregated and appropriately averaged according to requirements of the programming model. The only necessary action to be taken by the user is the selection of the relevant database file from the list to be displayed.

5.2.4 The PRINT Command - BASEin

If a hard copy of all the data entered and transferred into the windows, one has to activate the PRINT command. A sub-menu (Figure IV.2.4) will appear on the screen, prompting you to select the windows to be printed.

Ensure that a printer is attached to your computer, that it contains continuous form paper and that it is turned on, before you activate the PRINT command. Otherwise, an error message to that effect will be displayed and one has to restart all over again by pressing the *RETURN* or the *ENTER* key.

Once the appropriate window(s) is (are) selected, the printing will start immediately. One can stop the printing process by pressing the *Ctrl* and *Break* keys together. An error message will be displayed on the screen, and will prompt you to press the *RETURN* or the *ENTER* key in order to return to the MAIN menu.

When the printing procedure finishes and the PRINT sub-menu reappears on the screen, press the *ESC* key to return back to the MAIN menu.

5.2.5 The SAVE Command

This command, like the WRITE command to be described in the next section (5.2.6), saves a file on the hard disk. The type of file to be saved, however, is quite different. While the WRITE command saves a work file, the SAVE command saves an ASCII file containing the required data and instructions for obtaining a solution for the base year using the non-linear programming package. The file saved through this command will have a generic name of *BASEIN.** and will be saved in a directory caled *\GAMSDAT.*

FIGURE IV.2.4: The PRINT Sub-Menu - BASEin

Dom	*Print domestic production data*
Resource	*Print resource availability data*
Trade	*Print foreign trade data*
Coeff	*Print technical coefficient data*
Proctrad	*Edit foreign trade data for processed goods*

After this file is saved into the appropriate directory make sure the following steps are carefully taken:

Leave the spread sheet program.

Change into the *\GAMSDAT* directory.

Rename the *BASEIN.** file just saved through the SAVE command.

Delete the *BASEIN.** file

5.2.6 The WRITE Command - BASEin

The **WRITE** command has to be used after updating a base year programming file, in order to save the new file on the hard disk. When the command is activated, the top row of the screen will prompt the user to enter the name of the file under which the work sheet is going to be saved. The blinking cursor indicates where one should start keying in the name of the file. Do not erase the directory and the current drive indicators.

*C:\BASEIN_*

The user has to specify a unique name for the base year programming file, otherwise, it will not be saved. Because of this, get a listing of the *\BASEIN* directory before starting an editing session.

> It must be stressed that the WRITE command saves the *work file* that the BASEin module is currently editing; while, the SAVE command saves the *ASCII file* to be used as input into the non-linear programming package being used.

5.2.7 The FINISH Command - BASEin

When work in the **BASEin** module is finished, select the **FINISH** command from the **MAIN** menu. The sub-menu that will appear on the screen will allow the user to save the work sheet if it has not already been saved. If this is the case, choose the **NO** command from the sub-menu: the **MAIN** menu will reappear on the screen allowing the user to select the **WRITE** command (see, Section 5.2.6). If the work sheet has already been saved, choose the **YES** command. There are two options available for leaving the **BASEin** module if this is what is desired: one can either exit from the data preparation modules and return to the spread sheet by selecting the **EXIT** command or return to the module selection unit by selecting the **INIT** command (see Section 5.1.6).

5.3.THE POLICYin MODULE

The POLICYin module has to be selected from the initial MODULE SELECTION unit (see Section IV, Figure IV.1.1). This will load the *POLICYIN.** work sheet file located in the *\PROG* directory. This is a dummy file that does not contain any data. A file containing data, which was previously saved using the POLICYin module, can be loaded, however, after the dummy file is retrieved and the MAIN menu appears on the screen.

One can load the initial module selection unit either from within the spread sheet or, as already noted in Section 5.2., select it from other modules by following the same sequence of commands mentioned therein.

The commands available on the MAIN menu of this module seem as if they are exactly the same as to those of the BASEin module (Section 5.2.). The similarity is obvious if Figures I.2.1 and I.3.1 are compared.

FIGURE IV.3.1: THE MAIN MENU OF THE POLICYin MODULE

Load	*Load a previously saved POLICYin file into memory*
Edit	*Edit or enter data*
Transfer	*Transfer data from BASEin files*
Print	*Send POLICYin print file to the printer*
Save	*Save the POLICYin file to be used as input into GAMS*
Write	*Write the file onto the disk after changing data values*
Finish	*Leave module after completing work*

5.3.1 The LOAD Command - POLICYin

The LOAD command does not have any sub-menus: It simply lists on the screen the files located in a sub-directory of the current hard disk drive named *POLICYIN*. The file(s) to be loaded into the memory must have been saved in the named sub-directory using the WRITE command. Otherwise, it will not be possible to use the main menu described above. Once the list is brought on to the screen, use the cursor movement keys (i.e., the *UPARROW, DOWNARROW, LEFTARROW, RIGHTARROW, PGDOWN, PGUP, HOME* or *END* keys) to move the cursor on to the file desired and press the ***RETURN*** or the ***ENTER*** key. The screen will blank out and remain like that until the file selected is retrieved. The main menu will appear on the screen once again after the retrieval is complete. The user is now ready to enter new data, transfer certain types of data from the **BASEin** files created and saved through the **BASEin** module or edit the ones already entered.

5.3.2 The EDIT Command - POLICYin

Once the **EDIT** command is activated, the main menu will be replaced by the edit sub-menu. After selecting the desired data type to be entered or edited, a window will appear on the screen containing the raw data. One can, however, transfer some of the data entered through the **BASEin** module by selecting the **TRANSFER** command from the **MAIN** menu (see, Section 5.3.3), rather than entering them through the keyboard.

FIGURE IV.3.2: The EDIT Sub-Menu - POLICYin

Dom	*Edit domestic production data*
Resource	*Edit resource availability data*
Trade	*Edit foreign trade data*
Coeff	*Edit technical coefficient data*
Livestok	*Edit various livestock parameters*
Param	*Edit consumption parameters*
Special	*Edit special data*
Equation	*Edit GAMS equation block*

The **EDIT** menu in this module is quite different than that of the **BASEin** module, as can be seen from Figure IV.3.2. There are, in fact, four new commands available for selecting four other windows. This is because the **POLICYin** module allows the assessment of various different types of policies once a base solution is obtained. Potentially, all the parameters taken as constant in the base run, representing the actual situation in any particular year, become policy instruments. Thus, data contained in the BASEin module but not allowed access to, can now be changed in the policy runs of the model by selecting the appropriate window(s) from the **EDIT** sub-menu.

In addition to the domestic production, area, yield and price data (**DOM**), foreign trade quantities and prices (**TRADE**), resource availability and input prices (**RESOURCE**), and technical coefficients of production (**COEF**), livetock production coefficients (**LIVESTOK**), consumption price and income elasticities (**PARAM**) and foreign exchange rate and other special paramaters (**SPECIAL**) can now be changed.

There is an additional window that contains the equations of the non-linear programming package in obtaining the solution of the system. Access to this part of the input file has been provided principally for experienced users. Novice users should not change the statements contained therein because this might cause run-time errors when obtaining a solution.

> **As in other EDIT menus, the user should not press the *RETURN* or the *ENTER* key until he has completed his task with that particular window.**

> With the **EDIT** sub-menu on the screen, the user can return to the **MAIN** menu indicated in Figure IV.3.2, simply by pressing the *ESC* key.

5.3.2.1 The DOM , RESOURCE, TRADE and COEFF Commands

The **DOM**, **RESOURCE** and **COEFF** windows are exactly the same as those that appear the **BASEin** module (Section 5.2.2).

The **TRADE** command combines the **TRADE** and **PROCTRAD** commands of the **BASEin** module (Sections 5.2.3.3 and 5.2.3.4); this time, however, under a sub-menu. The windows that appear are exactly the same.

As already noted above, the primary purpose for including these commands on the menu is to allow the editing of individual data values that may be deemed necessary during policy runs. The editing procedure is the same as that described in other sections.

5.3.3 The TRANSFER Command

The **TRANSFER** command allows combining certain tables in the **DATABASE** module into different windows of the **POLICYin** module. This makes entering the relevant values from the keyboard redundant and saves a substantial amount of time. The **TRANSFER** sub-menu that will appear when the command is selected, is illustrated in Figure IV.3.3. As can be seen, only the data entered and processed through the **BASEin** module can be transferred

FIGURE IV.3.3: The TRANSFER Sub-Menu - POLICYin Module

Dom	*Transfer domestic production data*
Resource	*Transfer resource availability data*
Trade	*Transfer foreign trade data*

When one of the commands is selected from the sub-menu, the program will make the appropriate window current, erase any existing values in the window and bring a list of files located in the *\BASEin* directory on to the screen. The program will pause in order to allow the user to select the relevant file from the list. Use the cursor movement keys (see Section 5.1.) to move on to the name of the desired file and then press the ***RETURN*** or the ***ENTER*** key in order to make the selection.

> Make sure that the same BASEin file is selected each time a different command is selected from the sub-menu; otherwise, the data in different windows will not refer to the same year.

5.3.4 The PRINT Command - BASEin

If a hard copy of all the data entered and transferred into the windows, one has to activate the **PRINT** command. No sub-menus will appear; an **ASCII** file of all the data and the commands of the programming package contained in the work file will be sent to the printer.

Ensure that a printer is attached to your computer, that it contains continuous form paper and that it is turned on, before you activate the PRINT command. Otherwise, an error message to that effect will be displayed and one has to restart all over again by pressing the *RETURN* or the *ENTER* key.

One can stop the printing process by pressing the ***Ctrl*** and ***Break*** keys together. An error message will be displayed on the screen, and will prompt you to press the ***RETURN*** or the ***ENTER*** key in order to return to the MAIN menu.

5.3.5 The SAVE Command - POLICYin

This command, like the **WRITE** command to be described in the next section (5.3.6), saves a file on the hard disk. The type of file to be saved, however, is quite different. While the **WRITE** command saves a work file, the **SAVE** command saves an **ASCII** file containing the required data and instructions for obtaining a solution for the policy runs using the non-linear programming package. The file saved through this command will have a generic name of ***POLICYIN.**** and will be saved in a directory caled *\GAMSDAT.*

After this file is saved into the appropriate directory make sure the following steps are carefully taken:

Leave the spread sheet program.

Change into the *\GAMSDAT* directory.

Rename the *POLICYIN.** file just saved through the SAVE command.

Delete the *POLICYIN.** file

5.3.6 The WRITE Command - POLICYin

The **WRITE** command has to be used after updating a policy run programming file, in order to save the new file on the hard disk. When the command is activated, the top row of the screen will prompt the user to enter the name of the file under which the work sheet is going to be saved. The blinking cursor indicates where one should start keying in the name of the file. Do not erase the directory and the current drive indicators.

*C:\POLICYIN_*

The user has to specify a unique name for the policy run programming file, otherwise, it will not be saved. Because of this, get a listing of the *\POLICYIN* directory before starting an editing session.

It must be stressed that the WRITE command saves the *work file* that the POLICYin module is currently editing; while, the SAVE command saves the *ASCII file* to be used as input into the non-linear programming package being used.

5.3.7 The FINISH Command - POLICYin

When work in the **POLICYin** module is finished, select the **FINISH** command from the **MAIN** menu. The sub-menu that will appear on the screen will allow the user to save the work sheet if it has not already been saved. If this is the case, choose the **NO** command from the sub-menu: the **MAIN** menu will reappear on the screen allowing the user to select the **WRITE** command (see, Section 5.3.6). If the work sheet has already been saved, choose the **YES** command. There are two options available for leaving the **POLICYin** module if this is what is desired: one can either exit from the data preparation modules and return to the spread sheet by selecting the **EXIT** command or return to the module selection unit by selecting the **INIT** command (see Section 5.1.6).

VI. SOLUTION OF TASM

6.1 Introduction

The programming system, which is used to solve TASM-MAFRA, is particularly based on the package of GAMS-MINOS. This package allows solving linear and non-linear programming models.

Regarding the practical application of TASM-MAFRA it is important to understand the basic features and the handling of this programming package. Additionally, basic knowledge of mathematical programming is required.

6.2 Organisation of modeling work and the programming system

The programming system has been organized in such a way that it allows for a relatively easy handling of the complex problem to be addressed. Firstly, we have to distinguish between model runs regarding

(a) Past periods,
(b) Projections (future periods).

In relation to the methodology outlined in Chapter 2, we distinguish between

1) Consistency and calibration runs (relevant only for past periods),

2) Base runs (past period and base projection),

3) Policy runs (change of policy variables or parameters, past periods or future periods).

In order to solve the model we have to create a so called **INPUT** file, then the GAMS-MINOS Programm has to solve the problem as defined in the **INPUT** file. In addition GAMS-MINOS creates automatically a so called **OUTPUT** file, which contains the solution of the problem. Figure VI.1 ilustrates the principal approach to solving a problem with the GAMS-MINOS-Package.

The user of the model (practical application) has mainly to deal with the input file and the output file, but he should be informed about the conceptions, which are required, and the programming language, which is used in GAMS-MINOS.

If an appropriate input file is prepared and stored on the hard disk, the standard demand for solving the problem is:

```
C:\>GAMS (input file)
```

FIGURE VI.1: SOLVING A PROBLEM WITH GAMS-MINOS

Task	Programming system
1) Creating an Input-file	Input-file (Problemdefinition, Data)
2) Calling the GAMS-MINOS-Program	GAMS-MINOS (Formal Algorithm)
3) Interpretation and analysis of the solution	Output-file (Solution)

The name of the input file is, in our case, always termed as:

TASM*.prn

Including some extensions, which will be explained later. The GAMS-MINOS package then creates automatically an output file, including the solution, which has the same extension * and is a list file (lst):

TSAM*.lst

In order to identify all files exactly, the year is introduced additionally, such as:

TASM86*.*

Finally, a letter indicates, whether the files contain information concerning

-first step runs, e.g. TASM86B.*;
-second step runs, e.g. TASM86C.*;
-or policy runs, e.g. TASM86P1.*;

If several policy runs shall be carried out, they can be seperated by the number following the letter P (e.g. P1 .... P10).

Examples:

TASM92b.prn Input file for a base projection run in the year of 1992;

TASM92P5.lst	Output file for policy alternative P5 (e.g. less restrictive foreign trade regime) in year 1992.

In order to guarantee the conciency for further modeling work, it is adviceable to keep up with the above conventions.

As a final illustration we present below the different types of files, created for the example year of 1986:

TASM86B.prn	Input file for the first stage (calibration) run;
TASM86B.lst	Output file for the first stage (calibration) run;
TASM86C.prn	Input file for the second step run;
TASM86C.lst	Output file for the second step run;
TASM86P1.prn	Input file for the policy alternative 1 in the base year of 1986;
TASM86P1.lst	Output file for the policy alternative 1 in the base year of 1986;
TASM86P2.prn	Input file for the policy alternative 2 in the base year of 1986;
TASM86P2.lst	Output file for the policy alternative 2 in the base year of 1986;
TASM86P3.prn	Input file for the policy alternative 3 in the base year of 1986;
TASM86P3.lst	Output file for the policy alternative 3 in the base year of 1986.

The first four files exist for each year concerning the base period. Policy runs in the base period are optional, depending on the type of policy questions and the possibility of explicit projection. In some cases it may be suitable to run policy simulations in the base and projection period.

The input file for policy runs might be quite different from the other input files, if only some policy parameters are changed. Provided this, the GAMS-MINOS Package provides the options **SAVE** and **RESTART**.

Finally, we have to mention that, as far as Symphony is utilzed for the creation or changing of input files, it is adviceable to use the **SAVE**command of Symphony, which creates for each print file additonally a *.WR1 file. In reference to the example above we obtain the additional **WORK** files:

TASM86B.WR1
TASM86C.WR1
TASM86P1.WR1

6.3 GAMS-MINOS: A short overview and introduction of the syntax

6.3.1 Overview

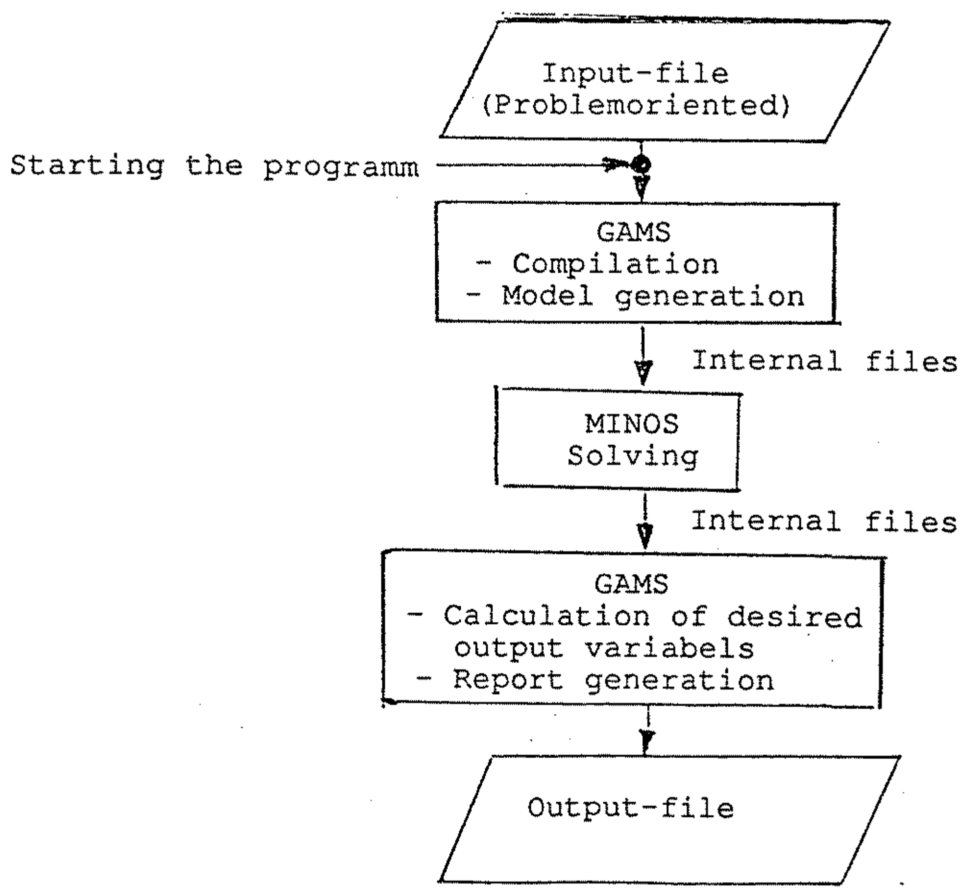
The GAMS-MINOS package consists bascially of two parts: a model generation part and a solution part.

GAMS (General Algebraic Modeling System) provides a programming language, which allows to develop, formulate, modify and document a mathematical programming model of linear or non-linear type, as well as other models (not relevant here) in pre-structured format.

MINOS (Modular In-core non-linear Optimization System) is a well tested package concerning the solution of mathematical programming models of linear or non-linear type. It also consists of certain mathematical algorithms, which have been well tested and therefore guarantee that an exact solution (optimal) and result is achieved, as long as the problem is well defined in the GAMS part.

The GAMS and the MINOS parts are internally linked: GAMS analyses and checks the input file (in our case TASM*.prn) and generates the information in such a way that it can be used by MINOS to start the solution process. If an accurat solution is achieved, then again GAMS accepts the result and prepares an output in standard form and in the form the user may create, if desired.

FIGURE VI.2: GAMS-MINOS CONFIGURATION AND APPLICATION



The user of the package has only to create the input file and to start the GAMS-MINOS Package. Beside the problem definition also all commands concerning the solving procedure and even the desired calculation of output variables (e.g. summary result tables) have to be started within the input file.

To create a GAMS input file it is required, however, to follow the conventions and to define the problem in the language, understandable by GAMS. In the following, a short overview of the GAMS syntax will be given and in the next chapter an example of the TASM input file will be presented and discussed.

All statements in a GAMS input file depend upon the categories of definition and they are sub divided into statements (e.g. define variables, assign varibles with values) and execution statements, by which, data, model coefficients or output varibles are calculated.

There are two exceptions:

(1) If the first character contains the asterisks (*), this line is ignored by GAMS. The asterisks (*) can therefore be used to include comments into the problem file, which may help to set up a logical problem structure offering a self-documenting layout of the file.

It is also adviceable to include some (*) lines, if attention has to be paid to certain parameters, special model formulations etc. Additional (*) lines should be implied, if one has to insist on certain changes in the program concerning special model runs. In reference to such kinds of indication, one should not forget to check these modifications for standard or other model runs.
Finally, the asterisks (*) can be used to change the programme itself. For example the calibration constraints obtained in the first step run can easily be removed by introducing(*) as the first character in the appropriate equation lines.

(2) The ($) symbol as the first character in a line indicates that certain options are in effect, which permit a certain control of the programme execution and the output listing. Regarding standard applications, the option set in the implemented TASM versions should not be changed. In case it is required, one can check the Gams.doc file for further explanations.

The most important standard statements and keywords are explained in the following sections.

6.3.2 SET statement

SET statements are used to define indices of block variables. For example in a two commodity case, one might formulate a set statement like

SET	C	commodities	/wheat, beans/
↑	↑	↑	↑
Gams keyword	Index name	Explanation concerning the meaning of C	List of elements belonging to C

In most cases, there is enough space available to indicate the elements in a self-documenting form, so that no futher explanation is necessary.

The indices defined in the SET statements can be utilied in other statements for computation purposes. Consider, that within such calculations an internal loop is carried out, which is defined by the SET statement. For example, the Variables P (prices) and Q (quantities), regarding our two commodities, can be calculated (derived from other variables) as follows:

```
P (C) = ....... (certain formula)
Q (C) = ....... (certain formula)
```

The list of elements can also be used to assign certain data to variables (see below).

For certain purposes it may be convenient to define sub-sets of indices. For example we may disaggregate the commodity list into

```
SETS    C1      crop commodities          /......../
        C2      livestock commodities     /......../
```

The two sub-sets can now easily be linked and the new index, which consists of all commodities, is available. This is executed by SET statementof the following type:

```
SET     C       all commodities;
        C (C1)  = yes;
        C (C2)  = yes;
```

(Note the semicolons, which are required).

Finally, we can use either the index C or the indices C1 for crops and C2 for livestock. If, for example regarding the calculation of prices, the same formula is used, we can write (example from above)

```
P (C) = ...
```

At the same time the yields Y for crops and livestock may be calculated by different formulas, because different information is available. We can therefore write:

```
Y (C1)  = ....
Y (C2)  = ....
```

SET statements can be placed anywhere in the programme, the only restriction is that they have to be located in a line before the first line, which makes use of it.

It may, however, be convenient to pool all sets at one or two places. In TASM all SET statements necessary for running the model, are placed at the beginning of the input file. A second pool of SETs, which is used for preparing and generating report tables, results are placed after the SOLVE statements in the last part of the programme.

6.3.3 Definition of Parameters and entering of Data

(1) The **PARAMETER** keyword is firstly used to define a parameter or a parameter block with certain elements. The example of calculating yield would require the following formulation:

```
PARAMETER Y      Yields of crop and livestock
Y (C1)  = ....
Y (C2)  = ...
```

Following the SET statement and after declaring the parameter Y as such, certain formulas can be used to assign certain values.

Secondly, the PARAMETER keyword can also be used for entering data into the system. This way of data entering is preferable for a vector of data (n x 1 dimension data set). In this case, the list of elements, defined in the SET statements, has to be used. Assuming one would not derive the yield coefficients from other data as done above, but enter them directly from statistics, then we could write:

```
PARAMETER      Y          Yield in t per ha
             / wheat        2.5
               beans        1.5
               .....
                   ./
```

It is also possible to enter only part of the data (e.g. for crops) and calculate the other (e.g. for livestock derive yields from total production and number of animals).

Note: Remember, the keyword PARAMETER is used for model parameters and exogenous Variables (including policy instruments). Therefore, also data for exogenous variables, like factor availabilities or government subsidies can be entered by the PARAMETER statement.

(2) Also the **SCALAR** statement serves for data entering. But only parameters with a single value can be defined and associated with certain data (no vectors or matrices). Typical examples are the definition and value assignments for exchange rate and inflation rate.

```
SCALARS       INFRATE    Inflation rate / 60 /
              EXRATE     Exchange rate TL to $ / 800 /
```

(3) Concerning larger data sets, which follow a certain order, the keyword **TABLE** may be used in order to enter two dimensional data sets. The TABLE syntax, for our example consisting of two commodities,can be expressed as follows for yields and prices.

```
TABLE            DATA          Production data for Crops
                                 yields      prices
                 wheat            2.5          80
                 beans            1.5          300
```

The syntax for TABLE requires no fixed format. Regarding correct assignment of numbers, the only requirement is that the number crosses the intersection of the row and column name, e.g. at least one character of a number, must match a letter of the column name.

The size of a table is not limited. If the column of a table is not confined to the size of the screen or the length of the paper, extended tables can be utilized just by making the intersection of the row and column name with a (+). For example the second part of table DATA can be entered as follows:

```
+          area          demand
wheat      xx              xx
yield      xx              xx
```

The information entered by the table format can latter be used for calculation purposes concerning other parameters or as part in the equation system in different ways:

DATA ("wheat", "yields")	- refers only to a single para-meter of the table;
DATA (C, "yields")	- refers to a (column) vector of parameters (yields). Index C has to be defined in a SET statement;
DATA ("wheat", KO)	- refers to a row vector(paramters for wheat). The index KO mut be defined in a SET statement;
DATA (C, KO)	- refers to all elements of the table DATA, which are defined by the SETs for C and KO.

For certain calculations it is possible to use only part of the information of a table. In such cases, one has to apply the index of the required sub-SET. Instead of C, for example the sub-index C1 can be written, if reference is made only to crop commodities.

6.3.4 Calculation of model parameters: Assignment Statement

If the SETs are defined and the data (including the exogenous model coefficients and parameters) have been entered into the input file, it is necessary - in applied modeling it is always convenient - to modify and manipulate data and to calculate the parameters, which finally enter into the mathematical programming model, e.g. the system of equations (see below).

This can easily be done by the so called assignment statement, which represents simple calculation equations written in the GAMS format similar to the formats in other programming languages.

If we intend, for example, to calculate the gross receipt of wheat and beans of our information in TABLE DATA, we have first to define the parameters, to which the result of the calculation should be assigned, and then we can write down the parameter statement e.g.

```
PARAMETER   RECEIPTS               Gross receipt  per  ha;
RECEIPT (C)   =   DATA (C, "yields") * DATA (C, prices);
```

The internal loop of the GAMS language automatically calculates (in our case wheat and beans) the gross receipts per ha for all C elements.

On the right hand side of the assignment statements,

```
+       for adding,
-       for substracting,
*       for multiplying,
/       for dividing,
**      for an exponential
```
can be employed.

Regarding certain calculations, it may be convenient to use standard functions for indexed operations, like

```
SUM     -       for summing up numbers over a certain domain,
PROD    -       for multiplicative operations,
SMIN    -       for searching the minimum value of a domain,
SMAX    -       for searching the maximum value of a domain.
```

Suppose, for example, we want to calculate the total area from the acreage of crops, then we may just write:

```
TAREA  = SUM (C, DATA (C, "Area"));
```

This statement sums up the value of the specific matrix domain over all elements of C.

The total value of agricultural production can easily be calculated in our example by:

```
TOPROD = SUM(C,DATA(C,"Area")*DATA(C,"Yields")*DATA(C,"Prices"));
```

It is also possible to add up the sum over two or more indices. Consider, for example, the case of different land types associated with various commodities. If area is specified in the DATA table in relation to commodities and land types, and if the land types are considered in a SET statement (S for land types), then we can write:

```
TAREA   =   SUM ((C,S), DATA (C,S));
```

At the same time, it has to be considered that the two indices, which are used for summing up, are arranged in seperate brackets.

6.3.5 Variables

The model itself can be formulated, as soon as all the model parameters are entered and if the calculation statements for the model parameters are well defined and entered correctly.

First, we have to define the variables. Consider that the GAMS language recognizes variables only as the endogenous variables of the model (in a linear version equivalent to the level of the activities).

This is done by the keyword **VARIABLES** followed by a list of single or block variables, e.g.:

```
VARIABLES
variable name           comments
SURPLUS         -       Consumer  and  Producer  Surplus,
CROP            -       Crop production in ha,
CONS            -       Domestic consumption;
```

The names of the variables will be used later in order to formulate the equations. In most cases block variables are defined and inserted.

Second, in opposition to other optimization programs MINOS can also calculate negative optimal values for the defined variables. This may be meaningful in some cases, if the problem is formulated in the folloing way. For example, instead of seperate export and import activities, one could just use net trade acitivities and interprete a negative value of this activitiy as import and a positive as export. One should have in mind that this kind of formulation assumes unique world market prices, not including transportation costs or specific export or import policy.

In most cases, however, only positive variables make sense. Therefore these variables have to be listed under the keyword:

```
POSITIVE VARIABLE
     CROP              Crop production
      ...                   ...
      ...                   ...
```

If the **VARIABLES** are defined, one can assign their value in reference to the variables.

Firstly, one can restrict the solution domain for variables, as we have already done by the keyword **POSITIVE** variables. This can be done by so called "upper and lower bounds. The syntax is (in our example):

(a) for explicit numbers:

```
CROP.LO (wheat) = value 1;
CROP.UP (wheat) = value 2;
   ...
   ...
```

LO stands for not lower, than the specified value;
UP stands for not higher, than the specified value;

(b) for bounds, entered as data or derived from data (example):

```
CROP.LO ("wheat") = 0.8 * DATA ("wheat", "area");
CROP.UP ("Wheat") = 1.2 * DATA ("wheat", "area");
```

In this case we have assumed that the solution value for wheat area should be within the domain of -20 % and +20 % of the observed wheat area in the base year.

If we would use this assumption for all crop commodities then we could just insert the set index C and write:

```
CROP.LO (C) = 0.8 * DATA (C, "area");
CROP.UP (C) = 1.2 * DATA (C, "area");
```

The lower and upper bounds serve as fixed limits, which are not changing during the solution process.

Secondly, the solver of mathematical programming follows an iterative procedure in order to achieve the maximum or minimum of the objective function. Without any additonal information, the solver starts from zero for all model variables and tries to fulfill the bounds and the restriction set up by the equation ("equal" or "greater than" conditions). In standard linear programs, there is generally no problem to reach a feasible solution, which satisfies all restrictions (if there exist any), and finally an optimal solution (if there exists one) after a number of iterations. In the non-linear case the solver may have some trouble with a zero starting value (because there may not exist any derivatives or gradients, or at least they may not be meaningful).

