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GROWTH AND EQUITY IN AGRICULTURAL DEVELOPMENT

PROCEEDINGS

EIGHTEENTH
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OXFORD

1983

Gower

CSABA CSAKI

*Limits and Potential of Growth in Agriculture in the CMEA
Member Countries – a Quantitative Approach*

The situation and the development possibilities of agriculture in the European member countries of the CMEA, and particularly of the Soviet Union, have often been the subject of discussion in both the Eastern and Western hemispheres. This concern is not surprising, since the European member countries of the CMEA and the Soviet Union can be regarded as countries disposing of about one-fourth of all agricultural resources available in the world. The share of the member countries of the CMEA, including the Soviet Union, amounted in 1980 to 28.7 per cent of wheat, 8.4 per cent of corn, 44.3 per cent of sugar beet and 49.0 per cent of the potatoes produced all over the world. In addition to this, 12.4 per cent of the cattle stock, 17.1 per cent of the pig stock and about 9 per cent of the world's population were held by this group.

In this paper the limits and potential for agricultural growth of the area are discussed, based on the assessment of the present situation and calculations made by using a mathematical model. The basis of our analysis is the *CMEA Agricultural Model* developed at the *Food and Agriculture Programme* of the *International Institute for Applied Systems Analysis* (Laxenburg, Austria)¹ The work summarized in this presentation was supported and initiated by the Food and Agriculture Organization of the United Nations, Rome, Italy.² The study covers only the European member countries (Bulgaria, GDR, Poland, Hungary, Rumania, Czechoslovakia), the CMEA and the Soviet Union, including its Asian territories. The aim of the investigation was very clearly a CMEA-level, aggregated analysis. The study of country-specific, region-specific and inter-CMEA problems was not our intention.

PRINCIPAL SUPPLY AND DEMAND TRENDS IN THE CMEA
AREA

The European CMEA countries, excluding the USSR, are situated in the central part of Europe. The natural conditions of agricultural production are generally favourable. The climate is of continental character. The per

caput supply of the population with land can also be considered favourable (about 0.7 ha agricultural land per caput). The proportion of arable acreage is particularly high. Possibilities for the increase of agricultural acreage are very restricted, but increasing share of plantations seems to be a general tendency. Agricultural territories amount to 553 million hectares in the Soviet Union (1978), and a significant part of it has a climate inclined to extremes, the climatic conditions being mostly similar to those of the Northern States of the USA and the Canadian prairies. The agricultural territories are relatively northern and only the most southern zones of the Soviet Union have a situation similar to that of San Francisco. The most varied climatic conditions can be encountered in this vast country, and, in addition to the coolness of the climate, the frequent fluctuations in precipitation and the relatively high probability of drought can be pointed out as fundamental characteristics. A significant part of the country's territory is not cultivated at all but in consequence of the unfavourable climatic conditions and of the northern situation, the possibilities of increasing the agricultural acreage and particularly of increasing sowing areas are more or less restricted.

Considerable decreases of agricultural population can be observed during the last two decades in each of the countries. On the other hand, recent years were characterized in CMEA agriculture by large-scale mechanization. The number of tractors and grain-harvesting combines vigorously increased everywhere, although significant differences continue to exist between the individual countries in question. The amount of fertilizer use was also increased (81 kg active ingredients in the Soviet Union, 151 kg in Rumania, 360 kg in the GDR in 1980) and considerable effort was made toward the extension of irrigation and for the improvement

TABLE 1 *Average annual growth of agricultural production in CMEA countries (%)*

Country	1966-1970	1971-1975	1976-1978	1976-1978
	Annual growth in the given period on the basis of the previous five years			for the whole period from 1961-1965
Bulgaria	4.7	2.3	2.8	3.3
Czechoslovakia	3.5	2.8	2.5	2.9
Poland	3.0	3.2	1.0	2.4
Hungary	3.0	3.5	4.1	3.5
GDR	3.7	2.1	1.9	2.6
Rumania	4.2	4.8	7.4	5.8
USSR	4.1	2.5	2.6	3.1

Source: *Thirty Years of CMEA*, Hungarian Central Statistical Bureau, 1979.

of soils. However, the share of irrigated land is still relatively small (6-10 per cent of the cultivated area). But besides these developments, the level of technical supply in the CMEA agriculture falls behind that of Western Europe and North America.

Agricultural production grew more rapidly in the course of the past decades in the CMEA countries than the world average. The growth of agriculture generally was relatively rapid in the late '60s and early '70s and slowed down at the end of the last decade. Of course, in actual growth there is a considerable country-to-country and commodity-to-commodity variation. For example, between 1961-65 and 1971-75 the gross production of Soviet agriculture increased by 37 per cent, and also the production of the major agricultural products increased at a similar rate. Table 1 summarizes the annual growth of agriculture in the respective countries. The annual growth on a two-decade basis was mainly between 2.5 and 3.5 per cent. The only exception is Rumania, where agriculture developed at a 5.8 per cent annual rate during the past twenty years.

