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SUPPLY RESPONSE OF BULGARIAN AGRICULTURE OVER THE TRANSITION PERIOD

Plamen Mishev, Maria Tzoneva and Nedka Ivanova

ABSTRACT

The objective of this paper is to estimate the price elasticity of supply for the major Bulgarian agricultural commodities. It estimates elasticities of total supply and of marketed quantities. The structural breaks in the economy due to transition do not allow the use of time series data and modern dynamic econometric analysis of supply response. Therefore, given such limitations, cross-section data from the regions were used. The results show that own total and cross-price elasticities are very low, indicating a low overall supply response to price changes, but high response of marketed quantities. In contrast, other factors such as incomplete land reform, market imperfections, etc., have a stronger impact on production than prices. Furthermore, macro-economic instability and transition have increased subsistence farming. This explains the paradox of a low overall supply elasticity but a high price elasticity of products supplied to market.

Keywords:

BULGARIA, AGRICULTURAL SUPPLY, TRANSITION ECONOMIES, SUBSISTENCE PRODUCTION

1. Introduction

Traditionally, agriculture has always constituted an important sector of the Bulgarian economy, since the country enjoys good natural conditions which enable the production of almost all kinds of agricultural products. Bulgaria has exhibited a high degree of self-sufficiency and a positive trade balance in agricultural products. In addition, in the pre-reform period the country had to specialise in the production of agricultural and food products under the agreements made between the governments of the COMECON countries. As a result of this the share of agriculture in exports was substantial and the main recipients of these exports were the former socialist countries. All the agricultural policy applied was intended to provide the domestic market with food products at low prices; export subsidies were used to offset the impact on exports of the overvaluation of the national currency. This contributed to the importance of agriculture in Bulgaria, and the effects of such agricultural policy are still felt.

In spite of the changes in the sector (land restitution, structural reform, financial constraints) and the decrease in gross agricultural output observed during the post-reform period, the share of agriculture continues to be high, accounting for 10-12% of GDP and 22-23% of employment. In spite of the importance of agriculture in Bulgaria and the substantial drop in production of some major agricultural products, no empirical studies have been made of factors which have an impact on the farmers' response; in particular there has been no supply analysis aimed at establishing supply elasticity. The latter is an important factor for the determination of developments in price and production.

The main objective of this paper is to evaluate the price elasticity of supply for some major agricultural products: wheat, barley, maize, sunflowers, sugar beet and potatoes.

2. Supply Profiles

2.1. Description of Data Set

The data used for the analysis are based on data collected by the National Statistical Institute (NSI). All the data reviewed at a national level (those for production, areas, yields of crop products and number of animals, livestock products and livestock productivity) are published annually in "Statisticheski godishnik".

Figures for both the total and private farm production, areas, and yields of crop products are given at a national level. These data are also available for the pre-reform period. Livestock products recorded in the statistical yearbook are: (i) meat - total production, beef and veal, pork, sheep and goats, poultry (live weight and carcass weight), (ii) milk - total production, cows' milk, sheep's milk, greasy wool, eggs. The data indicate the national level of production, while figures for production from private farms are also available.

Data for production, areas, and yields of crop products are also published in the bulletin "Plosti, dobivi, proizvodstvo" at national and regional levels (9 new regions). Data for crop production at the regional level (new regions) for some basic agricultural products are also included in the statistical yearbook, as are data for the numbers of animals at the beginning of the year and the production of milk (total, cows' milk, sheep's milk, eggs and greasy wool), but for meat there is no data available at regional level. Data for crop production (production, areas, yields) at regional level (28 old regions) have not been published, but they are available from the NSI. Detailed data are available from the authors of this paper.

Data for quantities purchased and prices at regional level (from 1991) have not been published, but they are available from the NSI (except data for prices in 1991). These data are only collected from the State processing enterprises, thus they do not indicate the total quantity of farm products sold. There are no data concerning the quantities and prices of agricultural products sold through other channels of distribution.

Farm prices at national level as well as at regional level (old and new regions) are determined on the basis of weighted average prices for the quantities purchased by the State enterprises. Since the new regions include three or four old regions and the relative characteristics of all are well-known, it is possible to calculate quantities purchased and prices (weighted average) for the new regions. Thus the regional data for livestock products (production and prices) will be consistent.