Therefore, it is adviceable to give the initial or starting value for the most important model variables. This can also be done by assigning absolute numbers directly (alternative a) or by using other informations available in the input file. For example:

```
Alternative  a) CROP.L ("wheat") = value
Alternative  b) CROP.L (0) = DATA (0, "area")
```

The extension .L means the model variable itself. During the solution process, the value of Crop.L (or any other variable) changes and the optimal value for initialized variables can be quite different from the starting value. As it can easily be checked (by changing the starting value), the optimal level of the variables will not be influenced by the initial values. However, the number of iteratons for reaching the optimum and solution time depend among others on initial values.

In general we know that at least certain variables will not equal zero. If we transfer this knowledge to the solver, the solution time can be much smaller in the cases of a linear as well as a non-linear model.

6.3.6 Equations and Solve

The equation part of the input file defines the mathematical relations between the model variables. Therefore, also non-linear relations have to be expressed within the equations explicitly. The equation part consists of two sub-parts:

In the first part the equations have to be declared and named and in the second part they have to be formulated explicitly. The equation part is indicated by the keyword **EQUATIONS**. The general syntax is the following (our example is the extended 3 blocks of equations):

```
EQUATIONS
         LAND               -       Available land,
         COMB               -       Commodity balance,
         OBJ                -       Objective function;

LAND..                   SUM (C, CROP (C)) = L = TLAND;
COMB (C)..               CROP (C) * DATA (C,"Yields") = E = CONS (C);
OBJ..                    SUM (C,ALPHA(C) * CONS (C) + 0.5. * BETA (C)
                         * CONS(C) ** 2) - SUM(C,CROP(C)) * COST (C))
                         = E = SURPLUS;

MODEL    EXAMPL /ALL/;
SOLVE    EXAMPL MAXIMIZING SURPLUS USING NLP;
```

We will first explain the economic problem and the assumptions of the small example and then the syntax will be described in more detail.

The problem covers a number of crop commodities as defined in the SET statement for C (not listed here). For each commodity only one production activity is considered. Beside the implicit land costs (shadow prices for land) there are only variable costs per ha (PARAMETER COST (C)).

Domestic production is assumed to be equivalent to domestic consumption (closed economy). Domestic demand follows a linear price responsive demand curve, which is used to consider the area beneath the demand curve. If the variable costs are substracted, one obtains the producer and consumer surplus, which is maximized (for methodological details see Chapter 2).

The LAND equation states that total land use must be equal or lower than the available land TLAND. Since all produciton activities are formulated in ha unit, the land input coefficient is 1 and may therefore not be considered.

The second equation is a commodity balance block which implies that for each commodity C's domestic supply equals domestic consumption CONS. Supply is just crop acreage multiplied with the given yield per ha.

The final equation defines the objective value (in our case SURPLUS), which enters the solve statements.

The model formulation and in principle the input file is finished by two additional statements.

In the **MODEL** statement a certain name has to be given to the entired model. Additonally, one has to define for MINOS, which equations shall be considered.
/ALL/ means that all equation stated as such in the program are considered;

A modification would be, for example, not to consider the land restriction. In such a case, instead of /ALL/ one has to list all equations explicitly. For example:
/COMB (C), OBJ/;

This statement allows for a very flexible model modification.

The **SOLVE** statement consists of

- the name of the model as defined in the statement before,
- the name of the objective variable and an order for **MINIMIZING** or **MAXIMIZING**,

- an order concerning the solver to be utilized by the programm. Alternative to NLP (Non-Linear-Programming), LP (Linear Programming) could be used.

Turning back to the syntax of the equation part, we can summerize:

- The mathematical operators (single or indexed operators) can be used in the same way as in the Assignment Statements.

- The equation can have an equality or inequality operator with the following meaning:

= E = left hand side of the equation equal to right hand side,
= L = left hand side of the equation is lower than or equal to right hand side,
= G = left hand side of the equation is greater than or equal to right hand side.

- Each equation must begin with a declaration, which is listed in the declaration block.

- Block equations are market by the associated SET index.

- The objective function must have an "=E=" sign. All arguments have to be listed on one side and the objective value has to be exposed on the other side.

6.3.7 Options, Preparation of results and Display

The concepts explained above are sufficient to define a complete input file, to run the model and to receive an output of the solution in standard form.

GAMS provides some additional possibilities in order to influence and direct the solution process as well as the output and alternatives are included in GAMS regarding the summarization and calculation of interesting results.

OPTIONS is such a GAMS programme statements and it is used for modifying default values. Especially in large problems, the default values may not be sufficient to run the programm successfully.

For example, there might be a default of "1000" in the program for the maximum number of iterations. In case that this is not sufficient, e.g.if the optimal solution is not achieved in the sequence of this number of iterations, one may place an OPTION statement before the SOLVE statement:

```
OPTION ITERLIN = 2000;
```

For more details about the available OPTIONs, check GAMS. DOC file (section 14).

There is also a number of so called **DOLLAR** control statements (written as $***), which permit some flexibility in controlling the GAMS compiler listing. Several of these statements are implemented in TASM-MAFRA in order to suppress non-necessary output and keep the output file small and transparent. For details about the meaning of these statements, see GAMS.DOC file (section 13).

GAMS offers the possibility to use the model results for certain additional calculations, for aggregating model results or just for arranging the results in a well structured table format.

The syntax is exactly the same as mentioned in the above sections, particularly in the section about the assignment statement. One can apply primal results as well as dual results in order to calculate values of interest. In sequence to the example above:

CROP.L (C)	indicates the optimal crop acreage allocation as an outcome of MINOS. (Remember that exactly the same variable has been used as for initiating the starting values).
COMB.M (C)	indicates the MARGINAL (shadow price) of a certain (block) of a model equation. In our case, this marginal or dual presents the endogenous (market) price of the commodities under competitive conditions on the demand and supply side.

For illustration purposes a short programme part as listed below calculates the value of agricultural production, the value of intermediate inputs (here equivalent to variable costs) and the value added. This programme part has to be placed after the solve statement in the input file.

```
PARAMETER        VALPROD -        Value of production,
                 VALINPUT-        Value of intermediate inputs,
                 VALADD   -       Value added of the sector;

VALPROD =        SUM (C,CROP.L(C) * DATA(C,"yields") * COMB.M(C));
VALINPUT=        SUM (C, CROP.L (C) * COST (L));
VALADD   =       VALPROD - VALINPUT;

DIPLAY VALPROD, VALINPUT, VALADD;
```

In the first statement the parameters used for assigning the calculated values are defined. The first assignment equation calculates the value of production in the agricultural example sector by endogenous crop acreage multiplied with the exogenous yields and multiplied with the endogenous agricultural prices. Of course, it would also be possible to calculate the value of agricultural production for each commodity (just remove the SUM on the right hand side and index the PARAMETER on the left hand side of the equation like VALPROD (C)). The VALINPUT and the VALADD statements can directly and easily be interpreted in a similar way.

The DISPLAY statement causes GAMS to print the values of the specified parameters in the output file. If the specified parameter has two dimensions, the values are printed in a table format similar to those used for data entering. It is also possible to display results directly. For example:

```
DISPLAY CROP.L (C), COMB.M (C);
```

The DISPLAY statement is particularly suitable for comparison of model results with the observed statistical data in the base year (model evaluation). Finally the DISPLAY statement can also be used in order to dexpose calculated parameters, which enter the equation system. For example, the parameters alpha (intercept) and beta (slope) of the demand curve may be calculated on the base of given prices, quantities and assumed elasticities. If it is useful to display them, the DISPLAY statement can also be placed before the SOLVE statement.

6.4 An example of a TASM-MAFRA Input-file (TASM81b.prn)

As mentioned earlier, if an Input-file is created in cooperation with Symphony or another editor programme like Kedit or Word, it has to be stored on the hard disk. Subsequently, the GAMS-MINOS Package can be started and the input file has to be declared. The following run creates an output file, which contains the complete input file in the first part. Any compilation errors can be detected in this first part of the output file.

In the following the first part of the output file (with a few exceptions) will be presented and briefly explained. We attend to this specific part, because of the included enumeration of all statements and the possibility of direct reference to interesting domains.

The real input file differs in the following aspects:

- It can be identified by small as well as large letters, depending on typing.

- The first two lines (headings, page indications) do not appear neccessarily.

- The input file can contain DOLLAR control statements, which are not listed in the output file.

- The lines are not enumerated on the left side.

The structure of the input file was created during the first half of this consultancy work. At that time only an older version of GAMS was available, which was more restrictive. The present GAMS version allows to begin with input statements in cloumn 1 of the file. However, the present version accepts also the format of input files, which were created in reference to the older version.

In the appendix to this chapter a complete input file is presented for the example year of 1981. Since this input file is the one of the first stage run, it can also be found on the hard disk of the Ministry's assigned PC under the file name:

TASM81B.PRN;

The input files of the other years differ only with respect to yearly data. They can also be found on the hard disk of the assigned Ministry PC.

Since most parts of the input files are self-documenting and because the GAMS syntax and main principles have been explained in the last chapter, only few comments will be made. The following reference numbers have to be seen in the context with the numbers of each line of the input file.
Line-No:

1-2	(Not printed) Dollar control statement for title "TASM1" and for suppressing non neccessary output;
3-29	- Commentary statements (* in first column), - no influence on the programme, - for remembrance of working with TASM-MAFRA, - space for a short notice in the case of some introduced changes to the programme;
30-165	- SET statements (see also chapter 3, dictionary), - 30 to 135 primary sets of block or sub-block elements, - 136 to 165 definition of higher leveled sets, based on the primary sets.
162-902	Entering of basic statistical data and model coefficients (exogenous variables, policy variables, input-output coefficients, elasticities from econometric estimates, numerical assumptions and guestimates);

172-233 The DOM Table presents basic statistical data for the domestic agricultural sector on the level of the 55 commodities (defined by the set index 0), as there are:

- domestic production in 1000 tons,
- area or number of animals in 1000 ha or 1000 heads (average stock of animals in the respective year),
- yields in tons per ha (crops) or kg per livestock unit,
- farm gate prices in Turkish Lira per kg.

The last colomn RYIELD presents the relative yield in relation to the base year of 1979 (= 1.). Relative yields are used for updating the basic production coefficients according to the commodities.

235-294 The TRADE table contains basic statistical foreign trade data concerning commidities in raw form, namely quantities (-Q) and prices on the export (EXP-) and import (IMP-) side.
Prices are in US-Dollar per ton and quantities are termed in 1000 tons.
The indices ESP-PQP and IMP-PQP are not relevant.

298 - 304 The PROCTRADE table also presents foreign trade data, but here in the processed form. Only for certain commodities, depending on the available statistics, foreign trade in processed form is considered explicitly and with the exception of an aggregated processed commodity. For commodities, which are not listed in PROCTRADE, exports and imports of processed commodities are converted into raw form and considered in the TRADE Table.

FACTOR means the conversion rate between raw and processed commodities. The coefficient 1.177 explains for example that 1.177 units of wheat are processed to receive one unit of wheatflour. TPRICE denotes the price per ton of the processed commoditiy. TRADEQ indicates the trade quantity. The No or a positive sign characterize exports and a negative sign means imports of processed commodities.

309-369 The table PAR contains parameters concerning demand for agricultural commodities. ELAST-P are the price elasticities and ELAST-I identifies income elasticities. These elasticities are based on econometric estimations and partly on assumptions (guestimates).

The coefficients listed under FACTOR and COST are not relevant, because in the present version the demand is modeled on farm gate level.
The columns PQP1 and PQP2 are reserved for coefficients of the non-linear cost function.

374-437 This part (TABLE RES) presents data of given resources or input costs. Under QUANT the quantity of resources, which are available in the respective year, are listed. The corresponding is true for prices.

REINDEX is utilized for updating purposes and only relevant for some inputs. PQP3 is indicated in the second step run of the model.

447-450 In the first step run the MACRO parameter only consists of the exchange rate (TL/US $), the technology coefficient TCOEF (sectoral relation between animal and mechanized technology) and a fallow coefficient FCOEF (relation between cereal and fallow area).

For the second step run and in the forecasting version some additional MACRO parameters are required.

463-820 The large IOC-table presents the basic process specific input and output coefficients of the production activities in the model. As far as crop production activities are concerned, only the animal technology processes are listed. The coefficients of tractor technology process will be derived from the animal technology by global assumption.

As far as specific information is available the coefficients of the animal and tractor technology based activity could also be entered directly (enlarged IOC table).

Specific knowledge about these coefficients can be gained by reading the SET statements in the beginning of the input file. More information on the sources of these coefficients is given in chapter 4.

In the present version, the IOC table is the same for every year. Some of the coefficients are updated by using the up-dating indices, already mentioned above.

All coefficient are based on the per ha or animal terminology. Usual land requirement is therefore 1 ha with the exception of fallow activities, which consequently need 2 ha.
Labour and animal power requirements are termed in hours per ha.

Fertilzer and seed requirements are measured in kg per ha.

The Yields of the commodity itself and the by-product (e.g. F-wheat) are exposed in tons per ha.

The livestock activities (lines 770-820) present the labour requirement per year, which is equally distributed to the quarterly periods.

The total feed requirement coefficient TENE is replaced and calculated by a feed requirement function.
The lines 776-782 present the various minimum feed requirements of the sub-components in percentage of the total feed requirement TENE. These relations are in the present version constant over time.
The outputs of the livestock activities are measured in kg per average stock.

833-902 In this part of the programme, some additional coefficients and technical relations, which are necessary for modeling the feed-livestock sector, are listed (for more details see below).

913-1014 This programme part contains assignment statements for transforming data and for calculating the parameters, which are needed for the final model. We have to consider that in most of these statements indices are used and because of the internal loop mechanisms of GAMS, the calculations are carried out for all of the associated elements defined in the set statement.

In line 919 the quadratic cost term of the labour supply function is calculated, based on the Turkish Lira labour wage rate, which is transformed into US-dollar (remember that the total final model is formulated in US-dollar terms). This wage rate is divided by the effective labour use, which is obtained from the available labour stock and an average unemployment rate (for the methodological details see chapter 2.3.3.2.2).

In Line 921 the corresponding calculation for tractor and machinery service supply is made.

In the following statements the coefficients of the IOC table are transformed and transferred to the parameter P (crops) and Q (livestock). At this stage a mechanized process for each crop production activity is created.

It is assumed that using a tractor for 1 hour is equivalent to the use of animals for 10 hours. Therefore, tractor demand is 1/10 of animal power demand per ha (lines 940-943). Accordingly, the labour requirement for the machanized process is 90 % lower than animal power time (lines 929-936).

Except for labour, animal power and tractor requirements as well as all the other coefficient are the same for both kinds of technology.

For tea and pasture use only, an animal power activity is assumed (lines 951-954).

In line 964 and 965 labour requirements and animal power supply of the livestock activities are transferred to quarterly coefficients (remember that the associated model restrictions are formulated on a quarterly basis).

In line 967 total feed requirements per animal unit is calculated. For this calculation a certain absolute feed requirement component and a yield depending (milk, meat, eggs) component is distinguished. The assumed coefficients are given in table FEEDABS (line 884-893) and by the parameter FEEDREQ (line 871-883). The last parameter is the feed requirement in kilostarch equivalent per kg output.

In line 969 the minimum feed requirements of the different feed sub-groups are calculated.

982-1014 For the computation of the demand function, first some additional parameters are defined.

(Line 998 presents the condition for the computation of 0/1 Index concerning foreign trade with processed commodities).

In the lines 1001-1005 domestic consumption is derived from domestic production, exports, imports, the by-products used for animal feeding and from feedgrain.

Then the slope (BETA, line 1009) and the intercept (ALPHA, line 1014) is derived for all commodities as stated in chapter 2.3.3.2.1 in this report.

Only for calibration purposes the slope of cereals is zero (line 1011), which means that prices are exogenous. This allows an exact calculation of feedgrain demand from the assumption mentioned above. In the second step run this statement is removed and the feedgrain demand numbers (line 899-902) are updated. This leads to a consistent calculation of domestic consumption.

1020-1174 The final model part presents the VARIABLE and EQUATIONS. (consider lines with a (*) in the first column are neglected).

The main statements refer exactly to the core matrix lined out in chapter 2.3.2.

The feed sector is more detailed. The equations in line 1088-1106 present feed supply disaggregated to different supply categories. Line 1108 presents the total feed balance, the supply of different categories (left hand side) and demand of the livestock sector are summed up. The lines 111-1117 ensure that the minimum feed composition requirements are fulfilled (feed subgroup balances).

Finally, the equation MINGRAIN (line 1119) ensures, that certain minimum shares of single cereal types is in relation to total feedgrain.

Line 1144-1145 expresses the calibration constraints for the first step run.

The equation CERBAL sums up the cereal area and FALBAL the fallow area, which are calibrates in the next two equations by using the coefficient MACRO ("FCOEF").

A similar procedure is applied to technology calibration in line 1160-1165.

The final equation defines the objective value PROFIT (here sum of producer and consumer surplus). In lines 1167-1168 the area beneath the demand curve is calculated. Sequently export revenues are added and import expenditure substracted (lins 1169-1171). Finally, production cost are substracted (line 1172: cost for seed, fertilizer and capital; line 1173: labour and tractor costs as defined by the assumed supply functions).

1177-1188 This part contains some options for controlling the execution process.

Line 1187 defines the model by all the equations listed above (except equations with (*) in the front) and line 1188 calls the model solver.

The remaining statements are applied for displaying model results at the desired aggregation level and format. Since these statements are optional, the input file could finish with line 1188.

1193-1202 Firstly, parameters for the additional output table are declared. In the following the output table DPRICE is defined by assignment statements. Since we want to compare the modeled price with the observed one, the statistical price is taken from DPRI (defined in line 1007 by the domestic price in TL

and the exchange rate) and the model price is characterized by the shadow price of the commodity balance COMBAL.M.

Line 1200 calculates the relation between both prices.

Finally, we take the shadow price from the export and import restriction as first indicator for the relativ competiveness of foreign trade.

1204-1215 In these lines an aggregated user balance is summerized for each commodity, existing of

- total production,
- total trade,
- feedgrain use,
- feed by products,
- and domestic consumption.

All these components are taken from model results. Therefore, this output table can be used in order to check, whether the model is really formulated consistent in terms of quantity. Only after a number of test runs consistency has been achieved.

1217-1227 In output table PQPCOM the coefficient of the quadratic cost function is calculated as described in chapter 2.3.3.2.3. Additionally, the relative share of the shadow price of the calibration constraints to the market price is calculated.

DEM is only for displaying the parameters of the demand functions in one output table.

In PQPLIV the non-linear cost terms for the livestock sector are calculated.

1228 This statement prints the described output table and some other informations into the output file.

1230-End The last part of the input file computes the cost structure and the revenue structure in absolute and relative terms for each production activity. This calculation is based on the physical input and output coefficients as well as an exogenous and endogenous prices for outputs and inputs. In economic terms, the calculated shares express the relative importance of the various input and output items.

This cost evaluation is based on the basic theorem of mathematical programming models which characterizes the fact that economic costs match the economic revenue for all realized activities.

More details will be explained in connection with the presentation of results.

```
*                   *-------------------------------------------------*
*                   *               T U R K I S H                     *
*                   *                                                 *
*                   *     A G R I C U L T U R A L    S E C T O R      *
*                   *                                                 *
*                   *                 M O D E L                       *
*                   *             (  TASM  -  MAFRA   )               *
*                   *-------------------------------------------------*
*                   *                                                 *
*                   *      CALIBRATION -VERSION  FOR THE              *
*                   *                                                 *
*                   *         PERIOD   1979  - 1986                   *
*                   *-------------------------------------------------*
*                   *             DEVELOPED BY(C):                    *
*                   *                                                 *
*                   *    PROF. DR. S. BAUER                           *
*                   *    INSTITUT FOR AGRICULTURAL POLICY             *
*                   *    NUSSALLEE 21 , D 5300 BONN , FRG             *
*                   *    TEL. 49-228-732502  OR 49-2255-4165          *
*                   *              AND                                *
*                   *    PROF. DR. H. KASNAKOGLU                      *
*                   *    DEPARTMENT OF ECONOMICS                      *
*                   *    MIDDLE EAST TECHNICAL UNIVERSITY, ANKARA     *
*                   *    TEL. 90-4-2237100 :2003 OR 2056              *
*---------------------------------------------------------------------*
*               1. SET  SECTION  ( DEFINITIONS )
*-----------------------------------------------------------------
 SETS S  AGREGATED LAND TYPES
      / DRY-EITH, IRR-EITH, DRY-GOOD, IRR-GOOD, TREE,   PASTURE /

      L  LABOR DIVIDED INTO 4 QUARTERS PER YEAR
      / LABOR-1Q, LABOR-2Q, LABOR-3Q, LABOR-4Q /

      A  ANIMAL POWER DIVIDED INTO 4 QUARTERS PER YEAR
      / ANIMAL-1Q, ANIMAL-2Q, ANIMAL-3Q, ANIMAL-4Q /

      M  MACHINES LIKE TRACTOR POWER DIVIDED INTO 4 QUARTERS PER YEAR
      / TRACTOR-1Q, TRACTOR-2Q, TRACTOR-3Q, TRACTOR-4Q /

      F  FERTILIZER (DUENGER)
      / NITROGEN, PHOSPHATE /

      D  SEEDS (SAATGUT)
      / S-WHEAT,     S-CORN,      S-RYE,       S-BARLEY,    S-SOYABEAN,
        S-CHICKPEA ,S-DRY-BEAN, S-LENTIL,    S-POTATO,    S-ONION,
        S-TOMATO,    S-GR-PEPPR ,S-CUCUMBER, S-SUNFLWER ,S-GROUNDNT ,
        S-COTTON,    S-TOBACCO,   S-SUG-BEET, S-MELON,     S-PISTACHI ,
        S-RICE,      S-SESAME,    S-ALFALFA,   S-FODDER /

      O1  OUTPUT  CROPS
      / WHEAT,       CORN,        RYE,         BARLEY,      RICE,
        CHICK-PEA,   DRY-BEAN,    LENTIL,      POTATO,      ONION,
        GR-PEPPER,   TOMATO,      CUCUMBER,    SUNFLOWER,   OLIVE,
        GROUNDNUT,   SOYABEAN,    SESAME,      COTTON,      SUG-BEET,
        TOBACCO,     TEA,         CITRUS,      GRAPE,       APPLE,
```

```
           PEACH,       APRICOT,     CHERRY,      WILDCHERRY, MELON,
           STRAWBERRY, BANANA,      QUINCE,      PISTACHIO,  HAZELNUT/
         O2  OUTPUT  ANIMALS
         / SHEEP-MEAT, SHEEP-MILK, SHEEP-WOOL, SHEEP-HIDE,
           GOAT-MEAT,  GOAT-MILK,  GOAT-WOOL,  GOAT-HIDE,
           ANGOR-MEAT, ANGOR-MILK, ANGOR-WOOL, ANGOR-HIDE,
           BEEF,       COW-MILK,   COW-HIDE,
           BUFAL-MEAT, BUFAL-MILK, BUFAL-HIDE,
           POLTR-MEAT, EGGS /

         G1  FEED -- STRAW AND HAY
         / F-WHEAT, F-CORN, F-RYE, F-BARLEY, F-PULSES,
          F-ALFALFA, F-FODDER/

         G2  FEED -- CONCENTRATES
         / WHEAT, RYE, BARLEY, SUG-BEET/

         G3  FEED -- GRAINS
         / WHEAT, CORN, RYE,BARLEY/

         G4  FEED  OILCAKE
         /SUNFLOWER, GROUNDNUT, COTTON, SOYABEAN /

         G5  FEED -- GREEN FODDER AND HIGH QUALITY HAY
         / FODDER,ALFALFA/

         TF  TOTAL FEED SUPPLY IN ENERGY VALUES
         /TSTRAW,  TCONCEN,  TGRAIN,  TFODD,  TOIL,  TPAST/

         TS  SUBGROUPS OF ENERGY REQUIREMENTS FROM THE LIVESTOCK SECTOR
         /   TGRCONOIL,  TGROIL ,PASTFEED /

         TE  TOTAL ENERGY
          /TENE/

         T  PRODUCTION TECHNIQUES
         /ANIMAL, MECHANIZED /

        I SINGLE CROP ACTIVITIES (FRUECHTE UND FRUCHTFOLGEN)
        / SWHEATD, FWHEATD, SWHEATI, SCORN-D, FCORN-D,
          SCORN-I, SRYE--D, FRYE--D, SRICE-I, FRICE-I,
          SBARLYD, FBARLYD, SCKPEAD, SCKPEAI, SDBEANI,
          SLENTLD, SPOTATI, SONIOND, SONIONI, SGPEPPI,
          STOMATI, SCUCUMI, SSUNFLD, SSUNFLI, SGRNUTI,
          SSBEANI, SSESAMI, SCOTTNI, STOBACD, SMELOND,
          SMELONI, SSBEETI, SALFALI, SFODDRD, PASTUSE,
          OLIVE-D,     TEA---D,     CITRS-I,      GRAPE-D,
          GRAPE-I,     APPLE-I,     PEACH-I,      APRIC-I,
          CHERR-I,     WCHER-I,     STBER-I,      BANAN-I,
          QUINC-I,     PISTA-D,     HAZEL-D /

         J  LIVESTOCK PRODUCTION ACTIVITIES (TIERHALTUNGS- AKTIVITAETEN)
         / SHEEP, GOAT, ANGORA, CATTLE, BUFFALO, MULE, POULTRY /

        JC  LIVESTOCK ACIVITY AND COMMODITY CORRESPONDENC
```

```
       /SHEEP-MEAT,GOAT-MEAT,ANGOR-MEAT,BEEF,BUFAL-MEAT,MULE,POLTR-MEAT/

       B AREA
       / A-WHEAT-, A-CORN--, A-RYE---, A-BARLEY,
         A-CHKPEA, A-DRBEAN, A-LENTIL, A-POTATO, A-ONION-, A-TOMATO,
         A-GRPEPR, A-CUCUMB, A-SUNFLR, A-GRDNUT, A-COTTON, A-TOBACO,
         A-SRBEET, A-MELON-, A-PISTAC, A-RICE--, A-SBEAN-, A-SESAME,
         A-OLIVE-, A-CITRUS, A-APPLE-, A-APRICO, A-WDCHER, A-SBERRY,
         A-QUINCE, A-HAZELN, A-TEA---, A-GRAPE-, A-PEACH-, A-CHERRY,
         A-BANANA, A-ALFALF, A-FODDER /

       BC CEREAL AREA
       / A-WHEAT-,   A-CORN--,    A-RYE---,    A-RICE--,    A-BARLEY /

       BF FALLOW AREA  / FALLOW /

       B1 FODDER     / ALFALFA,FODDER /

       B2 FODDER     /A-ALFALF,A-FODDER /

       E  PRODUCTION COST STRUCTURE (PROD.-KOSTEN-STRUKTUR)
      / SEED , FERTILIZER , CAPITAL /

SET  O    ALL OUTPUTS       ; O(O1) = YES; O(O2) = YES;
SET  OCR     CROPS          ; OCR(O1)=YES; OCR(G5)=YES;
SET LM LABOR AND TRACTOR; LM(L) = YES; LM(M) = YES;

SET  LMF LABOR TRACTOR AND FERTILIZER ;
        LMF(LM) = YES; LMF(F) = YES;

SET  TC FEED REQUIREMENT COEFFIENTS;
       TC(TF) = YES;   TC(TS) = YES;

SET  G   ALL FEED COMPONENTS INCLUDING TOTALENERGY AND SUBGROUPS;
         G(G1) = YES;      G(G2) = YES;
         G(G3) = YES;      G(G4) = YES;
         G(G5) = YES;      G(TC) = YES;
         G(TE) = YES;

SET  IO  ALL I-O COEFFICENTS EXCEPT LAND;
         IO(L) = YES; IO(A) = YES; IO(M) = YES; IO(F) = YES;
         IO(D) = YES; IO(O) = YES;
         IO(G) = YES; IO(B) = YES;

SET  IR  SINGLE AND ROTATION CROPS;
         IR(I) = YES;

SET  IRJ ALL PRODUCTION ACTIVITIES;
         IRJ(IR) = YES;   IRJ(J)  = YES;

SET  OAL  ALL OUTPUTS (MARKET AND INTERNAL PRODUCTION);
         OAL(O) = YES;  OAL(G5) = YES;

*-----------------------------------------------------------------------
*             2. BASIC STATISTCAL DATA (PROCESSED  IN SYMPHONY- GAMSDAT)
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*                 (TO  BE YEARLY UPDATED VS. PROJECTED )
*-----------------------------------------------------------------------
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TABLE DOM DOMESTIC PRODUCTION DATA

	DPROD	AREA	YIELDS	DPRICES	RYIELD
WHEAT	13538.51	6638.97	2.039	18.03	0.9872
CORN	1212.44	287.81	4.213	22.45	0.8966
RYE	704.81	423.51	1.664	14.11	1.0025
BARLEY	5629.77	1826.65	3.082	14.72	1.0633
RICE	198.00	42.18	4.694	54.38	0.9041
CHICK-PEA	297.67	158.49	1.878	35.07	1.0444
DRY-BEAN	66.91	43.95	1.522	61.25	1.0159
LENTIL	436.07	376.36	1.159	55.45	1.0500
POTATO	3000.00	220.13	13.628	21.25	0.9814
ONION	1090.00	58.50	18.634	24.33	1.0028
GR-PEPPER	600.00	31.38	19.119	28.27	1.1961
TOMATO	3600.00	99.71	36.106	21.58	1.1155
CUCUMBER	510.00	27.64	18.455	27.02	1.1062
SUNFLOWER	720.21	723.19	0.996	31.34	0.8674
OLIVE	400.00	484.47	0.826	43.55	0.9062
GROUNDNUT	57.00	23.98	2.377	76.38	0.9913
SOYABEAN	15.00	10.97	1.367	36.79	0.8556
SESAME	25.00	18.51	1.351	90.59	1.0817
COTTON	780.77	550.35	1.419	149.72	0.9595
SUG-BEET	11165.45	290.89	38.384	3.91	0.9536
TOBACCO	161.91	177.72	0.911	137.03	1.0181
TEA	192.26	87.25	2.204	41.00	0.3492
CITRUS	958.00	53.72	17.833	23.28	0.7857
GRAPE	3700.00	748.24	4.945	42.91	1.1232
APPLE	1450.00	247.42	5.861	21.32	1.0025
PEACH	265.00	23.69	11.185	41.52	1.1413
APRICOT	105.00	29.59	3.548	52.67	0.8791
CHERRY	95.00	20.52	4.629	48.36	0.9859
WILDCHERRY	60.00	13.67	4.388	41.05	1.0098
MELON	4500.00	263.19	17.098	18.95	0.9343
STRAWBERRY	23.00	4.99	4.606	148.07	1.0455
BANANA	30.00	1.59	18.813	225.43	1.2071
QUINCE	56.00	7.94	7.053	29.64	1.1462
PISTACHIO	25.00	74.74	0.334	350.93	0.9566
HAZELNUT	350.00	333.99	1.048	110.48	1.1645
SHEEP-MEAT	377.70	49598.00	7.615	137.05	1.0370
SHEEP-MILK	1196.59	49598.00	24.126	35.67	1.0074
SHEEP-WOOL	62.35	49598.00	1.257	262.92	0.9757
SHEEP-HIDE	28.71	49598.00	0.579	182.83	1.4885
GOAT-MEAT	103.36	15070.00	6.859	109.01	1.0012
GOAT-MILK	565.46	15070.00	37.522	35.06	0.9927
GOAT-WOOL	8.94	15070.00	0.593	198.28	0.9738
GOAT-HIDE	5.68	15070.00	0.377	182.83	1.3561
ANGOR-MEAT	6.90	3856.00	1.791	114.17	1.0099
ANGOR-MILK	57.76	3856.00	14.980	35.06	1.0003
ANGOR-WOOL	6.05	3856.00	1.570	477.62	0.9923
ANGOR-HIDE	0.50	3856.00	0.128	182.83	1.5688

BEEF	371.40	15981.10	23.240	110.42	0.9253
COW-MILK	3486.09	15981.10	218.138	35.91	1.0028
COW-HIDE	53.86	15981.10	3.370	87.89	1.0167
BUFAL-MEAT	32.21	1002.29	32.141	107.45	0.9834
BUFAL-MILK	283.58	1002.29	282.928	38.54	0.9923
BUFAL-HIDE	2.44	1002.29	2.433	87.89	0.8166
POLTR-MEAT	139.59	62328.92	2.240	155.80	1.0000
EGGS	281.70	62328.92	4.520	169.60	1.0041
ALFALFA	1323.00	143.14	9.243		0.9729
FODDER	1108.05	358.89	3.087		0.7719
MULE		2341.50			

TABLE TRADE FOREIGN TRADE DATA

	EXP-Q	EXP-P	IMP-Q	IMP-P	EXP-PQP	IMP-PQP
WHEAT	315.537	144.89	272.309	205.66		
CORN	0.000	0.00	0.000	0.00		
RYE	0.201	254.37	0.000	0.00		
BARLEY	372.020	156.00	0.000	0.00		
RICE	0.000	0.00	40.400	353.51		
CHICK-PEA	175.656	333.14	0.000	0.00		
DRY-BEAN	28.133	551.00	0.000	0.00		
LENTIL	228.386	459.21	0.000	0.00		
POTATO	17.729	197.85	0.000	0.00		
ONION	98.743	168.17	0.000	0.00		
GR-PEPPER	0.643	491.76	0.000	0.00		
TOMATO	75.423	178.51	0.000	0.00		
CUCUMBER	0.000	0.00	0.000	0.00		
SUNFLOWER	0.003	767.70	0.000	0.00		
OLIVE	1.384	402.56	0.000	0.00		
GROUNDNUT	5.444	1149.00	0.000	0.00		
SOYABEAN	0.000	0.00	752.926	427.40		
SESAME	0.872	825.95	0.000	0.00		
COTTON	241.000	1267.99	0.000	0.00		
SUG-BEET	201.635	168.46	619.404	493.15		
TOBACCO	131.014	2328.10	0.000	0.00		
TEA	0.000	0.00	0.000	0.00		
CITRUS	279.909	271.17	0.000	0.00		
GRAPE	9.770	233.29	0.000	0.00		
APPLE	127.697	277.77	0.000	0.00		
PEACH	5.535	321.62	0.000	0.00		
APRICOT	50.444	485.14	0.000	0.00		
CHERRY	0.000	0.00	0.000	0.00		
WILDCHERRY	0.891	510.88	0.000	0.00		
MELON	18.156	139.34	0.000	0.00		
STRAWBERRY	0.051	702.18	0.000	0.00		
BANANA	0.001	834.00	0.000	0.00		
QUINCE	0.978	229.63	0.000	0.00		
PISTACHIO	3.957	4020.34	0.000	0.00		
HAZELNUT	12.909	1599.09	0.000	0.00		
SHEEP-MEAT	26.330	1849.64	0.000	0.00		
SHEEP-MILK	0.000	0.00	0.000	0.00		
SHEEP-WOOL	22.182	1799.03	13.327	6381.00		

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SHEEP-HIDE	0.882	1040.98	0.056	2481.00
GOAT-MEAT	0.312	952.40	0.000	0.00
GOAT-MILK	0.000	0.00	0.000	0.00
GOAT-WOOL	1.480	704.52	0.000	0.00
GOAT-HIDE	0.882	1040.98	0.000	0.00
ANGOR-MEAT	0.000	0.00	0.000	0.00
ANGOR-MILK	0.000	0.00	0.000	0.00
ANGOR-WOOL	2.840	3598.05	0.000	0.00
ANGOR-HIDE	0.000	0.00	0.000	0.00
BEEF	12.835	1572.14	0.000	0.00
COW-MILK	46.257	241.95	47.790	483.90
COW-HIDE	0.000	0.00	3.321	2259.66
BUFAL-MEAT	0.029	1572.14	0.265	4716.41
BUFAL-MILK	0.000	0.00	0.000	0.00
BUFAL-HIDE	0.000	0.00	0.000	0.00
POLTR-MEAT	0.707	1007.00	0.000	0.00
EGGS	3.095	766.66	0.000	0.00

TABLE PROCTRADE TRADE OF PROCESSED PRODUCTS

	WHEAT	TOMATO	SUNFLOWER	OLIVE	TEA	GRAPE	HAZELNUT
FACTOR	1.177	5.00	3.00	5.00	5.25	4.0	2.2
TPRICE	305.57	554.08	813.18	1358.87	1944.05	687.32	2390.52
TRADEQ	111.56	26.72	-8.87	43.45	3.32	99.69	92.35

TABLE PAR CONSUMPTION PARAMETERS AND PQP TERMS

	ELAST-P	ELAST-I	FACTOR	COST	PQP1	PQP2
WHEAT	-0.337	0	0.85	47.95		
CORN	-0.3	0	0.9	44.55		
RYE	-0.2	0	0.9	43.15		
BARLEY	-0.25	0	0.65	0		
RICE	-0.2	0.38	0.9	89.77		
CHICK-PEA	-0.31	0.6	0	0		
DRY-BEAN	-0.31	0.6				
LENTIL	-0.31	0.6				
POTATO	-0.2	0.3				
ONION	-0.189	0.6				
GR-PEPPER	-0.189	0.6				
TOMATO	-0.189	0.6				
CUCUMBER	-0.189	0.6				
SUNFLOWER	-0.302	0.60	.33	290.18		
OLIVE	-0.305	0.6	0.2	290.18		
GROUNDNUT	-0.305	0.6	0	0		
SOYABEAN	-0.305	0.6	0.18	290.18		
SESAME	-0.305	0.6	0.4	290.18		
COTTON	-0.3	0.5	0	0		
SUG-BEET	-0.303	0.6	0.11	98.5		

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     TOBACCO        -0.3       0.5     0       0
     TEA            -0.5       0.5     0.19    241.42
     CITRUS         -0.197     0.75    0       0
     GRAPE          -0.13      0.1
     APPLE          -0.14      0.8
     PEACH          -0.14      0.8
     APRICOT        -0.14      0.8
     CHERRY         -0.14      0.8
     WILDCHERRY     -0.14      0.8
     MELON          -0.189     0.6
     STRAWBERRY     -0.14      0.8
     BANANA         -0.14      0.8
     QUINCE         -0.14       0.8
     PISTACHIO      -0.4        0.5
     HAZELNUT       -0.4        0.5
     ALFALFA
     FODDER
     SHEEP-MEAT     -0.5        1.2
     SHEEP-MILK     -0.3       0.95
     SHEEP-WOOL     -0.2       1.18
     SHEEP-HIDE     -0.365     1.18
     GOAT-MEAT      -0.5        1.2
     GOAT-MILK      -0.3       0.95
     GOAT-WOOL      -0.2       1.18
     GOAT-HIDE      -0.365     1.18
     ANGOR-MEAT     -0.5       1.2
     ANGOR-MILK     -0.3       0.95
     ANGOR-WOOL     -0.2       1.18
     ANGOR-HIDE     -0.365     1.18
     BEEF           -0.365     0.45
     COW-MILK       -0.5       1.75
     COW-HIDE       -0.365     1.18
     BUFAL-MEAT     -0.5       0.45
     BUFAL-MILK     -0.5       1.75
     BUFAL-HIDE     -0.365     1.18
     POLTR-MEAT     -0.605      0.9
     EGGS           -0.6        0.85


*----------------------------------------------------------------------

 TABLE RES    RESOURCE DATA
                    QUANT       PRICE   REINDEX    PQP3

   DRY-EITH      16955.56          0         1
   DRY-GOOD      11812.02          0         1
   IRR-EITH       3021.15          0         1
   IRR-GOOD       1035.67          0         1
   TREE              2160          0         1
   PASTURE          20000          0         1
   LABOR-1Q      3082941.       62.5         1
   LABOR-2Q      3082941.       62.5         1
   LABOR-3Q      3082941.       62.5         1
   LABOR-4Q      3082941.       62.5         1
   TRACTOR-1Q      188129     10.080         1
```

