PRODUCTION, CONSUMPTION AND TRADE OF SHEEP AND GOAT MEAT IN GREECE FOR THE PERIOD 1996-2005

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ABSTRACT

Sheep and goat meat is the most important sector of animal production in Greece because it represents 43% of the gross value of animal production and 13% of the gross value of crop production. Every effort of special reference and study concerning production and market of sheep and goat meat, always presents special interest. The purpose of this paper is the construction of a simulation model for the sheep and goat meat producing sector, able to contribute to the evaluation of relative agricultural policy measures as well as to the analysis of the effects from CAP reform and GATT agreement. The fact that until now there has been no relative research in Greece, lead to the construction of this model. The analysis is divided into two stages: the first stage comprises the estimation of supply and demand elasticities and the second stage includes the use of the estimated elasticities through which the pursued forecasts were realized. Concerning the results of the scenario on the effects of CAP reform and GATT agreement, the following points should be quoted: the inflows from the EU to Greece present a small decrease, sheep and goat meat production is slightly reduced and the consumption of this product is increased by 2.5% by the end of the decade (year 2005), finally, because of the above there is no essential effect on the trade balance.

RÉSUMÉ

La viande ovine et caprine est le secteur de la production animale le plus important en Grèce car il représente 43% de la valeur brute de la production animale et 13% de la valeur brute de la production végétale. Il est toujours intéressant de considérer les efforts et les études concernant la production et le marché de la viande ovine et caprine. Ce travail a pour objet la construction d'un modèle de simulation pour le secteur de la production de la viande ovine et caprine qui puisse contribuer à l'évaluation des mesures de politique agricole et à l'analyse des effets de la réforme de la PAC et des accords GATT. La nécessité de construire ce modèle est née du constat du manque de recherche à ce sujet en Grèce. L'analyse est subdivisée en deux étapes: la première concernant l'estimation de l'elasticité de l'offre et de la demande et la deuxième concernant l'utilisation des élasticités ainsi estimées à travers lesquelles les prévisions ont été possibles. Quant aux résultats du scénario sur les effets de la réforme de la PAC et les accords GATT, il faudrait tenir compte des points suivants: les contributions de l'UE à la Grèce sont en faible diminution, la production de viande ovine et caprine s'est légèrement réduite et la consommation de ce produit va augmentér de 2.5% d'ici l'année 2005; ce qui fait, enfin, qu'il n'y a pas d'effets importants sur la balance commerciale.

1. INTRODUCTION

Sheep and goat meat is the most important sector of animal production in Greece because it represents 43% of the gross value of animal production and 13% of the gross value of crop production. Concerning the European Union, its production rises up to 16% of the world sheep and goat meat production. This production refers mainly to goat meat. Since 1981 and within the boundaries of the CAP, the Common Market Organization has been applied. Nowadays, the CMO is based on the community regulation 3013/89, as it has been modified with the community regulation 2069/92.

During the past decade, the quantitative analysis of the effects of agricultural policy measures — especially of the world trade of agricultural products — has been in great demand. During the GATT negotiations, many efforts have been made to evaluate the effects on the world markets as well as the world economic prosperity of the state intervention for the support of the prices of agricultural products in the EU and in other countries or groups of countries. There is no similar model or quantitative evaluation of the effects of GATT agreement for Greece.

The methodology followed in this paper has also been used in a number of past papers respectively related to the analysis of the effects of trade liberalization (Roningen et al., 1991, Tyers and Anderson, 1992 etc.). More precisely, the analysis of the issue is divided into two stages: the first stage comprises the estimation of supply and demand elasticities and the second stage includes the use of the estimated elasticities through which the pursued forecasts were realized.

The selection of variables, hypotheses and their connections differentiates the models from each other. During the procedure of constructing sector models, two important theoretical categories have been adopted: the first one is known as the partial equilibrium approach. The partial equilibrium approach refers to those methods which are by nature more sectoraly precise and examine specific sectors or goods in the economy ignoring, however, the interdependencies with other sectors or the macro environment (Tyers and Anderson, 1992). The general equilibrium models examine economy in its totality and the relations among the various sectors. These models tend to include a number of important macroeconomic factors, such as savings, employment and income.