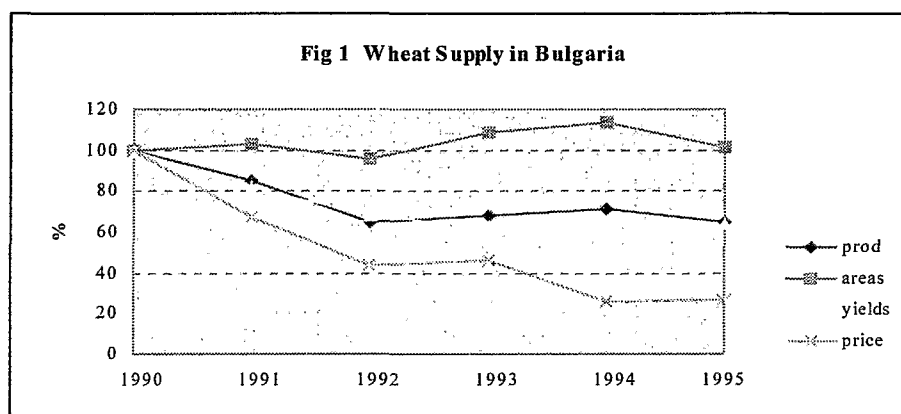
2.2. Production, prices and policy in the crop sector

Grain and particularly wheat is considered to be the most important crop in Bulgaria from the point of view of food security. Bread wheat is the most important type of grain for human consumption, while maize and barley are used for animal feed. Although about 50% of the cultivated area is under grain production, the area under wheat only accounts for about 25% of the total. Normally the country meets its own requirements where grain is concerned and has even been an exporter, mainly of wheat.

Grain output in Bulgaria remained stable over the period up to 1989 and then decreased, with the lowest output recorded in 1995. During the crop year 1994-1995, a problem concerning self-sufficiency in wheat arose because of bad climatic conditions, financial difficulties and constraints on the State budget, and the policies (particularly those relating to trade) applied since 1991.

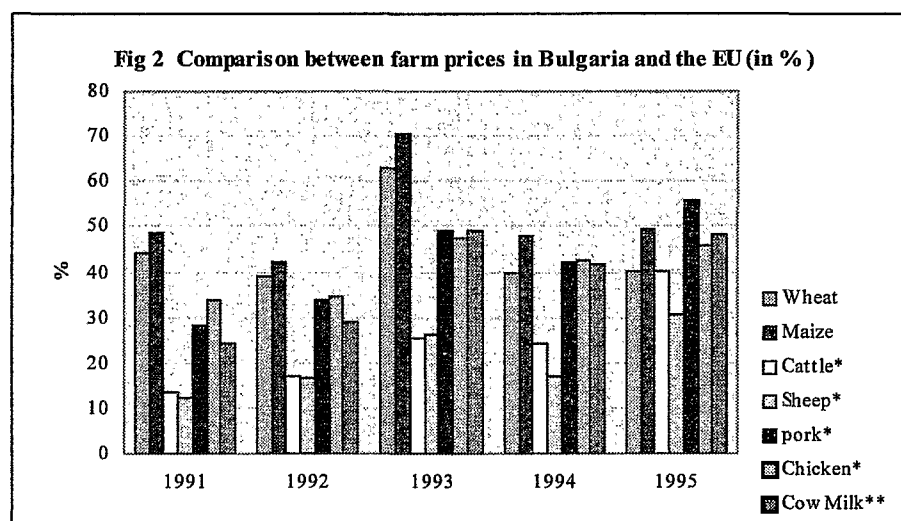
The quantities of wheat produced since 1991 have declined (Fig. 1), although the area under wheat cultivation has increased. Traditionally about 500,000 tons have been exported but since 1991, because of the decrease in production as well as the main goal of the policy applied (i.e. to provide bread at lower prices) exports have been banned over nearly the whole period.

The decrease in production in the grain sector during the transition stands at 20%, with the decrease in wheat production at 35%. The change in the area of land under wheat cultivation is insignificant (Fig 1). However, there is a substantial decline in the yields during the period (23% generally for grain, with 35% for wheat). Normally, 70% of the quantity of wheat produced is bread wheat, 1-2% durum wheat, while the remainder is feed wheat. Bulgaria is a net exporter of wheat, but during the transition, in order to keep do-mestic price of bread at a low level and to prevent a shortage of grain on the domestic market, the Govern-ment has changed the regime of trade frequently; the difference between the domestic and world market price of wheat is significant (Fig. 2) and the incentive to export is obvious, so that the export of wheat, ex-cept in 1995, was insignificant.