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TASM1

TRACTOR-2Q	188129	10.080	1
TRACTOR-3Q	188129	10.080	1
TRACTOR-4Q	188129	10.080	1
NITROGEN	776408	0.42180	0.900
PHOSPHATE	532984	0.41205	0.630
SHEEP	49598	0	1
GOAT	15070	0	1
ANGORA	3856	0	1
CATTLE	15981	0	1
BUFFALO	1002	0	1
MULE	2353	0	1
POULTRY	62329	0	1
S-WHEAT	0	22.8	1
S-CORN	0	30.3	1
S-RYE	0	20.3	1
S-BARLEY	0	24	1
S-RICE	0	70.3	1
S-CHICKPEA	0	54	1
S-DRY-BEAN	0	64.1	1
S-LENTIL	0	58.9	1
S-POTATO	0	23.2	1
S-ONION	0	26.9	1
S-GR-PEPPR	0	0.6	1
S-TOMATO	0	0.5	1
S-CUCUMBER	0	2390.5	1
S-SUNFLWER	0	56.9	1
S-SUG-BEET	0	230.1	1
S-GROUNDNT	0	106.1	1
S-SOYABEAN	0	46.4	1
S-SESAME	0	119.1	1
S-COTTON	0	29.8	1
S-TOBACCO	0	0.04	1
S-MELON	0	1435.9	1
S-ALFALFA	0	195	1
S-FODDER	0	40	1
OLIVE-D	0	3000	1
TEA---D	0	75000	1
CITRS-I	0	15000	1
GRAPE-D	0	11460	1
GRAPE-I	0	12930	1
APPLE-I	0	11760	1
PEACH-I	0	32430	1
APRIC-I	0	17970	1
CHERR-I	0	22770	1
WCHER-I	0	20190	1
STBER-I	0	139410	1
BANAN-I	0	218940	1
QUINC-I	0	19140	1
PISTA-D	0	6000	1
HAZEL-D	0	6000	1

```
    PARAMETER  MACRO          MACROECONOMIC VARIABLES AND RELATIONS
           /EXRATE    112.8477
            TCOEF    0.33
            FCOEF    0.5/;








*------------------------------------------------------------------
*              3 . PARAMETER AND COEFFICIENTS
*------------------------------------------------------------------

 TABLE   IOC     BASIC PRODUCTION COEFFICIENTS (BASIS-PROD.-KOEFF.)

                          SWHEATD  FWHEATD   SWHEATI  SCORN-D  FCORN-D

       DRY-GOOD                 1        0         0        1        1
       DRY-EITH                 1        2         0        1        2
       IRR-EITH                 0        0         1        0        0
       A-WHEAT-                 1        1         1        0        0
       A-CORN--                 0        0         0        1        1
       FALLOW                   0        1         0        0        1
       LABOR-1Q               0.8       18       1.4       14       42
       LABOR-2Q                 4     27.4      28.9     87.4     53.7
       LABOR-3Q              28.3     25.2      45.9     75.6     75.6
       LABOR-4Q              46.4     31.2      52.8        0      5.7
       ANIMAL-1Q                0       14         0       14       28
       ANIMAL-2Q                2       26         4     19.2     19.6
       ANIMAL-3Q               27       24        43      3.6     13.6
       ANIMAL-4Q               43       30        49        0        0
       NITROGEN                75     48.4      60.8       48       41
       PHOSPHATE             56.7     62.2        67       60       70
       S-WHEAT              193.3    186.8       188        0        0
       WHEAT                 1.55        2       3.4        0        0
       F-WHEAT               1.85      2.4       4.1        0        0
       S-CORN                   0        0         0       60       54
       CORN                     0        0         0      2.5      3.3
       F-CORN                   0        0         0      3.4      4.4

       +                  SCORN-I  SRYE--D  FRYE--D  SRICE-I  FRICE-I

       DRY-GOOD                 0        1        0        0        0
       DRY-EITH                 0        1        2        0        0
       IRR-EITH                 1        0        0        1     1.33
       IRR-GOOD                 0        0        0        1        0
       A-CORN--                 1        0        0        0        0
       A-RYE---                 0        1        1        0        0
```

A-RICE--	0	0	0	1	1
FALLOW	0	0	1	0	0.33
LABOR-1Q	88	11.2	22.4	0	0
LABOR-2Q	258.3	32.7	64.7	360	400
LABOR-3Q	177.6	22.3	11.3	95	105
LABOR-4Q	64.9	29.2	36.2	0	0
ANIMAL-1Q	88	11	22	0	0
ANIMAL-2Q	17	32	64	90	100
ANIMAL-3Q	0	21	10	23	25
ANIMAL-4Q	35	28	35	0	0
NITROGEN	66	40	38.5	115	100
PHOSPHATE	32.5	50	55	45	50
S-CORN	60	0	0	0	0
CORN	5.4	0	0	0	0
F-CORN	9.4	0	0	0	0
S-RYE	0	175.4	136.5	0	0
RYE	0	1.66	2	0	0
F-RYE	0	1.8	2.3	0	0
S-RICE	0	0	0	110	120
RICE	0	0	0	4	5.2

+	SBARLYD	FBARLYD	SCKPEAD	SCKPEAI	SDBEANI
DRY-GOOD	1	0	1	0	0
DRY-EITH	1	2	1	0	0
IRR-EITH	0	0	0	1	1
A-BARLEY	1	1	0	0	0
FALLOW	0	1	0	0	0
A-CHKPEA	0	0	1	1	0
A-DRBEAN	0	0	0	0	1
LABOR-1Q	2.5	8	27	14	19
LABOR-2Q	1	38.2	56.4	289	223.7
LABOR-3Q	168.1	19.4	88.1	165.2	238.8
LABOR-4Q	20.1	27.2	28	14	57.7
ANIMAL-1Q	0	8	27	14	19
ANIMAL-2Q	0	38	15	30	44
ANIMAL-3Q	95	18	4	15	31
ANIMAL-4Q	17	26	28	14	40
NITROGEN	42	40.4	20	27	30
PHOSPHATE	50	55	50	69	62.5
S-BARLEY	250	184	0	0	0
BARLEY	2.5	2.9	0	0	0
F-BARLEY	2.8	3.4	0	0	0
S-CHICKPEA	0	0	140	100	0
CHICK-PEA	0	0	1.2	2.5	0
F-PULSES	0	0	1.1	2.16	2.7
S-DRY-BEAN	0	0	0	0	110
DRY-BEAN	0	0	0	0	1.498

+	SLENTLD	SPOTATI	SONIOND	SONIONI	SGPEPPI
DRY-GOOD	1	0	1	0	0
IRR-EITH	0	1	0	1	1
DRY-EITH	1	0	1	0	0
A-LENTIL	1	0	0	0	0

A-POTATO	0	1	0	0	0
A-ONION-	0	0	1	1	0
A-GRPEPR	0	0	0	0	1
LABOR-1Q	5	16	197	197.6	33
LABOR-2Q	67.7	315.7	205.6	416.7	331.4
LABOR-3Q	143.8	324.4	527.2	565.3	1040.2
LABOR-4Q	10.4	176.2	0	48.6	0
ANIMAL-1Q	5	16	57	87	33
ANIMAL-2Q	33	53	0	10	68
ANIMAL-3Q	52	47	33	44	56
ANIMAL-4Q	10	101	0	27	0
NITROGEN	21.3	70.6	60	88.5	110
PHOSPHATE	8.3	84	80	102	110
S-LENTIL	99	0	0	0	0
LENTIL	1.103	0	0	0	0
F-PULSES	1.1	0	0	0	0
S-POTATO	0	1555	0	0	0
POTATO	0	13.886	0	0	0
S-ONOIN	0	0	31	22	0
ONION	0	0	9.2	18.6	0
S-GR-PEPPR	0	0	0	0	36000
GR-PEPPER	0	0	0	0	15.983

+	STOMATI	SCUCUMI	SSUNFLD	SSUNFLI	SGRNUTI
IRR-EITH	1	1	0	1	1
DRY-EITH	0	0	1	0	0
DRY-GOOD	0	0	1	0	0
IRR-GOOD	0	0	0	0	1
A-TOMATO	1	0	0	0	0
A-CUCUMB	0	1	0	0	0
A-SUNFLR	0	0	1	1	0
A-GRDNUT	0	0	0	0	1
LABOR-1Q	126.9	41	35.2	41.8	59
LABOR-2Q	728.8	262.9	132.1	104.7	304
LABOR-3Q	1067.4	948.4	21.3	21.9	353.3
LABOR-4Q	105.3	34	0	8	371.5
ANIMAL-1Q	57	41	34	38	57
ANIMAL-2Q	54	19	17	10	75
ANIMAL-3Q	122	95	19	0	6
ANIMAL-4Q	42	34	0	6	39
NITROGEN	118	80	30	40	50
PHOSPHATE	75.5	90	30	40	50
S-TOMATO	2667	0	0	0	0
TOMATO	32.367	0	0	0	0
S-CUCUMBER	0	5.5	0	0	0
CUCUMBER	0	16.687	0	0	0
S-SUNFLWER	0	0	10	11.5	0
SUNFLOWER	0	0	1.148	1.7	0
S-GROUNDNT	0	0	0	0	100
GROUNDNUT	0	0	0	0	2.397

+	SSBEANI	SSESAMI	SCOTTNI	STOBACD	SMELOND
IRR-EITH	1	1	1	0	0
IRR-GOOD	0	0	1	0	0
DRY-GOOD	0	0	0	1	0
DRY-EITH	0	0	0	1	1
A-SBEAN-	1	0	0	0	0
A-SESAME	0	1	0	0	0
A-COTTON	0	0	1	0	0
A-TOBACO	0	0	0	1	0
A-MELON-	0	0	0	0	1
LABOR-1Q	0	0	41	26	11.7
LABOR-2Q	0	188.3	317.8	476.5	28.5
LABOR-3Q	142.3	111.8	421.6	662.2	353.8
LABOR-4Q	257.7	58.9	403.7	378.2	83.5
ANIMAL-1Q	0	0	41	26	10
ANIMAL-2Q	0	54.5	121	90	26
ANIMAL-3Q	50.2	21.5	64	15	96
ANIMAL-4Q	61.8	42	41	20	0
NITROGEN	60	120	160	28	30
PHOSPHATE	0	40	100	21	20
S-SOYABEAN	15	0	0	0	0
SOYABEAN	2.1	0	0	0	0
S-SESAME	0	70	0	0	0
SESAME	0	1.248	0	0	0
S-COTTON	0	0	75	0	0
COTTON	0	0	1.479	0	0
S-TOBACCO	0	0	0	200000	0
TOBACCO	0	0	0	0.8948	0
S-MELON	0	0	0	0	6.9
MELON	0	0	0	0	10.4

+	SMELONI	SALFALI	SFODDRD	SSBEETI	PASTUSE
IRR-EITH	1	1	0	1	0
DRY-GOOD	0	0	1	0	0
DRY-EITH	0	0	1	0	0
A-MELON-	1	0	0	0	0
A-ALFALF	0	1	0	0	0
A-FODDER	0	0	1	0	0
A-SRBEET	0	0	0	1	0
PASTURE	0	0	0	0	1
LABOR-1Q	42	0	15	43.4	3
LABOR-2Q	173.7	85	40.5	470.6	6
LABOR-3Q	320.3	185.5	68.5	184.6	4
LABOR-4Q	16	0	0	362.9	2
ANIMAL-1Q	42	0	15	41.7	0

ANIMAL-2Q	58	50	35	28.9	0
ANIMAL-3Q	98	33	20	58.7	0
ANIMAL-4Q	16	0	0	89.3	0
NITROGEN	54	10	30	153.4	0
PHOSPHATE	63	10	0	144.9	0
S-MELON	4.5	0	0	0	0
MELON	18.3	0	0	0	0
S-ALFALFA	0	15	0	0	0
F-ALFALFA	0	5	0	0	0
ALFALFA	0	9.5	0	0	0
S-FODDER	0	0	30	0	0
FODDER	0	0	4	0	0
F-FODDER	0	0	1.5	0	0
S-SUG-BEET	0	0	0	10	0
SUG-BEET	0	0	0	40.25	0
PASTFEED	0	0	0	0	0.22

+	OLIVE-D	TEA---D	CITRS-I	GRAPE-D	GRAPE-I
TREE	1	1	1	1	1
A-OLIVE-	1	0	0	0	0
A-TEA---	0	1	0	0	0
A-CITRUS	0	0	1	0	0
A-GRAPE-	0	0	0	1	1
LABOR-1Q	42.8	12	711.7	158.7	203.9
LABOR-2Q	36.1	74	368.6	185.5	279.2
LABOR-3Q	1.9	55	190	347	417.3
LABOR-4Q	139.6	15	515.3	77.9	162.4
ANIMAL-1Q	30.4	0	45.6	0	39
ANIMAL-2Q	30.4	2	0	55	79
ANIMAL-3Q	0	0	0	44	37
ANIMAL-4Q	19	0	45.6	28	52
NITROGEN	7.6	25.9	152	25	50
PHOSPHATE	5.7	7.5	152	40	80
OLIVE	0.911	0	0	0	0
TEA	0	6.309	0	0	0
CITRUS	0	0	22.696	0	0
GRAPE	0	0	0	3.829	4.98

+	APPLE-I	PEACH-I	APRIC-I	CHERR-I	WCHER-I
TREE	1	1	1	1	1
A-APPLE-	1	0	0	0	0
A-PEACH-	0	1	0	0	0
A-APRICO	0	0	1	0	0
A-CHERRY	0	0	0	1	0

A-WDCHER	0	0	0	0	1
LABOR-1Q	69.9	103.9	107.2	256.5	85.1
LABOR-2Q	101.2	63.4	419.3	1365.7	340
LABOR-3Q	220.6	632.5	234.1	58	1151.3
LABOR-4Q	112.6	101.9	40	30	30
ANIMAL-1Q	0	0	0	137	0
ANIMAL-2Q	61.6	0	181	172	244
ANIMAL-3Q	74.8	77	9	0	28
ANIMAL-4Q	23.8	39.3	0	0	0
NITROGEN	15.8	6.2	40	50	50
PHOSPHATE	30.8	23.1	50	40	80
APPLE	5.846	0	0	0	0
PEACH	0	9.799	0	0	0
APRICOT	0	0	4.035	0	0
CHERRY	0	0	0	4.695	0
WILDCHERRY	0	0	0	0	4.345

+	STBER-I	BANAN-I	QUINC-I	PISTA-D	HAZEL-D
TREE	1	1	1	1	1
A-SBERRY	1	0	0	0	0
A-BANANA	0	1	0	0	0
A-QUINCE	0	0	1	0	0
A-PISTAC	0	0	0	1	0
A-HAZELN	0	0	0	0	1
LABOR-1Q	102.4	86	66.8	159	113
LABOR-2Q	1580.6	894	161.5	18	113
LABOR-3Q	77.5	285	159.4	170	591
LABOR-4Q	281	972.5	165.4	154.4	113
ANIMAL-1Q	0	0	0	120	0
ANIMAL-2Q	8.6	0	93.5	18	0
ANIMAL-3Q	8.1	0	0	10	10
ANIMAL-4Q	31.5	127	22.6	0	0
NITROGEN	24.8	400	27.5	0	130
PHOSPHATE	0	240	55	20	1.7
STRAWBERRY	4.405	0	0	0	0
BANANA	0	15.585	0	0	0
QUINCE	0	0	6.153	0	0
S-PISTACHI	0	0	0	15	0
PISTACHIO	0	0	0	0.3496	0
HAZELNUT	0	0	0	0	0.9

+	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
LABOR	11.53	10.53	10.2	120	120

ANIMAL	0	0	0	38	52
TENE	115.6	119.5	147.7	436.2	549.7
TPAST	8	8	8	8	8
TGRCONOIL	32	30	30	40	40
TGROIL	26	26	26	32	35
TOIL	1	1	1	1	1
TSTRAW	10	10	8	12	12
TFODD	4	4	2	6	5
SHEEP-MEAT	7.34	0	0	0	0
SHEEP-MILK	23.95	0	0	0	0
SHEEP-WOOL	1.29	0	0	0	0
SHEEP-HIDE	0.389	0	0	0	0
GOAT-MEAT	0	6.85	0	0	0
GOAT-MILK	0	37.8	0	0	0
GOAT-WOOL	0	0.609	0	0	0
GOAT-HIDE	0	0.278	0	0	0
ANGOR-MEAT	0	0	1.773	0	0
ANGOR-MILK	0	0	14.975	0	0
ANGOR-WOOL	0	0	1.582	0	0
ANGOR-HIDE	0	0	0.0826	0	0
BEEF	0	0	0	25.11	0
COW-MILK	0	0	0	217.54	0
COW-HIDE	0	0	0	3.315	0
BUFAL-MEAT	0	0	0	0	32.68
BUFAL-MILK	0	0	0	0	285.2
BUFAL-HIDE	0	0	0	0	2.98

+	MULE	POULTRY
LABOR	78	5
ANIMAL	120	0
TENE	347.5	25
TPAST	10	4
TGRCONOIL	10	72
TGROIL	5	65
TOIL	1	4
TSTRAW	10	5
TFODD	4.5	0
POLTR-MEAT	0	2.24
EGGS	0	4.501

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*------------------------------------------------------------------
*    3B. ADDITIONAL PARAMETERS
*-----------------------------------------------------------
 PARAMETERS  CONCENT      CONCENTRATE BY PRODUCT COEFF(PER OUTPUT UNIT)
              / WHEAT     0.15
                RYE       0.1
                BARLEY    0.15
                SUG-BEET  0.05 /,

      CONOIL   OILSEED BY PRODUCT COEFFICIENT
        / SUNFLOWER   0.26
          GROUNDNUT   0.10
          COTTON      0.40
          SOYABEAN    0.20/,

      ENEC   ENERGY EQUIVALENT BY PRODUCKTS PER BY PRODUCT UNIT
        /  WHEAT          0.50
           RYE            0.24
           BARLEY         0.60
           SUG-BEET       0.60
           SUNFLOWER      0.53
           GROUNDNUT      0.56
           COTTON         0.56
           SOYABEAN       0.68
           F-WHEAT        0.13
           F-CORN         0.15
           F-RYE          0.17
           F-BARLEY       0.23
           F-PULSES       0.19
           F-ALFALFA      0.30
           F-FODDER       0.40
           ALFALFA        0.30
           FODDER         0.40/,

      LABFED   LABOR FOR HARVESTING  AND FEEDING STRAW
         / LABOR-1Q     8.
           LABOR-2Q     3.
           LABOR-3Q    25.
           LABOR-4Q     5.
           TRACTOR-3Q   1./,

       FEEDREQ   FEED REQUIREMENTS (ENERY PER YIELD UNIT)
           /SHEEP-MEAT    1.5
            SHEEP-MILK    0.4
            GOAT-MEAT     1.6
            GOAT-MILK     0.4
            ANGOR-MEAT    2.0
            ANGOR-MILK    0.5
            BEEF          1.8
            COW-MILK      0.4
            BUFAL-MEAT    2.0
            BUFAL-MILK    0.5
            POLTR-MEAT    2.5
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              EGGS              3.5/;
TABLE FEEDABS   ABSOLUTE FEEDREQUIREMENTS AND TECHN. PROGRESS

                   NEED      PROGRESS
 SHEEP              95.        0.98
 GOAT               94.        0.98
 ANGORA            102.        0.98
 CATTLE            290.        0.98
 BUFFALO           340.        0.98
 MULE              280.        0.99
 POULTRY            10.        0.97

TABLE  FEEDGRAIN  DATA AND COEFF. FOR FEEDING GRAIN

                    ENEGR    MINGR     USEGR

 WHEAT               0.72     0.30      1108.
 CORN                0.78     0.11       677.
 RYE                 0.65     0.04       401.
 BARLEY              0.71     0.51      3399.

*---------------------------------------------------------------


*------------------------------------------------------------------
*       4.  CALCULATION OF MODEL PARAMETER AND COEFICIENTS
*------------------------------------------------------------------
*  QUADRATIC COST TERM CALCULATION FOR LABOUR AND TRACTORS
*  ASSUMED SHIFT FACTORS: AVAILABLE STOCK, AVERAGE COSTS,REL. UNEMPLOYM.