The partial equilibrium models differ from those of general equilibrium in the fact that they focus upon the various sectors in a different way. For example, the partial equilibrium approach, in order to examine the effects of

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trade liberalization tends to examine the effects of the changes of various policies upon specific products keeping the economic factor unchanged. The advantage of these models is that they can include the variety of the sector products as well as the number of policy measures and state interventions.
The main aim of this paper is to create a partial equilibrium model for sheep and goat meat in Greece for the simulation of alternative policy choices. The construction of a sector model for policy analysis is considered essential and useful, particularly for Greece it should be mentioned that sector modelling is of vital importance since there hasn't been any relative research up to now and since the effects of CAP reforms and GATT agreement will have a profound impact on the structure, production, and income of Greek farms which need to be estimated. The structure of this paper is as follows. The model structure is presented in section 2. In section 3, the estimation results are presented in section 3. Finally, a summary and conclusions of the study are presented in section 4.

2. Model structure

Simulation analysis involves the study of a"system" where a system is broadly defined as a set of interconnected elements (components) organized towards a goal or a set of goals. Analysis of a system involves defining the interconnections (structure) of the system in question and the goals of the system. Besides identifying the goals of the system one must also consider its participants, i.e., producers, consumers, policy-makers, etc. Simulation may be simple or complex. The desire for large models because of their greater realism, is traded against higher computational requirements and higher costs to build and maintain. Small models on the other hand, may be less powerful but less costly and easier to build and maintain. There is always merit in keeping simulation models as simple as possible consistent with meeting the needs of the policy analysis at hand.
Keeping simulation models simple provides, besides easy computational requirements and building cost, a simpler model to interpret and analyse. However, any model is only an approximation of reality and it can only serve as an illustration of the likely outcome of a certain action. Its usefulness lies more in the relative consequences rather than in its absolute predictions. Relative consequences, although still subject to error, tend to be more reliable in that data and structural inaccuracies usually affect the results of different experiments in the same way.
The logic of the present model structure is rather simple and is presented in **figure 1** (Mergos, 1988 and Mergos and Stoforos, 1994). In this structure, prices are determined by two major exogenous forces, the world market and/or the government. These prices, in turn, determine the demand and supply of sheep and goat meat. Trade is the equilibrating mechanism for balancing demand and supply of commodities given a certain set of prices.
Two key assumptions and simplifications underline the structure presented in **figure 1**. The first is that all prices are exogenous determined by the government and the world market. In fact, various policies followed by different governments may lead to differences across countries in the way that domestic markets are linked to the international market. Taxes or subsidies on external trade are policy measures used by almost all countries. The second assumption is that any imbalance between domestic demand and supply will result in trade. In fact, only incentives for trade are created which may or may not be fulfilled. These incentives may be constrained by government intervention in the form of quotas, tariffs, etc. or simply lack of foreign currency.
A more detailed presentation of the model structure is given in figure 2. In this way the various levels (retail, wholesale, farm level) as well as the various government policies influencing these three market levels and their link to the world market are made explicit. World prices are shown to be directly linked to the wholesale price. Depending on the size and efficiency of the market in question, a country's wholesale price is generally only a few percentage points above the border price for imports, and a few percentage points bellow the border price of exports. The existence, however, of government taxes and subsidies on imports and/or exports can drastically change the wholesale world market price spread. An export tax would result in a lower wholesale price while an export subsidy would result in a higher wholesale price. In this sense an export subsidy results

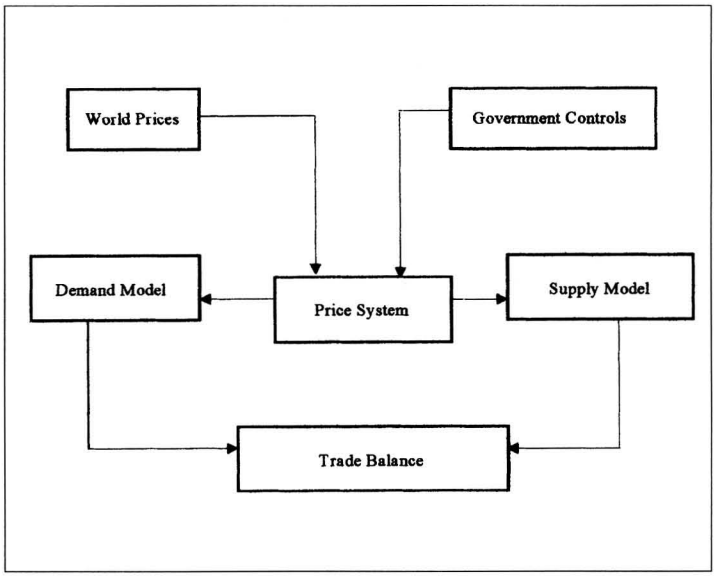

Figure 1 - Basic model structure.

