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AGRICULTURAL PRICES IN BULGARIA: DID TRANSITION CREATE STRUCTURAL BREAKS?

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I. INTRODUCTION

FIXED prices set below market-clearing levels by central authorities are the cornerstone of socialism, while decentralized price formation is the fundamental trait of a market economy. In a classical, centrally planned economy (CPE) the prices of most products and factors are fixed by the government for a relatively long period of time. These prices fail to reflect either the correct value of goods or the equilibrium of supply and demand. These fixed prices are distorted and lead to distorted incentives and the misallocation of scarce resources.

The main characteristic of the goods and services market in the former CPE is the implementation of price controls due to shortages. Price controls create "black markets," and people not only participate in ordinary "speculative" buying and selling activities, but also engage in barter and travel to find better supplies. Moreover, shortages create queues, and consumer search spontaneously emerges to perform the allocation function. The solution to such a problem is complete price deregulation: i.e., bringing consumer prices to their market-clearing levels, eliminating queues with benefits to the representative consumer.

Although this radical method of price determination was not adopted in the former CPEs, adjustments in administered prices and/or partial price deregulation have been applied in performing socialist economies. Price reform has been undertaken for several purposes: to alleviate shortages associated with queues, to correct relative price imbalances that lead to a less efficient allocation of resources, and to eliminate or reduce commodity subsidies. Price adjustment has been implemented in different ways. In some cases prices have simply been freed and allowed to adjust to market-clearing levels. In other cases the authorities have adjusted administered prices while maintaining some degree of control or restriction over them.

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The problem of pricing policies is of tremendous importance to the former CPE during its transition period. Price deregulation is the key step in the transition to market economy. It is widely recognized that reform of the price system is the key to the success or failure of reforming the entire economic system. By "reform of the price system," we mean precisely a liberalization, in a planned and deliberate way, of price controls to form gradually a price system that would flexibly reflect the balance in the free market supply-demand relationship, so that in the end, the price mechanism can play its full role.

In fact, the lifting of price controls has been advocated as a means to eliminate distortions and readjust relative prices, create production incentives and encourage domestic output, eliminate rationing, and absorb "excess" real money balances. Price liberalization can have the following effects: (a) market-clearing prices can give the right incentives to those firms that were profit maximizers before the reform; (b) the performance of the firm will become more efficient under flexible prices than under fixed prices, unless the firm enjoys substantial monopoly power; and (c) equilibrium prices, even if they deviate from marginal costs, will still reflect consumers' value and so will give better guidance than fixed prices to subsequent fundamental prices in the economy.

Since 1989, the agro-food sector in all Central and East European countries (CEEC) has moved toward a more market-oriented organization of production, consumption, and trade. Initial price and trade liberalization and subsidy abolishment caused dramatic impact on consumer purchasing power and agricultural incomes, inducing increased government intervention. Moreover, the reduction of agricultural trade with the Soviet Union created surpluses and depressed domestic food and agricultural prices following the loss of these markets. More precisely one can distinguish three phases in agricultural policy development in CEEC since 1989 (see also Kybczynski 1991): First, consumer prices increased significantly due to the abolition of subsidies and the liberalization of price and trade regimes. There has been a significant shift in the relative prices of agricultural product prices compared to the general price level. During the transition, abolishment of all subsidies for food products depressed demand for agricultural raw materials. As a result, real income dropped sharply and domestic household food demand fell. Secondly, the uncertainty induced by general economic reform forced some governments to introduce new policy measures to protect production and/or consumption. Thirdly, some CEEC have tried to apply policy packages that are similar to EU's Common Agricultural Policy (CAP), gaining as a final objective the EU membership.

Significant input-price increases have occurred recently. The rise of agricultural input prices was the result of both efforts to adjust to world prices and increased import prices due to exchange rate adjustments. Moreover, continuing monopolization and inefficiency in the supply of inputs have also pushed prices paid by the

producers above what would have been under more competitive conditions.

Price liberalization in Bulgaria began with the change in its political regime.[1] All prices, including input prices for agricultural products, farm-gate prices of agricultural products, and wholesale and retail prices of foodstuffs, were entirely deregulated.[2] Sharp price increases even for staple foodstuffs forced the government to make some exceptions to this general price liberalization strategy. The government tried to control prices of some basic food products by a "projected price" system. Projected prices were based on minimum purchasing prices calculated according to normative cost and normative profit margin (markup on cost). Profit margins were different for producers, processors, and traders, and were administratively set. These projected prices continued to exist until 1993, when they were replaced by ceiling prices calculated on the basis of actual costs and fixed profit margins. Moreover, the government introduced minimum guaranteed prices for some basic agricultural commodities, which fell below the market price level. This minimum guaranteed price system was introduced and abolished several times over.

The question actually in the former CPE is not whether or not to deregulate the prices, which is by definition the key step in the transition to the market. The question is rather how should prices be deregulated, slowly or by the big bang method. It is well known that in most CPEs, industries are extremely concentrated and vertically integrated. The rapid price deregulation would mean that firms would enjoy a considerable degree of monopoly power. This raises the difficult question whether in the short-run monopoly prices are worse than fixed prices and raises the question of the deregulation speed. Other related questions concern: At what stage of the reform process should price deregulation be introduced? Should deregulation of some specific prices be substantially postponed? How will agricultural price deregulation affect the general price level? How will price reform affect resource allocation and social welfare? And finally what should final prices be? In other words, what constitutes correct price reform, and what is the appropriate method for evaluating price distortion (see also Boycko 1991)?

There is already a lot of research work on price reform in CEEC: for example, Agenor (1993), Braverman and Guasch (1990), Dinopoulos and Lane (1992), and Kybczynski (1991). However, little empirical evidence on the transition process has been produced. The purpose of this paper is to investigate the effects of structural change on the process of price determination of agricultural products in Bulgaria. Explaining the determination of prices for final agricultural products and those used as intermediate consumption will constitute the main theme. The modeling work undertaken in this paper attempts to describe how the transformation

[1] This paragraph is largely based on information given in Mishev, Tzoneva, and Ivanova (1996). See also OECD (1995).

[2] The only exception concerns price of energy products.

process is being effected during the transition process and how general price levels have been affected. It is necessary to have a model to simulate the planned/market mixed system and to discuss the effects of price policy as the planned part of the economy is reduced. After having determined a formalized model for the determination of prices as employed in the past, we will seek the most appropriate way of determining actual prices. Then, the appropriateness of a model describing the equilibrium approach to price determination will be evaluated.

It seems that after changes in political regime, authorities has attempted to introduce structural change and shift from an administered price determination based on information concerning cost to a liberalized method where prices are market clearing. If this fundamental structural change has occurred, traditional tools of economic analysis and econometric model building rest to a large extent on the preconception that the structure of the economy is stable and thus the future will be similar to the past. This assumption is almost certainly inappropriate in the case of the Eastern European economies at the present time and for some time to come. The solution is then to employ a methodology which can take into account structural modifications and breaks and quantify them. We have thus opted for a model where old and new methods of price determination are both represented and have adopted the Kalman filter methodology in estimating the model.