PARAMETERS        PQPLT            QUADRATIC LABOUR AND TRACTOR COSTS    ,
                  RUNEMP           RELATIVE UNEMPL.  LABOUR AND TRACTORS
                    / LABOR        0.75
                      TRACTOR      0.18/;


 PQPLT(L)=  (RES(L,"PRICE") / MACRO("EXRATE"))
                              / (RUNEMP("LABOR") * RES(L,"QUANT")) ;
 PQPLT(M)=  (RES(M,"PRICE")) / (RUNEMP("TRACTOR") * RES(M,"QUANT"));

PARAMETER      P      CROP PRODUCTION COEFFICIENTS (KOEFFIZIENTEN)      ;

   P(S,I,T) = IOC(S,I)              ;
   P(B,I,T) = IOC(B,I)              ;
   P("FALLOW",I,T) = IOC("FALLOW",I)             ;
   P(L,I,"ANIMAL") = IOC(L,I)    ;
   P("LABOR-1Q", I,"MECHANIZED") =           IOC("LABOR-1Q",I)
                                      - 0.9*IOC("ANIMAL-1Q",I)     ;
   P("LABOR-2Q", I,"MECHANIZED") =           IOC("LABOR-2Q",I)
                                      - 0.9*IOC("ANIMAL-2Q",I)     ;
   P("LABOR-3Q", I,"MECHANIZED") =           IOC("LABOR-3Q",I)
                                      - 0.9*IOC("ANIMAL-3Q",I)     ;
   P("LABOR-4Q", I,"MECHANIZED") =           IOC("LABOR-4Q",I)
                                      - 0.9*IOC("ANIMAL-4Q",I)     ;
```

```
     P(A, I,"ANIMAL") = IOC(A, I)   ;

     P("TRACTOR-1Q",I,"MECHANIZED") =  0.1 * IOC("ANIMAL-1Q",I);
     P("TRACTOR-2Q",I,"MECHANIZED") =  0.1 * IOC("ANIMAL-2Q",I);
     P("TRACTOR-3Q",I,"MECHANIZED") =  0.1 * IOC("ANIMAL-3Q",I);
     P("TRACTOR-4Q",I,"MECHANIZED") =  0.1 * IOC("ANIMAL-4Q",I);

     P(F, I, T)  =  IOC(F, I) * RES(F,"REINDEX") ;
     P(D, I, T)  =  IOC(D, I)        ;
     P(G,I,T)   = IOC(G,I)             ;

     P(OAL, I, T)  =  IOC(OAL, I) * DOM(OAL,"RYIELD")    ;

     P(IO,"TEA---D","MECHANIZED")= 0;
     P(S ,"TEA---D","MECHANIZED")= 0;
     P(IO,"PASTURE","MECHANIZED")= 0;
     P(S ,"PASTURE","MECHANIZED")= 0;


  *   ---------------------------------------------------------

  PARAMETERS     Q          LIVESTOCK PRODUCTION COEFFICIENTS,
                 QQ         INDEX OF LIVESTOCK GRAIN CONSUMPTION
                 / WHEAT=1, CORN=1, RYE=1, BARLEY=1 /             ;


     Q(L,J) = IOC("LABOR",J) / 4       ;
     Q(A,J) = IOC("ANIMAL",J) / 4 ;
     Q(O,J) = IOC(O,J) * DOM(O,"RYIELD") / 1000          ;
     Q("TENE",J) =((SUM(O,IOC(O,J)  * FEEDREQ(O)) + FEEDABS(J,"NEED")))
                     *FEEDABS(J,"PROGRESS");
     Q(TC,J) = Q("TENE",J) * IOC(TC,J)/100;
     Q(G,J) = Q(G,J) / 1000          ;

  *---------------------------------------------------------
  PARAMETER     PCOST      CROP PRODUCTION COSTS;
  *             QCOST       LIVESTOCK PRODUCTION COSTS;

   PCOST("FERTILIZER",IR,T)=SUM(F,P(F,IR,T) *RES(F,"PRICE"));
   PCOST("SEED",IR,T) = SUM(D,P(D,IR,T)*RES(D,"PRICE")) /MACRO("EXRATE");
   PCOST("CAPITAL",IR,T) = P("TREE",IR,T)* RES(IR,"PRICE")/MACRO("EXRATE")
                                                                          ;

  *-----------     DEMAND CURVES CALCULATIONS

  PARAMETERS      IMPRICE    IMPORT PRICE,
                  EXPRICE    EXPORT PRICE,
                  TCON       CONSUMPTION OF RAW PRODUCTS,
                  DPRI       DEMAND CURVE PRICES,
                  ALPHA      DEMAND CURVE INTERCEPT,
                  BETA       DEMAND CURVE SLOPE,
                  IMPPPIND   IMPORTED PROCESSED PRODUCT INDEX,
                  EXPPPIND   IMPORTED PROCESSED PRODUCT INDEX,
                  EXPINDEX   EXPORT INDEX,
                  IMPINDEX   IMPORT INDEX;
```

```
                 IMPRICE(O)   =    TRADE(O,"IMP-P");
                 IMPINDEX(O) $ TRADE(O,"IMP-Q") = 1  ;
                 EXPRICE(O)   =    TRADE(O,"EXP-P");
                 EXPINDEX(O) $ TRADE(O,"EXP-Q")  =  1   ;

      EXPPPIND(O) $ (PROCTRADE("TRADEQ",O) NE 0
                         AND PROCTRADE("TPRICE",O) GT 0) = 1;

     TCON(O)      = DOM(O,"DPROD")*(1-CONCENT(O))*(1-CONOIL(O))
                  + TRADE(O,"IMP-Q")
                  - TRADE(O,"EXP-Q")
                  - FEEDGRAIN(O,"USEGR")
                  -PROCTRADE("TRADEQ",O) * PROCTRADE("FACTOR",O);

     DPRI(O)          = DOM(O,"DPRICES")*1000 / MACRO("EXRATE");

     BETA(O)          = DPRI(O) / (PAR(O,"ELAST-P") * TCON(O)) ;
   * ---------  GRAIN-FEED USE CALIBRATION
     BETA(G3)    =  0                                        ;
   *- ---------  END OF GRAIN CALIBRATION

     ALPHA(O)         = DPRI(O) - BETA(O) * TCON(O)          ;

   *-----------------------------------------------------------
   *           5.    EQUATION PART
   *-----------------------------------------------------------

    VARIABLES      PROFIT     OBJECTIVE FUNCTION (ZIELFUNKTION)
                   RELFAL     RELATIVE FALLOW
                   PPTRADE    TRADE OF PROCESSED COMMODITIES       ;

    POSITIVE VARIABLES
                   CROPS      PRODUCTION OF CROP
                   PRODUCT    PRODUCTION OF LIVESTOCK
                   PFERT      PURCHASE OF FERTILIZER
                   PRCOST     PRODUCTION COSTS
                   LATRUSE    LABOR AND TRACTOR USE
                   FEED       FEED USE IN ANIMAL PRODUCTION IN ENERGY UNITS
                   FGRAIN     COMPOSITION OF FEEDGRAIN IN PRODUCT WEIGHT
   *               TOTALPROD  TOTAL PRODUCTION IN RAW FORMS
                   TOTALCONS  TOTAL CONSUMPTION IN PROCESSED FORM
                   IMPORT     IMPORT OF LIVESTOCK AND CROPS
                   EXPORT     EXPORT OF LIVESTOCK AND CROPS
                   CERAREA    CEREAL AREA
                   FALAREA    FALLOW AREA
                   TECH       TECHNOLOGY
                   TECHNOL    RELATIVE TECHNOLOGY                      ;

    EQUATIONS      LAND       BASIC LAND CONSTRAINTS
                   LABTRAC    LABOR AND TRACTOR CONSTRAINTS
                   ANIMALPWER ANIMAL POWER BALANCES
                   ANIMALINV  ANIMAL INVENTORY
                   PURCFERT   PURCHASE FERTILIZER
                   PRODCOST   PRODUCTION COSTS
```

```
*                    PRODUCTION PRODUCTION BALANCES
                     FEEDSTRAW  FEED SUPPLY STRAW
                     FEEDCON    FEED SUPPLY CONCENTRATES
                     FEEDCERI   GRAIN USED FOR ANIMAL FEEDING
                     FEEDPAST   FEED SUPPLY FROM PASTURE
                     FEEDOIL    FEED SUPPLY OIL CAKE
                     FEEDFODD   FEED SUPPLY ALFALFA AND FODDER
                     TOTALFEED  TOTAL FEED BALANCE
                     MINFEED    MINIMUM FEED REQUIREMENTS BY COMPONENTS
                     MINGRCOIL  MINIMUM GRAIN CONCENTRATES AND OILCAKE
                     MINGROIL   MINIMUM GRAIN AND OILCAKE
                     MINGRAIN   MINIMUM SHARE OF INDIVIDUAL GRAINS
                     COMBAL     COMMODITIES BALANCES
                     IMPORTL    IMPORT LIMIT
                     EXPORTL    EXPORT LIMIT
                     VALTRADE   TRADE OF PROCESSED PRODUCTS
                     CALB       CALIBRATION( PRODUCTION LEVEL)
*                     AREAF      CALIBRATION FODDERAREA
                     CERBAL     CERIAL CALIBRATION
                     FALBAL     FALLOW CALIBRATION
                     FALDEVIAT  FALLOW CERIAL CALIBRATION
                     VALFAL     CALIBRATION OF FCOEF
                     TECHABSOL  TECHNOLOGY ABSULUTE
                     TECHDEVIAT TECHNOLOGY DEVIATION
                     VALTECH    VALITATION TECHNOLOGY
                     SURPLUS    OBJECTIVE FUNCTION (ZIELFUNKTION)          ;


     LAND(S)..             SUM((IR, T), P(S,IR,T) * CROPS(IR,T))
                          =L=   RES(S, "QUANT")                         ;

     LABTRAC(LM)..         SUM((IR,T), P(LM,IR,T) * CROPS(IR,T))
                           +SUM(J,Q(LM,J) * PRODUCT(J))
                           +LABFED(LM) * FEED("TSTRAW")
                          =E= LATRUSE(LM)                                ;

     ANIMALPWER(A)..       SUM((IR,T), P(A,IR,T) * CROPS(IR,T))
                          =L=   SUM(J, Q(A,J) * PRODUCT(J))              ;

     ANIMALINV(J)..        PRODUCT(J)  =L=  RES(J, "QUANT")             ;

     FEEDSTRAW..          SUM((IR,T,G1),P(G1,IR,T) * CROPS(IR,T) *ENEC(G1))
                          =G= FEED("TSTRAW")                             ;

     FEEDCON..            SUM((IR,T,G2),  P(G2,IR,T) * CROPS(IR,T)
                            * CONCENT(G2) * ENEC(G2))
                          =G= FEED("TCONCEN")                            ;

     FEEDCERI..           SUM(G3,FGRAIN(G3) *FEEDGRAIN(G3,"ENEGR"))
                          =G= FEED("TGRAIN")                             ;

     FEEDPAST..           SUM(T,CROPS("PASTUSE",T)*P("PASTFEED","PASTUSE",T))
                          =G= FEED("TPAST")                              ;

     FEEDOIL..             SUM((IR,T,G4), P(G4,IR,T) * CROPS(IR,T)
```

```
                              * CONOIL(G4) * ENEC(G4))
                              =G= FEED("TOIL")                                    ;

        FEEDFODD..          SUM((IR,T,G5),CROPS(IR,T) * P(G5,IR,T) * ENEC(G5))
                              =G= FEED("TFODD")                                   ;

        TOTALFEED..          SUM(TF,FEED(TF))
                             =G= SUM(J,Q("TENE",J) * PRODUCT(J))                  ;

        MINFEED(TF)..        FEED(TF) =G= SUM(J,Q(TF,J) *PRODUCT(J))              ;

        MINGRCOIL..          FEED("TGRAIN") + FEED("TCONCEN") + FEED("TOIL")
                             =G= SUM(J,Q("TGRCONOIL",J) * PRODUCT(J))             ;

        MINGROIL..           FEED("TGRAIN") + FEED("TOIL")
                             =G= SUM(J,Q("TGROIL",J) * PRODUCT(J))                ;

        MINGRAIN(G3)..       FGRAIN(G3) * FEEDGRAIN(G3,"ENEGR")
                              =G= FEED("TGRAIN") * FEEDGRAIN(G3,"MINGR")         ;

        PURCFERT(F)..        SUM((IR,T), P(F,IR,T) * CROPS(IR,T))
                            =E=    PFERT(F)                                       ;

        PRODCOST(E)..        SUM((IR,T), PCOST(E,IR,T) * CROPS(IR,T))
    *                        +SUM(J,QCOST(E,J)*PRODUCT(J))
                            =E= PRCOST(E)                                         ;

        COMBAL(O)..         SUM((IR,T), P(O,IR,T) * CROPS(IR,T))
                             * (1-CONCENT(O))   *(1-CONOIL(O))
                            +SUM(J,Q(O,J) * PRODUCT(J))
                            + IMPORT(O) *IMPINDEX(O)
                            =E=   TOTALCONS(O)
                            + EXPORT(O)*EXPINDEX(O)
                            +   QQ(O) * FGRAIN(O)
                            +   PROCTRADE("FACTOR",O) *PPTRADE(O)                 ;

        IMPORTL(O)..        IMPINDEX(O) * IMPORT(O)     =E= TRADE(O,"IMP-Q")      ;

        EXPORTL(O)..        EXPINDEX(O) * EXPORT(O)     =E=  TRADE(O,"EXP-Q")     ;

        VALTRADE(O)..      EXPPPIND(O) * PPTRADE(O) =E= PROCTRADE("TRADEQ",O);

        CALB(OAL)..         SUM((IR,T), P(OAL,IR,T) * CROPS(IR,T))
                            =L=    DOM(OAL, "DPROD")                              ;

    *    AREAF(B2)..           SUM((IR,T),P(B2,IR,T) * CROPS(IR,T))
    *                          =L= RES(B2,"AREA")                                 ;

        CERBAL..             SUM((BC,IR,T), P(BC,IR,T) * CROPS(IR,T))
                            =E= CERAREA                                           ;

        FALBAL..             SUM((IR,T), P("FALLOW",IR,T) * CROPS(IR,T))
                            =E=    FALAREA                                        ;

        FALDEVIAT..          FALAREA - CERAREA *MACRO("FCOEF") =E= RELFAL
```

```
                                                                           ;

      VALFAL..               RELFAL =L= 0                                 ;

      TECHABSOL(T)..         SUM((B,IR),P(B,IR,T)*CROPS(IR,T)) =E=TECH(T)   ;

      TECHDEVIAT..           TECH("ANIMAL")-TECH("MECHANIZED")*MACRO("TCOEF")
                             =E= TECHNOL                                  ;

      VALTECH..              TECHNOL  =L= 0                               ;

      SURPLUS..             SUM(O, ALPHA(O) * TOTALCONS(O) + 0.5 * BETA(O)
                             * TOTALCONS(O) ** 2)
                             +  SUM(O, EXPRICE(O) * EXPORT(O))
                             -  SUM(O, IMPRICE(O) * IMPORT(O))
                             +  SUM(O,PROCTRADE("TPRICE",O)* PPTRADE(O))
                             -  SUM(E,PRCOST(E))
                             -  0.5 * SUM(LM,PQPLT(LM) * LATRUSE(LM) ** 2 )
                             =E=     PROFIT                               ;
   * ----------------------------------------------------------

   OPTION        ITERLIM =  5000      ;
   OPTION        LIMROW  =     0      ;
   OPTION        RESLIM  =   760      ;
   OPTION        LIMCOL  =     0      ;
   OPTION        BRATIO  =    0       ;
   OPTION        DOMLIM  =    10      ;
   * OPTION       SYSOUT  =    ON      ;
   * OPTION       INTEGER2=      1      ;
   * OPTION       INTEGER3=      2      ;

   MODEL          TASM        /ALL/                                  ;
   SOLVE          TASM        MAXIMIZING PROFIT      USING NLP     ;

   *-------------------------------------------------------------
   *              6.SUMMARIZING THE MODEL RESULTS
   *-------------------------------------------------------------
   PARAMETERS  DPRICE    STATISTICAL AND MODELLED PRICES    ,
               MARKBAL   PRODUCTION AND MARKET BALANCES    ,
               PQPCOM    SHADOW PRICES AND QUADRATIC COST TERMS ,
               DEM        DEMAND COEFFIENTS                ,
               PQPLIV     QUADRATIC COST LIVESTOCK ;
   DPRICE(O,"STATISTIC") = DPRI(O)    ;
   DPRICE(O,"MODEL")      = COMBAL.M(O)          ;
   DPRICE(O,"DEVIATION") =  COMBAL.M(O)/DPRI(O)   ;
   DPRICE(O,"SHAD-EXP")   = EXPORTL.M(O)         ;
   DPRICE(O,"SHAD-IMP")   = IMPORTL.M(O)         ;
   *---------------------------------------------------
   MARKBAL(O,"PRODUCTION") = SUM((IR,T), P(O,IR,T) * CROPS.L(IR,T))
                             +SUM(J,Q(O,J) *PRODUCT.L(J))               ;

   MARKBAL(O,"TOTALTRAD")    = EXPORT.L(O)
                             + PPTRADE.L(O) * PROCTRADE("FACTOR",O)
                               - IMPORT.L(O)                              ;
```

```
 MARKBAL(O,"FEDGRAIN")      = FGRAIN.L(O)                                    ;
 MARKBAL(O,"FEEDBYPROD")      = MARKBAL(O,"PRODUCTION") *( CONCENT(O)
                              + CONOIL(O))                                      ;

 MARKBAL(O,"CONSUMPT")    = TOTALCONS.L(O)                                        ;
*-----------------------------------------------
 PQPCOM(OAL,"SHADOW")    =   CALB.M(OAL)                   ;
 PQPCOM(OAL,"LEVEL")     =   CALB.L(OAL)                    ;
 PQPCOM(OCR,"PQPKOEF")   =   CALB.M(OCR)/CALB.UP(OCR)           ;
 PQPCOM(O1,"RELSHAD")  =   CALB.M(O1)/COMBAL.M(O1)             ;
 DEM(O,"DALPHA")     =   ALPHA(O)                         ;
 DEM(O,"DBETA")      =   BETA(O)                           ;


 PQPLIV(J,"SHADOWL") = ANIMALINV.M(J)   ;
 PQPLIV(J,"LEVELL")  = ANIMALINV.L(J)   ;
 PQPLIV(J,"PQP3")    = ANIMALINV.M(J)/ANIMALINV.UP(J)   ;
 DISPLAY  MARKBAL,DPRICE,DEM,Q,PQPLT,PQPLIV,PQPCOM;

*----------  COST CALCULATIONS -----------------
 SETS  COP     OPPORTUNITY COSTS CROPS
        / LABOURCO, MASCHINCO, ANIMALPW,LANDRENT,ROTATIONC,SPECLANDCO/
       COS     SUBGROUPS OF COSTS
        / VARIABLCO, OPPORTCOST /
       COUT    OUTPUT VALUES
        /VALPROD, VALSTRAW, VALCON, VALOEL/
       SCA    SUBGROUPS OF COSTS ANIMAL
        /SUMFEED, LABOURCO, ANIMALSTOC/
 SET  CAL    ALL COST ITEMS CROPS;
             CAL(COP)  = YES ;
             CAL(COS)  = YES ;
             CAL(E)    = YES ;
 SET  ACA    ALL COSTS ANIMAL ;
             ACA(TC)  = YES;
             ACA(SCA) =YES ;

 PARAMETERS  CO   COST STRUCTURE CROPS,
             RCO  RELATIVE CROP COSTS,
             RCA  RELATIVE ANIMAL COSTS,
             CA   COST STRUCTURE ANIMALS;

 CO(E,IR) = PCOST(E,IR,"ANIMAL")   ;


 CO("LABOURCO",IR)  = SUM(L,P(L,IR,"ANIMAL")* LABTRAC.M(L))   ;

 CO("MASCHINCO",IR)  = SUM(M,P(M,IR,"ANIMAL")* LABTRAC.M(M))
                        + TECHABSOL.M("ANIMAL")                        ;
 CO("ANIMALPW",IR)  = SUM(A,P(A,IR,"ANIMAL")* ANIMALPWER.M(A))   ;


 CO("LANDRENT",IR)  = SUM(S,P(S,IR,"ANIMAL")* LAND.M(S))   ;
 CO("ROTATIONC",IR)  = SUM(BC,P(BC,IR,"ANIMAL")*CERBAL.M)
                      + P("FALLOW",IR,"ANIMAL")*FALBAL.M;
```

```
CO("SPECLANDCO",IR) = SUM(OAL,P(OAL,IR,"ANIMAL")* CALB.M(OAL))  ;
CO("VARIABLCO",IR) = SUM(E,PCOST(E,IR,"ANIMAL"))  ;
CO("OPPORTCOST",IR) = SUM(COP,CO(COP,IR));
CO("TOTALCOS",IR) = SUM(COS,CO(COS,IR));
RCO(CAL,IR) = CO(CAL,IR)/CO("TOTALCOS",IR);
* -------  CROP OUTPUT VALUES --------------
CO("VALPROD",IR)= SUM(OAL,P(OAL,IR,"ANIMAL") *(1-CONCENT(OAL))
                  * (1-CONOIL(OAL)) *  COMBAL.M(OAL)) * (-1)        ;
CO("VALPROD","PASTUSE") = P("PASTFEED","PASTUSE","ANIMAL")*FEEDPAST.M;
CO("VALSTRAW",IR)= SUM(G1,P(G1,IR,"ANIMAL")
                  * ENEC(G1) *  FEEDSTRAW.M) * (-1)       ;
CO("VALCON",IR)= SUM(G2,P(G2,IR,"ANIMAL") * CONCENT(G2)
                  * ENEC(G2) *FEEDCON.M) * (-1)           ;
CO("VALOEL",IR)= SUM(G4,P(G4,IR,"ANIMAL") * CONOIL(G4)
                  * ENEC(G4) *FEEDOIL.M) * (-1)            ;
CO("TOTALPROD",IR) = SUM(COUT, CO(COUT,IR))                ;
CO("DIFFCROP",IR)  = CO("TOTALPROD",IR) - CO("TOTALCOS",IR) ;
RCO(COUT,IR) =  CO(COUT,IR) / CO("TOTALPROD",IR)              ;
RCO("RSTOTAL",IR) = SUM(COUT,RCO(COUT,IR))                 ;
*--------   COST STRUCTURE ANIMAL ---------------
CA("TENE",J) = Q("TENE",J) * TOTALFEED.M * (-1)  ;
CA(TF,J) =   Q(TF,J) * MINFEED.M(TF) * (-1)  ;
CA("TGRCONOIL",J) = Q("TGRCONOIL",J) * MINGRCOIL.M * (-1);
CA("TGROIL",J) = Q("TGROIL",J) * MINGROIL.M * (-1);
CA("SUMFEED",J) = SUM(TC,CA(TC,J))+ CA("TENE",J) ;
CA("LABOURCO",J) = SUM(L,Q(L,J) *LABTRAC.M(L)) ;
CA("ANIMALSTOC",J) = ANIMALINV.M(J)  ;
CA("TOTALCOST",J) = SUM(SCA,CA(SCA,J)) ;
RCA("TENE",J) = CA("TENE",J)/CA("TOTALCOST",J);
RCA(ACA,J) = CA(ACA,J) / CA("TOTALCOST",J) ;
RCA("RTOTAL",J) = SUM(SCA,RCA(SCA,J));
* -----------  ANIMAL  OUTPUT -------------------------
 CA("PRODANIMAL",J) = SUM(O,Q(O,J) * COMBAL.M(O)) * (-1) ;
 CA("ANIMALPW",J)    = SUM(A,Q(A,J) * ANIMALPWER.M(A));
 CA("TOTALVAL",J)    = CA("PRODANIMAL",J) + CA("ANIMALPW",J);
 CA("DIFFERANI",J)   = CA("TOTALVAL",J) - CA("TOTALCOST",J) ;
 RCA("RELPRODUCT",J)  = CA("PRODANIMAL",J) / CA("TOTALVAL",J);
 RCA("RELANIMP",J)   = CA("ANIMALPW",J) / CA("TOTALVAL",J);
 DISPLAY CO,RCO,CA,RCA ;
*------------------------------------------------
*      END OF PROGAM INPUT FILE
*------------------------------------------------
```

COMPILATION TIME   =   2.519 MINUTES

6.5 Output of the model and interpretation of results

In sequence of successful model runs it is possible to achieve a standard output and an output, which is declared by the DISPLAY statements. Additonally, the input file is also included as a part of the output file.

In the following, we explain the results of the first step run in regard to the example year of 1981. We will refer to the listed output as given in appendix B of this chapter. The presented printout is exactly the same as the one stored on the hard disk of the Ministry PC, listed under

TASM81B.LST ;

Additionally, we will make some references to the page numbers as listed by the GAMS programme.

Page 25: Some statistics are given concerning the size and the elements of the model (equation system) as well as the time for generation and execution of the input file.

Page 26: The summary statistics presenting information about the solution status (important: optimal solution found, evaluation errors) and the space and time requirement for solving the model. The information about work space available and required gives some ideas about the possible enlargement of the model.

6.5.1 Standard output

The standard solution, following this general information, has two main parts:

- a dual solution
- and a primal solution.

6.5.1.1 DUAL Solution

The listing of dual solutions follows the order of the equation block and within each block the order of the set statement. Each block in the dual solution starts with:
---- EQU *** (Explanation)

Each line in the dual solution contains the following infomration:

LOWER: Indicates that a certain value in the RHS part of the model (after transformation of the equation) might be given as a minimum for the equation. This is only possible, if an equation is formulated as
=G= greater than,
or =E= equal to.

An INF means, that no minimum for the equation value is defined, which is for example the case in the LAND equations.

UPPER: Under this headline the maximum of the equation value is listed. It exists of a number only, if the equation is of:
=L= lower than,
or =E= equal to type.
The land equation illustrates that the resource availability, as entered in the RES table and used in the land equation of the input file, is included.

LEVEL: Under the level heading the amount of the value of the RHS section, which is utilized in the optimal solution, is printed. Observing the land equation one can notice that DRY-EITH is not used completely and that IRR-EITH reaches the limits of land availability!

In the case of an equation formulated by =E= under LOWER, LEVEL and UPPER, the same values appear.

MARGINAL: Following this heading, the most interesting dual variables (shadow prices are generally used as synonyms)are printed. The MARGINAL(s) present the change of the objective function, if one increases the RHS value of a model by one unit. Provided the LEVEL value of an equation is not at the limit of UPPER or LOWER (if the restriction is not binding), the objective value of the model will not react to a marginal change of the RHS value. Assuming, for example, the amount of 1 ha additonal dry land availability, then nothing would change in the solution. Consequently, the MARGINAL for dry and equals zero (see Page 26). Instead, an increase of irrigated land would permit to extend the production of this land type and the objective value of the model would increase by 129.682 US$ per ha.

The MARGINAL(s) express therefore the economic scaricity of a resource or commodity or in general the economic implication of a model restriction. Therefore, the MARGINAL(s) can be interpreted as economic value in one unit of a restriction or the shadow price of a factor or commodity. This shadow price evaluation is independent of the fact, whether the commodity or factor is tradeable and in fact traded or not.

The shadow price for irrigated area means that it would be profitable for a farmer to rent irrigated land up to a price of 129 US dollar per ha (1981). In practice the shadow price for land reflects a high variation between different locations. All the other results of the dual solution can be interpreted similarily. Therefore, only some selective comments will follow (see page 26-31 of appendix B):

- The results of the EQU LAND mirror that available land is, with the exception of irrigated land, not as restrictive in economic terms.

- The shadow price of labour, measured in Dollar per hour, represents the equilibrium point of labour demand (as computed by the produciton activity levels and the labour requirement coefficients) and the non-linear labour supply funciton. The differentation of the quarterly shadow prices of labour (internal wage rate) is caused by various kinds of labour use in each quarter of the year. Remember,the same supply function is assumed for each quarter.

- The shadow prices for tractor services can be analogously interpreted. Consider,however, that this shadow price may for a number of reasons (e.g. waiting costs) not necessarily correspond with the price, which has actually to be paid by the farmer.

- Animal power is restrictive in the second, third and fourth quarters and it is characterized by internal prices up to 0.5 Dollar per hour. This shadow price implies internal costs for the crop production activities and leads to the internal economic revenue of the livestock sector, e.g. the activities supplying animal power.

- With the exception of mule, all livestock activities reach the upper bound, which presents the actual livestock numbers.

- The last part of page 27 disposes the internal costs of feed supply with a high variation. As one would expect, oilcake (high protein content) has the highest shadow price and - equivalent to this -the highest production costs. The grain feed price is internally derived from the grain prices themselves, considering the compositon of feedgrain and the energy contents. In this specific solution concentrates, feed from pasture and the total feed are identified by the same price. The shadow price for straw reflects only the costs (labour) for harvesting.

- Beside the shadow price for total feed (supply and demand) the minimum requirements concerning certain feed components, such as fodder, grain and oilseeds, are restrictive (page 28). Due to the minimum requirements, formulated as additional restrictions to the total feed balance, the shadow price of fodder supply FEEDFODD is equivalent to the shadow price of TOTALFEED and MINFEED ("TFOOD"). Also the shadow prices for MINGROIL and for TOTALFEED adds up to the shadow price for FEEDFODD.

In order to calculate the shadow price for feedgrain (FEEDCERI, page 27) one has to consider the shadow prices of the minimum feed grain composition (EQU MINGRAIN on page 28).

The feed sector is one of the most complicated parts in most sector models. Firstly, the statistical information is very poor or often not available at all. Secondly, a number of consistency checks and test runs of the model are a necessity in order to receive the consistency of the physical balances and the feed ration. Finally, depending on the substitution possibilites permitted in this model, it might be very complicated to derive a suitable economic evaluation of feed supply as well as demand and the related internal linkages.

However, the feed sector is a very critical and important part in sector models, since it represents main linkages between the crop and livestock sector. Therefore, further attention should be paid to this part (detailed analysis of the implications, collection of additional information, modification of this model part, if needed).

- The agricultural prices on farm gate level appear in the solution as MARGINAL(s) of the commodity balance EQU COMBAL. The negative sign indicates that the objective value would decrease, if one would reduce the commodity balance by one unit (e.g. one ton of a certain commodity). These MARGINAL(s) express therefore exactly their marginal costs of producing one unit and at the same time the willingness of the consumer concerning the payment for the last unit, or under the conditions of a competitive market the market price.

- Imports and Exports have been fixed by equality constraints (=E=). Therefore, the same value appears under LOWER, LEVEL and UPPER. The MARGINAL(s) reflect the difference between the internal market price and the export or import price. Observing for example "wheat" (in brackets references to the input and output files are made):

Domestic price (MARGINAL, page 28)	159.77	Difference (MARGINAL, page 30)	-14.88
Export price (line 240, input file)	144.89		
		Difference (MARGINAL, page 30)	-45.88
Import price (line 240, input file)	205.66		

A direct interpretation of this result would conclude that the export and input level in the base year of 1981 (the solution is restricted to this level) has not been in an economic optimum. Lower exports (the export price is lower than the domestic price level) would increase the objective value by about 15 $ per ton (marginal change). Less imports would also increase the producer and consumer surplus, since the costs of domestic production are about 45 $ lower in comparison with the import price. Finally, one can sequently point out that there is no economic sense in importing and exporting at the same time, particularly in a situation where the import price is higher than the export price (which is the case in our example year of 1981).

However, for a number of reasons one has to deal very carefully with this kind of interpretations and policy conclusions, e.g.:

* There may be quality differences between the improved and exported commodities (e.g. export of feed wheat, import of high quality wheat).

* Transportation have not explicitly been considered.

* Some special bilateral trade arrangements may exist (e.g. wheat export, oil import deal) with important advantages for Turkey.

* Finally, because of the high rate of inflation, there is a rapid change in the foriegn exchange rate. The relevant exchange rate regarding exports and imports in a specific year can differ to a high degree from the average exchange rate used for converting the domestic price level into dollar prices. This is always the case, if export as well as imports are concentrated to a specific time within a year. Assuming an inflation of 100 % and further that imports are transacted during the first part of a one year period, while export activities take place in the end of the same year, then it is possible to justify the foriegn trade structure of wheat from an economic point of view.

For all these reasons, exports and imports have not been formulated as "free" activities. The binding restrictions imply that the model results do not necessarily correspond with a foreign trade equilibrium situation. However, starting from the discussed base model, several modifications and foreign trade policy runs can be made.

As another conclusion it has to be pointed out that the foreign trade structure should be analysed in more detail, especially with respect to the country specific trade structure including special trade arrangements (e.g. preferential trade with EC) and in relation to the seasonal trade flows. For certain commodities, it is also important to analyze the impact of Turkey's export on the export price level (price setter case).

- On page 31 and 32 the shadow prices of the calibration constraints are given. With the exception of tea and fodder, all commodities reach the upper limits, which present the observed production quantities. Tea is a production activity near the limit. The expression EPS in the MARGIAL column means that a slightly different other solutions are possible with the same

APPENDIX B: GAMS-MINOS SOLUTION FILE 88/06/04 00:04:05 PAGE 25

TASM1
MODEL STATISTICS SOLVE TASM USING NLP FROM LINE 1188

MODEL STATISTICS

BLOCKS OF EQUATIONS	30	SINGLE EQUATIONS	207
BLOCKS OF VARIABLES	17	SINGLE VARIABLES	248
NON ZERO ELEMENTS	2026	NON LINEAR N-Z	59
DERIVATIVE POOL	62	CONSTANT POOL	104
CODE LENGTH	1005		

GENERATION TIME = 11.199 MINUTES

EXECUTION TIME = 14.479 MINUTES

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TASM1
SOLUTION REPORT      SOLVE TASM USING NLP FROM LINE 1188


               S O L V E      S U M M A R Y

     MODEL    TASM                   OBJECTIVE  PROFIT
     TYPE     NLP                    DIRECTION  MAXIMIZE
     SOLVER   MINOS5                 FROM LINE  1188

**** SOLVER STATUS      1 NORMAL COMPLETION
**** MODEL STATUS       2 LOCALLY OPTIMAL
**** OBJECTIVE VALUE          29327359.1890

 RESOURCE USAGE, LIMIT          67.750       760.000
 ITERATION COUNT, LIMIT        375          5000
 EVALUATION ERRORS               0             10

     M I N O S  ---  VERSION  5.0    APR  1984
     = = = = =
     courtesy of B. A. Murtagh and M. A. Saunders,
                 Department of Operations Research,
                 Stanford University,
                 Stanford   California    94305    U.S.A.


 WORK SPACE NEEDED (ESTIMATE)  --     16697 WORDS.
 WORK SPACE AVAILABLE          --     17034 WORDS.

 EXIT -- OPTIMAL SOLUTION FOUND
 MAJOR ITERATIONS                  1
 NORM RG / NORM PI   8.525E-11
 TOTAL USED              68.22 UNITS
 MINOS5 TIME             66.25 (INTERPRETER -          3.08)


---- EQU LAND           BASIC LAND CONSTRAINTS

              LOWER      LEVEL       UPPER     MARGINAL

DRY-EITH      -INF   14657.861  16955.560       .
IRR-EITH      -INF    3021.150   3021.150    129.682
DRY-GOOD      -INF    5718.068  11812.020       .
IRR-GOOD      -INF     574.175   1035.670       .
TREE          -INF    2160.000   2160.000     66.853
PASTURE       -INF   19123.800  20000.000       .


---- EQU LABTRAC        LABOR AND TRACTOR CONSTRAINTS

                LOWER      LEVEL       UPPER     MARGINAL

LABOR-1Q          .          .           .         0.302
LABOR-2Q          .          .           .         0.488
LABOR-3Q          .          .           .         0.602
LABOR-4Q          .          .           .         0.397
TRACTOR-1Q        .          .           .         3.103
TRACTOR-2Q        .          .           .         8.210
TRACTOR-3Q        .          .           .         9.993
```

options

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TASM1
SOLUTION REPORT SOLVE TASM USING NLP FROM LINE 1188

EQU LABTRAC LABOR AND TRACTOR CONSTRAINTS

	LOWER	LEVEL	UPPER	MARGINAL
TRACTOR-4Q	.	.	.	9.056

---- EQU ANIMALPWER ANIMAL POWER BALANCES

	LOWER	LEVEL	UPPER	MARGINAL
ANIMAL-1Q	-INF	-5.721E+4	.	.
ANIMAL-2Q	-INF	.	.	0.382
ANIMAL-3Q	-INF	.	.	0.450
ANIMAL-4Q	-INF	.	.	0.520