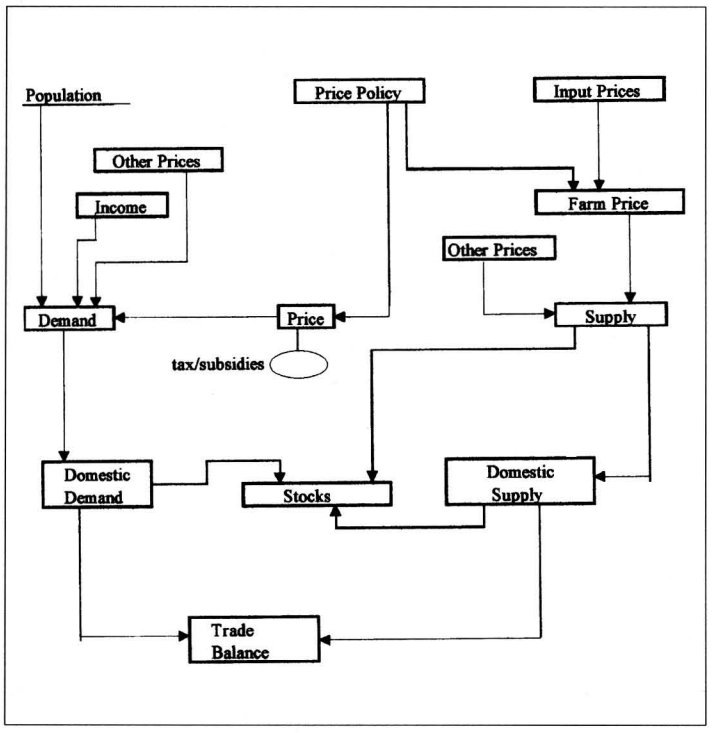

Figure 2 - Detailed model structure.

in a domestic price of an export product that is higher than the world market price. A similar reasoning can be used to deduce the effects of taxes and subsidies on imports. This model is flexible enough to accommodate government policies (albeit rather crudely) that affect the direction and volume of trade. A rather important characteristic of the model is the incorporation of dynamics in supply response. Supply dynamics have been associated with the dynamic nature of the production process. Demand is modeled as per capita demand and is specified to be a function of prices and income. Multiplication of per capita demand by population gives total retail demand.

The model simulates the impact of changes in a set of exogenous variables and government policies on a set of endogenous variables. The model starts from a Base year and then projects the changes that result from the implementation of the scenarios. The core of the model constitute of two elasticity matrices, a matrix of demand elasticities and a matrix of supply elasticities. The model explicitly recognizes the relation between quantities demanded or supplied to changes in prices. In fact, consumer and producer responses to price changes are quantified in terms of own- and cross-elasticities. The structure of the commodity supply and demand, as it is pointed out above, requires a set of own- and cross-price elasticities (**tables 1** and **2**). The production and consumption relationships in the commodity sector of the model are all based on elasticity functions, but the computer program permits the researcher to change the elasticities across time.

The demand function may be written:

$$Q^D = A + BlnP + ClnI \qquad (2.1)$$

where, Q^D: the vector of commodity demanded for each commodity, A: the vector of the constant parameters for each equation, B: the symmetric matrix of demand elasticities, P: the vector of retail price for each commodity, C: the vector of income elasticities of demand, I: the matrix of income.