This paper is divided into five sections. In Section II the price corresponding to different market organization structures is formalized. In Section III a brief description of the actual situation in the agricultural sector in Bulgaria and the model to be estimated is described, while in Section IV the estimation results are discussed. Some concluding remarks close the paper.

II. MARKET ORGANIZATION AND PRICES

Agricultural and food pricing policy in the CPE is characterized by centralized price determination. Producer and consumer prices are set without reference to international prices. Producer prices of individual commodities are generally established without reference to each other, since producers respond to centrally determined production targets and not market signals. Furthermore, consumer prices do not necessarily cover producer prices plus processing and marketing costs. The result is that the maintenance of the price structure involves a costly system of implicit and explicit subsidies.

The issue of price relationships in the agricultural sector of economies in transition is of considerable interest. Price developments in these economies have been characterized by the evolution of the price/cost ratio. In fact, price increases have not followed the evolution of cost, the components of which are highly subsidized. On the other hand, the abolition of consumer subsidies, lower disposable income, and the disruption of export markets has put severe downward pressure on food and

product prices, which in general have not increased as fast as the general level of prices. Moreover, in the early stages of transition, governments tended to liberalize input prices, but continued control of basic food prices.

The establishment of a market-oriented agriculture will require the completion of the process of price reform. Prices paid to producers should be allowed to adjust by (i) eliminating price controls, (ii) removing remaining delivery obligations and restrictions on domestic trade, (iii) eliminating cost-based pricing mechanisms, including the system of fixed profit margins for processing and trade, and (iv) creating competition in input supply of fixed profit margins for marketing.

Economic theory does not yet offer a theoretical framework describing transition dynamics. The only existing basis for the study of the impact of price reform is the Arrow-Debreu paradigm, which allows analysis of small changes in a market economy. This paradigm assumes, however, the existence of well- defined property rights, financial and market institutions, so their absence limits the analysis.

Microeconomic theory teaches that in the absence of externalities and policy distortions, a competitive equilibrium is efficient. Although "equilibrium" is only a conceptual phenomenon, it can help us understand how economic variables tend to behave under certain conditions. The equilibrium price is used as a reference to evaluate the degree of price distortion. In the transition process major attention has been paid to the liberalization of the economy from excessive government regulation.

In both the transition and developed market economies, pricing of individual commodities can be divided into three broad methods: (i) prices are fixed impersonally on an auction-market basis; (ii) prices are fixed as a result of some administrative decision; and (iii) prices are not administered, but fixed by firms according to their average cost and with no apparent relation to market conditions. Prices determined by the first method emerge, typically, through a process of offer and counter-offer. By contrast prices determined by the second method are simply announced. In the third method firms fix their prices with reference to a profit rate applied on average cost.

The competitive market theory of pricing is the basis for the hypothesis developed concerning relationships between price change and excess demand. Excess demand, which is defined as the difference between the demand and supply of a product, has an expected positive effect on price. It is a proxy for the elasticities that exist in both demand and supply markets. Competitive market theory bases price behavior on the difference between demand and supply. Only in cases of infinitely fast price adjustment will equilibrium always be attained between supply and demand. In most cases a gap between demand and supply exists as given in the following price adjustment equation, which, in combination with a demand and supply function, forms a model of competitive theory. The price hypothesis based on excess demand is as follows:

TABLE I

MARKET ORGANIZATION AND THE CORRESPONDING PRICE

	Price Adjustment	Quantity Adjustment	Administered Prices
Demand	$D=f(p)$	$D=f(p)$	$D=f(p)$
Supply	$S=g(p)$	$S'=g(p)$	$S=\bar{S}$
Equilibrium	$D=S$	$D=S$	$min\ (D, S)$
Price	$D=S$	$p=h$(unit cost, U) $U=S'/S$	$p=\bar{p}$

$$\Delta P = \lambda\ (D - S) = \lambda\ (ED),$$

where λ = adjustment coefficient and Δ = change in a variable. This function was originally developed in the *tâtonnement* (trial and error) hypothesis of Walras. Most studies, instead of measuring D and S, utilize measures of excess demand which indicate relative movements in the supply-demand situation.

Prices fixed by firms in accordance with average cost are included. Such prices are frequently described as "markup" prices, because the process by which the seller fixes the price of a unit of output is by "marking up" the cost of a unit of output (unit cost), that is, add on to unit cost some fraction of the figure, which is known as the profit margin. In a markup model, the price is determined in the following way:

$$\text{Price} = \text{unit cost} + (x \cdot \text{unit cost}) = (1 + x) \cdot \text{unit cost}.$$

The term ($x \cdot$ unit cost) is the profit margin: clearly it is equal to price *minus* the unit cost. The fraction x is referred to as the *relative* profit margin because it represents the profit margin expressed as a proportion of unit cost.

Each method of price determination corresponds to a certain market organization. The sets of equations in Table I illustrate the alternative mechanisms for representing market types. If D, S, and p denote demand, supply, and prices respectively, it is clear that the first column corresponds to a price-adjusted competitive market, since the market-clearing price is determined from demand-supply equality. Both supply and demand are perfectly elastic, and price is determined so as to equilibrate the market. The second column indicates an imperfectly competitive market where market supply is rationed by demand, and this affects prices through the rate of utilization U. In fact, in this type of market organization, potential (S') and actual supplies are distinguished. Whereas potential supply depends on prices, actual supply follows effective demand, and in the latter case excess supply is assumed. In fact, this market organization corresponds to a situation in which a downward stickiness of prices results in excess capacity in terms of installed capital. This situation is modeled through a markup pricing rule and production levels

which adapt exactly to demand. Finally, in the third column the central price and production determination is represented. In this case, supply and prices are exogenously set by the government ($\bar{S}$, $\bar{p}$) and are perfectly rigid. Equilibrium cannot be obtained except at minimum supply and demand, which is not the case in the first two markets where supply is elastic and is influenced either by prices (price adjustment) or by demand (quantity adjustment).

III. THE SITUATION IN BULGARIA AND THE PROPOSED MODEL

A. *Situation of the Agricultural Prices in Bulgaria*

The share of agriculture in total GDP was about 9.0 per cent in 1994, a slight drop from 9.2 per cent in 1993. It is clear that the contribution of agriculture to GDP has decreased substantially since reform began.

The liberalization which began in 1990 was accomplished in February 1991. The measures implemented by the government to decentralize the economy led to setting up a price formation under market equilibrium based on supply and demand. In order to diminish the negative consequences of the transition period for both the economy and consumers, the government continued its intervention in the price formation for certain goods: namely, fuel, electricity, coal, transport, and communication services. Moreover, the government continued to regulate the retail prices of some major goods. During the 1990–95 period, the list of the commodities to be monitored and the rules for regulation were changed. While in 1992 and 1993 retail price controls covered eleven commodities including bread, meat, milk, and milk products, in 1995 the list of monitored commodities was expanded to thirty-three items, including food and some nonfood products.