TABLE 2 *Major indicators of grain and meat production (average of 1976-78)*

Country	Grain production kg/grain cropland	Meat production kg/agri- cultural land	Grain production kg/caput	Meat production kg/caput
Bulgaria	3425	102	895	69.7
Czechoslovakia	3802	190	674	89.1
Poland	2615	142	594	79.5
Hungary	4077	194	1162	124.6
GDR	3506	276	525	104.2
Rumania	3015	99	889	68.4
USSR	1704	24	815	55.9

Source: *FAO Production Yearbook*, FAO, 1979.

The rate of increase in animal husbandry generally surpassed that of crop-growing.

Yields in agricultural production generally increased in the region, although showing vigorous dispersion in the diverse countries. The yields of grain crops are relatively similar in Czechoslovakia, the German Democratic Republic, and Hungary and are not very far from the level reached in other developed countries; they are significantly smaller in Rumania and Poland (see Table 2). In comparison with other developed countries, relatively modest yields as well as large fluctuations of yield are ascribed to the impact of the weather characteristic of Soviet agriculture. The fluctuations of grain yields are particularly great here. The annual crop yield might differ from the 5-year average by 30-40 per cent.

TABLE 3 *Share of agriculture and forestry in national income (%)*

Country	1950	1960	1970	1975
	%	%	%	%
Bulgaria	42.5	32.2	22.6	21.9
Czechoslovakia	16.2	14.7	10.1	8.3
Poland	47.9	30.3	17.5	15.1
Hungary	47.7	29.2	16.8	16.3
GDR	28.4	16.4	11.6	10.0
Rumania	27.3	34.9	19.1	16.6
USSR	22.2	20.7	22.0	16.8

Source: *Thirty Years of CMEA*, Hungarian Central Statistical Bureau, 1979.

So far as the structure of agricultural production is concerned, the general tendency is the increasing share of animal husbandry within total production, and this trend definitely will be continued in the future. The share of animal husbandry in the GDR and Czechoslovakia is around 54-56 per cent, and in most other countries higher than 40 per cent or around this level. The structure of crop production has not changed significantly during the past decade. Grain crops and leguminous plants continue to occupy about 60 per cent of total acreage. Within animal husbandry the growth of poultry and pig numbers was the most rapid. Pork production is the most determinant within total meat production. The share of beef shows greater variation and is about 20-30 per cent.

In each CMEA country – including the Soviet Union – agricultural production is performed on farms of different types of ownership and size. Except for Poland, where the majority of the land has remained in the hands of small peasant farmers, most of the land belongs to relatively large-scale state and co-operative farms. Individual farming activity continues, however, to exist, mainly in the form of so-called household farming of co-operative members and in the gardens of people working in the state sector of the economy. The role of the private and household sectors is significant, mainly in meat, vegetable and fruit production. (In some cases 30-40 per cent of the total production is due to these farms.)

In spite of the absolute increase of agricultural production its relative importance within the national economy shows a decreasing tendency in each of the countries of the area until the mid '70s. Since then a slight increase in the share of agriculture in total national income could be observed (see Table 3). Agriculture had the largest share in the production of national income in Bulgaria and Hungary in 1977 and the lowest shares (10.1 and 9.1 per cent) were in the GDR and in Czechoslovakia. The relative role of agriculture decreased also in the Soviet Union. In the period between 1965 and 1975, total national product more than doubled, while agriculture grew by about 1.7 times. The share of agriculture in the total national product of the USSR was 17.2 per cent in 1977.

Food consumption is vigorously increasing in the area and grew to a

relatively high level. Regarding total calorie consumption, each CMEA country reached the level of 3,000 calories daily. Comparing the consumption levels of the diverse countries, we can see that consumers' habits express the production potential determined by natural conditions. The inner structure of food consumption is not the most favourable, since the significant part consists of carbohydrates and starch, and the consumption of animal proteins lags behind the desirable level. The development was rather moderate in this respect. First of all, the significant increase in fruit consumption should be pointed out as one of the favourable structural changes, though the consumption of tropical fruits is still rather small. The level of vegetable as well as of milk and dairy product consumption is also relatively high. The meat consumption per caput can still be qualified as relatively small, even at present.

Undoubtedly, the increased incomes of the population played a significant role in the development of food consumption. At present cash availability presents no obstacles to an increase in food consumption per caput. Rising personal incomes and a relatively inadequate supply of manufactured consumer goods have created a situation in some of the countries where the income elasticity of food demand is unusually high. On the other hand, government planners use scientific norms of optimal diet to plan the development in per caput food consumption as well as supply. In this situation, the dynamics of food consumption depend on not only the income, but are also significantly influenced by the supply side.

