

# **Modelling the effects of subsistence on Bulgarian agricultural performance**

**Philip Kostov**

Department of Agricultural and Food Economics, Queen's  
University Belfast, UK

**John Lingard**

Department of Agricultural Economics and Food Marketing,  
University of Newcastle, UK

## ***Acknowledgements***

This research was undertaken with support from the European Union's Phare ACE Programme. The content of the publication is the sole responsibility of the authors and it in no way represents the views of the Commission or its services.

## **Abstract**

The paper demonstrates the effects that the largely ignored, phenomenon of subsistence farming can have on agricultural development in countries in transition. The problem of subsistence consists of the different economic behaviour of subsistence farms compared to commercial ones. The paper evaluates the impacts of subsistence on overall agriculture for Bulgaria.

These are assessed using a dualistic agricultural sector model, namely SCAPAM, the main elements of which are highlighted. The above model is based on theoretical principles, analysed in previous work of the authors, and on existing, but largely unreported empirical work in this area. The purpose of the study is not to produce forecasts of the future dynamics of the agricultural sector, but to evaluate and quantitatively test the effects of subsistence on total agriculture for a real agricultural economy in transition, namely Bulgaria. The results are consistent with the theoretical and empirical work of the authors for a hypothetical agricultural economy.

JEL classification: C69, P20, Q11

## **Non-technical summary**

The agricultural sector in Central and Easter Europe is characterised by significant in terms of relative size small-scale farming. This small-scale farming has characteristics similar to the observed in many developing countries practices of subsistence agriculture. This largely ignored phenomenon of subsistence farming can have considerable impact on agricultural development in countries in transition. The problem of subsistence consists of the different economic behaviour of subsistence farms compared to commercial ones. The impacts of subsistence on overall agriculture are evaluated for one country in transition with significant subsistence farming namely Bulgaria.

First, we present an overview of Bulgarian subsistence agriculture in order to assess its importance in the overall agricultural economy. Then the problems and challenges introduced by its existence are presented. The main task of the paper is to evaluate the role of the subsistence sector by providing quantitative estimates of its impact on total agriculture in terms of production and consumption.

The rationale behind the quantitative methodology used to assess the importance of subsistence on total agriculture is briefly presented and discussed. The purpose of the study is not to produce forecasts of the future dynamics of the agricultural sector, but to evaluate and quantitatively test the effects of subsistence on total agriculture for a real agricultural economy in transition, namely Bulgaria. The results are consistent with the theoretical and empirical work of the authors for a hypothetical agricultural economy.

It is demonstrated that subsistence agriculture has considerable effect on both agricultural production and food consumption. Surprisingly the effects on consumption are positive, in the sense that subsistence increases aggregate food consumption and thus contributes to an increase general welfare of the population.

The effects of subsistence agriculture are not only considerable, but are shown to be relatively stable with regard to some policies. In particular, price policies are inappropriate to deal with subsistence. General income and employment policies would be much more effective.

## 1. Introduction

Bulgarian agricultural production, as in many other CEECs, is characterised by a bimodal farm structure comprising a relatively small number of very large productive units – co-operatives, private farming companies, informal associations and partnerships and a very large number of small scale farms. In 1996 72% of the farms cultivated only 7.2% of the total land, while at the other extreme, only 0.4% of farms cultivated 85% of the land. The first group of farms is often ignored in economic analyses. It is regarded as an "exception to the rule" and is defined as "neither efficient nor equitable" (Sarris et al. 1999). The logical conclusion of this approach is that small scale farms are not viable and will disappear some time in the near future. However such a view is incomplete. The farms are out there, not only in Bulgaria, but all over Eastern Europe and can not be dismissed so easily. They have now survived for almost ten years during transition and as the data shows they are the rule rather than the exception. Therefore they deserve attention and analysis. Owing to the product specialisation in Bulgaria, small scale household farms account for more than 30% of the total agricultural production in value terms. Therefore small scale agricultural production is not as unimportant as it may first appear.