Up to March 1993 consumer price controls were carried out by a system of so-called projected prices. They were based on normatively determined expenditures plus normative margins. Processors and traders were obliged to pay minimum prices consistent with estimated production cost. These minimum prices were added to their normative costs and profitability margins to give their projected retail prices.

The system changed in March 1993. The council of ministers approved new rules for controlling the prices of basic food through ceilings. The government determined only profit margins through the food chain in an attempt to control them. Profit margins for producers and processors were fixed at 12 per cent of cost and at 10 per cent for traders. Price ceilings were calculated as actual cost plus normative profit margin. Price changes due to cost modifications were to be announced to consumers three days before they were implemented.

During the transition period, minimum prices for farmers were introduced. They became valid at certain times and were abolished repeatedly. For example, in 1992

such minimum prices covered wheat, milk, and meat and meat products, and were valid only from April to the end of the same year.

During the transition period, the above increases in retail prices together with decreases in real income reduced demand for agricultural products. Besides the liberalization process, which took place during the transition period, another factor that influenced price increase was the monopolistic power held by the agricultural processing industries. The market structure has given them the possibility to buy inexpensive agricultural products and sell expensive processed products.

B. *Specification of the Proposed Model*

Those centrally planned economies which are actually undergoing a transition period are trying to move gradually from accounting prices to equilibrium prices. This is the main aspect of the transition process. However, during the transition period the price formation mechanism is partly liberalized, and thus different price systems may occur. The most likely situation is one in which a group of prices are either set according to the situation prevailing in the market or fixed by the firms, while some others are still fixed by the government (or state-owned enterprises). As a result two or three prices can coexist for the same product, and some of them can be far away from the market-clearing equilibrium price. The distance of each price from its equilibrium level can measure the distortions that prevail in the economy (see also Xu 1988, 1993). In former CPEs price reform may require a period of time and the liberalization of prices can be slow, may start from certain sectors and/or products, and end up determining the whole economy. As a result different pricing methods can coexist for different products. Prices of certain products may follow a "cost-oriented" pricing approach, whereas others may be administered. If one wants to model the transition during which structural breaks may exist, it is necessary to introduce all these methods of price formation.

1. *Planned prices*

The planned price corresponds to the price fixed by the state or state-owned enterprises. It is exogenously fixed and corresponds to the pre-liberalization period. In fact, during the pre-transition period all prices were fixed by the government according to a plan which determined production and its corresponding system of prices for a certain period of time. During the process of price determination, elements such as the cost of materials, the cost of factors, and the market situation were completely ignored.

$$P_a = \bar{P}_a.$$

2. *Cost-based prices*

To evaluate the price resulting from the quantity adjustment process, one has to take into account the cost of labor, the cost of inputs, and the profit rate. This

method of price determination follows the model based on the markup hypothesis and was formalized by Eckstein (1964). According to the markup hypothesis, the unit cost is increased by a rate to cover the indirect costs, while another rate is added, which represents the profit rate. Eckstein was the first to propose a formalized equation to represent the markup hypothesis as follows:

$$P_m = \pi K/Q + wL/Q + mM/Q,$$

where π = profit rate, K = capital stock, w = wage rate, L = standard employment, m = raw material price, M = the quantity of raw materials, and Q = production. A variant of this approach can be represented by the following equation:

$$P_m = (1 + \delta)\frac{wL + mM}{Q},$$

where δ is the markup coefficient. This model casts doubt about the usefulness of profit maximization based on marginal cost / marginal revenue equality. Price fluctuations are linked in order to normalize unit cost changes based on market structures and the economic situation of firms with no reference to the profit maximization process. While this reasoning would imply a total absence of the influence of demand on price, it is generally admitted that when excess demand is very high, a faster price increase is expected. It is thus normal to add a demand proxy in a markup model, implying that firms are obliged to vary their profit rate according to demand fluctuations. This is very important because, theoretically, when we say that prices are independent of demand, we mean that firms are not affected by certain macroeconomic aggregates.

This method of price determination was quite common in centrally planned economies. In fact, state-owned enterprises used to fix prices following the cost-based approach. According to this approach, firms evaluate their production cost, include net taxes (taxes – subsidies), but make no reference either to the firm's profit or to any conditions that prevail in the market. The specification of a model describing such a method of price determination can be approximated by a cost-based price model as described above, in which any profit term or any impact of demand is excluded.

3. *Market-clearing prices*

The market-clearing price structure is based on supply and demand equilibrium and requires that (1) all parties participating in the market do so via economically rational behavior (utility and profit maximization) and (2) there should not be any monopolistic element in the market.

This specification is based on the following assumptions:

$$P_e = f(D - S),$$

where D, S are respectively the demand and supply of the product.

This model specification could represent the actual situation in CEEC where the markets are almost liberalized. In fact, the removal of subsidies and the increasing influence of market forces can be formalized according to the above model in cases where demand-supply disequilibrium are the only explanatory factors for the price formation.

4. *Synthesis of the three models*

When different types of price are employed, the overall aggregate price per product or group of products will be specified as follows:

$$P = P_a^A P_m^B P_e^C, \quad A, B, C \geq 0, \quad A + B + C = 1,$$

where P_a, P_m, and P_e are respectively the administered, cost-based, and equilibrium prices. A, B, and C are the weight of each type of price in total final aggregate price. The values of A, B, and C also indicate the degree of transition in the economy from centrally planned to market oriented. A, B, and C are coefficients measuring the speed of economic transformation. This way of representing the transition from CPE to market economy makes it possible to evaluate the impact on P by the implementation of economic reforms, as well as to evaluate the importance of the impact of speed of adjustment. The situation in the past can be represented if we set $A = 1$, $B = 0$, and $C = 0$. The transition is represented by the gradual convergence of A to 0 and C to 1. The next step is to estimate the coefficients A, B, and C, and trace the path of transition.

IV. ESTIMATION RESULTS

The timing and nature of reform varies from country to country; moreover, the post-reform period has been characterized by structural instability, as the reform process continues toward private ownership of land. Time series data points are insufficient to obtain meaningful price variations. Economic modeling should include the pre- and post-reform periods, leading to a specification of a time-varying parameter model (see also Hall 1993; Hallam 1995). The estimation method used here is based on the Kalman filter methodology which is useful in estimating variable parameter models, unobservable components, standard ARMA, and the least squares problem.[3] The advantage of this method is that it allows for variation of the estimated coefficients through time and produces an estimation of the entire set of k coefficients for each of the last $T - k$ periods covered by the sample. By applying such a methodology one can observe and estimate the structural breaks that

[3] For a description of the methodology, see Harvey (1987) and Cuthbertson, Hall, and Taylor (1992).

occurred in the behavioral relation estimated. Such a characteristic of the methodology allows the appearance of differences in the responsiveness of price formation to cost evolution and to excess demand. The question of the structural change to be examined for agricultural prices in Bulgaria concerns the change of price determination from a cost-based to a market equilibrium approach.[4]

The functional form for each product is either a linear function of the price in terms of total cost and demand-supply equilibrium or a Cobb-Douglas function, which by using logs for linearization of the equations helps to reduce variability in the data and yields a straight interpretation of the elasticities for the coefficient estimates. The estimation is for nine products: namely, barley, beef, goat meat, cow's milk, pork, poultry, sunflower seeds, oriental tobacco, and wheat.[5] The period covered is from 1971 to 1995, except for barley, cow's milk, and goat meat, for which the available data stops at 1993. For each product three different demand pressure indicators were used in the equations: (1) excess demand resulting from demand-supply difference; (2) demand-supply ratio, and (3) the excess demand as measured by the difference of observed demand from its time trend.