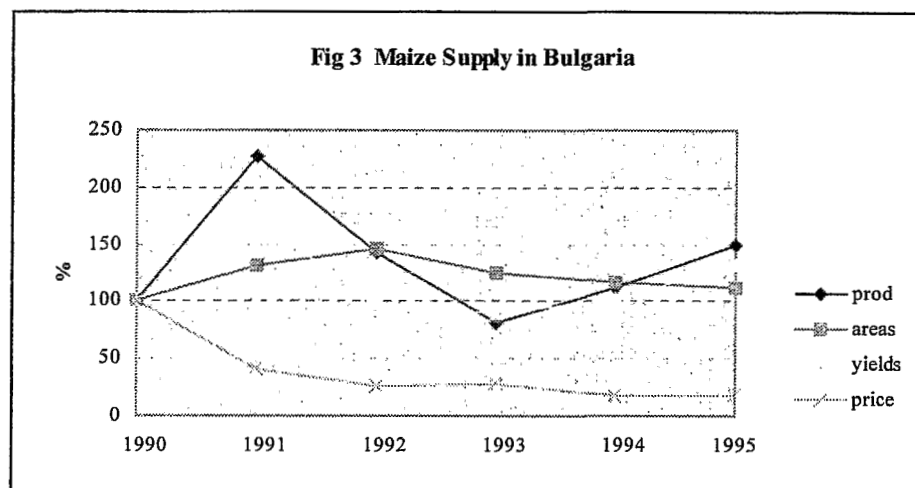


A regime of licenses, quotas, bans on the export of cereals and high export taxes was in force during the whole period. Normally, exports are allowed within a quota from after the harvest to the end of the year, when export tax is introduced; however, from the spring of 1993 (Decree 49/1993) until the end of 1994 the export of wheat was banned, although during this period decrees were issued which permitted export. The export allowance was abolished before they came into force (Decrees 130/1993 and 172/1993). These trade restrictions have kept domestic prices of wheat comparatively low, and this is reflected in a further decrease in production.

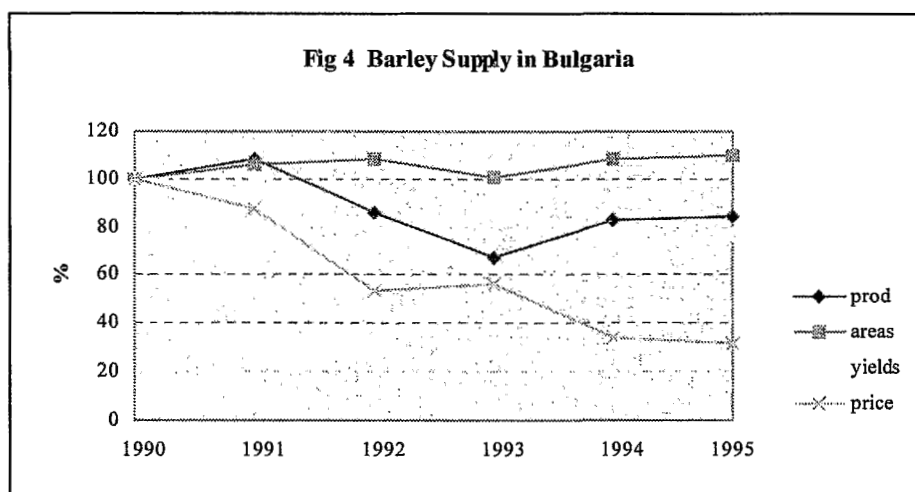
During the period 1990-1995 the total of maize production varied within very broad limits, from



983,000 tons in 1993 to 2,775,000 tons in 1991. The area under maize increased during the first three years of the period, and then declined to approximately the same level as that of 1990 (Fig 3.)