Table 1.1

Percentage of Bought Quantities in Total Consumption of Some Food Products in Bulgaria, 1989-1997

<b>Products</b>	<b>1989</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>
<b>Vegetables</b>	75.9	71.4	60.0	59.9	63.6	68.1	59.8	63.9
<b>Meat products</b>	74.1	64.2	57.8	59.3	61.1	66.1	59.8	54.1
<b>Milk</b>	80.2	82.4	68.5	60.6	59.4	52.4	52.4	48.3
<b>Potatoes</b>	55.2	46.0	39.5	39.9	44.4	39.6	44.3	48.2
<b>Meat</b>	70.4	65.6	54.9	52.0	55.0	54.5	48.8	44.1
<b>Fresh fruits</b>	55.6	60.0	62.3	51.5	45.0	46.1	49.2	39.7
<b>Eggs</b>	39.4	39.6	41.2	43.5	38.8	40.9	38.4	34.4

Source: National Statistical Institute, Household Budgets Data.

The main feature of this small scale agricultural production is its loose and incomplete links with the market. A substantial part of total consumption is not provided through

the market but by household self-sufficient production. Table 1.1 shows the share of the marketed quantities in total consumption. The data clearly demonstrate the tendency towards self-sufficiency, since the share of marketed quantities in total consumption has decreased during transition. In general the fact that the market provides less than half the supply of major food products indicates the huge importance of household production in Bulgarian agriculture. This production is mainly self-sufficient and we may define it as subsistence farming.

Table 1.2

Distribution of Farms, According to Degree of Commercialisation (Share of Marketed Production) and Size, Cropping Season 1997/1998

	0	up to 25%	up to 50%	up to 75%	up to 100%
<b>Individual farms</b>					
less than 0.5 ha	84.0	6.0	3.4	3.3	3.4
0.5-1 ha	64.0	9.3	11.4	10.5	4.8
1-5 ha	63.5	6.0	12.4	13.6	4.4
5-10 ha	31.2	32.4	11.5	9.7	15.2
more than 10 ha	10.8	14.4	54.0	11.9	8.9
<b>Companies and co-operatives</b>					
Small company	40.0	15.0	0	5.0	40.0
Large company	0	8.3	8.3	16.7	66.7
Small co-op	68.0	0.0	4.0	8.0	20.0
Medium co-op	11.5	9.0	24.4	26.9	28.2
Large co-op	0.0	6.7	20.0	35.6	37.8

Source: FAO, 1999

Although the consumption side provides a general picture of the overall importance of subsistence behaviour patterns in Bulgarian agriculture, we are mainly interested in the production side. Table 1.2 presents information on the degree of commercialisation of the various farming structures according to survey data. A significant number of the individual farms (77.2% on average) do not sell any of their production. This clearly

indicates the dominance of subsistence behaviour. Even the large (over 10 ha) individual farms exhibit a low degree of commercialisation. Only 21% of large individual farms sell more than half their production. Part of the non-marketed production however is used as inputs for further production (e.g.. fodder for livestock), and the statistics do not accurately represent subsistence patterns. Nevertheless when none of the production is marketed, this is clearly subsistence type production. Large private companies and co-operatives appear to be market oriented. Non-marketed production in the companies can be attributed to the use of some products as inputs, while the slightly smaller degree of commercialisation in co-operatives could indicate some subsistence functions. The figures on small co-operatives reveal a strong self-sufficiency orientation. Interestingly there seems to be a polarisation among the small private companies. About half of them are predominantly self-sufficient, while the other half are mainly commercial. As a whole, agricultural production is dominated by self-sufficient production units.

## **2. The Challenge of Subsistence Agriculture**

The data shows that the market for many major food products is absent or missing. This redefines the problem of the persistence of small scale farms and reveals its true dimensions. The real problem is the lack of the market. It is clear that in some cases the primary aim of this type of production is self-sufficiency rather than for sale. Farm efficiency is therefore not the main issue. The problem lies not just in the nature of subsistence, but in its significant size and place in the overall agricultural economy. The following points have to be considered regarding the significance of subsistence farming. Firstly the problem lies in the very definition of subsistence - the lack of market. How can market inspired analysis be meaningfully applied to situations where the market itself does not exist? One could assume that, notwithstanding their lack of involvement with the market, subsistence farmers will tend to act rationally and in the same ways as commercial farmers. Unfortunately matters are not so simple. Subsistence farmers are prone to maximise utility functions that reflect both economic and non-economic factors and are subject to both economic and non-economic constraints. Subsistence farming uses resources which otherwise could be used elsewhere in market-oriented farming and in other sectors and may itself cause a loss of overall production efficiency. Notwithstanding this loss of efficiency at the aggregate level, subsistence farmers may be fully efficient with respect to their own utility functions. Consequently from a conventional economic point of view, small-scale farmers are unlikely to react to government policies in a normal, "rational way". However when they dominate the production of some products, predictions based on "normal" economic models will tend to be unreliable. The reactions of the small farm sector to market signals are probably weak and a conventional market-oriented agricultural policy may not have a substantial influence on it.