Detailed estimation results for each product are presented in the Appendix Table, while the results of the retained variables are presented in Table II. For beef and goat meat, log-linear specifications in which market pressure is represented by demand-supply difference are the most successful concerning the sign of the parameters and the statistical tests. For barley and cow's milk, linear equations with demand to supply ratios are the most successful specifications, whereas, for poultry and sunflower seeds, log-linear specifications with excess demand over its general trend have the most powerful explanatory power. The evolution of prices of pork and oriental tobacco are best described by linear specifications: in the former the difference of demand from its trend is the only variable with the correct sign, while in the latter the minimization of the sum of squared residuals is realized when the demand-supply difference is introduced into the equation. Finally, for wheat, a log-linear form with the ratio of demand over supply is retained.

[4] It should, however, be noticed that according to Charemza (1993), estimation of time-varying parameter models via an updating procedure, such as the Kalman filter, is appropriate only under the assumption that the variables are cointegrated. In the period of transition there may be no cointegrating relationship, and the error term will be non-stationary for this period. In this model the long-run mechanism is of limited memory, and with the absorption of new information, old information may be forgotten as belonging to the old regime.

[5] All data used for the estimation were supplied by the Bulgarian Ministry of Agriculture. More specifically, the data for production, prices, and costs for individual products up to 1990 can be found in the annual publication of the Ministry of Agriculture, *Godishen otchet na NAPS* [Annual report of NAPS] (Sofia). Data after 1990 are from the annual publication of the National Statistical Institute (NSI), *Plotsy, dobivy, proisvodsto* [Sown area, yield, and production] (Sofia). Farm-gate prices after 1990 are from unpublished NSI sources.

TABLE II

ESTIMATION RESULTS OF ADOPTED EQUATIONS

	Barley	Beef	Goat Meat	Cow's Milk	Pork	Poultry	Sunflower Seeds	Oriental Tobacco	Wheat
Constant	−2,122.7	1.070	0.879	−4,516.14	268.5	0.405	1.618	8,408.94	−0.509
	(−4.171)	(2.143)	(1.755)	(−1.924)	(0.486)	(2.286)	(14.96)	(5.109)	(−1.785)
Cost	1.802			2.127	1.198			0.434	
	(38.53)			(27.61)	(24.13)			(31.15)	
Demand−supply								0.089	
								(3.454)	
Demand/supply	2,117.5			4,448.32					
	(4.155)			(1.750)					
Demand−trend					0.012				
					(1.060)				
Log (cost)		0.739	0.713			0.962	0.806		1.221
		(21.72)	(24.72)			(42.42)	(43.99)		(24.64)
Log (demand−supply)		0.095	0.141						
		(2.302)	(3.854)						
Log (demand/supply)									1.012
									(1.330)
Log (demand−trend)						0.406	0.140		
						(3.369)	(1.224)		
SSR	67,717.5	0.928	0.226	815,781	$0.10 \cdot 10^9$	0.271	0.345	$0.43 \cdot 10^8$	0.950
Variance of residuals	3,385.87	0.044	0.012	40,789.1	$0.49 \cdot 10^7$	0.013	0.016	$0.19 \cdot 10^7$	0.043
Mean of dependent var.	582.08	8.08	8.09	1,727.45	7,924.60	7.85	6.25	12,081.53	5.47

For all products, total cost and demand pressure seem to play an important role in the determination of production price. All cost and excess demand parameters are significantly different from zero in the adopted equations. For the logarithmic equations, the total cost parameters lie between 0.71 and 1.22, the lowest being for goat meat, and the highest for wheat. For equations estimated in levels, the parameters cover a wider range, since the lowest, oriental tobacco, is 0.43 and the highest, 2.12, is the estimated coefficient for cow's milk. Excess demand is also significantly different from zero for the determination of all prices considered in the paper. However, excess demand is represented differently in the equations, as all three types of proxies tested in the specifications are retained in the final equations.

For oriental tobacco, beef, and goat meat, the proxy retained is the demand-supply difference in levels or logs; higher impact of the excess demand is observed for goat meat (0.14), while for oriental tobacco and beef the estimated coefficient is around 0.09. For barley, cow's milk, and wheat the ratio of demand to supply was considered; for these products cow's milk appears to be more influenced by the excess demand. Finally for pork, poultry, and sunflower seeds, the excess demand over its trend seems to fit the data better.[6]

The advantage of estimating equations with the Kalman filter methodology is to investigate if any structural change in the behavior of price formation has occurred during the transition period. In fact, in Tables III and IV as well as Figure 1, the evolution of time-varying parameters of total cost as well as of the excess demand are presented. Moreover, in Figure 1 the time trend of the evolution of the parameter is also included.

Looking at Table III, we can observe a mixed behavior of parameters through time, depending on the agricultural product. The overall trend for sunflower seeds and wheat is positive, meaning that since 1971 the impact of total cost in determining the production price of these agricultural products is increasing. For oriental tobacco, cow's milk, beef, and goat meat, the trend has a negative slope. The impact of total cost in the determination of price is decreasing constantly through time. For barley, pork, and poultry, the time evolution of the estimated coefficients is not clear-cut. The time path has upward or downward fluctuations. If, however, one considers the transition period only, the impact is slowing down.

Whereas the time trend for total cost coefficients is not always clear-cut, this is not the case when excess demand coefficients are considered (see Table IV). For all the agricultural products considered here, one can observe that the impact of estimated coefficient of demand is increasing over time. For six of the products, the estimated coefficients were negative at the beginning of the estimation period and became positive in the end of the sample period. It is remarkable to observe that for

[6] The choice of the final form of the proxy used is not based on any theoretical consideration, but rather the criteria used are absolutely practical.