---- EQU ANIMALINV ANIMAL INVENTORY

	LOWER	LEVEL	UPPER	MARGINAL
SHEEP	-INF	49598.000	49598.000	6.478
GOAT	-INF	15070.000	15070.000	5.781
ANGORA	-INF	3856.000	3856.000	0.037
CATTLE	-INF	15981.000	15981.000	15.722
BUFFALO	-INF	1002.000	1002.000	41.189
MULE	-INF	.	2353.000	.
POULTRY	-INF	62329.000	62329.000	3.287

---- EQU PURCFERT PURCHASE FERTILIZER

	LOWER	LEVEL	UPPER	MARGINAL
NITROGEN	.	.	.	EPS
PHOSPHATE	.	.	.	EPS

---- EQU PRODCOST PRODUCTION COSTS

	LOWER	LEVEL	UPPER	MARGINAL
SEED	.	.	.	1.000
FERTILIZER	.	.	.	1.000
CAPITAL	.	.	.	1.000

	LOWER	LEVEL	UPPER	MARGINAL
---- EQU FEEDSTRAW	.	.	+INF	-1.065
---- EQU FEEDCON	.	.	+INF	-31.980
---- EQU FEEDCERI	.	.	+INF	-183.720
---- EQU FEEDPAST	.	.	+INF	-31.980
---- EQU FEEDOIL	.	.	+INF	-203.368
---- EQU FEEDFODD	.	.	+INF	-125.268
---- EQU TOTALFEED	.	.	+INF	-31.980

FEEDSTRAW FEED SUPPLY STRAW
FEEDCON FEED SUPPLY CONCENTRATES
FEEDCERI GRAIN USED FOR ANIMAL FEEDING
FEEDPAST FEED SUPPLY FROM PASTURE
FEEDOIL FEED SUPPLY OIL CAKE
FEEDFODD FEED SUPPLY ALFALFA AND FODDER
TOTALFEED TOTAL FEED BALANCE

---- EQU MINFEED MINIMUM FEED REQUIREMENTS BY COMPONENTS

	LOWER	LEVEL	UPPER	MARGINAL
TSTRAW	.	2760.443	+INF	.
TCONCEN	.	1873.946	+INF	.
TGRAIN	.	5290.006	+INF	.
TFODD	.	.	+INF	-93.289
TOIL	.	53.851	+INF	.
TPAST	.	2933.856	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
---- EQU MINGRCOIL	.	760.230	+INF	.
---- EQU MINGROIL	.	.	+INF	-171.389

MINGRCOIL MINIMUM GRAIN CONCENTRATES AND OILCAKE
MINGROIL MINIMUM GRAIN AND OILCAKE

---- EQU MINGRAIN MINIMUM SHARE OF INDIVIDUAL GRAINS

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	.	+INF	-38.187
CORN	.	.	+INF	-71.332
RYE	.	.	+INF	-8.643
BARLEY	.	211.600	+INF	.

---- EQU COMBAL COMMODITIES BALANCES

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	.	.	-159.773
CORN	.	.	.	-198.941
RYE	.	.	.	-125.036
BARLEY	.	.	.	-130.441
RICE	.	.	.	-481.888
CHICK-PEA	.	.	.	-310.773
DRY-BEAN	.	.	.	-542.767
LENTIL	.	.	.	-491.370
POTATO	.	.	.	-188.307
ONION	.	.	.	-215.600
GR-PEPPER	.	.	.	-250.515

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TASM1
SOLUTION REPORT   SOLVE TASM USING NLP FROM LINE 1188

EQU COMBAL   COMMODITIES BALANCES

	LOWER	LEVEL	UPPER	MARGINAL
TOMATO	.	.	.	-191.231
CUCUMBER	.	.	.	-239.438
SUNFLOWER	.	.	.	-277.719
OLIVE	.	.	.	-385.918
GROUNDNUT	.	.	.	-676.841
SOYABEAN	.	.	.	-326.015
SESAME	.	.	.	-802.763
COTTON	.	.	.	-1326.744
SUG-BEET	.	.	.	-34.648
TOBACCO	.	.	.	-1214.291
TEA	.	.	.	-374.059
CITRUS	.	.	.	-206.296
GRAPE	.	.	.	-380.247
APPLE	.	.	.	-188.927
PEACH	.	.	.	-367.930
APRICOT	.	.	.	-466.735
CHERRY	.	.	.	-428.542
WILDCHERRY	.	.	.	-363.765
MELON	.	.	.	-167.925
STRAWBERRY	.	.	.	-1312.122
BANANA	.	.	.	-1997.648
QUINCE	.	.	.	-262.655
PISTACHIO	.	.	.	-3109.767
HAZELNUT	.	.	.	-979.019
SHEEP-MEAT	.	.	.	-1215.719
SHEEP-MILK	.	.	.	-316.026
SHEEP-WOOL	.	.	.	-2313.169
SHEEP-HIDE	.	.	.	-1618.786
GOAT-MEAT	.	.	.	-966.116
GOAT-MILK	.	.	.	-310.634
GOAT-WOOL	.	.	.	-1760.384
GOAT-HIDE	.	.	.	-1618.921
ANGOR-MEAT	.	.	.	-1010.436
ANGOR-MILK	.	.	.	-310.668
ANGOR-WOOL	.	.	.	-4211.199
ANGOR-HIDE	.	.	.	-1623.064
BEEF	.	.	.	-979.182
COW-MILK	.	.	.	-318.189
COW-HIDE	.	.	.	-778.773
BUFAL-MEAT	.	.	.	-952.650
BUFAL-MILK	.	.	.	-341.546
BUFAL-HIDE	.	.	.	-780.293
POLTR-MEAT	.	.	.	-1380.179
EGGS	.	.	.	-1502.973

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TASM1
SOLUTION REPORT SOLVE TASM USING NLP FROM LINE 1188

---- EQU IMPORTL IMPORT LIMIT

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	272.309	272.309	272.309	-45.887
RICE	40.400	40.400	40.400	128.378
SOYABEAN	752.926	752.926	752.926	-101.385
SUG-BEET	619.404	619.404	619.404	-458.502
SHEEP-WOOL	13.327	13.327	13.327	-4067.831
SHEEP-HIDE	0.056	0.056	0.056	-862.214
COW-MILK	47.790	47.790	47.790	-165.711
COW-HIDE	3.321	3.321	3.321	-1480.887
BUFAL-MEAT	0.265	0.265	0.265	-3763.760

---- EQU EXPORTL EXPORT LIMIT

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	315.537	315.537	315.537	-14.883
RYE	0.201	0.201	0.201	129.334
BARLEY	372.020	372.020	372.020	25.559
CHICK-PEA	175.656	175.656	175.656	22.367
DRY-BEAN	28.133	28.133	28.133	8.233
LENTIL	228.386	228.386	228.386	-32.160
POTATO	17.729	17.729	17.729	9.543
ONION	98.743	98.743	98.743	-47.430
GR-PEPPER	0.643	0.643	0.643	241.245
TOMATO	75.423	75.423	75.423	-12.721
SUNFLOWER	0.003	0.003	0.003	489.981
OLIVE	1.384	1.384	1.384	16.642
GROUNDNUT	5.444	5.444	5.444	472.159
SESAME	0.872	0.872	0.872	23.187
COTTON	241.000	241.000	241.000	-58.754
SUG-BEET	201.635	201.635	201.635	133.812
TOBACCO	131.014	131.014	131.014	1113.809
CITRUS	279.909	279.909	279.909	64.874
GRAPE	9.770	9.770	9.770	-146.957
APPLE	127.697	127.697	127.697	88.843
PEACH	5.535	5.535	5.535	-46.310
APRICOT	50.444	50.444	50.444	18.405
WILDCHERRY	0.891	0.891	0.891	147.115
MELON	18.156	18.156	18.156	-28.585
STRAWBERRY	0.051	0.051	0.051	-609.942
BANANA	0.001	0.001	0.001	-1163.648
QUINCE	0.978	0.978	0.978	-33.025
PISTACHIO	3.957	3.957	3.957	910.573
HAZELNUT	12.909	12.909	12.909	620.071
SHEEP-MEAT	26.330	26.330	26.330	633.921
SHEEP-WOOL	22.182	22.182	22.182	-514.139
SHEEP-HIDE	0.882	0.882	0.882	-577.806
GOAT-MEAT	0.312	0.312	0.312	-13.716
GOAT-WOOL	1.480	1.480	1.480	-1055.864
GOAT-HIDE	0.882	0.882	0.882	-577.941
ANGOR-WOOL	2.840	2.840	2.840	-613.149

SOLUTION REPORT SOLVE TASM USING NLP FROM LINE 1188

EQU CALB CALIBRATION(PRODUCTION LEVEL)

	LOWER	LEVEL	UPPER	MARGINAL
CHERRY	-INF	95.000	95.000	178.932
WILDCHERRY	-INF	60.000	60.000	70.222
MELON	-INF	4500.000	4500.000	133.050
STRAWBERRY	-INF	23.000	23.000	813.690
BANANA	-INF	30.000	30.000	1821.817
QUINCE	-INF	56.000	56.000	181.914
PISTACHIO	-INF	25.000	25.000	2038.304
HAZELNUT	-INF	350.000	350.000	345.478
FODDER	-INF	1108.050	1108.050	14.613
ALFALFA	-INF	948.817	1323.000	.

	LOWER	LEVEL	UPPER	MARGINAL
---- EQU CERBAL	.	.	.	-19.825
---- EQU FALBAL	.	.	.	39.651
---- EQU FALDEVIAT	.	.	.	39.651
---- EQU VALFAL	-INF	.	.	39.651

CERBAL CERIAL CALIBRATION
FALBAL FALLOW CALIBRATION
FALDEVIAT FALLOW CERIAL CALIBRATION
VALFAL CALIBRATION OF FCOEF

---- EQU TECHABSOL TECHNOLOGY ABSULUTE

	LOWER	LEVEL	UPPER	MARGINAL
ANIMAL	.	.	.	1.290
MECHANIZED	.	.	.	-0.426

	LOWER	LEVEL	UPPER	MARGINAL
---- EQU TECHDEVIAT	.	.	.	1.290
---- EQU VALTECH	-INF	.	.	1.290
---- EQU SURPLUS	.	.	.	1.000

TECHDEVIAT TECHNOLOGY DEVIATION
VALTECH VALITATION TECHNOLOGY
SURPLUS OBJECTIVE FUNCTION (ZIELFUNKTION)

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR PROFIT	-INF	2.9327E+7	+INF	.
---- VAR RELFAL	-INF	.	+INF	.

PROFIT OBJECTIVE FUNCTION (ZIELFUNKTION)
RELFAL RELATIVE FALLOW

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TASM1
SOLUTION REPORT SOLVE TASM USING NLP FROM LINE 1188

---- VAR PPTRADE TRADE OF PROCESSED COMMODITIES

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	-INF	111.560	+INF	.
TOMATO	-INF	26.720	+INF	.
SUNFLOWER	-INF	-8.870	+INF	.
OLIVE	-INF	43.450	+INF	.
TEA	-INF	3.320	+INF	.
GRAPE	-INF	99.690	+INF	.
HAZELNUT	-INF	92.350	+INF	.

---- VAR CROPS PRODUCTION OF CROP

	LOWER	LEVEL	UPPER	MARGINAL
SWHEATD.ANIMAL	.	.	+INF	-0.292
SWHEATD.MECHANIZED	.	3010.865	+INF	.
FWHEATD.ANIMAL	.	.	+INF	-0.137
FWHEATD.MECHANIZED	.	2439.277	+INF	.
SWHEATI.ANIMAL	.	991.423	+INF	.
SWHEATI.MECHANIZED	.	234.652	+INF	.
SCORN-D.ANIMAL	.	.	+INF	-4.598
SCORN-D.MECHANIZED	.	.	+INF	-3.454
FCORN-D.ANIMAL	.	.	+INF	-0.533
FCORN-D.MECHANIZED	.	409.777	+INF	.
SCORN-I.ANIMAL	.	.	+INF	-193.685
SCORN-I.MECHANIZED	.	.	+INF	-196.337
SRYE--D.ANIMAL	.	.	+INF	-0.328
SRYE--D.MECHANIZED	.	423.526	+INF	.
FRYE--D.ANIMAL	.	.	+INF	-34.866
FRYE--D.MECHANIZED	.	.	+INF	-35.089
SRICE-I.ANIMAL	.	.	+INF	-51.747
SRICE-I.MECHANIZED	.	.	+INF	-50.245
FRICE-I.ANIMAL	.	.	+INF	-1.482
FRICE-I.MECHANIZED	.	42.116	+INF	.
SBARLYD.ANIMAL	.	.	+INF	-79.938
SBARLYD.MECHANIZED	.	.	+INF	-79.421
FBARLYD.ANIMAL	.	.	+INF	-0.519
FBARLYD.MECHANIZED	.	1825.731	+INF	.
SCKPEAD.ANIMAL	.	237.513	+INF	.
SCKPEAD.MECHANIZED	.	.	+INF	-0.148
SCKPEAI.ANIMAL	.	.	+INF	-43.599
SCKPEAI.MECHANIZED	.	.	+INF	-42.943
SDBEANI.ANIMAL	.	43.967	+INF	.
SDBEANI.MECHANIZED	.	.	+INF	-0.399
SLENTLD.ANIMAL	.	.	+INF	-0.834
SLENTLD.MECHANIZED	.	376.523	+INF	.
SPOTATI.ANIMAL	.	220.140	+INF	.
SPOTATI.MECHANIZED	.	.	+INF	-2.139
SONIOND.ANIMAL	.	.	+INF	-115.893
SONIOND.MECHANIZED	.	.	+INF	-116.607
SONIONI.ANIMAL	.	58.439	+INF	.
SONIONI.MECHANIZED	.	.	+INF	-2.715

SOLUTION REPORT SOLVE TASM USING NLP FROM LINE 1188

VAR CROPS PRODUCTION OF CROP

	LOWER	LEVEL	UPPER	MARGINAL
SGPEPPI.ANIMAL	.	27.700	+INF	.
SGPEPPI.MECHANIZED	.	3.685	+INF	.
STOMATI.ANIMAL	.	99.708	+INF	.
STOMATI.MECHANIZED	.	.	+INF	-2.601
SCUCUMI.ANIMAL	.	27.629	+INF	.
SCUCUMI.MECHANIZED	.	.	+INF	-1.542
SSUNFLD.ANIMAL	.	.	+INF	-0.264
SSUNFLD.MECHANIZED	.	723.266	+INF	.
SSUNFLI.ANIMAL	.	.	+INF	-59.533
SSUNFLI.MECHANIZED	.	.	+INF	-59.446
SGRNUTI.ANIMAL	.	23.988	+INF	.
SGRNUTI.MECHANIZED	.	.	+INF	-1.650
SSBEANI.ANIMAL	.	8.348	+INF	.
SSBEANI.MECHANIZED	.	.	+INF	-0.415
SSESAMI.ANIMAL	.	.	+INF	-0.338
SSESAMI.MECHANIZED	.	18.519	+INF	.
SCOTTNI.ANIMAL	.	550.187	+INF	.
SCOTTNI.MECHANIZED	.	.	+INF	-1.553
STOBACD.ANIMAL	.	70.600	+INF	.
STOBACD.MECHANIZED	.	107.128	+INF	.
SMELOND.ANIMAL	.	.	+INF	-83.522
SMELOND.MECHANIZED	.	.	+INF	-82.925
SMELONI.ANIMAL	.	263.193	+INF	.
SMELONI.MECHANIZED	.	.	+INF	-1.110
SSBEETI.ANIMAL	.	290.900	+INF	.
SSBEETI.MECHANIZED	.	.	+INF	-2.868
SALFALI.ANIMAL	.	.	+INF	-1.444
SALFALI.MECHANIZED	.	102.658	+INF	.
SFODDRD.ANIMAL	.	.	+INF	-0.975
SFODDRD.MECHANIZED	.	358.871	+INF	.
PASTUSE.ANIMAL	.	19123.800	+INF	.
PASTUSE.MECHANIZED	.	.	+INF	EPS
OLIVE-D.ANIMAL	.	333.196	+INF	.
OLIVE-D.MECHANIZED	.	151.330	+INF	.
TEA---D.ANIMAL	.	86.095	+INF	.
CITRS-I.ANIMAL	.	53.723	+INF	.
CITRS-I.MECHANIZED	.	.	+INF	-1.322
GRAPE-D.ANIMAL	.	.	+INF	-0.565
GRAPE-D.MECHANIZED	.	502.027	+INF	.
GRAPE-I.ANIMAL	.	275.481	+INF	.
GRAPE-I.MECHANIZED	.	.	+INF	-1.566
APPLE-I.ANIMAL	.	.	+INF	-0.449
APPLE-I.MECHANIZED	.	247.414	+INF	.
PEACH-I.ANIMAL	.	.	+INF	-0.020
PEACH-I.MECHANIZED	.	23.695	+INF	.
APRIC-I.ANIMAL	.	.	+INF	-1.566
APRIC-I.MECHANIZED	.	29.601	+INF	.
CHERR-I.ANIMAL	.	20.524	+INF	.
CHERR-I.MECHANIZED	.	.	+INF	-3.603
WCHER-I.ANIMAL	.	.	+INF	-1.394
WCHER-I.MECHANIZED	.	13.675	+INF	.

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VAR CROPS PRODUCTION OF CROP

	LOWER	LEVEL	UPPER	MARGINAL
STBER-I.ANIMAL	.	.	+INF	-0.757
STBER-I.MECHANIZED	.	4.994	+INF	.
BANAN-I.ANIMAL	.	1.595	+INF	.
BANAN-I.MECHANIZED	.	.	+INF	-1.886
QUINC-I.ANIMAL	.	.	+INF	-1.033
QUINC-I.MECHANIZED	.	7.940	+INF	.
PISTA-D.ANIMAL	.	74.755	+INF	.
PISTA-D.MECHANIZED	.	.	+INF	-2.959
HAZEL-D.ANIMAL	.	.	+INF	-1.640
HAZEL-D.MECHANIZED	.	333.954	+INF	.

---- VAR PRODUCT PRODUCTION OF LIVESTOCK

	LOWER	LEVEL	UPPER	MARGINAL
SHEEP	.	49598.000	+INF	.
GOAT	.	15070.000	+INF	.
ANGORA	.	3856.000	+INF	.
CATTLE	.	15981.000	+INF	.
BUFFALO	.	1002.000	+INF	.
MULE	.	.	+INF	-6.736
POULTRY	.	62329.000	+INF	.

---- VAR PFERT PURCHASE OF FERTILIZER

	LOWER	LEVEL	UPPER	MARGINAL
NITROGEN	.	7.7703E+5	+INF	.
PHOSPHATE	.	5.1844E+5	+INF	.

---- VAR PRCOST PRODUCTION COSTS

	LOWER	LEVEL	UPPER	MARGINAL
SEED	.	5.2731E+5	+INF	.
FERTILIZER	.	5.4138E+5	+INF	.
CAPITAL	.	2.3602E+5	+INF	.

---- VAR LATRUSE LABOR AND TRACTOR USE

	LOWER	LEVEL	UPPER	MARGINAL
LABOR-1Q	.	1.2620E+6	+INF	.
LABOR-2Q	.	2.0363E+6	+INF	.
LABOR-3Q	.	2.5143E+6	+INF	.
LABOR-4Q	.	1.6556E+6	+INF	.
TRACTOR-1Q	.	10425.236	+INF	.

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VAR LATRUSE LABOR AND TRACTOR USE

	LOWER	LEVEL	UPPER	MARGINAL
TRACTOR-2Q	.	27580.344	+INF	.
TRACTOR-3Q	.	33572.291	+INF	.
TRACTOR-4Q	.	30424.525	+INF	.

---- VAR FEED FEED USE IN ANIMAL PRODUCTION IN ENERGY UNITS

	LOWER	LEVEL	UPPER	MARGINAL
TSTRAW	.	4486.636	+INF	.
TCONCEN	.	1873.946	+INF	.
TGRAIN	.	5290.006	+INF	.
TFODD	.	727.865	+INF	.
TOIL	.	279.369	+INF	.
TPAST	.	4207.236	+INF	.

---- VAR FGRAIN COMPOSITION OF FEEDGRAIN IN PRODUCT WEIGHT

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	2204.169	+INF	.
CORN	.	746.027	+INF	.
RYE	.	325.539	+INF	.
BARLEY	.	4097.892	+INF	.

---- VAR TOTALCONS TOTAL CONSUMPTION IN PROCESSED FORM

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	9129.030	+INF	.
CORN	.	466.413	+INF	.
RYE	.	308.589	+INF	.
BARLEY	.	315.392	+INF	.
RICE	.	238.400	+INF	.
CHICK-PEA	.	122.014	+INF	.
DRY-BEAN	.	38.777	+INF	.
LENTIL	.	207.684	+INF	.
POTATO	.	2982.271	+INF	.
ONION	.	991.257	+INF	.
GR-PEPPER	.	599.357	+INF	.
TOMATO	.	3390.977	+INF	.
CUCUMBER	.	510.000	+INF	.
SUNFLOWER	.	559.562	+INF	.
OLIVE	.	181.366	+INF	.
GROUNDNUT	.	45.856	+INF	.
SOYABEAN	.	764.926	+INF	.
SESAME	.	24.128	+INF	.
COTTON	.	227.462	+INF	.
SUG-BEET	.	11024.946	+INF	.

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VAR TOTALCONS TOTAL CONSUMPTION IN PROCESSED FORM

	LOWER	LEVEL	UPPER	MARGINAL
TOBACCO	.	30.896	+INF	.
TEA	.	172.247	+INF	.
CITRUS	.	678.091	+INF	.
GRAPE	.	3291.470	+INF	.
APPLE	.	1322.303	+INF	.
PEACH	.	259.465	+INF	.
APRICOT	.	54.556	+INF	.
CHERRY	.	95.000	+INF	.
WILDCHERRY	.	59.109	+INF	.
MELON	.	4481.844	+INF	.
STRAWBERRY	.	22.949	+INF	.
BANANA	.	29.999	+INF	.
QUINCE	.	55.022	+INF	.
PISTACHIO	.	21.043	+INF	.
HAZELNUT	.	133.921	+INF	.
SHEEP-MEAT	.	351.189	+INF	.
SHEEP-MILK	.	1196.662	+INF	.
SHEEP-WOOL	.	53.572	+INF	.
SHEEP-HIDE	.	27.893	+INF	.
GOAT-MEAT	.	103.041	+INF	.
GOAT-MILK	.	565.488	+INF	.
GOAT-WOOL	.	7.457	+INF	.
GOAT-HIDE	.	4.799	+INF	.
ANGOR-MEAT	.	6.904	+INF	.
ANGOR-MILK	.	57.761	+INF	.
ANGOR-WOOL	.	3.213	+INF	.
ANGOR-HIDE	.	0.500	+INF	.
BEEF	.	358.472	+INF	.
COW-MILK	.	3487.774	+INF	.
COW-HIDE	.	57.183	+INF	.
BUFAL-MEAT	.	32.438	+INF	.
BUFAL-MILK	.	283.570	+INF	.
BUFAL-HIDE	.	2.438	+INF	.
POLTR-MEAT	.	138.910	+INF	.
EGGS	.	278.598	+INF	.

---- VAR IMPORT IMPORT OF LIVESTOCK AND CROPS

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	272.309	+INF	.
RICE	.	40.400	+INF	.
SOYABEAN	.	752.926	+INF	.
SUG-BEET	.	619.404	+INF	.
SHEEP-WOOL	.	13.327	+INF	.
SHEEP-HIDE	.	0.056	+INF	.
COW-MILK	.	47.790	+INF	.
COW-HIDE	.	3.321	+INF	.
BUFAL-MEAT	.	0.265	+INF	.

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---- VAR EXPORT EXPORT OF LIVESTOCK AND CROPS

	LOWER	LEVEL	UPPER	MARGINAL
WHEAT	.	315.537	+INF	.
RYE	.	0.201	+INF	.
BARLEY	.	372.020	+INF	.
CHICK-PEA	.	175.656	+INF	.
DRY-BEAN	.	28.133	+INF	.
LENTIL	.	228.386	+INF	.
POTATO	.	17.729	+INF	.
ONION	.	98.743	+INF	.
GR-PEPPER	.	0.643	+INF	.
TOMATO	.	75.423	+INF	.
SUNFLOWER	.	0.003	+INF	.
OLIVE	.	1.384	+INF	.
GROUNDNUT	.	5.444	+INF	.
SESAME	.	0.872	+INF	.
COTTON	.	241.000	+INF	.
SUG-BEET	.	201.635	+INF	.
TOBACCO	.	131.014	+INF	.
CITRUS	.	279.909	+INF	.
GRAPE	.	9.770	+INF	.
APPLE	.	127.697	+INF	.
PEACH	.	5.535	+INF	.
APRICOT	.	50.444	+INF	.
WILDCHERRY	.	0.891	+INF	.
MELON	.	18.156	+INF	.
STRAWBERRY	.	0.051	+INF	.
BANANA	.	0.001	+INF	.
QUINCE	.	0.978	+INF	.
PISTACHIO	.	3.957	+INF	.
HAZELNUT	.	12.909	+INF	.
SHEEP-MEAT	.	26.330	+INF	.
SHEEP-WOOL	.	22.182	+INF	.
SHEEP-HIDE	.	0.882	+INF	.
GOAT-MEAT	.	0.312	+INF	.
GOAT-WOOL	.	1.480	+INF	.
GOAT-HIDE	.	0.882	+INF	.
ANGOR-WOOL	.	2.840	+INF	.
BEEF	.	12.835	+INF	.
COW-MILK	.	46.257	+INF	.
BUFAL-MEAT	.	0.029	+INF	.
POLTR-MEAT	.	0.707	+INF	.
EGGS	.	3.095	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
---- VAR CERAREA	.	9377.366	+INF	.
---- VAR FALAREA	.	4688.683	+INF	.

CERAREA CEREAL AREA
FALAREA FALLOW AREA

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---- VAR TECH           TECHNOLOGY

                  LOWER       LEVEL       UPPER     MARGINAL

ANIMAL              .       3759.104      +INF         .
MECHANIZED          .      11391.224      +INF         .

                          LOWER       LEVEL       UPPER     MARGINAL

---- VAR TECHNOL            .           .          +INF         .