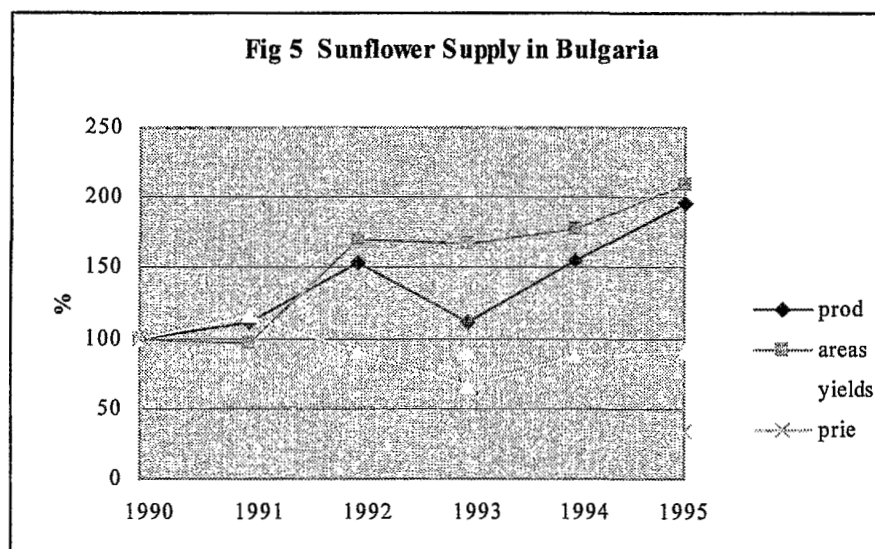
Yields have been nearly the same, except in 1991 and 1995 when the increase in them was substantial (72% in 1991 and 30% in 1995). All production of maize is concerned with feed maize. Usually Bulgaria met its own maize requirements but during the transition, because of the restructuring of the agriculture and macroeconomic instability, the decrease in number of animals, and the shortage of financial resources for the new production units, there has been some import of maize, though insignificant. Although Bulgaria has been a net importer of maize during the transition, because of the substantial difference between the domestic and world prices of maize there were strong restrictions on its export (the trade regime for maize was the same as that for wheat) during the whole period. The import of maize was subject to normal duty, according to the customs tariff, and there was duty-free import of maize only for short periods in 1990, 1991, 1993 (Decree 113/1990, Decree 72/1991, Decree 199/1993). In view of the difference between domestic and world prices of maize this can only be explained through the potentially positive effect that the duty would have on government revenue (there was a large budget deficit during the whole period), but due to insignificant imports of maize this positive effect remained only a potential one.



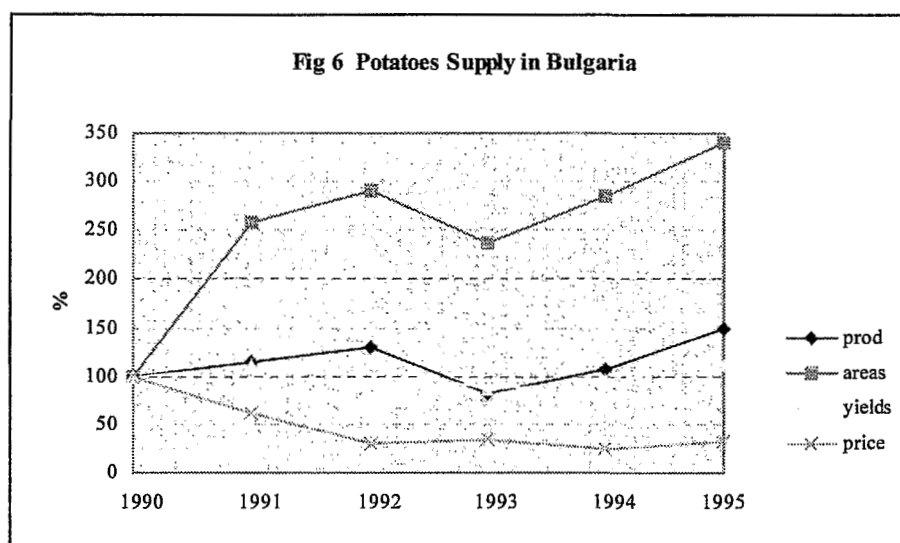
Production of barley decreased by 15% in 1995 when compared to that in 1990. The area under barley increased by 10%, but yields decreased by more than 23% (Fig 4). There is no data to indicate how much of the quantity of barley produced is intended for animal feed. Normally, Bulgaria

is neither a net exporter nor a net importer of barley. The quantities exported or imported are insignificant, except for the year 1995. In spite of this, due to a large gap between the domestic and world prices of barley during the whole transition period there were strong restrictions on the export of barley (the trade regime was the same as that for wheat and maize).

Bulgarian production of sunflowers is exceeding its own consumption. While in general the production of most agricultural products constantly decreased after 1989, sunflowers are the only exception for which the area under cultivation and quantities produced have increased (Fig. 5). The reason for this is the strong incentive to export sunflowers and sunflower oil because of the favourable market situation and the fact that the international market prices have been higher than the domestic prices during the last few years.