Total output (= Q of any product) is given by the product of number of animals (= A) and yield (= Y). Thus we have, QP = A * Y, where, QP: vector of quantities produced, A: vector of number of animals, Y: vector of yield. The functions for number of animals (= A) and yield (= Y) are:

$$A_t = F\ (A_{t-1},\ P_{t-n},\ Z_A) \qquad (2.2)$$

where (2.2) is estimated using econometric methods, as mentioned above, in its logarithmic form and, P is the vector of prices, Z_A are other variables.

$$Y_t = H\ (Y_{t-1},\ P_{t-n},\ Z_B) \qquad (2.3)$$

where (2.3) is also estimated using econometric methods in its logarithmic form and, P is the vector of prices and Z_B are other variables (i.e. trend etc.).

Production of the commodities depends number of animals and average yield response (equations 2.2 and 2.3). Domestic supply is the sum of production and beginning stocks (Eq. 1 in the appendix). Trade is usually

Table 1 ***Supply elasticities.***

Products	Short-run	Long-run
Sheep meat: number of animals	0.04	0.08
Yield	0.03	0.06
Goat meat: number of animals	0.03	0.06
Yield	0.03	0.05

Source: C. Apostolopoulos and C. Stoforos, 1996.

Table 2 ***Demand elasticities.***

Products	Price	Income
Sheep meat	– 0.55	0.55
Goat meat	– 0.50	0.50

Source: N. Baltas 1990 pp. 76.

calculated as the difference between total demand and domestic supply, implying that the government will import what is needed and export what is surplus. Total supply is equal to domestic supply and imports (Eq. 2 in the appendix). Per capita consumption is influenced by changes in prices and income (Eq. 2.1). Total food consumption is determined by multiplying population and per capita consumption (Eq. 3 in the appendix). Industrial use, seed, waste and other uses are determined by a fixed proportion of production or consumption, depending on the product (Eq. 4, 5 in the appendix). Domestic demand is the sum of total food demand, industrial use, seed, waste, other use, and ending stocks (Eq. 6 in the appendix). In addition to the supply and components, aggregate measures are also included for per capita consumption expenditures and self-sufficiency ratio.

It is assumed that producers have fixed inputs and, at the margin, allocate these inputs to alternative enterprises based on relative product prices. Consumers are assumed to allocate income to alternative goods, at the margin, based on relative prices of goods. So the present production and consumption structure provides the initial conditions, and this pattern of production and consumption changes through time primarily in response to price, income, inflation and exchange rate changes.

The model has three basic components: i) the first component includes the exogenous assumptions defining the policies, technology, state of the economy, and behavioral parameters of supply and demand, ii) the second component represents the food and feed commodity sector, including commodity supply, consumption, and trade (this component indicates how prices influence the distribution of production and consumption across commodities) and iii) the third component develops estimates of various performance measures (these performance measures are derived from the first two components and include growth and distribution of production and consumption, farm revenues, and government or CAP expenditures).

Implementation of the model begins with data collection. Given the structure of the model described in the previous paragraphs the following data are required for model implementation: 1) Population and Income, 2) Demand and Supply Elasticities, 3) Quantities of the Products, 4) Domestic Prices, 5) International Market Prices, 6) Taxes and Subsidies, 7) Cost Share of production Inputs, 8) Number of Animals.

3. Estimation results

In order to stress the ability of the specific model to predict correctly and according to the changes in the economic environment, this was checked through the use of historic simulation. That means that the results of the model are compared to the real facts for the years 1990-92. The results of this test can be considered very satisfactory keeping in mind that the evaluated quantities present a deviation of 0-2% from their real prices. The necessity to use historic simulation is clarified even more by the fact that the possible forecasts of the model, for the years that do not present real facts, can be considered satisfactory only in the case where the model can reproduce itself successfully.

In order to analyze the effects of CAP reform and GATT agreement, the following scenario was used: in the first stage, the international price of sheep and goat meat for the period 1986-1988 was calculated. For the calculation of the international price the volumes and values of imports and exports were used, taking into consideration the tariff equivalent (86-88) as well as the reduction that is going to present during the next six years (1995-2000/1) and following the equation below:

$$P_i = P_d + Ä + Ð \qquad (3.1)$$

where P_i is the predicted price for the year i, P_d the international price, Ä the tariff equivalent and Ð the policy followed by the reformed CAP, the estimation of the price became possible (**table 3**). Moreover, through this scenario the inflows from the EU to Greece were calculated. The results are presented in **tables 4-6**.