TABLE III

TIME PATH OF THE ESTIMATED PARAMETERS FOR COST

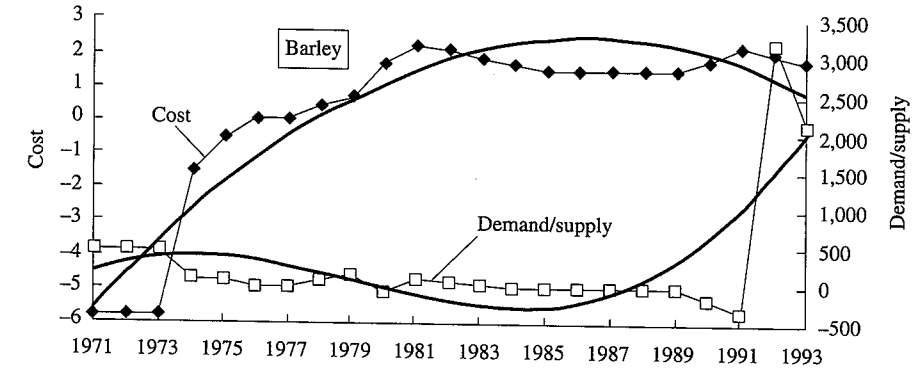
	Barley (Level)	Cow's Milk (Level)	Pork (Level)	Oriental Tobacco (Level)	Beef (Log)	Goat Meat (Log)	Poultry (Log)	Sunflower Seeds (Log)	Wheat (Log)
1971	−5.765	2.008	—	0.867	—	—	—	−0.317	−0.029
1972	−5.765	2.008	1.200	0.867	1.113	1.027	0.953	−0.317	−0.029
1973	−5.765	2.008	1.200	0.867	1.113	1.027	0.953	−0.317	−0.029
1974	−1.520	1.506	1.200	0.972	1.113	1.027	0.953	−0.249	−0.028
1975	−0.539	2.218	1.441	1.076	1.121	1.210	0.857	−0.297	−0.019
1976	0.056	1.962	1.427	0.769	1.106	1.212	0.880	0.051	−0.131
1977	0.075	1.675	1.437	0.588	1.130	1.213	0.892	0.021	−0.029
1978	0.450	1.386	−6.107	0.936	−0.028	0.807	0.567	0.049	−0.052
1979	0.687	1.563	−4.785	0.961	0.009	0.778	0.560	0.059	−0.066
1980	1.726	1.436	−1.670	0.663	0.307	0.330	0.475	0.480	0.191
1981	2.261	1.534	−0.822	0.919	0.654	0.679	0.499	0.497	0.282
1982	2.124	1.588	−0.346	0.982	0.695	0.707	0.663	0.476	0.175
1983	1.889	1.633	−0.034	1.001	0.697	0.722	0.881	0.473	0.153
1984	1.687	1.663	0.242	1.005	0.681	0.727	1.054	0.455	0.223
1985	1.530	1.695	0.538	1.003	0.653	0.741	1.206	0.451	0.177
1986	1.531	1.664	0.588	0.994	0.649	0.770	1.229	0.449	0.193
1987	1.504	1.608	0.687	0.957	0.624	0.800	1.159	0.438	0.219
1988	1.527	1.483	0.953	0.944	0.480	0.813	1.047	0.436	0.281
1989	1.550	1.340	1.121	0.945	0.450	0.776	0.964	0.553	0.323
1990	1.806	0.670	1.213	0.746	0.338	0.579	0.754	0.681	0.822
1991	2.271	2.034	1.145	0.519	0.465	0.654	0.930	0.859	1.261
1992	2.015	1.866	1.129	0.583	0.536	0.661	0.955	0.821	1.273
1993	1.802	2.127	1.154	0.577	0.597	0.713	0.964	0.822	1.306
1994	—	—	1.005	0.430	0.667	—	0.960	0.810	1.234
1995	—	—	1.198	0.434	0.739	—	0.962	0.806	1.221

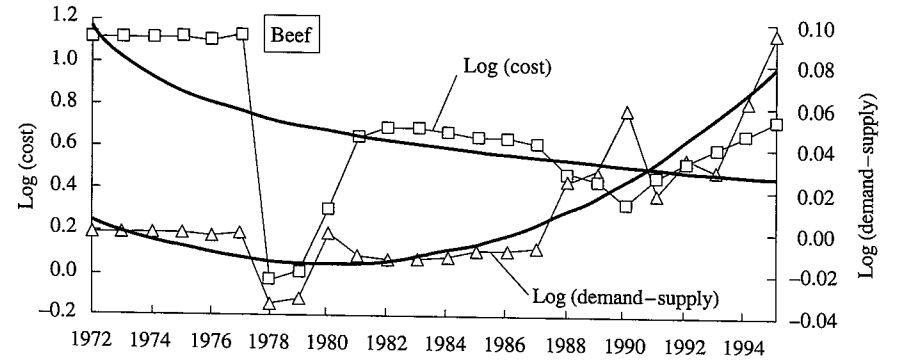
barley, wheat, sunflower seeds, oriental tobacco, and cow's milk the most important modification takes place after 1990, i.e., after the major modification occurred in Bulgaria with the beginning of the transition period.

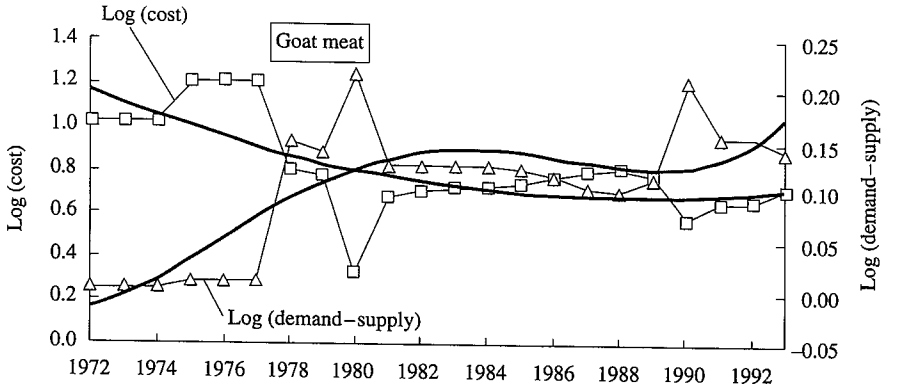
V. CONCLUSIONS

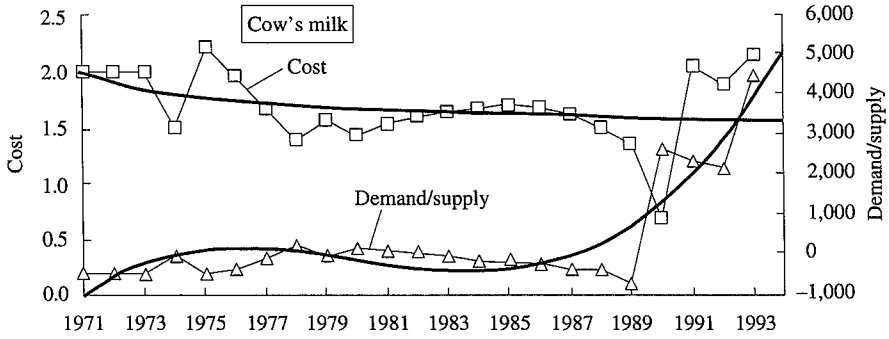
The agricultural sector in Bulgaria is without a doubt in transition. Price formation there is moving from an accounting price based on the evolution of total cost to a market-clearing price. The aim of this paper has been to investigate and quantify effort made in that direction in Bulgaria's agricultural sector. To evaluate this effort, an estimation of a price determination model including three methods of price determination is proposed in the paper. The model, in which the new and old regimes can coexist, contains estimations using the Kalman filter for nine agricultural products. This method makes it possible to quantify the importance of each