Bulgaria has never been self-sufficient in sugar beet and sugar, thus consumption is based to a great extent on imports.



Potato production has increased during the transition period (from 433,000 tons in 1990 to 641,000 tons in 1995, Fig 6). There has also been some increase in yields and a substantial increase in areas under potato cultivation. The liberalised trade regime and the absence of price control on the domestic market account for this positive trend in potato production.

The reduction in the quantities of most crops produced (with the exception of sunflowers and potatoes) is due, as mentioned above, to the crucial economic changes which have created problems for agriculture and the food industry. These include uncompleted land reform, the fact that after the price liberalisation and the dramatic changes in price proportions, the prices of inputs (fertilisers, preparations, services, etc.) tend to increase at a faster rate than producer prices for outputs, and the Government policy of monitoring and restricting the retail prices of some basic foods, which has more or less depressed grain prices. Therefore farmers have suffered drawbacks where the funding of their operation is concerned. All these difficulties have resulted in the use of fewer chemicals and fertilisers than necessary to comply with modern production technologies, which in turn has reduced output.

3. Estimation of Supply Elasticity

3.1. Model description and results

Since prices in Bulgaria were centrally fixed until 1990 and quantities produced and areas planted were subject to a central plan, these data do not constitute a reliable basis for the estimation of the supply response to price changes (price elasticity). Therefore purchasing and prices since 1991 should be used in the price elasticity analysis. In order to be able to apply any econometric models for estimation of the price elasticity in the period 1991-1995, only data at regional level (i.e. old regions) should be used. In this way cross-section analysis can be used in determining the price elasticity. Since only the data for crops are available for the old regions the analysis is applied to the above-mentioned crop products.

Given the availability of data, the most appropriate approach for the calculation of supply elasticity in Bulgaria is cross-section analysis. The regression equation studied is the following:

$$\ln Y = a + \ln X,$$

where the dependent variable is produced (purchased) quantities and independent variable is the price for the product analysed. Calculations are made for the six products analysed.

Cross-elasticities are calculated on the basis of regression equation:

$$\ln Y = a + \ln X_1 + \ln X_2 + \dots + \ln X_5$$

where the dependent variable is purchased (produced) quantities of one of the products and independent variables are prices of the five other products analysed.

Estimation of the regression equations mentioned above is made on the basis of data for produced and purchased quantities and prices, areas and yields for 28 old regions, for the period 1991-1995. Since for 1991 prices by region are not available they are estimated on the basis of the deviation of prices from the average by regions in 1992. Prices used in equations are nominal prices deflated by the CPI index.

The results of the calculation are given in Table 1. As can be seen from the table there is strong correlation between purchased quantities and prices for all products analysed, as well as between purchased quantities of sunflowers and sugar beet and areas under these crops. There is also strong correlation between produced quantities of sugar beet and sunflowers and prices for these two products, as well as between produced quantities and areas and yields for all products analysed.

Correlation between produced quantities and prices for the cereals and potatoes analysed as well as purchased quantities and areas and yields for the same products is low.

As can be seen from the table there are substantial differences between the estimated price

elasticities for produced and purchased quantities of all the products analysed, particularly in the case of grain and potatoes. The lower price elasticity of production can be explained by :

- i) the low prices of cereals. Changes here do not have a substantial impact on production if they do not exceed a given level, i.e. at least the level of production costs (see Fig. 2)
- ii) market imperfection, with delays in payments to the producers, a lack of market information, etc.
- iii) severe structural problems. For instance, the inefficient banking system in Bulgaria cannot facilitate the transformation of price incentives into production assets.

Table 1 - Estimated own elasticity parameters

	price			areas			yields		
	coefficient	r ²	error	coefficient	r ²	error	coefficient	r ²	error
Wheat									
purchased quantities	1.23	0.45	0.129	0.63	0.15	0.120	0.07	0.000	0.46
produced quantities	0.01	0.28	0.074	0.90	0.96	0.016	1.98	0.92	0.056
Barley									
purchased quantities	1.42	0.50	0.122	0.78	0.24	0.117	0.13	0.00	0.334
produced quantities	0.32	0.05	0.109	0.91	0.94	0.021	1.80	0.89	0.058
Maize									
purchased quantities	1.50	0.62	0.099	0.71	0.14	0.153	-0.12	0.000	0.279
produced quantities	0.14	0.02	0.086	0.93	0.79	0.045	1.49	0.83	0.063
Sunflowers									
purchased quantities	1.36	0.63	0.877	0.76	0.48	0.676	0.17	0.01	0.127
produced quantities	0.86	0.38	0.094	0.79	0.93	0.019	0.87	0.38	0.105
Sugar beet									
purchased quantities	2.22	0.73	0.112	1.00	0.59	0.070	0.71	0.16	0.137
produced quantities	1.41	0.45	0.133	1.04	0.91	0.029	1.02	0.51	0.085
Potatoes									
purchased quantities	0.71	0.44	0.076	0.33	0.04	0.136	0.25	0.01	0.207
produced quantities	0.12	0.02	0.070	0.97	0.94	0.023	1.36	0.92	0.038