  TECHNOL      RELATIVE TECHNOLOGY

**** REPORT SUMMARY :          0      NONOPT
                               0  INFEASIBLE
                               0   UNBOUNDED
                               0      ERRORS
```

6.5.2 Display output

The DISPLAY output produced by the present TASM-version is listed on the pages 40-53, in Appendix C to this section. As already mentioned, this kind of reporting results is optional and can be structured and influenced by the user.

Page 40 contains an aggregated commodity balance reported from the model results. It reflects the importance of foreign trade of feedgrain use and of the by-products for the different commodities. From the last column the relative importance of domestic consumption on total production can be derived.

Such tables (based on the balancing technique) express the impact of policy changes in a more comprehensive way than single variables do. For example, in order to evaluate the impact of a foreign trade policy change one should not only consider the foreign trade itself, but also take into account the impact on domestic production, consumption and on the internal use of commodities.

On page 41 and 42 the statistical and modeled prices are listed. The high conformity of both prices may not be interpreted as a model test. It has rather to be recognized as a check, whether the assumed methodology is in fact working, whether all logical and technical errors(formulation of the assignment statement and the equations, data, programming errors) are eliminated and whether the base model is consistent or not. If the statistical prices remain unchanged, this table can directly indicate the impact of a policy change (policy run results) in relation ot the base prices.

In the next tables the calculated demand function coefficients (DEM, page 42), the input parameters of the livestock production activities (for checking the calculated feed input coefficients) and the parameters of the labour and tractor supply function are listed.

Table PQPLIV (page 44) consists of the parameters for the non-linear cost function of the livestock activities, derived from the shadow prices of calibration restriction and the activitiy level.

The next table PQPCOM contains the same regarding the various crop commodities. Since this parameter can not directly be interpreted, a more simple relation between the shadow price of the calibration constraints and the market price is computed (page 45, RELSHAD). This proportion expresses the relative costs of production not explicitly covered by various input factors, or in other words the importance of the non-linear cost part at the given production level. If this factor is relatively high valued, then one should check, whether all of the relevant input components have been considered and measured adequately.

Otherwiese, if a high proportion of the total costs (equal to total revenue) is covered by the non-linear cost part, the degree of interdependence in the production sector will be low. In the extreme case one would approximate the basic assumptions of partial commodity models. This is not the intention of working with a mathematical programming model.

The discussion above clarifies the possibilities and limits of the incorporated non-linear cost function approach. It presents a valuable and sophisticated possibility for calibrating a programming model exactly and for improving the (continuous) reponsiveness of a sector model. On the other hand, the basic mechanisms of a programming model should not be restricted too much.

The last pages of the appendix (45-53) present an analysis of the cost structure implied by the model. This analysis has been made according to only animal power based crop activities (for testing purposes and for keeping up the output file within manageble limits) and for the livestock activities. An extension to overall technology can easily be done.

This cost strcuture analysis is carried out for the various cost components on the basis of the input coefficients. On the price side either the given market prices, or the shadow prices for price responsive supplied factors, for fixed factor and for intermediate inputs are used. The same calculation has been made on the output side, based on marketable and on non-marketable outputs.

Regarding crop activities the following components are considered:

SEED	(Seed Costs)
+FERTILIZER	(Fertilizer Costs)
+CAPITAL	(Capital Costs)

=VARIABLCO	(Variable Costs)

LABOURCO	(Labor Cost)
+MASCHINCO	(Tractor Costs)
+ANIMALPW	(Animal Power Costs)
+LANDRENT	(Shadow Price for Land)
+ROTATIONC	(Fallow Costs)
+SPECLANDCO	(Calibration Costs)

=OPPORTCOST	(Opportunity Costs)

=TOTALCOS	(Total Costs)

The variable cost components are exogenous in prices and quantities and therefore easy to calculate. For the other cost components shadow prices are used.

Labour costs are based on the quarterly labour requirement coefficients and the shadow prices for labour.

The machinery (tractor) and the animal power costs, also based on quarterly input coefficients, include additonally shadow prices for the technology calibration contraints. Therefore, the shadow price for the tractor technoloy constraints (1.29 $ for 1981) appears as cost component in all animal based crop production activities. The internal animal power costs are consequently corrected by the equivalent calibration shadow price.

The fallow-cereal rotation constraints implies also economic costs or benefits. In our example year, the fallow activities include positive rotation costs (for compensation of the higher competitiveness, discussed above). The negative rotation costs of single cereal activities lead to lower total production costs for these activities.

The cost component SPECLANDCO is derived from the calibration constraints for total agricultural production. These costs express the non-linear cost component. For the same commodity these costs differ in relation to yield differentiation.

On the output side, following components have to be considered:
- marketable output VALPROD, evaluated by the model endogenous shadow price;

- by-product, like VALSTRAW and VALCON (economic value of straw and concentrates), which are also calculated on the basis of the model endogenous shadow prices.

TOTALPROD is the sum of these output components.

The last column in each block calculates the difference between TOTALPROD and TOTALCOS. This difference should be equal to the marginal of the activities, mentioned above (pages 34 und 35). A check of these two values permits therefore to test, whether really all output and input components and their prices are considered correctly in the cost calculation.

A negative difference means that total costs level higher than total revenue. Therefore, such activities are not realized in the optimal solution. For further investigations, the explicit cost structure of the realized and also the non-realized acitivities presents an important information base.

On the pages 49-52 relative costs and revenues of the crop activities (animal technology) are presented.

If one observes, for example, the SWHEATD activity (Page 49), one can conclude that fertilizer, seed, animal power and labour costs have about the same economic importance (each component is about 15-20 % of total costs). The calibration constraint for total wheat production, which presents implicit costs, explained in chapter 2.3.3.2.3, accounts for about 35 % of total costs. Under the present assumption of TASM-MAFRA, this implicit cost component is the most important one in nearly all activities. Therefore, further investigations should be made in order to explain and to evaluate this cost component in more detail.

The cereal-fallow constraint reduces total costs of SWHEATD by about 10 %.

Regarding the output side one can point out that in the example year of 1981, the economic value of the straw by-product is neglegable and that the concentrate by-product contributes less than 2 % to the total economic revenue of this activity.

On the last pages 52 and 53 the same calculation is made for livestock commodities. Total feed costs account for about 40-60 % of the total costs. Labour costs are about 25-50 % and the residuals are the implicit livestock costs, expressed by the costs for ANIMALSTOC.

Finally, we would like to emphasize that, according to our experience with TASM-MAFRA and with other sector models, this kind of cost calculation should be considered as an important part in applied sector modeling for a number of reasons.

- The specified assumptions and the used data as well as all the parameters, which were assumed for the model, are in a certain way reflected in the cost structure.

- This cost structure calculation reflects the economic importance of specific assumptions concerning the explicit factor inputs and the additional constraints, which are always used for model calibaration (rotation constraints, behavioural or flexibility constraints, or explicit calibration constraints used for this model)

- The modeled cost sturcuture can be compared with the available information of book keeping farms or special cost surveys, like the TOPRAKSU data.

- On the basis of this cost structure calculation, one can point out the most important cost components, which should be given special consideration in practical modeling work. Since it is impossible to generate all data and coefficients exactly before running the model, one should start with a first model run based on the available data and rough guestimates and then evaluate and compare the implied cost structure. Based on this evaluation, more detailed investigations on the most important parts should be made.

- The cost structure concept can also be applied to the comparison over time and between countries. The approach shows the change of the relative importance of the cost-components over time (impact of technical progress and factor price changes). International comparisons of the cost structure are very useful for answering the question, why Turkish agricultural is for a certian commodity highly or less competitive in relation to other countries.

- The given cost structure in a base year provides already a first indication of the impact of changed economic and policy conditions. For example, one can conclude from the presented results, how the different commodities and activities would be affected from a reduction of the fertilizer subsidies.

- Finally, the cost structure in the base period indicates also important model elements, which may receive special consideration for forecasting and policy simulation work.

APPENDIX C: GAMS-MINOS DISPLAY RESULTS

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E X E C U T I N G

---- 1228 PARAMETER MARKBAL PRODUCTION AND MARKET BALANCES

	PRODUCTION	TOTALTRAD	FEDGRAIN	FEEDBYPROD	CONSUMPT
WHEAT	13538.510	174.534	2204.169	2030.776	9129.030
CORN	1212.440		746.027		466.413
RYE	704.810	0.201	325.539	70.481	308.589
BARLEY	5629.770	372.020	4097.892	844.465	315.392
RICE	198.000	-40.400			238.400
CHICK-PEA	297.670	175.656			122.014
DRY-BEAN	66.910	28.133			38.777
LENTIL	436.070	228.386			207.684
POTATO	3000.000	17.729			2982.271
ONION	1090.000	98.743			991.257
GR-PEPPER	600.000	0.643			599.357
TOMATO	3600.000	209.023			3390.977
CUCUMBER	510.000				510.000
SUNFLOWER	720.210	-26.607		187.255	559.562
OLIVE	400.000	218.634			181.366
GROUNDNUT	57.000	5.444		5.700	45.856
SOYABEAN	15.000	-752.926		3.000	764.926
SESAME	25.000	0.872			24.128
COTTON	780.770	241.000		312.308	227.462
SUG-BEET	11165.450	-417.769		558.272	11024.946
TOBACCO	161.910	131.014			30.896
TEA	189.677	17.430			172.247
CITRUS	958.000	279.909			678.091
GRAPE	3700.000	408.530			3291.470
APPLE	1450.000	127.697			1322.303
PEACH	265.000	5.535			259.465
APRICOT	105.000	50.444			54.556
CHERRY	95.000				95.000
WILDCHERRY	60.000	0.891			59.109
MELON	4500.000	18.156			4481.844
STRAWBERRY	23.000	0.051			22.949
BANANA	30.000	0.001			29.999
QUINCE	56.000	0.978			55.022
PISTACHIO	25.000	3.957			21.043
HAZELNUT	350.000	216.079			133.921
SHEEP-MEAT	377.519	26.330			351.189
SHEEP-MILK	1196.662				1196.662
SHEEP-WOOL	62.427	8.855			53.572
SHEEP-HIDE	28.719	0.826			27.893
GOAT-MEAT	103.353	0.312			103.041
GOAT-MILK	565.488				565.488
GOAT-WOOL	8.937	1.480			7.457
GOAT-HIDE	5.681	0.882			4.799
ANGOR-MEAT	6.904				6.904
ANGOR-MILK	57.761				57.761
ANGOR-WOOL	6.053	2.840			3.213
ANGOR-HIDE	0.500				0.500
BEEF	371.307	12.835			358.472
COW-MILK	3486.241	-1.533			3487.774
COW-HIDE	53.862	-3.321			57.183
BUFAL-MEAT	32.202	-0.236			32.438

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E X E C U T I N G
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1228 PARAMETER MARKBAL   PRODUCTION AND MARKET BALANCES

	PRODUCTION	TOTALTRAD	FEDGRAIN	FEEDBYPROD	CONSUMPT
BUFAL-MILK	283.570				283.570
BUFAL-HIDE	2.438				2.438
POLTR-MEAT	139.617	0.707			138.910
EGGS	281.693	3.095			278.598

---- 1228 PARAMETER DPRICE   STATISTICAL AND MODELLED PRICES

	STATISTIC	MODEL	DEVIATION	SHAD-EXP	SHAD-IMP
WHEAT	159.773	-159.773	-1.000	-14.883	-45.887
CORN	198.941	-198.941	-1.000		
RYE	125.036	-125.036	-1.000	129.334	
BARLEY	130.441	-130.441	-1.000	25.559	
RICE	481.888	-481.888	-1.000		128.378
CHICK-PEA	310.773	-310.773	-1.000	22.367	
DRY-BEAN	542.767	-542.767	-1.000	8.233	
LENTIL	491.370	-491.370	-1.000	-32.160	
POTATO	188.307	-188.307	-1.000	9.543	
ONION	215.600	-215.600	-1.000	-47.430	
GR-PEPPER	250.515	-250.515	-1.000	241.245	
TOMATO	191.231	-191.231	-1.000	-12.721	
CUCUMBER	239.438	-239.438	-1.000		
SUNFLOWER	277.719	-277.719	-1.000	489.981	
OLIVE	385.918	-385.918	-1.000	16.642	
GROUNDNUT	676.841	-676.841	-1.000	472.159	
SOYABEAN	326.015	-326.015	-1.000		-101.385
SESAME	802.763	-802.763	-1.000	23.187	
COTTON	1326.744	-1326.744	-1.000	-58.754	
SUG-BEET	34.648	-34.648	-1.000	133.812	-458.502
TOBACCO	1214.291	-1214.291	-1.000	1113.809	
TEA	363.322	-374.059	-1.030		
CITRUS	206.296	-206.296	-1.000	64.874	
GRAPE	380.247	-380.247	-1.000	-146.957	
APPLE	188.927	-188.927	-1.000	88.843	
PEACH	367.930	-367.930	-1.000	-46.310	
APRICOT	466.735	-466.735	-1.000	18.405	
CHERRY	428.542	-428.542	-1.000		
WILDCHERRY	363.765	-363.765	-1.000	147.115	
MELON	167.925	-167.925	-1.000	-28.585	
STRAWBERRY	1312.122	-1312.122	-1.000	-609.942	
BANANA	1997.648	-1997.648	-1.000	-1163.648	
QUINCE	262.655	-262.655	-1.000	-33.025	
PISTACHIO	3109.767	-3109.767	-1.000	910.573	
HAZELNUT	979.019	-979.019	-1.000	620.071	
SHEEP-MEAT	1214.469	-1215.719	-1.001	633.921	
SHEEP-MILK	316.090	-316.026	-1.000		
SHEEP-WOOL	2329.866	-2313.169	-0.993	-514.139	-4067.831
SHEEP-HIDE	1620.148	-1618.786	-0.999	-577.806	-862.214
GOAT-MEAT	965.992	-966.116	-1.000	-13.716	
GOAT-MILK	310.684	-310.634	-1.000		

1228 PARAMETER DEM DEMAND COEFFIENTS

	DALPHA	DBETA
BANANA	16266.564	-475.646
QUINCE	2138.761	-34.097
PISTACHIO	10884.183	-369.454
HAZELNUT	3426.565	-18.276
SHEEP-MEAT	3643.406	-6.913
SHEEP-MILK	1369.722	-0.881
SHEEP-WOOL	13979.195	-217.765
SHEEP-HIDE	6058.910	-159.187
GOAT-MEAT	2897.977	-18.748
GOAT-MILK	1346.298	-1.831
GOAT-WOOL	10542.350	-1177.653
GOAT-HIDE	6058.910	-925.128
ANGOR-MEAT	3035.153	-293.251
ANGOR-MILK	1346.298	-17.930
ANGOR-WOOL	25394.580	-6592.570
ANGOR-HIDE	6058.910	-8877.524
BEEF	3659.273	-7.476
COW-MILK	954.649	-0.182
COW-HIDE	2912.638	-37.317
BUFAL-MEAT	2856.505	-58.692
BUFAL-MILK	1024.567	-2.409
BUFAL-HIDE	2912.638	-874.509
POLTR-MEAT	3662.641	-16.431
EGGS	4007.761	-8.991

---- 1228 PARAMETER Q LIVESTOCK PRODUCTION COEFFICIENTS

	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
LABOR-1Q	2.882	2.632	2.550	30.000	30.000
LABOR-2Q	2.882	2.632	2.550	30.000	30.000
LABOR-3Q	2.882	2.632	2.550	30.000	30.000
LABOR-4Q	2.882	2.632	2.550	30.000	30.000
ANIMAL-1Q				9.500	13.000
ANIMAL-2Q				9.500	13.000
ANIMAL-3Q				9.500	13.000
ANIMAL-4Q				9.500	13.000
SHEEP-MEAT	0.008				
SHEEP-MILK	0.024				
SHEEP-WOOL	0.001				
SHEEP-HIDE	5.7903E-4				
GOAT-MEAT		0.007			
GOAT-MILK		0.038			
GOAT-WOOL		5.9304E-4			
GOAT-HIDE		3.7700E-4			
ANGOR-MEAT			0.002		
ANGOR-MILK			0.015		
ANGOR-WOOL			0.002		
ANGOR-HIDE			1.2958E-4		
BEEF				0.023	

1228 PARAMETER DPRICE STATISTICAL AND MODELLED PRICES

	STATISTIC	MODEL	DEVIATION	SHAD-EXP	SHAD-IMP
GOAT-WOOL	1757.058	-1760.384	-1.002	-1055.864	
GOAT-HIDE	1620.148	-1618.921	-0.999	-577.941	
ANGOR-MEAT	1011.718	-1010.436	-0.999		
ANGOR-MILK	310.684	-310.668	-1.000		
ANGOR-WOOL	4232.430	-4211.199	-0.995	-613.149	
ANGOR-HIDE	1620.148	-1623.064	-1.002		
BEEF	978.487	-979.182	-1.001	592.958	
COW-MILK	318.216	-318.189	-1.000	-76.239	-165.711
COW-HIDE	778.837	-778.773	-1.000		-1480.887
BUFAL-MEAT	952.168	-952.650	-1.001	619.490	-3763.760
BUFAL-MILK	341.522	-341.546	-1.000		
BUFAL-HIDE	778.837	-780.293	-1.002		
POLTR-MEAT	1380.622	-1380.179	-1.000	-373.179	
EGGS	1502.911	-1502.973	-1.000	-736.313	

---- 1228 PARAMETER DEM DEMAND COEFFIENTS

	DALPHA	DBETA
WHEAT	159.773	
CORN	198.941	
RYE	125.036	
BARLEY	130.441	
RICE	2891.331	-10.107
CHICK-PEA	1313.266	-8.216
DRY-BEAN	2293.628	-45.152
LENTIL	2076.435	-7.632
POTATO	1129.841	-0.316
ONION	1356.343	-1.151
GR-PEPPER	1575.989	-2.211
TOMATO	1203.036	-0.298
CUCUMBER	1506.304	-2.484
SUNFLOWER	1197.320	-1.643
OLIVE	1651.224	-6.977
GROUNDNUT	2895.994	-48.394
SOYABEAN	1394.915	-1.397
SESAME	3434.774	-109.085
COTTON	5749.224	-19.443
SUG-BEET	149.000	-0.010
TOBACCO	5261.930	-131.008
TEA	1089.965	-4.156
CITRUS	1253.482	-1.544
GRAPE	3305.224	-0.889
APPLE	1538.407	-1.021
PEACH	2995.998	-10.129
APRICOT	3800.559	-61.108
CHERRY	3489.558	-32.221
WILDCHERRY	2962.083	-43.958
MELON	1056.420	-0.198
STRAWBERRY	10684.426	-408.397

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1228 PARAMETER Q LIVESTOCK PRODUCTION COEFFICIENTS

	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
COW-MILK				0.218	
COW-HIDE				0.003	
BUFAL-MEAT					0.032
BUFAL-MILK					0.283
BUFAL-HIDE					0.002
TSTRAW	0.011	0.012	0.009	0.050	0.064
TFODD	0.005	0.005	0.002	0.025	0.027
TOIL	0.001	0.001	0.001	0.004	0.005
TPAST	0.009	0.009	0.009	0.033	0.043
TGRCONOIL	0.036	0.035	0.033	0.166	0.215
TGROIL	0.029	0.031	0.029	0.132	0.188
TENE	0.113	0.118	0.111	0.414	0.537

+	MULE	POULTRY
LABOR-1Q	19.500	1.250
LABOR-2Q	19.500	1.250
LABOR-3Q	19.500	1.250
LABOR-4Q	19.500	1.250
ANIMAL-1Q	30.000	
ANIMAL-2Q	30.000	
ANIMAL-3Q	30.000	
ANIMAL-4Q	30.000	
POLTR-MEAT		0.002
EGGS		0.005
TSTRAW	0.028	0.002
TFODD	0.012	
TOIL	0.003	0.001
TPAST	0.028	0.001
TGRCONOIL	0.028	0.022
TGROIL	0.014	0.020
TENE	0.277	0.030

---- 1228 PARAMETER PQPLT QUADRATIC LABOUR AND TRACTOR COSTS

LABOR-1Q 2.3953E-7, LABOR-2Q 2.3953E-7, LABOR-3Q 2.3953E-7
LABOR-4Q 2.3953E-7, TRACTOR-1Q 2.9767E-4, TRACTOR-2Q 2.9767E-4
TRACTOR-3Q 2.9767E-4, TRACTOR-4Q 2.9767E-4

---- 1228 PARAMETER PQPLIV QUADRATIC COST LIVESTOCK

	PQP3	SHADOWL	LEVELL
SHEEP	1.3060E-4	6.478	49598.000
GOAT	3.8360E-4	5.781	15070.000
ANGORA	9.6238E-6	0.037	3856.000
CATTLE	9.8380E-4	15.722	15981.000
BUFFALO	0.041	41.189	1002.000
POULTRY	5.2744E-5	3.287	62329.000

---- 1228 PARAMETER PQPCOM SHADOW PRICES AND QUADRATIC COST TERMS

	SHADOW	LEVEL	PQPKOEF	RELSHAD
WHEAT	49.272	13538.510	0.004	-0.308
CORN	142.029	1212.440	0.117	-0.714
RYE	40.531	704.810	0.058	-0.324
BARLEY	59.221	5629.770	0.011	-0.454
RICE	354.482	198.000	1.790	-0.736
CHICK-PEA	142.767	297.670	0.480	-0.459
DRY-BEAN	178.978	66.910	2.675	-0.330
LENTIL	293.995	436.070	0.674	-0.598
POTATO	113.661	3000.000	0.038	-0.604
ONION	169.953	1090.000	0.156	-0.788
GR-PEPPER	185.552	600.000	0.309	-0.741
TOMATO	152.928	3600.000	0.042	-0.800
CUCUMBER	180.162	510.000	0.353	-0.752
SUNFLOWER	104.816	720.210	0.146	-0.377
OLIVE	134.415	400.000	0.336	-0.348
GROUNDNUT	269.232	57.000	4.723	-0.398
SOYABEAN	64.428	15.000	4.295	-0.198
SESAME	435.861	25.000	17.434	-0.543
COTTON	196.708	780.770	0.252	-0.148
SUG-BEET	12.281	11165.450	0.001	-0.354
TOBACCO	194.723	161.910	1.203	-0.160
TEA	EPS	189.677	EPS	EPS
CITRUS	148.218	958.000	0.155	-0.718
GRAPE	235.463	3700.000	0.064	-0.619
APPLE	103.026	1450.000	0.071	-0.545
PEACH	287.222	265.000	1.084	-0.781
APRICOT	263.514	105.000	2.510	-0.565
CHERRY	178.932	95.000	1.883	-0.418
WILDCHERRY	70.222	60.000	1.170	-0.193
MELON	133.050	4500.000	0.030	-0.792
STRAWBERRY	813.690	23.000	35.378	-0.620
BANANA	1821.817	30.000	60.727	-0.912
QUINCE	181.914	56.000	3.248	-0.693
PISTACHIO	2038.304	25.000	81.532	-0.655
HAZELNUT	345.478	350.000	0.987	-0.353
FODDER	14.613	1108.050	0.013	
ALFALFA		948.817		

---- 1314 PARAMETER CO COST STRUCTURE CROPS

	SWHEATD	FWHEATD	SWHEATI	SCORN-D	FCORN-D
SEED	39.055	37.741	37.984	16.110	14.499
FERTILIZER	43.190	34.520	40.474	33.797	33.736
LABOURCO	37.637	46.355	63.101	92.392	86.680
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	35.283	36.326	46.365	8.945	13.595
LANDRENT			129.682		
ROTATIONC	-19.825	19.825	-19.825	-19.825	19.825
SPECLANDCO	75.394	97.283	165.381	318.358	420.232

1314 PARAMETER CO COST STRUCTURE CROPS

	SWHEATD	FWHEATD	SWHEATI	SCORN-D	FCORN-D
VARIABLCO	82.245	72.262	78.457	49.907	48.235
OPPORTCOST	129.779	201.080	385.994	401.159	541.623
VALPROD	207.806	268.137	455.833	445.926	588.622
VALSTRAW	0.256	0.332	0.568	0.543	0.703
VALCON	3.670	4.736	8.050		
TOTALCOS	212.024	273.342	464.452	451.067	589.858
TOTALPROD	211.733	273.205	464.452	446.469	589.325
DIFFCROP	-0.292	-0.137		-4.598	-0.533

+	SCORN-I	SRYE--D	FRYE--D	SRICE-I	FRICE-I
SEED	16.110	31.552	24.555	68.526	74.756
FERTILIZER	33.492	28.164	28.893	55.338	50.942
LABOURCO	285.285	44.345	59.490	232.804	258.336
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	24.700	36.226	47.131	44.685	49.400
LANDRENT	129.682			129.682	172.477
ROTATIONC	-19.825	-19.825	19.825	-19.825	-6.741
SPECLANDCO	687.653	67.450	81.265	1281.949	1666.534
VARIABLCO	49.602	59.717	53.448	123.864	125.697
OPPORTCOST	1108.785	129.485	209.001	1670.584	2141.296
VALPROD	963.199	187.270	225.627	1742.701	2265.512
VALSTRAW	1.502	0.326	0.417		
VALCON		1.277	1.539		
TOTALCOS	1158.387	189.202	262.448	1794.448	2266.994
TOTALPROD	964.701	188.874	227.582	1742.701	2265.512
DIFFCROP	-193.685	-0.328	-34.866	-51.747	-1.482

+	SBARLYD	FBARLYD	SCKPEAD	SCKPEAI	SDBEANI
SEED	53.169	39.132	66.993	47.852	62.482
FERTILIZER	28.924	29.614	20.572	28.162	27.613
LABOURCO	110.454	43.521	99.834	250.236	281.554
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	51.574	36.125	22.093	25.479	51.547
LANDRENT				129.682	129.682
ROTATIONC	-19.825	19.825			
SPECLANDCO	157.424	182.611	178.926	372.764	272.371
VARIABLCO	82.093	68.747	87.565	76.014	90.096
OPPORTCOST	300.916	283.372	302.143	779.450	736.444
VALPROD	294.734	341.891	389.485	811.428	825.993
VALSTRAW	0.686	0.833	0.223	0.437	0.547
VALCON	7.651	8.875			
TOTALCOS	383.009	352.119	389.708	855.464	826.539
TOTALPROD	303.071	351.599	389.708	811.865	826.539
DIFFCROP	-79.938	-0.519	-9.3132E-10	-43.599	

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1314 PARAMETER CO COST STRUCTURE CROPS

+	SLENTLD	SPOTATI	SONIOND	SONIONI	SGPEPPI
SEED	51.672	319.688			191.408
FERTILIZER	10.241	48.607	43.545	60.075	70.313
LABOURCO	125.261	424.065	477.345	622.708	798.085
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	41.183	93.920	14.842	37.656	51.133
LANDRENT		129.682		129.682	129.682
SPECLANDCO	340.490	1548.942	1567.949	3169.984	3547.243
VARIABLCO	61.913	368.294	43.545	60.075	261.722
OPPORTCOST	508.224	2197.899	2061.426	3961.320	4527.433
VALPROD	569.080	2566.194	1989.077	4021.394	4789.155
VALSTRAW	0.223				
TOTALCOS	570.137	2566.194	2104.970	4021.394	4789.155
TOTALPROD	569.303	2566.194	1989.077	4021.394	4789.155
DIFFCROP	-0.834	3.7253E-9	-115.893	1.1176E-8	2.2352E-8

+	STOMATI	SCUCUMI	SSUNFLD	SSUNFLI	SGRNUTI
SEED	11.817	116.509	5.042	5.799	94.021
FERTILIZER	64.394	53.733	19.176	25.568	31.961
LABOURCO	1078.441	725.288	87.901	80.065	526.210
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	97.332	67.670	15.032	6.938	51.610
LANDRENT	129.682	129.682		129.682	129.682
SPECLANDCO	5521.521	3325.647	104.373	154.559	639.734
VARIABLCO	76.211	170.242	24.219	31.367	125.981
OPPORTCOST	6828.265	4249.578	208.595	372.534	1348.527
VALPROD	6904.476	4419.820	204.644	303.044	1447.447
VALOEL			27.906	41.324	27.061
TOTALCOS	6904.476	4419.820	232.814	403.901	1474.508
TOTALPROD	6904.476	4419.820	232.550	344.368	1474.508
DIFFCROP		-7.4506E-9	-0.264	-59.533	

+	SSBEANI	SSESAMI	SCOTTNI	STOBACD	SMELOND
SEED	6.168	73.878	19.805	70.892	87.797
FERTILIZER	22.777	55.938	86.698	16.081	16.580
LABOURCO	187.894	182.533	581.403	789.066	263.629
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	54.738	52.321	96.289	51.494	53.098
LANDRENT	129.682	129.682	129.682		
SPECLANDCO	115.762	588.396	279.148	177.392	1292.812
VARIABLCO	28.945	129.816	106.504	86.973	104.378
OPPORTCOST	489.366	954.221	1087.812	1019.242	1610.829
VALPROD	468.616	1083.700	1129.670	1106.215	1631.685
VALOEL	49.695		64.646		
TOTALCOS	518.311	1084.038	1194.316	1106.215	1715.207
TOTALPROD	518.311	1083.700	1194.316	1106.215	1631.685
DIFFCROP	9.3132E-10	-0.338	3.7253E-9	3.7253E-9	-83.522

1314 PARAMETER CO COST STRUCTURE CROPS

+	SMELONI	SSBEETI
SEED	57.259	20.390
FERTILIZER	36.854	95.849
LABOURCO	296.667	497.742
MASCHINCO	1.290	1.290
ANIMALPW	74.533	83.899
LANDRENT	129.682	129.682
SPECLANDCO	2274.852	471.369
VARIABLCO	94.113	116.239
OPPORTCOST	2777.024	1183.982
VALPROD	2871.137	1263.397
VALSTRAW		
VALCON		36.824
TOTALCOS	2871.137	1300.221
TOTALPROD	2871.137	1300.221
DIFFCROP	1.1176E-8	

+	OLIVE-D	TEA---D	CITRS-I	GRAPE-D	GRAPE-I
FERTILIZER	4.365	11.779	97.160	19.874	39.748
CAPITAL	26.585	664.613	132.923	101.553	114.579
LABOURCO	87.050	78.794	713.705	378.328	513.541