The inflows from the EU were calculated based on data from the Ministry of Agriculture. The methodology used was based on hypotheses connected to the CAP reform (Ministry of Agriculture). The essential factors that determine the variations of inputs are: a) the subsidies included in the reformed CAP (and those that have been preserved), b) the number of animals and c) the yield.

4. Conclusions

As it was previously mentioned, the purpose of this paper is the construction of a sector model for the sheep and goat meat market, that would contribute to the evaluation of agricultural policy measures. The methodology used is based on previously applied econometric methods as well as the simulation method. Concerning the results of the scenario, for the effects of CAP reform and GATT agreement, the following points should be stressed: 1) the inflows from the EU to Greece present a small decrease due to the foreseen reduction of domestic sheep and goat meat production, 2) the production of sheep and goat meat appears to be slightly reduced due to the price reduction, predicted by the policy scenario that is followed. The consumption of this product rises by 2.5% (year 2005) despite the considerable reduction of the price which is primarily related to

Table 3 ***World prices, tariff equivalents and Common Agricultural Policy for the main agricultural products of greece.***

	(1) World price ECU/t (86-88)	(2) Tariff equivalent ECU/t (86-88)	(3) Tariff t equivalen ECU/t (2000/1)	(4) Policy (CAP)	(5) Prices 1995/96 ECU/t	(6) % Change of the prices (1996-2000/1)
Soft wheat	93.0	149.0	95.0	54.34 ECU/t*historic yield	173.53	– 15%
Hard wheat	90.0	149.0	92.0	54.34 ECU/t*his. yield + 35.86 ECU per yield	210.09	– 11%
Barley	85.0	145.0	93.0	54.34 ECU/t* historic yield	173.53	– 15%
Maize	95.0	147.0	94.0	54.34 ECU/t* historic yield	173.53	– 15%
Other cereals	95.0	147.0	94.0	54.34 ECU/t* historic yield	173.53	– 15%
Tomatoes	828.0	372.0	298.0	249.59 ECU/t + 10% reduction of the withdr. price	249.59	– 10%
Cotton	–	–	–	(1010 ECU/t – corresponsibility) - world price (371.10)	1577	–
Tobacco	–	–	–	2818.56 ECU/t average	2818.56	–
Sugar	176.0	424.0	339.2	–	631.9	– 5%
Vegetables	–	175.65	140.5	421.049	421.049	– 10%
Vines	450.3	120.0	96.0	1200-10800 per ha for uprooting	386.76	– 10%
Olives, olive oil	2851.8	1556	1245	120.7 ECU*consumption,1422 ECU* production of large producers, 1514.8 + 35.7 ECU* production of small producers	1919.2	– 10%
Pig meat	–	838	536	1509.39	1509.39	–
Sheep and goat meat	1423	2013	1288	5040.7 ECU/t + 26.046 (subsidy for heavy/head) and 5040.7 + 20.83 (subsidy for light/head)	5066.8	– 20%
Milk	685	1485	1188	2052.2 for milk powder and 306.8 for milk	2055.2	– 10%
Beef	1526	475	304	2383.9ECU/t + 106.68 (for veals), 2383.9 + 169.05 (for milking cows)	2055.2	– 5%
Eggs	–	475.0	304.0	–	331	–

Sources: (1), (2), (3) Sarris et al. (1996), (4) Ministry of Agriculture and Commission of the EC (1993), (5) Ministry of Agriculture, (6) Assumptions of the model.

Table 4 ***Sheep and goat meat production, consumption and trade (000 tones).***

Year	Production	% Change	Consumption	% Change	Trade
1993	155		145		10
2000	150	– 3.2	147	1.4	3
2005	148	– 4.5	148	2.1	0

Source: Computed.

Table 5 ***Self-sufficiency ratio.***

Year	1993	1994	1995	1998	1999	2000	2003	2005
	1.07	1.06	1.06	1.04	1.03	1.02	1.02	1.00

Source: Computed.

the consumption patterns. Because of the above, there are no important effects on the trade balance.

The inflows from the EU to Greece (FEOGA) are expected to present a small decrease due to the predicted slight reduction of domestic sheep and goat meat production. Apart, however, from this reduction, within the limits of the Common Market Organization there is an expectancy of a qualitative improvement of the slaughter-houses in sheep and goat meat production on a national level (quality controls, etc.).