Table 2 - Cross Elasticity Matrix

Products	wheat	maize	barley	sunflowers	sugar beet	potatoes	r ²
Produced quantity							
wheat	0.01	-0.36	0.32	0.35	0.27	-0.05	0.26
maize	0.03	0.14	-0.05	0.29	0.28	0.00	0.31
barley	-0.03	0.03	0.32	0.34	0.33	-0.09	0.30
sunflowers	-0.37	-0.12	0.51	1.36	0.86	-0.17	0.24
sugar beet	-0.39	0.17	0.58	0.67	2.22	0.17	0.34
potatoes	0.00	-0.06	-0.06	0.08	-0.02	0.12	0.02
Purchased quantity							
wheat	1.23	-0.29	1.41	0.34	0.24	-0.16	0.51
maize	-0.15	1.50	1.26	0.21	0.39	-0.01	0.58
barley	0.26	0.87	0.32	0.25	0.40	-0.23	0.51
sunflowers	-0.15	0.25	0.07	0.86	1.04	-0.31	0.23
sugar beet	-0.15	0.29	0.41	0.64	1.41	0.48	0.27
potatoes	0.27	0.23	-0.01	0.15	0.55	0.71	0.28

Since the own consumption of sugar beet and sunflowers is comparatively low when compared to that of cereals (production of these products is intended mainly for the market) the price elasticity of produced quantities for these products is higher than for cereals.

Results given in Table 1 also indicate that, in practice, purchased quantities do not depend on areas and yields (the correlation is too low, except in the case of sunflowers and sugar beet) while the dependence of produced quantities on the same two factors is substantial (the correlation is higher than 0.85), particularly for cereals and potatoes.

The own price elasticity of purchased quantities calculated for Bulgaria is two to three times higher than supply elasticity in developed countries. This can be explained by the relatively low price level of agricultural and food products as well as by non-stable macroeconomic factors in Bulgaria during the transition period, which obliges farmers to leave a substantial part of production to provide for their own self-sufficiency instead of selling it on the market.

The results concerning cross-price elasticity given in Table 2 show a low correlation between a produced quantity of a given product and prices of the other products analysed (r^2 is smaller than 0.35 for all products analysed). The same is valid for purchased quantities of sunflowers, sugar beet and potatoes. This shows that other factors (the level of completion of land restitution, restructuring of agriculture, etc.) have a more substantial impact on production of a given product than the prices of those products which can be used as substitutes for it.

Conclusions arising from the quantitative analysis carried out are:

- i) As a result of macroeconomic instability, market imperfections, and the low level of prices of agricultural products, the impact of price changes on the production of cereals and potatoes is too low.
- ii) The own price elasticity of products supplied to the market is substantially higher than that in developed countries. This high own price elasticity of supply explains the strong shortage of grain on the domestic market over the last two years, bearing in mind the decrease in real prices.
- iii) Changes in the price of the product substitutes do not have a significant impact on production. Other factors (completion of land reform, market imperfections) have a more substantial impact on production than the prices of product substitutes.
- iv) Results of multiple regression analysis for cereals (wheat, maize and barley) show that there is a strong correlation between the purchased quantity of a product and the prices of the other products analysed. Calculated regression coefficients do not show the traditional linkage between quantity and prices of the product substitutes. For example, the results show that an increase in the price of barley (also of sunflowers and sugar beet) leads to an increase in the purchased quantity of wheat (the same is valid for the purchased quantity of maize, sugar beet and sunflowers). This becomes even more inexplicable when the fact that areas under wheat can be used for the production of barley, sunflowers and sugar beet and vice versa is taken into account. The only reasonable explanation of these results could be autocorrelation between the prices of wheat (maize) and barley, which is the case here. There is a strong linkage between the prices of wheat (maize) and those of barley.