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	21.487	0.763	23.730	55.346	73.844
LANDRENT	66.853	66.853	66.853	66.853	66.853
SPECLANDCO	110.966	EPS	2643.057	1012.663	1317.070
VARIABLCO	30.949	676.392	230.083	121.427	154.328
OPPORTCOST	287.645	147.699	3448.634	1514.479	1972.598
VALPROD	318.594	824.091	3678.717	1635.341	2126.925
TOTALCOS	318.594	824.091	3678.717	1635.906	2126.925
TOTALPROD	318.594	824.091	3678.717	1635.341	2126.925
DIFFCROP		1.0636E-6	-1.1176E-8	-0.565	1.1176E-8

+	APPLE-I	PEACH-I	APRIC-I	CHERR-I	WCHER-I
FERTILIZER	13.993	8.350	28.164	29.365	39.748
CAPITAL	104.211	287.378	159.241	201.776	178.914
LABOURCO	248.001	483.670	393.770	790.485	896.837
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	69.531	55.083	73.109	65.627	105.693
LANDRENT	66.853	66.853	66.853	66.853	66.853
SPECLANDCO	603.798	3212.172	934.727	828.241	308.106
VARIABLCO	118.205	295.729	187.406	231.141	218.662
OPPORTCOST	989.474	3819.068	1469.749	1752.495	1378.779
VALPROD	1107.230	4114.776	1655.589	1983.636	1596.047
TOTALCOS	1107.678	4114.797	1657.155	1983.636	1597.441
TOTALPROD	1107.230	4114.776	1655.589	1983.636	1596.047
DIFFCROP	-0.449	-0.020	-1.566	3.7253E-9	-1.394

1314 PARAMETER CO COST STRUCTURE CROPS

+	STBER-I	BANAN-I	QUINC-I	PISTA-D	HAZEL-D
FERTILIZER	9.415	214.150	24.717	5.192	49.792
CAPITAL	1235.382	1940.137	169.609	53.169	53.169
LABOURCO	959.997	1019.340	260.556	220.457	490.021
MASCHINCO	1.290	1.290	1.290	1.290	1.290
ANIMALPW	23.317	66.089	47.436	11.366	4.498
LANDRENT	66.853	66.853	66.853	66.853	66.853
SPECLANDCO	3747.389	34273.204	1282.964	681.665	362.078
VARIABLCO	1244.796	2154.287	194.326	58.361	102.961
OPPORTCOST	4798.846	35426.776	1659.098	981.630	924.740
VALPROD	6042.885	37581.063	1852.392	1039.991	1026.060
TOTALCOS	6043.642	37581.063	1853.424	1039.991	1027.701
TOTALPROD	6042.885	37581.063	1852.392	1039.991	1026.060
DIFFCROP	-0.757	-5.9605E-8	-1.033	1.8626E-9	-1.640

---- 1314 PARAMETER RCO RELATIVE CROP COSTS

	SWHEATD	FWHEATD	SWHEATI	SCORN-D	FCORN-D
SEED	0.184	0.138	0.082	0.036	0.025
FERTILIZER	0.204	0.126	0.087	0.075	0.057
LABOURCO	0.178	0.170	0.136	0.205	0.147
MASCHINCO	0.006	0.005	0.003	0.003	0.002
ANIMALPW	0.166	0.133	0.100	0.020	0.023
LANDRENT			0.279		
ROTATIONC	-0.094	0.073	-0.043	-0.044	0.034
SPECLANDCO	0.356	0.356	0.356	0.706	0.712
VARIABLCO	0.388	0.264	0.169	0.111	0.082
OPPORTCOST	0.612	0.736	0.831	0.889	0.918
VALPROD	0.981	0.981	0.981	0.999	0.999
VALSTRAW	0.001	0.001	0.001	0.001	0.001
VALCON	0.017	0.017	0.017		
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	SCORN-I	SRYE--D	FRYE--D	SRICE-I	FRICE-I
SEED	0.014	0.167	0.094	0.038	0.033
FERTILIZER	0.029	0.149	0.110	0.031	0.022
LABOURCO	0.246	0.234	0.227	0.130	0.114
MASCHINCO	0.001	0.007	0.005	7.1878E-4	5.6896E-4
ANIMALPW	0.021	0.191	0.180	0.025	0.022
LANDRENT	0.112			0.072	0.076
ROTATIONC	-0.017	-0.105	0.076	-0.011	-0.003
SPECLANDCO	0.594	0.356	0.310	0.714	0.735
VARIABLCO	0.043	0.316	0.204	0.069	0.055
OPPORTCOST	0.957	0.684	0.796	0.931	0.945
VALPROD	0.998	0.992	0.991	1.000	1.000
VALSTRAW	0.002	0.002	0.002		
VALCON		0.007	0.007		
RSTOTAL	1.000	1.000	1.000	1.000	1.000

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E X E C U T I N G

1314 PARAMETER RCO RELATIVE CROP COSTS

+	SBARLYD	FBARLYD	SCKPEAD	SCKPEAI	SDBEANI
SEED	0.139	0.111	0.172	0.056	0.076
FERTILIZER	0.076	0.084	0.053	0.033	0.033
LABOURCO	0.288	0.124	0.256	0.293	0.341
MASCHINCO	0.003	0.004	0.003	0.002	0.002
ANIMALPW	0.135	0.103	0.057	0.030	0.062
LANDRENT				0.152	0.157
ROTATIONC	-0.052	0.056			
SPECLANDCO	0.411	0.519	0.459	0.436	0.330
VARIABLCO	0.214	0.195	0.225	0.089	0.109
OPPORTCOST	0.786	0.805	0.775	0.911	0.891
VALPROD	0.972	0.972	0.999	0.999	0.999
VALSTRAW	0.002	0.002	5.7138E-4	5.3857E-4	6.6125E-4
VALCON	0.025	0.025			
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	SLENTLD	SPOTATI	SONIOND	SONIONI	SGPEPPI
SEED	0.091	0.125			0.040
FERTILIZER	0.018	0.019	0.021	0.015	0.015
LABOURCO	0.220	0.165	0.227	0.155	0.167
MASCHINCO	0.002	5.0262E-4	6.1275E-4	3.2074E-4	2.6932E-4
ANIMALPW	0.072	0.037	0.007	0.009	0.011
LANDRENT		0.051		0.032	0.027
SPECLANDCO	0.597	0.604	0.745	0.788	0.741
VARIABLCO	0.109	0.144	0.021	0.015	0.055
OPPORTCOST	0.891	0.856	0.979	0.985	0.945
VALPROD	1.000	1.000	1.000	1.000	1.000
VALSTRAW	3.9113E-4				
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	STOMATI	SCUCUMI	SSUNFLD	SSUNFLI	SGRNUTI
SEED	0.002	0.026	0.022	0.014	0.064
FERTILIZER	0.009	0.012	0.082	0.063	0.022
LABOURCO	0.156	0.164	0.378	0.198	0.357
MASCHINCO	1.8681E-4	2.9183E-4	0.006	0.003	8.7475E-4
ANIMALPW	0.014	0.015	0.065	0.017	0.035
LANDRENT	0.019	0.029		0.321	0.088
SPECLANDCO	0.800	0.752	0.448	0.383	0.434
VARIABLCO	0.011	0.039	0.104	0.078	0.085
OPPORTCOST	0.989	0.961	0.896	0.922	0.915
VALPROD	1.000	1.000	0.880	0.880	0.982
VALOEL			0.120	0.120	0.018
RSTOTAL	1.000	1.000	1.000	1.000	1.000

1314 PARAMETER RCO   RELATIVE CROP COSTS

+	SSBEANI	SSESAMI	SCOTTNI	STOBACD	SMELOND
SEED	0.012	0.068	0.017	0.064	0.051
FERTILIZER	0.044	0.052	0.073	0.015	0.010
LABOURCO	0.363	0.168	0.487	0.713	0.154
MASCHINCO	0.002	0.001	0.001	0.001	7.5199E-4
ANIMALPW	0.106	0.048	0.081	0.047	0.031
LANDRENT	0.250	0.120	0.109		
SPECLANDCO	0.223	0.543	0.234	0.160	0.754
VARIABLCO	0.056	0.120	0.089	0.079	0.061
OPPORTCOST	0.944	0.880	0.911	0.921	0.939
VALPROD	0.904	1.000	0.946	1.000	1.000
VALOEL	0.096		0.054		
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	SMELONI	SSBEETI
SEED	0.020	0.016
FERTILIZER	0.013	0.074
LABOURCO	0.103	0.383
MASCHINCO	4.4924E-4	9.9200E-4
ANIMALPW	0.026	0.065
LANDRENT	0.045	0.100
SPECLANDCO	0.792	0.363
VARIABLCO	0.033	0.089
OPPORTCOST	0.967	0.911
VALPROD	1.000	0.972
VALSTRAW		
VALCON		0.028
RSTOTAL	1.000	1.000

+	OLIVE-D	TEA---D	CITRS-I	GRAPE-D	GRAPE-I
FERTILIZER	0.014	0.014	0.026	0.012	0.019
CAPITAL	0.083	0.806	0.036	0.062	0.054
LABOURCO	0.273	0.096	0.194	0.231	0.241
MASCHINCO	0.004	0.002	3.5062E-4	7.8844E-4	6.0642E-4
ANIMALPW	0.067	9.2600E-4	0.006	0.034	0.035
LANDRENT	0.210	0.081	0.018	0.041	0.031
SPECLANDCO	0.348	EPS	0.718	0.619	0.619
VARIABLCO	0.097	0.821	0.063	0.074	0.073
OPPORTCOST	0.903	0.179	0.937	0.926	0.927
VALPROD	1.000	1.000	1.000	1.000	1.000
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	APPLE-I	PEACH-I	APRIC-I	CHERR-I	WCHER-I
FERTILIZER	0.013	0.002	0.017	0.015	0.025
CAPITAL	0.094	0.070	0.096	0.102	0.112
LABOURCO	0.224	0.118	0.238	0.399	0.561
MASCHINCO	0.001	3.1346E-4	7.7833E-4	6.5023E-4	8.0743E-4
ANIMALPW	0.063	0.013	0.044	0.033	0.066
LANDRENT	0.060	0.016	0.040	0.034	0.042

1314 PARAMETER RCO RELATIVE CROP COSTS

+	APPLE-I	PEACH-I	APRIC-I	CHERR-I	WCHER-I
SPECLANDCO	0.545	0.781	0.564	0.418	0.193
VARIABLCO	0.107	0.072	0.113	0.117	0.137
OPPORTCOST	0.893	0.928	0.887	0.883	0.863
VALPROD	1.000	1.000	1.000	1.000	1.000
RSTOTAL	1.000	1.000	1.000	1.000	1.000

+	STBER-I	BANAN-I	QUINC-I	PISTA-D	HAZEL-D
FERTILIZER	0.002	0.006	0.013	0.005	0.048
CAPITAL	0.204	0.052	0.092	0.051	0.052
LABOURCO	0.159	0.027	0.141	0.212	0.477
MASCHINCO	2.1342E-4	3.4321E-5	6.9591E-4	0.001	0.001
ANIMALPW	0.004	0.002	0.026	0.011	0.004
LANDRENT	0.011	0.002	0.036	0.064	0.065
SPECLANDCO	0.620	0.912	0.692	0.655	0.352
VARIABLCO	0.206	0.057	0.105	0.056	0.100
OPPORTCOST	0.794	0.943	0.895	0.944	0.900
VALPROD	1.000	1.000	1.000	1.000	1.000
RSTOTAL	1.000	1.000	1.000	1.000	1.000

---- 1314 PARAMETER CA COST STRUCTURE ANIMALS

	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
TFODD	0.423	0.439	0.207	2.316	2.505
TGROIL	5.048	5.244	4.936	22.693	32.213
TENE	3.623	3.763	3.542	13.232	17.173
LABOURCO	5.156	4.709	4.562	53.666	53.666
ANIMALPW				12.841	17.572
SUMFEED	9.093	9.446	8.685	38.241	51.890
ANIMALSTOC	6.478	5.781	0.037	15.722	41.189
TOTALCOST	20.727	19.936	13.284	107.629	146.746
PRODANIMAL	20.727	19.936	13.284	94.788	129.174
TOTALVAL	20.727	19.936	13.284	107.629	146.746
DIFFERANI	-5.8208E-11	-2.9104E-11			-2.3283E-10

+	MULE	POULTRY
TFODD	1.164	
TGROIL	2.375	3.388
TENE	8.865	0.973
LABOURCO	34.883	2.236
ANIMALPW	40.551	
SUMFEED	12.404	4.361
ANIMALSTOC		3.287
TOTALCOST	47.287	9.884
PRODANIMAL		9.884
TOTALVAL	40.551	9.884
DIFFERANI	-6.736	1.4552E-11

---- 1314 PARAMETER RCA RELATIVE ANIMAL COSTS

	SHEEP	GOAT	ANGORA	CATTLE	BUFFALO
TFODD	0.020	0.022	0.016	0.022	0.017
TGROIL	0.244	0.263	0.372	0.211	0.220
TENE	0.175	0.189	0.267	0.123	0.117
LABOURCO	0.249	0.236	0.343	0.499	0.366
SUMFEED	0.439	0.474	0.654	0.355	0.354
ANIMALSTOC	0.313	0.290	0.003	0.146	0.281
RTOTAL	1.000	1.000	1.000	1.000	1.000
RELPRODUCT	1.000	1.000	1.000	0.881	0.880
RELANIMP				0.119	0.120

+	MULE	POULTRY
TFODD	0.025	
TGROIL	0.050	0.343
TENE	0.187	0.098
LABOURCO	0.738	0.226
SUMFEED	0.262	0.441
ANIMALSTOC		0.333
RTOTAL	1.000	1.000
RELPRODUCT		1.000
RELANIMP	1.000	

**** FILE SUMMARY

INPUT C:\TASM\TASM81B.PRN
OUTPUT C:\TASM\TASM81B.LST

EXECUTION TIME = 4.793 MINUTES

6.6 Some base period model results

In the last chapters we have elaborated in detail on the model for a certian base year. For a more comprehensive evaluation one should, however, not only consider a specific year, but also observe the model results over a longer period of time.

In order to carry out projections and policy analysis based on future scenarios, the model is solved and tested for the base periods 1979 to 1986. Since the model calibrates exactly with the base period, the conventional procedures of comparing simulated and observed values become irrelevant. However, the base period model runs present some insights into the past development process, which have to be analysed carefully before further policy runs are carried out.

As a first step towards the evaluation of sectoral programming models in general, and a non-linear model like TASM-MAFRA in particular, the shadow prices generated by the model provide a vital criteria. We wish to elaborate only on these results below, and therefore refer those interested in more conventional results to the output files at MAFRA's-PC .

In Table VI.1, the shadow prices of the calibration constraints devided by the level of production (the parameters b of the quadratic cost function part) are given for selected commodities. The structure of these parameters remain relatively stable over the years. This encouraging result suggests that yearly yield and price variations are fully reflected in the associated shadow prices. In fact, there is a high correlation between the short term fluctuation of the parameters and the yearly yield variations. Compared to the results of conventional linear programming models and also, earlier versions of TASM, the shadow price structure of the present version contains relatively less instability, due to the model structure itself. The results are also encouraging for the possibility of predicting the quadratic cost function terms for policy runs of future scenarios. We suggest to carry out and evaluate simple trend forecasts and, econometric estimations (influence of prices and yields) of these critical model parameters.

Table VI.2 contains selected shadow prices (in US-dollars) of selected resources employed in the agricultural sector. As far as agricultural land is concerned, only irrigated area is restricting. The associated shadow price (marginal value of irrigated land) reflects a tendency to decrease, as a result of the pressure on real agricultural prices (unfavourable sectoral terms of trade), limited domestic and foreign demand potentials and at the same time productivity increases in agricultural production.

The other endogenous factor prices share the same tendencies. The shadow prices for labour and tractor use, influenced by the

implied supply function, reflect a tendency to decrease in real wage rates in the reported period and also an increasing relative unemployment of this factor in agriculture. The shadow prices for animal power and feed reflect the economic importance of linkages (intermediate input supply and demand) between crop and animal production.

These shadow prices and the associated input and output coefficients of the activities present the basis for the internal calculation of the opportunity costs, which constitute, in addition to costs for purchased input, an important component of total costs, which are presented above for 1981. As also mentioned above, the residual between the output prices and these cost items is exactly represented by the shadow price of the calibration constraint.

In Table VI.3 we have grouped the commodities in relation to the share of the calibration shadow prices in total costs, or in other words in relation to the cost share covered by the quadratic part of the cost function. It becomes clear that for most commodities less than half of the total costs can be explained by the costs of purchased inputs and the traditonal factor opportunity costs. However, there are large differences between individual commodities. Three conclusions, which should guide the future work an TASM-MAFRA, emerge:

- First, the non-linear cost function part, in the case of TASM-MAFRA is important. Further investigations concerning estimating and forecasting this cost part (functional forms, econometric estimation of the influence of economic factors) are required.

- Second, the higher the share of the quadratic cost part is, the smaller is the economic interaction between the different production sectors, e.g. the implicit cross price supply elasticities. If the opportunity cost shares are relatively large, which is the case in most crop production sectors and especially in the livestock sector, then the model repesents economic interdependencies between the various production sectors.

- Third, a detailed examination of the implicit relative cost structure of the various model activities is an important step prior to policy applications. Such an analysis may also lead to a re-examination of the various model assumptions and the estimates about model coefficients.

Further evaluations of base year developments will be presented within the programming system implemented at MAFRA's PC and during the main training of this project.

TABLE VI.1: ESTIMATED PARAMETERS OF THE QUADRATIC TERMS OF THE COST FUNCTIONS FOR SELECTED PRODUCTS IN TASM

Products	1980	1981	1982	1983	1984	1985	1986
WHEAT	0.003	0.004	0.004	0.003	0.004	0.004	0.003
CORN	0.101	0.117	0.096	0.063	0.066	0.047	0.040
RYE	0.051	0.058	0.065	0.063	0.088	0.096	0.089
BARLEY	0.012	0.011	0.009	0.009	0.010	0.008	0.007
RICE	1.474	1.790	1.202	1.005	1.253	1.301	2.580
CHICKPEA	0.604	0.480	0.546	0.419	0.438	0.556	0.355
DRYBEAN	3.348	2.675	4.845	3.735	2.078	1.325	4.368
LENTIL	0.869	0.674	0.197	0.141	0.208	0.307	0.272
POTATO	0.045	0.038	0.027	0.026	0.033	0.032	0.017
ONION	0.276	0.156	0.072	0.083	0.136	0.106	0.052
GR.PEPPER	0.386	0.309	0.182	0.142	0.185	0.205	0.439
TOMATO	0.042	0.042	0.020	0.025	0.027	0.032	0.037
CUCUMBER	0.332	0.353	0.256	0.211	0.196	0.180	0.345
SUNFLOWER	0.096	0.146	0.140	0.126	0.146	0.155	0.119
OLIVE	0.301	0.336	0.215	0.471	0.398	0.630	0.382
GROUNDNUT	10.506	4.723	3.641	4.213	7.357	5.130	6.095
SESAME	24.355	17.434	19.150	19.607	11.347	11.634	15.404
COTTON	0.107	0.252	0.246	0.449	0.334	0.189	0.274
TOBACCO	0.012	1.[illegible]03	[illegible].911	1.250	0.287	0.750	0.307
TEA	0.366	0.000	0.390	0.430	0.348	0.326	0.897
CITRUS	0.132	0.155	0.120	0.089	0.056	0.180	0.140
GRAPE	0.085	0.064	0.057	0.062	0.059	0.061	0.078
APPLE	0.093	0.071	0.080	0.059	0.052	0.066	0.077
PEACH	0.947	1.084	0.955	0.612	1.267	1.231	0.929
APRICOT	0.987	2.510	1.816	0.910	1.559	1.373	1.010
CHERRY	1.038	1.883	3.668	3.087	4.177	1.401	1.782
WILDCHERRY	1.162	1.170	2.880	0.384	3.043	1.484	0.007
MELON	0.034	0.030	0.020	0.018	0.023	0.014	0.028
STRAWBERRY	25.854	35.378	62.178	53.440	60.658	22.350	27.119
BANANA	51.113	60.727	81.717	89.913	76.724	37.938	47.094
QUINCE	2.981	3.248	3.074	2.615	2.805	3.470	2.754
HAZELNUT	0.197	0.987	0.395	0.803	0.138	0.206	1.728

TABLE VI.2: SHADOW PRICES FOR SELECTED RESOURCES IN TASM

Resources	1980	1981	1982	1983	1984	1985	1986
Irrigated land	124.141	129.682	103.009	85.262	80.285	80.056	86.921
Labour							
Quarter 1	0.355	0.30	0.245	0.219	0.210	0.209	0.206
Quarter 2	0.576	0.48	0.406	0.381	0.376	0.384	0.377
Quarter 3	0.721	0.60	0.506	0.476	0.487	0.486	0.472
Quarter 4	0.464	0.39	0.323	0.294	0.300	0.293	0.282
Tractor							
Quarter 1	3.525	3.10	2.255	1.967	1.888	1.878	1.850
Quarter 2	8.432	8.21	5.731	5.107	4.292	4.104	4.735
Quarter 3	9.999	9.99	7.384	6.461	5.211	5.110	6.005
Quarter 4	3.848	9.05	6.007	5.211	4.363	4.231	4.872
Animal power							
Quarter 1	.	.	.	.	.	.	.
Quarter 2	0.315	0.382	0.203	0.168	0.090	0.065	0.134
Quarter 3	0.356	0.450	0.285	0.218	0.083	0.073	0.176
Quarter 4	0.407	0.520	0.293	0.257	0.166	0.159	0.233
Animal feed							
Straw	-3.067	-1.065	-1.711	-1.972	-3.015	-3.276	-2.247
Concent.	-97.991	-31.980	-26.528	-24.690	-24.708	-24.830	-24.231
Cereals	-152.109	-183.720	-148.249	-131.521	-151.192	-137.915	-134.100
Pasture	-97.991	-31.980	-26.528	-24.690	-24.708	-24.830	-24.231
Oilseeds	-171.401	-203.368	-169.741	-144.919	-156.342	-149.597	-146.001

TABLE VI.3: RELATIVE SHARE OF THE SHADOW PRICES OF THE CALIBRATION CONSTRAINTS IN TOTAL COSTS (1986 Summary statistics)

Relative share(%)	Products
‹ 30	Cotton,
30 - 50	Wheat, Rye, Drybean, Groundnuts, Sugarbeet, Tobacco,
50 - 60	Barley, Potato, Sunflower, Hazelnuts,
60 - 70	Chickpea, Lentil, Soyabean, Sesame, Cherry,
70 - 80	Corn, Onion, Grape, Apple,
› 80	Rice, Greenpepper, Tomato, Cucumber, Tea, Peach, Apricot, Melon, Strawberry, Banana, Quince, Pistachio,

VII. POLICY SIMULATION WITH TASM-MAFRA IN THE BASE PERIOD

7.1. Introduction

Real policy simulation runs should be carried out on the basis of a forecasting version of TASM-MAFRA. This follows from the simple fact that all policy decisions are likely to influence the future. Therefore, also present policy considerations should take into account the foreseable tendencies and the accentuated future policy problems.

Policy simulations in the base period have to be seen as an undertaking for learning the typcial reactions of the model, for testing the model, whether and to which extend it reacts to changed economic conditions and getting some first impressions about the impact of changed economic and policitical parameters on the agricultural sector.

In the following sections, some results of three types of policy simulations will be presented:

- Firstly, the impact of changed world market prices and foreign trade policies will be elaborated.

- Secondly, domestic economic conditions and policies, which influence primarily the domestic market, will be analyzed.

- Finally, we will elaborate the question about the sectoral impact of an increase of the irrigated area in Turkey by special projects.

These simulations shall exemplify some possible model applications and some principle impacts of policy measures, rather than actual agricultural policy alternatives in Turkey.

All the simulations, which are presented in the following sections, are carried out for the base year solution of 1986.

7.2 Free trade run and alternative world market prices

In the following pages, the results of a free trade run with alternative world market prices will be presented. Free trade is simulated by removing the export and import restrictions. This implies the assumption that the export and import prices of the base year remain unchanged in relation to the foreign trade adoption of Turkey.

As a background information, we should point out that Turkey has suffered from very high rates of inflation, 50-100 %, in the base period. Under such circumstances it is almost impossible to work out stable relationships in nominal Turkish Lira terms, which can be used for forecasting and policy analysis. We have therefore converted all national prices and values into US-Dollars using the average official exchange rates. Despite the improvements over the past few years, Turkish Lira is still overvalued, and the swith to a freely fluctuating exchange rate regime is in the agenda of the present government. In the realization of this turn, Turkish exports are expected to be more competitive and imports more expensive.

In order to examine the impact of these policies on agriculture, we have first removed all trade restrictions (quotas, taxes, subsidies, public enterprise trade policy) and modeled a so called free trade base scenario (tables VII.1-VII.7). Nearly 100% inflation and significant changes in the exchange rate imply that, in principle, commodity specific exchange rates resulting from the seasonality of exports and imports deviate from the average exchange rates. With these reservations in mind, we have nevertheless used average exchange rates for the first preliminary simulations.

In relation to the free trade run based on the official exchange rate in 1986, several runs with different world market prices are carried out:

- 10 % increase of all export and import prices,
- additional 20 % increase of all export and import prices (32 % over the base),
- additional 30 % increase of all export and import prices (72 % over the base),
- additional 40 % increase of all export and import prices (140 % over the base).

The last alternative is mainly to test the reliability of the model under extreme conditions. Also, the results presented should not directly be used for policy conclusions, because several trade restrictions, which are relevant even under principally free trade conditions must be considered (international marketing, quality , product differentiation, limitations in processing). Finally, we are aware of the fact that Turkey is a price taker in some products, but also price setter for some other products in the world markets. Therefore, our assumption of price taking behaviour in the simulations should also be taken with care.

The results of the world market price simulations under free trade conditions, which are presented in Tables VII.1-VII.7 can be summarized as follows:

- Imports of agricultural products, which are small to begin with, will sharply decrease with the exception of rice.

- Domestic consumption will be effected, because internal prices will increase. The results in Table VII.3 show that concerning the 140 % increase in world market prices, we already reached the limits of the present model version. What would be necessary in this case, is to incorporate the domestic income effects of such a price increase on domestic demand.

- Table VII.8 suggests that, the factors used in agricultural production would also be affected, in absolute and relative terms.

- The domestic prices, modeled as internal shadow prices, would in most cases follow the changes in the world market prices. Even commodities which are not traded will be affected indirectly via the increasing factor costs.

- The internal shadow prices would, under the assumed conditions, increase substantially. This is especially the case for fixed agricultural land. The shadow prices for feed are affected from the supply side (higher grain prices, shadow prices for land) as well as from the demand side (increased marginal value products for feed demand, expansion of animal production).

- The final table disposes the impact of changed world market prices under free trade conditions on the production structure, e.g. the levels of the different crop production activities. In general, one can conclude that with increasing world market and domestic prices, there is a shift from animal power technology to tractor technology (with the increasing wage rate a higher level of mechanization becomes more profitable) and also a shift from fallow-cereal activities to single cereal activities. The latter change is mainly due to the higher land prices, which induce the fallow-cereal activities to be relatively more expensive.

7.3 Changes in economic conditions in the domestic markets

In a number of simulation runs a given foreign trade policy with fixed exports and imports has been assumed and certain conditions on the supply or demand side have been changed. The following model runs are executed:

A1: 50 % increase of the prices for fertilizer, seeds and capital (increase variable production costs);

A2: 20 % increase of the yield in the livestock sector, as an outcome of special policy measures (livestock projects, intensified extension, import of improved livestock breedings);

A3: 20 % shift of the domestic demand curve in response to the increase of population and general income level;

A4: A1 and A2 simultaneously;

A5: A1 and A2 and A3 simultaneously.

In Table VII.8 the impacts of these alternatives on the agricultural producer prices are given, as well as the base solution, which is needed for comparison:

- The cost increase for seeds, fertilizer and capital leads particularly to producer price increase for cereals (10-15 %) and for most of the vegetables. Tree crops are only affected little. Via the higher feedgrain prices and the increased shadow price for fodder crops, there is also an impact on the prices for the livestock commodities. This price increase is certainly connected with a lower demand for agricultural commodities.

- A productivity increase in the livestock sector through 20 % higher yields per animal leads to a price decrease for livestock commodities within the range of 10-30 %. The figures in Table VII.8 indicate that there is also some influence on the crop commodity prices. This is mainly due to the impact of a slight decrease in the number of animals and the feed and labour demand of the livestock sector, which affect via lower shadow prices for labour and land the production costs of the crop sector.