The lack of markets and the inclusion of non-economic considerations in decision-making processes are some aspects of subsistence agriculture. Subsistence behaviour could result in a possibly perverse aggregate supply response (Ozanne, 1999) or an unusual consumption response (Kostov, 1999). This could invalidate the conclusions of any market grounded analysis. There is however another side to the problem. Even if subsistence farmers exhibit similar behaviour patterns to commercial ones, they will be different. The above differences invalidate the image of representative economic agents and produce a different world of heterogeneous economic behaviour. By not accounting for this, we may introduce significant bias into aggregate analysis which may lead to inconsistent results (Kostov and Lingard, 1999a, 1999b). The economic side on its own is difficult to assess. Subsistence does not fit into the conventional concept of transition. Even in LDCs theories of subsistence lack consensus on its importance, contribution and aggregate effects. In addition, the reasons for the emergence of subsistence in the countries in transition are very different from those in the developing countries (Kostov, 1999).

### **3. Methodology**

This paper attempts to assess the effects of subsistence farming on overall agriculture. The main tool used is the SCAPAM (Structural Change Agricultural Policy Analysis Model) methodology. We present a general description of the main principles of this approach. Detailed representation can be found in Mishev et al. (1999). SCAPAM is a partial equilibrium, dual structure, small country, agricultural simulation model. It is constructed on the assumption that agricultural policies result in a change in prices of agricultural products. That is domestic prices quantitatively express the agricultural policies and are the main instruments for transforming the policies adopted into corresponding production and consumption responses. In the case of Bulgaria, a small country, world prices are not influenced by domestic policies. Consequently both domestic and world prices are exogenous to the model.

The partial equilibrium assumption is needed to make the model workable and means that markets are at equilibrium in the base and following periods, other commodity markets outside the agricultural sector being in equilibrium, too, and changes in these other markets having no direct influence on agricultural markets. The latter effects are not totally excluded from the model but are assessed through some macroeconomic variables. Therefore developments of the other sectors of the economy are implicitly included in the model. Every individual product market is cleared through foreign trade. The total crop area is constant and price movements and other variables only affect the distribution of this area between the different crops. Liberalised exports and imports are also assumed - that is, if no specific agricultural policies are assumed, the price of each

product equals the world price, corrected for an assumed relative discrepancy due to price transmission.

The basic idea is that commercial and self-sufficient production have different objectives, and therefore their outcomes will have different characteristics. Thus the products of subsistence and commercial agriculture, although having the same labels of convenience are intrinsically different and should be treated as such. As a result one can expand the existing agricultural product structure by splitting every product into both market and subsistence components and then treat these components as different products. The way one defines subsistence is important for the analysis. Here we define subsistence as the non-marketed part of total production. One can of course adopt a production unit based division and the main principles will still apply, but the specific details will be different. The main reason for defining subsistence as non-marketed production is that it allows for easier decomposition of total agricultural production. Another advantage of this approach is that when subsistence is defined as the non-marketed part of the production, which is left over and available for self-consumption, then subsistence consumption and subsistence production are obviously identical and we do not need to model them separately.

The split of agricultural production and consumption into subsistence and commercial components significantly increases data requirements for estimation of the behavioural parameters, because it represents a two fold increase in the number of products. Fortunately Kostov and Lingard (1999a) prove that one can obtain an exact block diagonal, with regard to the subsistence and commercial representation of the behavioural parameters. This representation is derived in a general framework without making implicit assumptions about specific functional forms. It allows both subsistence and commercial sectors to be modelled by incorporating the cross effects between them in separate models for subsistence and commercial products. The functional dependence of the block diagonal representation on the original representation and the cross effects imposes certain restrictions on it. These restrictions can however be excluded when modelling is based on invariant with regard to the division of total agriculture into subsistence and commercial sectors measures of production and consumptions. How is this applied in SCAPAM? SCAPAM for simplicity uses constant elasticities functions to represent the production and consumption components of agriculture. The behavioural parameters are these elasticities. An invariant with regard to the subsistence/commercial division measure of agricultural crop production is the land area. A unit of land can belong to only one of these two sectors. Therefore crop production can be represented via area/price elasticities, which reflect the area re-allocation between the different products within the subsistence or commercial sectors. Different yield functions for subsistence and commercial farming, applied to the results of this land re-allocation give the total production effect. An invariant measure of livestock production is the number of animals, which allows the same approach to be applied to livestock production.