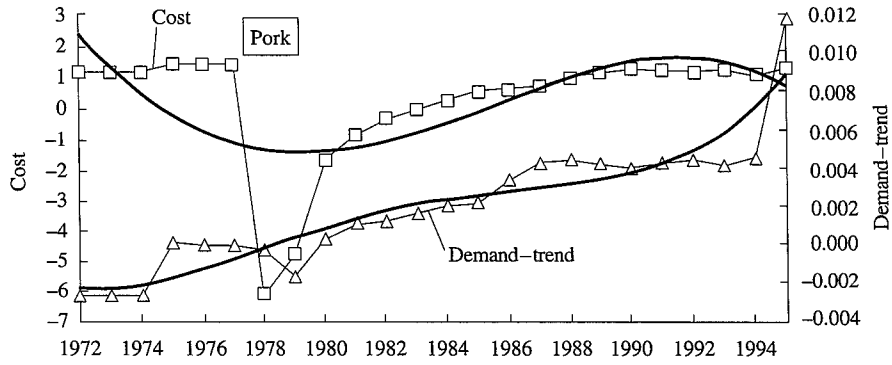
Fig. 1. Evolution of Estimated Coefficients and Their Time Trend

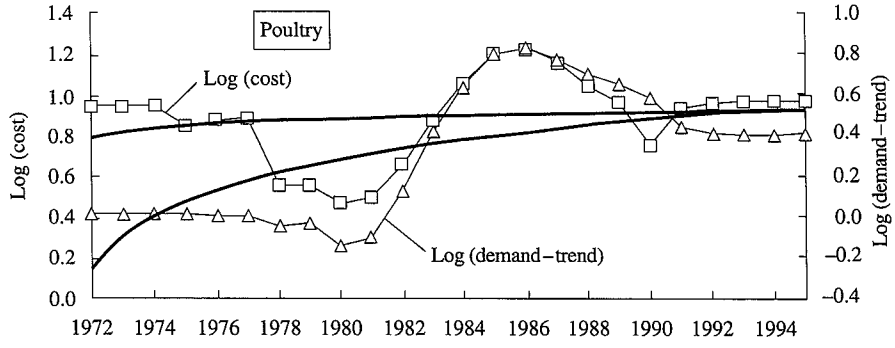


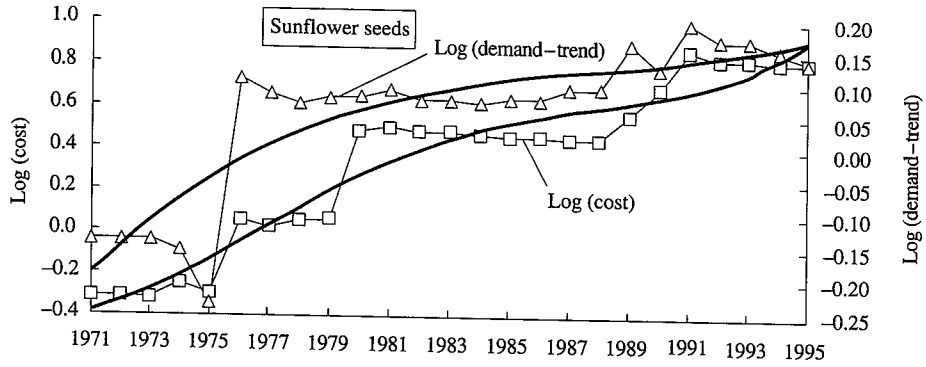


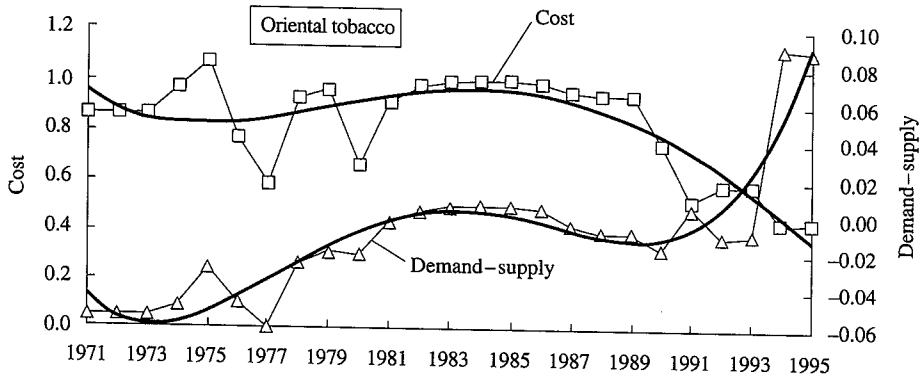



Cow's milk
Cost
Demand/supply
Cost
Demand/supply
2.5
2.0
1.5
1.0
0.5
0.0
6,000
5,000
4,000
3,000
2,000
1,000
0
−1,000
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993


Pork
Cost
Demand−trend
Cost
Demand−trend
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
0.012
0.010
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994


Poultry
Log (cost)
Log (demand−trend)
Log (cost)
Log (demand−trend)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994


Sunflower seeds
Log (demand–trend)
Log (cost)
Log (cost)
Log (demand–trend)
1.0
0.8
0.6
0.4
0.2
0.0
–0.2
–0.4
0.20
0.15
0.10
0.05
0.00
–0.05
–0.10
–0.15
–0.20
–0.25
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995


Oriental tobacco
Cost
Demand–supply
Cost
Demand–supply
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.10
0.08
0.06
0.04
0.02
0.00
–0.02
–0.04
–0.06
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995

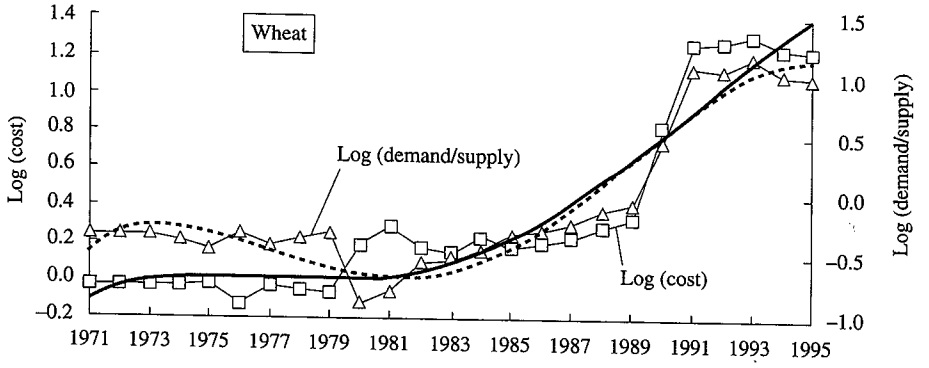

Wheat
Log (demand/supply)
Log (cost)
Log (cost)
Log (demand/supply)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
–0.2
1.5
1.0
0.5
0.0
–0.5
–1.0
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995