The production of sheep and goat meat is expected to increase slightly because of price reduction which is foreseen by the followed policy scenario. Despite the fact that sheep and goat meat price reduction is expected to be considerable, its production appears to be slightly reduced due to the necessary preservation of the respective sector for the production of sheep and goat milk and traditional milk products (cheese, yogurt).

It is widely known that the sheep and goat meat producing sector, as a traditional Greek meat sector, is usually based more upon milk than meat (milk-producing sheep, direction of milk production).

This explains the differentiation of the level of reduction between price and sheep and goat meat produc-

Table 6 ***Inflows from EU to Greece (FEOGA) in ECU's.***

Year	1993	2000	2005
	240.879.305	235.123.931	235.123.931

Source: computed.

tion for the next decade.
Moreover, the EU divides sheep and goat meat producers into two categories (depending on the line of production). The first category includes producers who trade milk and milk products from sheep milk and are regarded as"light" sheep producers.
This category also includes all goat products.
The second category includes the rest of sheep meat producers, who are regarded as"heavy sheep producers. Greece probably belongs to the first category since it rears the 10% of sheep and approximately the 40% of the total number of goats of the EU and milks the 95% of its sheep, when the EU milks, about 30% of the sheep population.
The consumption of sheep and goat meat is expected to increase just by 2,5% (year 2005) despite the considerable decrease of the price, a fact that is primarily related to the consumption patterns.
More precisely, in Greece as well as in other countries, there has been an important shift of the consumers towards white meat during the last years. It is known that in Greece as well as in other Mediterranean countries, consumers are constantly refraining from the so-called"Mediterranean Diet" and are gradually adopting consuming patterns met in Central and West Europe as well as in North America.
Through this differentiation, an important increase in poultry and pig meat consumption occurs, setting aside natural protein products and red meat respectively.
Furthermore, sheep and goat meat consumption constitutes a traditional dietary characteristic of GreeK consumers which no longer attracts young consumers.
The continuous increase in poultry consumption is also related to their competitive price whereas the increase in pig meat consumption is related to the competitive price of the product as well as to its qualitative improvement which resulted from a long-lasting effort of genetic interventions. ●

APPENDIX

Domestic Supply
$QDS_{it} = QP_{it} + QBS_{it}$ (1)
Total Supply
$QTS_{it} = QDS_{it} + QM_{it}$ (2)
Total Food Demand
$QCT_{it} = QC_{it} * POP_t$ (3)
Industrial Use
$QIU_{it} = QP_{it} * IUR_{it}$ (4)
Seed, Waste and Other Use
$QSW_{it} = QP_{it} * SWR_{it}$ (5)
Domestic Demand
$QDD_{it} = QCT_{it} * QIU_{it} + QSW_{it} + SWR_{it} + QES_{it}$ (6)
Exports
$QX_{it} = QTS_{it} - QDD_{it}$ (7)
Per Capita Expenditure on i^{th} Commodity
$E_{it} = QC_{it} * RP_{it}$ (8)
Self Sufficiency Ratio
$SSR_{it} = QDS_{it} / QDD_{it}$ (9)
Beginning Stocks
$QBS_{it} = QES_{it-1}$ (10)
Ending Stocks
$QES_{it} = QTS_{it} - QSW_{it}$ (11)

The variables are defined as: QP_{it} is production of i^{th} product, QBS_{it} is beginning stocks of i^{th} product, QES_{it} is ending stocks of i^{th} product, QDS_{it} is domestic supply of i^{th} product, QM_{it} is imports of i^{th} product, QTS_{it} is total supply of i^{th} product, QC_{it} is per capita consumption of i^{th} product, RP_{it} is price of i^{th} product, QCT_{it} is total food consumption of i^{th} product, POP_t is population, QIU_{it} is industrial use of i^{th} product, IUR_{it} is ratio of industrial use to production of i^{th} product, QSW_{it} is seed, waste, and other use of i^{th} product, SWRit is ratio of seed, waste, and other use to production or consumption, QDD_{it} is domestic demand of i^{th} product, QX_{it} is exports of i^{th} product, Eit is per capita expenditure on i^{th} commodity, SSR_{it} is self-sufficiency ratio for i^{th} product.

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