Consumption is modelled similarly, based on "consumption units". While subsistence consumption is equal to subsistence production, commercial consumption is determined in terms of the division of the total population into "commercial" and "subsistence". The above division is done separately for each product, according to the size of subsistence. Commercial consumption for a given product is therefore obtained by applying consumption elasticities to the "product population".

Thus far subsistence and commercial sectors are presented separately, without paying attention to the possible interactions between them. The essence of the block diagonal representation (Kostov and Lingard, 1999a) is to incorporate these interactions into the separate models for subsistence and commercial production and consumption. In terms of SCAPAM this is achieved by using a parameter which simulates the process of interaction between subsistence and commercial production, by transforming area (or number of animals) from subsistence into commercial use and vice versa, according to the real income changes. One can define this parameter as the elasticity of substitution between subsistence and commercial production. Real income is selected as a proxy for the economic opportunities (incomes, job opportunities, overall economic development). Insofar as the above interaction is of highly non-linear nature (Kostov, 1999), using such an elasticity-like parameter can be reliable only in the medium term, because it is only a local linear approximation of a non-linear process (Kostov and Lingard, 1999b).

The transformation process thus drives resources in and out of the subsistence sector thereby changing its size. In terms of consumption, this change means change in the product specific "populations", that is transforming some production from subsistence into commercial use drives some people out of the subsistence sector and enlarges product markets.

SCAPAM can be used to obtain projections about the future performances of the agricultural sector taking into account its dualistic structure. Our objective here is to evaluate the impacts of this existing dualistic structure, that is of subsistence farming on the overall agricultural economy. These effects in general can be expressed as the difference between the total production and consumption responses with and without subsistence. The latter can be calculated by constructing an additional model in which we pool together subsistence and commercial product components. The behavioural parameters of this additional model should be the same as those of commercial components in the main model. This is equivalent to allowing subsistence to exhibit exactly the same behaviour as commercial agriculture. The difference in projections of these two models at the aggregate level will be a measure of the impacts of subsistence on total agriculture. It is worth noting that this is not a comparison between modelling the agricultural sector by accounting for and ignoring its dualistic structure, which is a different aspect of the problems posed by subsistence farming and is analysed elsewhere in Kostov and Lingard (1999b). The impacts of subsistence, as calculated here, assume that the model parameters, i.e. elasticities for commercial and subsistence sectors are

correctly specified. It is clear, however, that under the severe data constraints prevalent in economies in transition this is not possible (Kostov and Lingard, 1999b).

Moreover the approach adopted to model the interaction process between subsistence and commercial sectors could over or underestimate the effects in the long run. Due to this we present the results of the comparison in the medium term, in this case seven years ahead forecasts.

## 4. Results

Several scenarios with liberalised agricultural policies and gradual implementation of CAP 2000-like policies, as well as different rates of economic growth have been calculated. The price scenarios of CAP Agenda 2000 policies consist of gradual price adjustments over three years and application of the quantitative restrictions in the year of accession. The liberalised agricultural price scenario is expressed by imposing world prices<sup>1</sup> on the domestic market. The above two price scenarios are combined with moderate (2%), high(3-5%) and explosive (5-8%) annual real income growth. In the former two cases, the higher figure is applied for the first two years with the lowest figure for the rest of the projected period. As a result six scenarios are obtained. In the scenarios that simulate possible EU membership, the year of comparison is the year of joining the EU. Therefore the full effect of the CAP can not be estimated. It is worth reminding that the impacts of subsistence on total agriculture, presented hereafter represent the difference in agricultural performances of the current dualistic agriculture compared to an entirely commercialised agriculture. This is a dynamic comparison. It also includes an assumption of agricultural commercialisation due to the assumed income growth.

Although production and consumption response vary from scenario to scenario, the estimated impacts of subsistence on total agricultural production and consumption, which are the ratio of the forecasts of the two models, appear to be robust with regard to the modelled price policies and income growth<sup>2</sup>. These effects will, of course, be quite different after several years of quantitative restrictions. Therefore the results should be understood as the likely impacts of subsistence on overall agriculture in the period

---

<sup>1</sup> USDA 1998 world price projections are used. Domestic prices are corrected by a factor representing price transmission between world and domestic prices.