TABLE IV

TIME PATH OF THE ESTIMATED PARAMETERS FOR EXCESS DEMAND

	Oriental Tobacco ($D-S$)	Barley (D/S)	Cow's Milk (D/S)	Beef (Log $[D-S]$)	Goat Meat (Log $[D-S]$)	Wheat (Log $[D/S]$)	Pork ($D-T$)	Poultry (Log $[D-T]$)	Sunflower Seeds (Log $[D-T]$)
1971	−0.053	451.37	−432.86	—	—	−0.3094	—	—	−0.1338
1972	−0.053	451.37	−432.86	−0.0007	0.0045	−0.3094	−0.0026	0.0271	−0.1338
1973	−0.053	451.37	−432.86	−0.0007	0.0045	−0.3094	−0.0026	0.0271	−0.1338
1974	−0.047	83.60	−12.25	−0.0007	0.0045	−0.3596	−0.0026	0.0271	−0.1502
1975	−0.027	61.74	−429.24	−0.0007	0.0112	−0.4229	0.0002	0.0210	−0.2337
1976	−0.046	−29.43	−316.72	−0.0019	0.0121	−0.2962	0.0001	0.0191	0.1129
1977	−0.060	−24.41	−71.93	−0.0009	0.0119	−0.3888	0.0002	0.0119	0.0890
1978	−0.024	73.94	266.69	−0.0343	0.1504	−0.3353	−0.0002	−0.0372	0.0735
1979	−0.019	125.09	1.05	−0.0318	0.1408	−0.2980	−0.0016	−0.0230	0.0829
1980	−0.020	−78.58	182.27	−0.0009	0.2166	−0.8696	0.0004	−0.1359	0.0843
1981	−0.002	77.03	106.45	−0.0111	0.1281	−0.7768	0.0011	−0.0969	0.0952
1982	0.004	44.87	67.19	−0.0125	0.1276	−0.5336	0.0013	0.1320	0.0795
1983	0.006	2.53	−25.22	−0.0125	0.1268	−0.5288	0.0017	0.4209	0.0803
1984	0.007	−21.51	−155.83	−0.0117	0.1268	−0.4302	0.0021	0.6403	0.0753
1985	0.006	−30.94	−188.98	−0.0084	0.1240	−0.3056	0.0022	0.8117	0.0824
1986	0.005	−30.47	−252.68	−0.0089	0.1161	−0.2738	0.0034	0.8332	0.0799
1987	−0.004	−37.22	−368.20	−0.0069	0.1055	−0.2219	0.0043	0.7740	0.0973
1988	−0.008	−34.09	−401.45	0.0246	0.1014	−0.1071	0.0044	0.7013	0.0969
1989	−0.009	−23.24	−715.95	0.0296	0.1139	−0.0420	0.0042	0.6525	0.1654
1990	−0.017	−166.57	2,623.04	0.0590	0.2109	0.4606	0.0040	0.5849	0.1288
1991	0.005	−338.91	2,312.54	0.0184	0.1545	1.0830	0.0043	0.4371	0.1962
1992	−0.010	3,201.57	2,137.20	0.0358	0.1554	1.0693	0.0044	0.4069	0.1707
1993	−0.009	2,117.49	4,448.32	0.0296	0.1414	1.1728	0.0042	0.4016	0.1701
1994	0.091	—	—	0.0632	—	1.0361	0.0046	0.4008	0.1539
1995	0.089	—	—	0.0953	—	1.0122	0.0118	0.4058	0.1405

regime by estimating parameters that vary over time and by identifying any structural breaks that may have occurred.

The estimation results show that for many products the impact of total cost in price formation is being reduced during the transition period. On the other hand, the impact of excess demand has an increasing impact for all the products that were considered in the study.

According to model results, it seems that an important structural break is actually occurring in Bulgaria in the determination of agricultural prices. This structural break, which has been observed in the years following transition, confirms that a transformation of the price formation mechanism is actually occurring there, thus leading the agricultural sector toward more liberalized price determination.

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APPENDIX TABLE

ESTIMATION RESULTS

Barley	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.899	−2,122.7	−11.61	0.164	0.017	0.149
	(−0.057)	(−4.171)	(−0.603)	(1.380)	(0.147)	(1.277)
Cost	1.779	1.802	1.706			
	(37.09)	(38.53)	(32.45)			
Demand−supply	0.002					
	(3.557)					
Demand/supply		2,117.5				
		(4.155)				
Demand−trend			0.475E–04			
			(1.140)			
Log (cost)				1.059	1.093	1.060
				(40.57)	(43.06)	(43.79)
Log (demand−supply)				−0.001		
				(−0.257)		
Log (demand/supply)					1.747	
					(2.568)	
Log (demand−trend)						0.063
						(0.903)
SSR	77,259.4	67,717.5	118,465	0.183	0.138	0.176
Variance of residuals	3,862.97	3,385.87	5,923.27	0.009	0.007	0.009
Mean of dependent variable	582.08	582.08	582.08	5.44	5.44	5.44

Beef	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−965.1	20,462.5	511.794	1.070	1.757	2.279
	(−0.644)	(1.119)	(0.574)	(2.143)	(5.753)	(7.709)
Cost	0.477	0.476	0.460			
	(17.15)	(17.20)	(13.64)			
Demand−supply	−0.159					
	(−1.021)					
Demand/supply		−21,555.8				
		(−1.104)				
Demand−trend			−0.060			
			(−0.828)			
Log (cost)				0.739	0.736	0.693
				(21.72)	(21.75)	(19.82)
Log (demand−supply)				0.095		
				(2.302)		
Log (demand/supply)					−2.413	
					(−2.286)	
Log (demand−trend)						−1.015
						(−2.534)
SSR	$0.28 \cdot 10^9$	$0.28 \cdot 10^9$	$0.28 \cdot 10^9$	0.928	0.931	0.896
Variance of residuals	$0.13 \cdot 10^8$	$0.13 \cdot 10^8$	$0.14 \cdot 10^8$	0.044	0.044	0.042
Mean of dependent variable	6,855.22	6,855.22	6,855.22	8.08	8.08	8.08

APPENDIX TABLE (Continued)

Goat meat	(1)	(2)	(3)	(4)	(5)	(6)
Constant	52.12	4,828.7	1,242.4	0.879	2.244	2.635
	(0.104)	(2.858)	(5.866)	(1.755)	(8.355)	(10.28)
Cost	0.432	0.427	0.403			
	(19.84)	(19.13)	(19.24)			
Demand – supply	– 0.073					
	(– 2.572)					
Demand/supply		– 4,625.9				
		(– 2.134)				
Demand – trend			– 0.017			
			(– 0.783)			
Log (cost)				0.713	0.687	0.658
				(24.72)	(22.78)	(20.55)
Log (demand – supply)				0.141		
				(3.854)		
Log (demand/supply)					– 0.726	
					(– 2.755)	
Log (demand – trend)						– 0.238
						(– 1.194)
SSR	$0.10 \cdot 10^8$	$0.11 \cdot 10^8$	$0.13 \cdot 10^8$	0.226	0.288	0.374
Variance of residuals	540,666	587,984	706,168	0.012	0.015	0.020
Mean of dependent variable	6,227.67	6,227.67	6,227.67	8.09	8.09	8.09