- A general demand shift for all agricultural commodities leads to an increase of all agricultural prices. The quantitative impact is, however, different, and depends on the price elasticity of demand and the implicit elasticity of agricultural supply. Grain prices would considerably increase, while most of the livestock commodity prices vary around 10 %. The impact on food demand is the result of the initial shift of the supply curve and of the price increase. Under the assumed conditions, there is, however, in all cases an increase of domestic demand.

- The combined effect of an increase of production costs (20 %) and of higher livestock yields can not - at least not in all cases - be derived from the individual effects of A1 and A2. However, as one would expect the tendential effect is an increase of all the crop commodity prices and a decrease of livestock commodity prices. Agricultural demand is affected in the opposite direction.

- Finally, the last column of Table VII.8 presents the agricultural commodity prices at a simultaneous change of the production costs, the livestock yields and of a demand shift by the same percentages as in the single sceanario runs A1 to A3. Under these conditons all agricultural commodity prices would increase, mainly because of the dominating impact of the demand shift.

For a more detailed analysis of this alternative or other ones, it would be necessary to consider also the other variables of the primal and dual solution.

7.4 Increased irrigated area

At present roughly about 20 % of arable land are irrigated. Since there are significant yield and productivity differences between crop production on dry and on irrigated land, an increase of irrigated land by irrigation projects is on the policy agenda of Turkish agricultural policy. In the following we will apply TASM-MAFRA for analyzing the question about the impact of an extension of irrigated area on the agricultural sector. However, these results have to be interpretated very carefully, since international trade is assumed to be fixed and since no regional specific impacts have been considered.

The alternative A1 assumes an increase of irrigated area by 1 Mill. ha and consequently a decease of dry land by the same amount. In A2 the increase of irrigated area by 2 Mill. ha is assumed.

Table VII.9 presents the impact on land use, and on the shadow prices for labour, tractor, animal power and for feed. Except for the land use structure, which follows the exogenous change, the impact on internal shadow prices is very small. Accordingly, there is also some influences on factor use and allocation.

Table VII.10 presents the impact on agricultural producer prices. As one can observe, also the agricultural prices are only little affected. For for some commodities we have a slight price increase. The main reason for this is to be found in the present version, which assumes that some commodities are only grown on dry land. In the alternatives A1 and A2 dry land receives a shadow price and consequently total production costs and the producer prices increase.

This example shows very clearly the necessity of modifying the model (e.g. extension of production activities based on irrigated land) and of adapting different policy areas (e.g. foreign trade policy) to specific policy measures, like an extension of irrigation.

In the last part, the dual solution results for the technology and fallow calibration constraints are presented.

The fallow balance EQU FALBAL shows a positive shadow price and the cereal balance EQU CERBAL is represented by a negative one. This means that cereal produciton in combination with fallow is under the given economic conditions relatively competitive. The result can be explained as follows: The fallow-grain activities (see lines 460-545 in the input file) indicate a higher yield per ha. Since the shadow price for dry land equals zero, the internal land costs are in both cases zero. Therefore, it is essential to note the revenue difference minus the labour costs difference, which creates the shadow price for fallow and cereal area.

A similar interpretation is possible concerning animal and tractor technology.

TABLE VII.1: EXPORT OF AGRICULTURAL COMMODITIES AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated) 10%	20%	30%	40%
WHEAT	.	.	.	.	.
CORN	.	.	.	125.9	1380.3
RYE	184.7	302.9	407.8	410.5	416.4
BARLEY	.	.	473.8	1063.7	1442.6
CHICK-PEA	.	12.3	164.9	356.0	686.1
DRY-BEAN	.	.	.	.	.
LENTIL	.	8.1	304.1	723.3	1436.6
POTATO	.	63.5	1369.5	3474.3	7120.3
ONION	.	.	.	11.7	519.2
GR-PEPPER	.	47.3	240.6	580.9	1168.5
TOMATO	.	.	.	1188.3	3779.8
OLIVE	177.9	184.3	204.1	229.0	279.4
GROUNDNUT	9.8	18.7	35.4	61.0	105.0
COTTON	58.3	110.4	169.8	190.3	213.8
SUG-BEET	3614.0	7261.1	13056.4	20896.3	34520.3
TOBACCO	452.0	531.7	696.2	984.4	1473.3
CITRUS	.	.	40.4	444.7	1147.9
GRAPE	.	.	.	.	.
APPLE	.	.	.	.	.
PEACH	.	.	.	.	.
APRICOT	1.3	11.2	32.2	69.2	135.0
WILDCHERRY	.	.	.	.	.
MELON	.	224.3	1416.3	3399.3	7081.4
STRAWBERRY	.	.	.	.	.
QUINCE	.	.	.	13.1	38.9
PISTACHIO	7.1	7.5	8.50	10.0	12.5
HAZELNUT	661.6	681.4	725.4	803.8	922.4
SHEEP-MEAT	435.1	471.1	567.7	684.2	826.2
SHEEP-MILK	957.7	1079.0	1400.7	1799.0	2431.8
SHEEP-WOOL	50.0	54.5	67.3	80.9	101.4
GOAT-MEAT	106.0	116.2	141.5	186.7	223.5
GOAT-MILK	444.2	489.8	605.1	810.4	1154.4
GOAT-WOOL	7.6	8.0	9.3	11.5	15.1
ANGOR-MILK	.	.	.	0.1	10.6
ANGOR-WOOL	0.7	0.4	.	.	.
BEEF	16.3	22.6	32.6	49.8	78.6
COW-MILK	.	.	.	.	.
BUFAL-MILK	242.4	278.3	350.5	454.4	532.7
POLTR-MEAT	.	.	6.1	24.6	55.8
EGGS	.	.	.	.	.

TABLE VII.2: IMPORTS OF AGRICULTURAL COMMODITIES AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated)			
		10%	20%	30%	40%
WHEAT	.	.	.	.	.
CORN	.	.	.	.	.
RICE	298.247	289.820	277.041	261.839	235.351
POTATO	.	.	.	.	.
GROUNDNUT	.	.	.	.	.
SOYABEAN	.	.	.	.	.
SESAME	22.238	16.453	7.202	.	.
COTTON	.	.	.	.	.
SUG-BEET	.	.	.	.	.
CITRUS	208.890	100.992	.	.	.
GRAPE	.	.	.	.	.
SHEEP-MEAT	.	.	.	.	.
SHEEP-WOOL	.	.	.	.	.
SHEEP-HIDE	13.821	10.397	1.345	.	.
BEEF	.	.	.	.	.
COW-MILK	.	.	.	.	.
COW-HIDE	.	.	.	.	.
BUFAL-HIDE	.	.	.	.	.

TABLE VII .3: DOMESTIC CONSUMPTION OF SELECTED AGRICULTURAL COMMODITIES AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated)			
		10%	20%	30%	40%
WHEAT	11001.2	11001.2	10590.3	8778.3	5625.7
CORN	1766.2	1768.6	1729.4	1581.7	1265.3
RYE	169.6	164.8	154.3	135.3	102.4
BARLEY	1805.2	1828.4	1732.8	1552.9	1241.3
RICE	342.4	339.9	334.4	324.5	307.4
CHICK-PEA	568.2	565.1	535.6	482.4	390.2
DRY-BEAN	60.1	59.7	57.7	52.4	43.2
LENTIL	1098.4	1094.4	1032.5	921.0	727.7
POTATO	3967.8	3950.1	3782.1	3479.6	2955.4
ONION	1143.5	1140.3	1128.8	1100.8	1001.1
GR-PEPPER	733.4	726.1	696.5	643.2	550.9
TOMATO	4396.5	4392.6	4379.5	4200.6	3821.5
CUCUMBER	747.7	747.0	744.4	738.8	728.5
SUNFLOWER	925.1	915.4	873.0	762.4	570.1
OLIVE	867.0	832.7	757.3	621.4	386.0
GROUNDNUT	40.9	39.5	36.2	30.3	20.1
SOYABEAN	377.8	374.7	365.1	340.9	298.6
SESAME	54.7	53.3	50.2	45.5	39.7
COTTON	8.0	7.8	7.4	6.7	5.5
SUG-BEET	9514.3	9154.8	8363.9	6940.3	4472.8
TOBACCO	75.4	69.5	56.5	33.1	.
TEA	675.2	666.4	647.2	611.9	551.1
CITRUS	1251.5	1231.8	1201.2	1127.2	998.9
GRAPE	2554.4	2531.1	2480.3	2388.9	2230.7
APPLE	1783.6	1759.8	1708.2	1614.3	1451.6
PEACH	267.8	266.3	262.9	256.9	246.4
APRICOT	189.7	187.7	183.3	175.4	161.7
CHERRY	138.2	137.0	134.4	129.8	121.9
WILDCHERRY	77.4	76.2	73.7	69.1	61.0
MELON	4943.9	4904.6	4705.6	4347.3	3726.3
STRAWBERRY	34.4	34.3	34.1	33.8	33.2
BANANA	34.9	34.9	34.9	34.8	34.7
QUINCE	73.1	72.5	71.3	67.8	61.3
PISTACHIO	21.9	20.8	18.4	14.2	6.7
HAZELNUT	23.3	20.7	14.8	4.2	.
SHEEP-MEAT	178.2	162.5	128.0	65.9	.
SHEEP-MILK	969.4	912.0	785.6	558.2	164.0
SHEEP-WOOL	51.2	50.0	47.4	42.8	34.9
GOAT-MEAT	51.2	44.8	30.5	5.0	.
GOAT-MILK	417.6	392.9	338.4	240.5	70.6
GOAT-WOOL	6.8	6.7	6.5	6.1	5.4
ANGOR-MEAT	4.3	3.8	3.2	2.7	2.0
ANGOR-MILK	35.3	31.9	26.3	22.2	6.5
ANGOR-WOOL	2.6	2.6	2.5	2.1	1.6
BEEF	308.8	289.8	247.9	172.4	41.6
COW-MILK	2942.4	2826.7	2538.3	2011.1	1088.5
BUFAL-MEAT	41.4	43.2	46.2	51.4	60.3
BUFAL-MILK	123.7	103.2	58.1	.	.
POLTR-MEAT	128.1	125.5	110.6	76.0	15.9
EGGS	299.5	293.3	272.9	235.2	167.7

TABLE VII.4: RESOURCE USE AT DIFFERENT WORLD MARKET PRICES (SELECTED FACTORS)

Factors	Base run (Free trade)	World market prices (accumulated)			
		10%	20%	30%	40%
LIVESTOCK					
SHEEP	79037.952	81658.295	89667.443	96678.469	1.0646E+5
GOAT	22936.202	33491.376	25108.740	27965.715	32599.394
ANGORA	2329.389	2102.918	1735.348	1477.668	1130.224
CATTLE	13495.027	12964.396	11641.571	9223.771	4992.421
BUFFALO	1266.798	1320.377	1414.192	1572.383	1843.059
MULE	.	.	.	.	.
POULTRY	57212.831	56029.421	52135.991	44925.535	32028.121
FERTILIZER					
NITROGEN	1.1271E+6	1.1829E+6	1.2268E+6	1.2596E+6	1.2537E+6
PHOSPHATE	5.7100E+5	5.8993E+5	6.0237E+5	6.1324E+5	6.0338E+5
PURCHASED INPUTS					
SEED	6.9600E+5	7.3301E+5	8.0064E+5	9.0888E+5	1.0665E+6
FERTILIZER	4.2485E+5	4.4361E+5	4.5779E+5	4.6877E+5	4.6488E+5
CAPITAL	1.1711E+5	1.1663E+5	1.1543E+5	1.1354E+5	1.1026E+5
LABOUR UND TRACTOR USE					
LABOR-1Q	1.2487E+6	1.2474E+6	1.2434E+6	1.2158E+6	1.1432E+6
LABOR-2Q	2.2896E+6	2.3432E+6	2.4989E+6	2.7134E+6	3.0149E+6
LABOR-3Q	2.9572E+6	3.0546E+6	3.2901E+6	3.6617E+6	4.4033E+6
LABOR-4Q	1.7557E+6	1.8260E+6	1.9324E+6	2.0566E+6	2.3101E+6
TRACTOR-1Q	15774.097	16331.215	16328.869	16059.195	19566.632
TRACTOR-2Q	30255.598	30676.622	34545.876	41865.369	52541.653
TRACTOR-3Q	44744.897	46662.727	49585.662	53699.879	67318.117
TRACTOR-4Q	42832.914	46452.581	49313.475	51907.840	52835.085
FEED CATEGORIES					
STRAW	5584.830	5593.425	5618.572	5492.156	5208.196
CONCENTRATES	2452.637	2548.031	2582.284	2617.270	2662.122
GRAIN	5988.169	5974.706	6001.656	5871.286	5559.504
FODDER	840.299	842.549	1184.343	1389.332	1590.382
OILSEEDS	279.671	281.983	295.335	279.249	246.655
PASTURE	4784.120	4784.120	4784.120	4784.120	4784.120
FEEDGRAIN					
WHEAT	2495.071	2489.461	2500.690	2446.369	2316.460
CORN	844.485	842.587	846.387	1129.093	1069.135
RYE	368.503	367.674	369.333	361.310	342.123
BARLEY	4638.723	4628.293	4649.170	4217.403	3993.446

TABLE VII.5: SHADOW PRICES OF SELECTED AGRICULTURAL COMMODITIES AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated)			
		10%	20%	30%	40%
WHEAT	-130.7	-130.7	-143.4	-199.1	-296.1
CORN	-133.4	-132.9	-141.5	-174.0	-243.6
RYE	-128.2	-141.1	-169.3	-220.1	-308.1
BARLEY	-107.5	-102.8	-122.3	-159.0	-222.6
RICE	-205.5	-226.1	-271.3	-352.7	-493.8
CHICK-PEA	-362.2	-370.0	-444.0	-577.2	-808.1
DRY-BEAN	-697.8	-709.7	-784.1	-980.9	-1323.8
LENTIL	-484.5	-490.8	-589.0	-765.7	-1072.0
POTATO	-130.2	-133.0	-159.6	-207.5	-290.6
ONION	-91.6	-93.0	-98.1	-110.5	-154.8
GR-PEPPER	-373.8	-393.3	-472.0	-613.6	-859.1
TOMATO	-191.3	-192.3	-195.6	-241.2	-337.7
CUCUMBER	-299.2	-300.7	-305.9	-317.8	-339.0
SUNFLOWER	-290.5	-299.2	-337.3	-436.7	-609.7
OLIVE	-517.8	-569.6	-683.5	-888.5	-1244.0
GROUNDNUT	-701.2	-771.3	-925.6	-1203.3	-1684.6
SOYABEAN	-507.3	-511.5	-524.6	-557.8	-615.7
SESAME	-910.6	-1001.7	-1202.0	-1510.5	-1890.0
COTTON	-739.8	-813.8	-976.6	-1269.6	-1777.5
SUG-BEET	-28.0	-30.8	-37.0	-48.1	-67.4
TOBACCO	-2594.0	-2853.4	-3424.1	-4451.4	-6232.0
TEA	-706.3	-723.9	-762.6	-833.3	-955.1
CITRUS	-184.1	-202.5	-231.2	-300.6	-420.9
GRAPE	-314.4	-336.1	-383.6	-469.0	-616.9
APPLE	-200.3	-217.4	-254.3	-321.6	-438.1
PEACH	-324.5	-337.1	-364.5	-413.9	-500.2
APRICOT	-282.7	-311.0	-373.2	-485.1	-679.2
CHERRY	-402.2	-423.7	-472.6	-559.8	-707.9
WILDCHERRY	-333.5	-362.0	-426.5	-542.0	-744.2
MELON	-165.9	-172.7	-207.2	-269.4	-377.2
STRAWBERRY	-1150.4	-1169.7	-1212.6	-1287.9	-1415.0
BANANA	-1730.1	-1735.9	-1748.3	-1769.9	-1806.8
QUINCE	-251.6	-264.2	-291.8	-374.2	-523.9
PISTACHIO	-2557.0	-2812.7	-3375.3	-4387.9	-6143.1
HAZELNUT	-1880.6	-2068.7	-2482.4	-3227.1	-4518.0
SHEEP-MEAT	-1063.3	-1169.6	-1403.5	-1824.6	-2554.5
SHEEP-MILK	-434.0	-477.4	-572.9	-744.8	-1042.8
SHEEP-WOOL	-1723.3	-1895.7	-2274.8	-2957.3	-4140.2
GOAT-MEAT	-1007.6	-1108.4	-1330.1	-1729.1	-2420.8
GOAT-MILK	-434.0	-477.4	-572.9	-744.8	-1042.8
GOAT-WOOL	-666.5	-733.2	-879.8	-1143.8	-1601.3
ANGOR-MEAT	-949.4	-1041.1	-1190.0	-1294.3	-1435.1
ANGOR-MILK	-495.9	-561.1	-667.0	-744.8	-1042.8
ANGOR-WOOL	-3446.7	-3791.4	-4897.3	-8591.7	-13572.7
BEEF	-1039.0	-1142.9	-1371.5	-1783.0	-2496.2
COW-MILK	-260.4	-277.6	-320.3	-398.4	-535.0
BUFAL-MEAT	241.8	342.0	517.3	813.0	1319.0
BUFAL-MILK	-434.0	-477.4	-572.9	-744.8	-1042.8
POLTR-MEAT	-1035.6	-1063.6	-1220.2	-1586.2	-2220.8
EGGS	-991.2	-1021.6	-1121.5	-1306.6	-1637.6

TABLE VII.6: SHADOW PRICES FOR SELECTED RESOURCES AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated) 10%	20%	30%	40%
LAND					
DRY-EITH	12.561	19.234	58.529	139.330	280.092
IRR-EITH	118.392	135.604	224.614	466.320	885.056
DRY-GOOD	.		.	27.909	75.016
IRR-GOOD	.	.	.	.	.
TREE	152.084	278.602	554.302	1061.462	1934.197
PASTURE	3.829	9.020	16.931	29.905	52.697
LABOUR AND TRACTOR USE					
LABOR-1Q	0.251	0.251	0.250	0.244	0.230
LABOR-2Q	0.460	0.471	0.502	0.545	0.606
LABOR-3Q	0.594	0.614	0.661	0.736	0.885
LABOR-4Q	0.353	0.367	0.388	0.413	0.464
TRACTOR-1Q	2.179	2.256	2.255	2.218	2.703
TRACTOR-2Q	4.179	4.237	4.772	5.783	7.258
TRACTOR-3Q	6.181	6.445	6.875	7.418	9.299
TRACTOR-4Q	5.916	6.416	6.812	7.170	7.298
ANIMALPOWER					
ANIMAL-1Q	.	.	.	.	0.064
ANIMAL-2Q	.	.	0.025	0.088	0.181
ANIMAL-3Q	0.085	0.092	0.090	0.080	0.134
ANIMAL-4Q	0.273	0.311	0.332	0.345	0.312
FEED COMPONENTS					
STRAW	-21.197	-44.710	-80.785	-139.798	-242.100
CONCENTRATES	-47.383	-71.751	-109.608	-171.265	-279.493
CERIALS	-151.489	-144.840	-172.325	-223.146	-312.405
PASTURE	-47.383	-71.751	-109.608	-171.265	-279.493
OILSEEDS	-164.529	-161.586	-184.923	-244.259	-349.177
FODDER	-97.483	-92.716	-109.608	-171.265	-279.493
TOTALFEED	-47.383	-71.751	-109.608	-171.265	-279.493
FEED GRAIN COMPOSITION					
WHEAT	-30.164	-36.812	-26.885	-53.486	-98.924
CORN	-19.594	-25.560	-9.135	.	.
RYE	-45.864	-72.249	-88.182	115.513	-161.718
BARLEY	.	.	.	-0.877	-1.227

TABLE VII.7: CROP ACTIVITY LEVEL AT DIFFERENT WORLD MARKET PRICES

Products	Base run (Free trade)	World market prices (accumulated) 10%	20%	30%	40%
SWHEATD.ANIMAL	1256.516	1802.319	1533.515	.	.
SWHEATD.MECHANIZED	4337.476	4378.311	5231.696	6570.683	4977.431
FWHEATD.ANIMAL	1118.102	536.522	.	.	.
FWHEATD.MECHANIZED	.	.	.	.	.
SWHEATI.ANIMAL	.	.	.	.	.
SWHEATI.MECHANIZED	1593.794	1622.580	1065.904	562.920	248.660
SCORN-D.ANIMAL	.	.	.	637.553	834.892
SCORN-D.MECHANIZED	.	.	.	.	.
FCORN-D.ANIMAL	.	.	.	.	.
FCORN-D.MECHANIZED	444.500	444.589	438.562	.	.
SCORN-I.ANIMAL	.	.	.	.	.
SCORN-I.MECHANIZED	.	.	.	.	.
SRYE--D.ANIMAL	.	.	.	.	.
SRYE--D.MECHANIZED	409.648	473.413	527.866	514.096	487.876
FRYE--D.ANIMAL	.	.	.	.	.
FRYE--D.MECHANIZED	.	.	.	.	.
SRICE-I.ANIMAL	.	.	.	.	.
SRICE-I.MECHANIZED	.	.	.	.	.
FRICE-I.ANIMAL	.	.	.	.	.
FRICE-I.MECHANIZED	8.493	9.634	11.035	12.058	13.858
SBARLYD.ANIMAL	.	.	.	.	.
SBARLYD.MECHANIZED	.	.	.	.	491.593
FBARLYD.ANIMAL	.	.	.	.	.
FBARLYD.MECHANIZED	2336.406	2341.010	2485.733	2477.840	1997.241
SCKPEAD.ANIMAL	.	.	.	.	.
SCKPEAD.MECHANIZED	66.589	458.903	556.729	666.333	855.348
SCKPEAI.ANIMAL	184.798	.	.	.	.
SCKPEAI.MECHANIZED	.	.	.	.	.
SDBEANI.ANIMAL	.	.	.	.	.
SDBEANI.MECHANIZED	54.177	53.886	52.081	47.301	38.976
SLENTLD.ANIMAL	.	.	.	.	.
SLENTLD.MECHANIZED	918.884	922.347	1118.135	1375.580	1810.604
SPOTATI.ANIMAL	237.782	240.533	308.729	416.738	44.693
SPOTATI.MECHANIZED	.	.	.	.	559.126
SONIOND.ANIMAL	.	.	.	.	.
SONIOND.MECHANIZED	.	.	.	.	.
SONIONI.ANIMAL	.	.	49.390	48.682	66.521
SONIONI.MECHANIZED	50.032	49.894	.	.	.
SGPEPPI.ANIMAL	35.805	37.760	45.748	59.761	83.940
SGPEPPI.MECHANIZED	.	.	.	.	.
STOMATI.ANIMAL	40.805	85.053	57.251	28.010	144.729
STOMATI.MECHANIZED	59.837	15.498	43.000	95.349	29.272
SCUCUMI.ANIMAL	.	.	.	.	30.811
SCUCUMI.MECHANIZED	31.620	31.590	31.483	31.243	.
SSUNFLD.ANIMAL	.	.	.	.	.
SSUNFLD.MECHANIZED	1058.299	1047.242	998.766	872.262	652.275
SSUNFLI.ANIMAL	.	.	.	.	.
SSUNFLI.MECHANIZED	.	.	.	.	.

TABLE VII .7: CROP ACTIVITY LEVEL AT DIFFERENT WORLD MARKET PRICES(continued)

Products	Base run (Free trade)	World market prices (accumulated)			
		10%	20%	30%	40%
SGRNUTI.ANIMAL	23.850	27.346	33.612	42.869	58.753
SGRNUTI.MECHANIZED	.	.	.	.	.
SSBEANI.ANIMAL	.	.	.	.	.
SSBEANI.MECHANIZED	104.361	103.514	100.869	94.184	82.493
SSESAMI.ANIMAL	.	37.941	44.299	46.844	40.860
SSESAMI.MECHANIZED	33.424	.	.	.	.
SCOTTNI.ANIMAL	65.780	117.177	175.635	182.389	102.782
SCOTTNI.MECHANIZED	.	.	.	12.856	114.490
STOBACD.ANIMAL	.	296.651	442.888	.	.
STOBACD.MECHANIZED	609.430	397.984	426.705	1175.512	1702.001
SMELOND.ANIMAL	.	.	.	.	.
SMELOND.MECHANIZED	.	.	.	187.861	1149.058
SMELONI.ANIMAL	298.721	309.898	369.896	361.300	.
SMELONI.MECHANIZED	.	.	.	.	.
SSBEETI.ANIMAL	.	.	.	483.009	507.501
SSBEETI.MECHANIZED	365.371	456.867	596.142	291.701	577.698
SALFALI.ANIMAL	.	.	.	.	.
SALFALI.MECHANIZED	123.549	112.651	326.283	493.806	565.264
SFODDRD.ANIMAL	.	534.149	270.670	.	.
SFODDRD.MECHANIZED	500.702	.	.	.	.
PASTUSE.ANIMAL	21746.000	21746.000	21746.000	21746.000	21746.000
PASTUSE.MECHANIZED	.	.	.	.	.
OLIVE-D.ANIMAL	.	.	.	.	.
OLIVE-D.MECHANIZED	502.509	489.123	462.332	409.002	320.010
TEA---D.ANIMAL	134.247	132.494	128.665	121.648	109.570
CITRS-I.ANIMAL	.	.	54.040	68.417	93.435
CITRS-I.MECHANIZED	45.377	49.217	.	.	.
GRAPE-D.ANIMAL	.	.	.	.	.
GRAPE-D.MECHANIZED	.	.	.	.	.
GRAPE-I.ANIMAL	271.439	.	.	.	.
GRAPE-I.MECHANIZED	150.971	418.563	410.165	395.056	368.895
APPLE-I.ANIMAL	248.801	.	.	.	.
APPLE-I.MECHANIZED	.	245.485	238.285	225.191	202.491
PEACH-I.ANIMAL	.	.	.	.	.
PEACH-I.MECHANIZED	26.345	26.193	25.864	25.272	24.236
APRIC-I.ANIMAL	28.515	29.696	.	.	.
APRIC-I.MECHANIZED	.	.	32.174	36.526	44.290
CHERR-I.ANIMAL	22.665	22.478	22.052	21.293	20.002
CHERR-I.MECHANIZED	.	.	.	.	.
WCHER-I.ANIMAL	14.362	14.152	.	.	.
WCHER-I.MECHANIZED	.	.	13.675	12.821	11.328
STBER-I.ANIMAL	4.909	4.897	4.871	4.825	4.747
STBER-I.MECHANIZED	.	.	.	.	.
BANAN-I.ANIMAL	1.444	1.443	1.442	1.439	.
BANAN-I.MECHANIZED	.	.	.	.	1.435
QUINC-I.ANIMAL	.	7.613	7.487	.	.
QUINC-I.MECHANIZED	7.670	.	.	8.489	10.518
PISTA-D.ANIMAL	.	30.641	60.379	54.266	43.228
PISTA-D.MECHANIZED	65.074	32.833	.	.	.
HAZEL-D.ANIMAL	.	.	.	.	.
HAZEL-D.MECHANIZED	779.672	799.171	842.568	919.757	1049.814

Table VII.10 Impact of an increase of the irrigated on agricultural prices

	base	a1	a2
WHEAT	-114.772	-113.969	-112.242
CORN	-119.933	-119.925	-119.604
RYE	-97.014	-96.682	-96.348
BARLEY	-98.690	-98.114	-96.837
RICE	-504.241	-504.266	-503.215
CHICK-PEA	-422.283	-421.816	-419.994
DRY-BEAN	-693.296	-690.409	-684.517
LENTIL	-526.824	-525.639	-524.522
POTATO	-125.669	-125.292	-124.765
ONION	-94.837	-94.744	-94.516
GR-PEPPER	-369.208	-369.122	-368.863
TOMATO	-209.609	-209.526	-209.383
CUCUMBER	-294.490	-294.332	-294.069
SUNFLOWER	-259.933	-260.006	-260.116
OLIVE	-427.252	-426.702	-426.130
GROUNDNUT	-615.860	-614.434	-611.415
SOYABEAN	-239.439	-238.672	-237.594
SESAME	-1047.490	-1044.582	-1038.379
COTTON	-954.204	-949.393	-940.782
SUG-BEET	-23.814	-23.659	-23.441
TOBACCO	-1362.446	-1360.757	-1358.896
TEA	-686.536	-686.560	-686.585
CITRUS	-222.851	-222.743	-222.652
GRAPE	-309.790	-309.275	-308.763
APPLE	-181.769	-181.371	-180.984
PEACH	-309.405	-309.058	-308.820
APRICOT	-364.414	-364.342	-363.968
CHERRY	-368.859	-369.325	-369.464
WILDCHERRY	-285.452	-285.032	-284.158
MELON	-163.532	-163.342	-162.949
STRAWBERRY	-1129.607	-1130.003	-1130.500
BANANA	-1719.830	-1719.626	-1719.519
QUINCE	-238.027	-237.850	-237.605
PISTACHIO	-2213.613	-2212.152	-2210.423
HAZELNUT	-1008.335	-1007.781	-1007.569
SHEEP-MEAT	-760.143	-759.209	-756.844
SHEEP-MILK	-269.645	-269.317	-268.489
SHEEP-WOOL	-1547.659	-1544.284	-1535.734
SHEEP-HIDE	-2597.440	-2596.049	-2592.525
GOAT-MEAT	-603.396	-602.790	-601.253
GOAT-MILK	-269.732	-269.358	-268.411
GOAT-WOOL	-870.029	-867.653	-861.632
GOAT-HIDE	-2594.710	-2591.746	-2584.233
ANGOR-MEAT	-630.898	-630.600	-629.856
ANGOR-MILK	-269.652	-269.440	-268.911
ANGOR-WOOL	-5015.308	-5004.769	-4978.416
ANGOR-HIDE	-2539.401	-2537.710	-2533.481
BEEF	-729.707	-737.424	-742.480
COW-MILK	-232.278	-234.174	-235.416
COW-HIDE	-687.345	-694.362	-698.960
BUFAL-MEAT	-712.616	-718.818	-722.881
BUFAL-MILK	-233.195	-235.227	-236.558
BUFAL-HIDE	-689.060	-692.646	-694.995
POLTR-MEAT	-902.775	-901.120	-897.417
EGGS	-925.143	-923.348	-919.330

VIII. POLICY ORIENTED APPLICATION OF TASM-MAFRA: Institutional Requirements and Model Improvements

A successful application of a sector model within the policy making process requires certain institutional conditions and continuous relation between model builder and user. There are not many examples existing over the world, in which a comprehensive sector model, like TASM-MAFRA, is continuously used within a Ministry or another related administrative institution.

In most cases, in which a comprehensive sector model is successfully applied for policy analysis within an administrative unit, the model builders have not only been engaged during the model developing period, but also participated in continuous connection and on a permanent bases in the exchange of ideas and experience and a mutual learning process with the users of the model.

The basic reason for the necessity of a close collaboration is that any comprehensive agricultural sector model will never be finished and will continuously be improved through cooperative ideas. In this sense a sector model will never be in a final stage, in which no weak points are left. Additionally, methodological improvements in an applied modeling system can only successfully be made in relation to the main fields of practical application, the experiences gained and new types of policy questions, which arise over time.

In this sense, TASM-MAFRA can not be seen as a final product, which needs only a correct technical handling for being correctly applied. Rather we have to interprete it as a raw product, which needs a careful cultivation to come into flower.

From our experiences with different kinds of sector models and from an intensive collaboration between model builders and users in Germany, as well as from the experiences gained through this consultancy services with TASM-MAFRA, we would suggest the following points for the practical model application in MAFRA:

- The model should be used continuously. This is the only way to gaining experience with the model, and a prerequiite for it future developments and succesful applications in real policy issues.

- The forming and updating of an agricultural data base should also be seen as a continuous task. The task should not only include updating of the specified data set, but also an integration of different sources of information (farm sample data, new econometric estimates, etc.) and a consistency check. The model developed can serve as a useful tool for this task and serve as a basis for creating an accounting system for agriculture.

- The permanent model use and work on the data system will also lead to a feedback towards the data collection system, and especially it can help to identify priorities, which may improve the statistics of the agricultural sector.

- Since the forecasting of economic development and of policy impacts is a critical issue, past forecasts should contin uously be evaluated in the face of the available statistics. This forecasting evaluation should particularly analyze the " errors" made in forecasting the exogenous variables and parameters and the "errors" implied by the model itself. Such a systematic supplementary forecasting evaluation may help to improve the model itself and also the forecasting of exogenous parameters.

- In order to fulfill these tasks a modeling group in the Ministry has to be formed, which consists of specialists for the technical model handling, for the data system and for policy evaluation (core group). This modeling core group should have enough time for concentrating on the task specified above and must have priority in the use of the PC. The modeling core group should , however, not be isolated as a seperate unit. Instead, a close contact to the group, which prepares actual policy alternatives and a participation in corresponding Ministry sessions at the middle to higher level is required. These are absolutely necessary requirements. If they can not be realized,there is not much hope that the model will continuously and successfully be used as a tool for agricultural policy preparation.

- Finally, we would like to stress the necessity for a permanent collaboration with the model builders. This follows from the necessity for a permanent elaboration and testing of certain methodological aspects. In several parts of this report we have mentioned possible modifications. During the first phase of model use in the Ministry, other problems and suggestions for modifying certain model elements will most likely occur.

In our experiences such modifications, to be analysed and tested, should be done with great care. Otherwise it may happen that the basic characters of the model are distorted. It is also possible that some confusion occurs, if a number of ad hoc modifications are made and if consequently a number of different versions of the same model exist.

Therefore, we suggest that modifications and extensions of the model should be carried out from time to time in collabration with the group, which developed the model. This suggestion has the advantage that the policy oriented modeling work in the Ministry will not be disturbed by the time consuming work in methodological and empirical model improvement. Finally, this suggestion would allow further and detailed help for MAFRA's core group in the initial phases and a permanent exchange and discussion of ideas and experiences.