<sup>2</sup> Income growth is positive in all scenarios which means a one way transformation process of subsistence into commercial. Therefore the robustness of the results is conditional on the positive income growth.

before possible accession into the EU. The process of joining the EU could itself induce structural breaks that are likely to change the rate of transformation of subsistence into commercial. It is difficult, if not impossible, to make reliable assumptions about the nature and the intensity of such future structural breaks. Nevertheless the robustness of the results to the chosen price scenarios, confirms the conclusions of Mishev et al. (1999) that price policies do not have a considerable influence on the development of a dualistic agricultural economy.

Figure 1

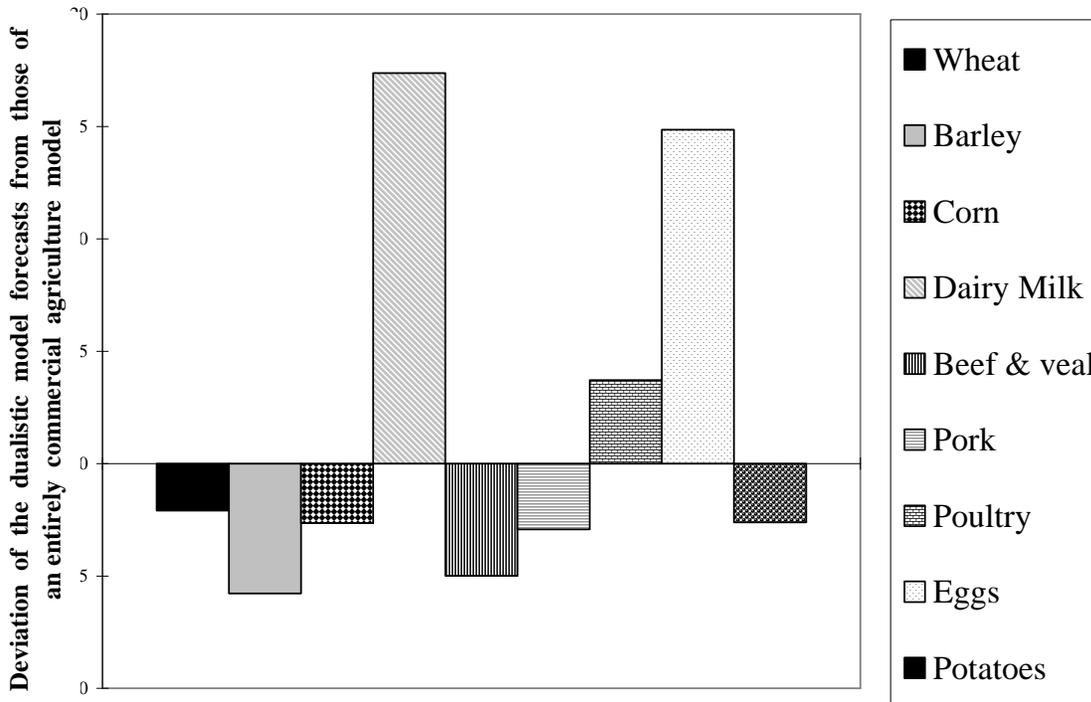


It can be expected from the definition of subsistence that its existence represents an aggregate loss of efficiency and therefore should reduce the expected agricultural output. This reduction is shown in figure 1. One product, namely pork does not seem to be affected by the subsistence phenomenon. This may seem surprising, bearing in mind the significant share of subsistence in total pork production. The current relative price for pork is quite high, which means that in all scenarios it is assumed to decrease. This restricts the potential growth of commercial pork production. Consequently the subsistence effects on pork production are insignificant. Milk, poultry and potatoes are products for which the effects of subsistence are greater. These products have a considerable share of subsistence, which explains their results. The result for beef and veal may seem low, given the fact that the price increase in EU scenarios is significant.

However, Bulgaria has traditionally been a net importer of beef and the pre-conditions for effective beef production are largely missing.

Figure 2.

**Consumption Impacts of Subsistence (in %) - Seven Years Ahead Forecast**



It has to be stressed however that subsistence is predominantly a consumption phenomenon. Therefore the consumption effects represent the main interest in the present analysis. In terms of consumption, the results are mixed; there is an increase for some products, a decrease for others. Except for the considerable positive effects for the consumption of milk and eggs, the consumption effects of subsistence are relatively low. The huge share of household milk production logically should lead to considerable subsistence effects for this product. There are significant technological differences between subsistence and commercial egg production, which explains the considerable consumption effects of subsistence for this product. The negative effects in consumption for cereals are due to the negative production effects for livestock, which are expressed in lower relative feed consumption for cereals. Consumption effects of subsistence are a combination of the impacts of the relative share of subsistence in a given product, technological differences between subsistence and commercial production and the different demand functions in the subsistence and commercial sectors. These effects all have the expected direction. The only exception seems to be, as in production, pork.