Cow's milk	(1)	(2)	(3)	(4)	(5)	(6)
Constant	– 128.0	– 4,516.14	– 382.03	0.032	– 1.497	– 2.062
	(– 0.712)	(– 1.924)	(– 4.985)	(0.012)	(– 2.038)	(– 2.486)
Cost	2.110	2.127	2.101			
	(26.26)	(27.61)	(19.07)			
Demand – supply	0.002					
	(1.670)					
Demand/supply		4,448.32				
		(1.750)				
Demand – trend			0.000			
			(– 0.675)			
Log (cost)				1.311	1.312	1.353
				(11.54)	(12.19)	(9.989)
Log (demand – supply)				– 0.154		
				(– 0.738)		
Log (demand/supply)					4.431	
					(1.315)	
Log (demand – trend)						0.144
						(0.294)
SSR	825,484	815,781	919,683	1.813	1.715	1.855
Variance of residuals	41,274.2	40,789.1	45,984.1	0.090	0.086	0.093
Mean of dependent variable	1,727.45	1,727.45	1,727.45	6.45	6.45	6.45

APPENDIX TABLE (Continued)

Pork	(1)	(2)	(3)	(4)	(5)	(6)
Constant	410.19	3,002.95	268.5	1.683	1.456	1.104
	(0.472)	(0.134)	(0.486)	(3.016)	(4.538)	(3.376)
Cost	1.162	1.162	1.198			
	(29.98)	(29.92)	(24.13)			
Demand – supply	– 0.010					
	(– 0.138)					
Demand/supply		– 2,574.26				
		(– 0.111)				
Demand – trend			0.012			
			(1.060)			
Log (cost)				0.870	0.873	0.912
				(21.37)	(22.96)	(21.50)
Log (demand – supply)				– 0.031		
				(– 0.796)		
Log (demand/supply)					1.903	
					(0.915)	
Log (demand – trend)						0.258
						(1.002)
SSR	$0.11 \cdot 10^9$	$0.11 \cdot 10^9$	$0.10 \cdot 10^9$	0.914	0.905	0.898
Variance of residuals	$0.51 \cdot 10^7$	$0.51 \cdot 10^7$	$0.49 \cdot 10^7$	0.043	0.043	0.043
Mean of dependent variable	7,924.60	7,924.60	7,924.60	8.08	8.08	8.08

Poultry	(1)	(2)	(3)	(4)	(5)	(6)
Constant	– 700.76	2,999.3	265.11	–1.474	1.095	0.405
	(– 0.755)	(0.677)	(1.295)	(–0.988)	(2.491)	(2.286)
Cost	0.922	0.912	0.912			
	(40.56)	(40.34)	(59.82)			
Demand – supply	– 0.036					
	(– 1.151)					
Demand/supply		– 3,302.2				
		(– 0.600)				
Demand – trend			0.011			
			(1.442)			
Log (cost)				0.997	0.890	0.962
				(17.54)	(22.35)	(42.42)
Log (demand – supply)				0.161		
				(1.496)		
Log (demand/supply)					0.678	
					(0.874)	
Log (demand – trend)						0.406
						(3.369)
SSR	$0.16 \cdot 10^8$	$0.17 \cdot 10^8$	$0.15 \cdot 10^8$	0.377	0.403	0.271
Variance of residuals	762,515	796,933	737,623	0.018	0.019	0.013
Mean of dependent variable	6,580.92	6,580.92	6,580.92	7.85	7.85	7.85

APPENDIX TABLE (Continued)

Sunflower seeds	(1)	(2)	(3)	(4)	(5)	(6)
Constant	177.25	1,437.2	228.58	1.411	1.643	1.618
	(2.728)	(1.845)	(4.271)	(5.919)	(14.48)	(14.96)
Cost	0.820	0.825	0.843			
	(37.85)	(42.19)	(44.72)			
Demand – supply	– 0.002					
	(– 1.442)					
Demand/supply		– 1,271.44				
		(– 1.548)				
Demand – trend			0.000			
			(– 0.916)			
Log (cost)				0.795	0.796	0.806
				(33.85)	(37.26)	(43.99)
Log (demand – supply)				0.027		
				(0.924)		
Log (demand/supply)					– 0.455	
					(– 1.098)	
Log (demand – trend)						0.140
						(1.224)
SSR	$0.12 \cdot 10^7$	$0.12 \cdot 10^7$	$0.13 \cdot 10^7$	0.355	0.350	0.345
Variance of residuals	55,351.6	54,632.5	58,357.8	0.016	0.016	0.016
Mean of dependent variable	1,257.51	1,257.51	1,257.51	6.25	6.25	6.25

Oriental tobacco	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8,408.94	– 2,159.17	2,771.37	2.512	2.273	2.114
	(5.109)	(– 1.066)	(6.960)	(5.648)	(16.77)	(19.22)
Cost	0.434	0.462	0.477			
	(31.15)	(48.13)	(46.17)			
Demand – supply	0.089					
	(3.454)					
Demand/supply		8,812.41				
		(2.500)				
Demand – trend			0.011			
			(0.645)			
Log (cost)				0.740	0.747	0.758
				(37.15)	(62.29)	(61.34)
Log (demand – supply)				– 0.022		
				(– 0.840)		
Log (demand/supply)					0.120	
					(1.313)	
Log (demand – trend)						0.028
						(0.692)
SSR	$0.43 \cdot 10^8$	$0.51 \cdot 10^8$	$0.65 \cdot 10^8$	0.098	0.094	0.099
Variance of residuals	$0.19 \cdot 10^7$	$0.23 \cdot 10^7$	$0.29 \cdot 10^7$	0.004	0.004	0.004
Mean of dependent variable	12,081.53	12,081.53	12,081.53	8.81	8.81	8.81

APPENDIX TABLE (Continued)

Wheat	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−11.53	−883.92	−96.06	−0.251	−0.509	−0.776
	(−0.123)	(−1.210)	(−1.998)	(−0.240)	(−1.785)	(−3.207)
Cost	2.690	2.691	2.740			
	(24.78)	(24.96)	(26.51)			
Demand − supply	0.000					
	(1.068)					
Demand/supply		872.15				
		(1.077)				
Demand − trend			0.000			
			(−0.229)			
Log (cost)				1.223	1.221	1.258
				(16.86)	(24.64)	(26.209)
Log (demand − supply)				−0.029		
				(−0.484)		
Log (demand/supply)					1.012	
					(1.330)	
Log (demand − trend)						0.094
						(0.426)
SSR	804,820	804,150	844,530	1.015	0.950	1.017
Variance of residuals	36,582.7	36,552.3	38,387.7	0.046	0.043	0.046
Mean of dependent variable	642.37	642.37	642.37	5.47	5.47	5.47