This looks surprising given the significant share of subsistence in pork consumption and production and its extremely low price responsiveness, the latter being a result of subsistence pork production being aimed only at self-sufficiency. One should not however forget that subsistence effects, as defined, are derived from a seven years ahead comparison, which includes some dynamic effects. The main dynamic effect is the assumed economic growth, which is expressed in a relative increase in commercial consumption.

## 5. Conclusions

The calculated impacts of subsistence agriculture are the future impacts of the current dualistic agricultural structure and these effects are therefore path and time dependent. The low magnitude of the negative consumption effects, given the assumed increase in incomes, means that the contemporary consumption effects of subsistence are positive. Under contemporary effects, we include the current differences between subsistence and commercial consumption functions. The latter is consistent with the view that subsistence is an income related phenomenon and therefore income opportunities are a major factor in its developments. Hence subsistence farming, although seemingly a contradiction in market economics and often understood as a negative phenomenon restricting agricultural production growth has significant welfare effects. It restricts the fall in consumption due to price and income shocks during transition. Moreover its impact on production is not necessarily negative. When the relative market price for some product decreases, the lower price response of subsistence leads to a smaller fall in total production compared to the case when there is no subsistence. Therefore unless there is considerable improvement in incomes and employment, subsistence agriculture will retain its significant share, because, as demonstrated, its existence is consistent with the hypothesis of utility optimisation.

This view of subsistence effects reveals why they are price inelastic. Subsistence and commercial price elasticities, although evolving over time according to the transformation process of subsistence into commercial, remain relatively stable with regard to each other, that is they are almost constant in relative terms. The assumed income growth has substantial effects on commercial consumption, because it affects both its behavioural parameters and the "population" base. Hence the main effects of subsistence are related to food consumption. The above discussion leads to the conclusion that even if the production functions of subsistence and commercial agriculture were identical, there would be significant dynamic consumption effects.

Both production and consumption effects are time dependent and the main factor influencing them is the process of transformation of subsistence into commercial. Therefore the factors that determine this process are instrumental in assessing the impacts of subsistence. One such factor is economic growth. It is clear that these factors

are external to agriculture and exogenous to the model. The process of transformation however deserves special attention. Its representation is a problem of greater complexity. However some of the assumptions employed by the SCAPAM approach, namely the constant elasticity of transformation and the similar pattern of the transformation process for different products appear too restrictive. Therefore a product specific representation of the process of agricultural commercialisation will be instrumental for further understanding and comprehensive assessment of the total impacts of subsistence agriculture.

## References:

- FAO (1999) Strategy for Agricultural Development and Food Security in Bulgaria, Main Report, July
- Kostov, P. (1999) Overview of Economic Developments in Bulgaria During Transition and Emergence of Subsistence Farming, Working Paper, Dept. of Agricultural Economics and Food Marketing, University of Newcastle
- Kostov, P. and J. Lingard (1999a) Subsistence versus Commercial Agriculture in Economies in Transition: (How) Does It Matter?, Working Paper, Dept. of Agricultural Economics and Food Marketing, University of Newcastle
- Kostov, P. and J. Lingard (1999b) Dualistic Agriculture and its Impacts on Forecasting: A Quantitative Study, Working Paper, Dept. of Agricultural Economics and Food Marketing, University of Newcastle
- Mishev, P. N. Ivanova and P. Kostov (1999) "Partial Equilibrium Dual Structure Sector Model for Bulgaria", Phare ACE
- Mishev, P. and P. Kostov (2000) Subsistence Farming in Bulgaria - Trends and Prospects, Scientific Conference "Subsistence Production in Central and Eastern Europe", 7th East-West Agricultural Forum , Berlin
- Ozanne, A. (1999) Perverse Supply Response in Peasant Agriculture: A Review, *Oxford Development Studies*, **27(2)**, 251-270
- Sarris, A. H., T. Doucha and E. Mathijs (1999) Agricultural Restructuring in Central and Eastern Europe: Implications for Competitiveness and Rural Development, *European Review of Agricultural Economics*, **26(3)**, 305-329