The European CMEA region as a whole in recent years has had a negative balance of foreign trade in agricultural products. Only Bulgaria, Hungary and Rumania have a considerable positive balance while the agricultural foreign trade balance of the other countries is negative. The share of agriculture within the total foreign trade turnover of the smaller CMEA countries generally shows a decreasing trend and there is a great disparity in its importance among the countries in question. In contrast to this, the agriculture of the Soviet Union takes part to an always increasing extent in the foreign trade of the country and the significance of imports in the satisfaction of consumer demand is ever growing. The increase of the Soviet foreign trade turnover was most dynamic in 1974-75 when compared to the previous year the rate of increase reached 26 and 28 per cent respectively. Even so, however, only a very small part, 3 per cent, of the national income could be realized in the foreign trade turnover. The share of the socialist countries within the foreign trade of the Soviet Union is around 62-64 per cent. Within this increasing foreign trade turnover the share of agricultural products is relatively modest but is also increasing. Foodstuffs and raw materials of the food industry represent an increasing part of global foreign trade turnover (about 15-20 per cent). The share of agriculture within the exports is relatively small, while the share of agricultural produce within the imports increased from 15.9 per cent in 1970 to about 25 per cent in the late 1970s.

As far as the smaller CMEA countries are concerned, grain crops have an outstanding importance in agricultural foreign trade and their import is

particularly significant in the GDR, Poland, and Czechoslovakia; but Bulgaria also entered into the group of grain importing countries in 1975. The second in order of importance in imports is fruit, whose quantity most dynamically developed at the same time; it trebled between 1960 and 1975 and the increase of citrus fruit imports had a considerable role in this development. In respect to the exports, grain crops again (in the HPR and the RSR), as well as meat products, vegetables and fruit, had the leading part. The importance of Hungary and of Bulgaria is outstanding in the export of fresh, preserved and canned vegetables and fruit and that of Hungary and Poland in meat export is the most considerable. The general characteristic is that the greater part of the turnover is realized within the framework of the CMEA.

Until the year 1973 the Soviet Union had a net export of wheat but the import share of meat products was also relatively small. In consequence of the unfavourable weather conditions of the years 1972 and 1975 and in recent years, however, the foreign trade of these products has a negative turn and thereby increased the burden that was laid upon the Soviet balance of payment. A large-scale wheat and meat import was also rendered necessary by both the project declared for the improvement of living standards and the disadvantageously developed actual food situation. Concerning the structure of the export and import of the above-specified agricultural and food products, it is characteristic that the *export* of grain is destined for socialist countries, and the main source of *imports* was the United States (recently other countries, for example Argentina, Canada, and Australia, have gained an increasing role as sources of Soviet grain imports), while the major part of the imported meat and meat products has its origin from the capitalist countries and from Hungary. At the end of the 1970s the net grain import of the Soviet Union reached the 14-15 million tonne level annually. CMEA countries were the origin of most of the canned vegetables and about half of the fresh fruit and berries imported. Thus it can generally be established that the role of grains, meat and meat products as well as fresh and canned fruits and vegetables is outstanding within the foreign trade of the Soviet Union. The import of sugar is also considerable, coming almost entirely from Cuba. In recent years cotton was the only agricultural product of which the Soviet Union disposed of a significant surplus.

GOVERNMENT POLICIES REGARDING GROWTH IN AGRICULTURE

A common feature of agricultural policy in CMEA countries is that to produce the quantity needed for the planned level of personal consumption and industrial demand for agricultural products is the most important overall objective. This general target receives, of course, concrete content depending on specific conditions and the actual economic situation which prevails in the respective country and, in spite of the similarity of the basic

objectives, no uniform agricultural policy prevails. The development of industry is put in the centre of the economic policy in each country but, in addition, the increase of agriculture and of food production represents a politically very important task.

The investment policy regarding agriculture is also developed in this context. It is well known that investing activities develop in the CMEA countries according to central plans or in a way determined by them. Thus the scale of agricultural investments or their share within the total of investments gives at a given date expression to the state of economic funds available in the respective country for the implementation of agricultural development. The development of agricultural investments shows a rather varying picture for the region in question regarding both space and time. Agriculture is often allotted considerable financial means surpassing the rate of its contribution to national income, but the reverse example is not infrequent when even the proportionate part of income produced by agriculture does not remain in the sector but it is in part redistributed for the development of industry. If the concrete situation prevailing in recent years is considered, we can establish that the estimation of agriculture was fairly different in various CMEA countries, the role of agriculture within development plans and correspondingly the financial means invested in agriculture were also different.

Regarding the smaller CMEA countries during the last decade, in general the development of agriculture was not the main target. Therefore, the increase of agricultural investments did not surpass the rate of increase of all investments. In some countries (Bulgaria, Rumania) a considerable part of the national income produced in agriculture came to redistribution, that is was used in other national economic branches. The Soviet Union represents a different case, where the development of agriculture was stressed, and during the last two decades, the share of agriculture within all investments highly surpassed the level achieved in other CMEA countries. The fact that in the whole period of the Soviet régime until 1975, a total of 320 thousand million roubles was invested in agriculture, and of this 213 thousand million roubles (that is 66.5 per cent) were invested in the course of the last decade (that is in the period between 1966 and 1975) is more characteristic than anything else of the increasing role of agricultural investment. The redistribution of investment goods to the benefit of the development of agriculture was continued in the Soviet Union in the period 1976–1980. The share of agriculture within all investments was higher than its contribution to the national income (about 30 per cent of all investments were allocated to agriculture and food production).

A very important general characteristic of agricultural policy in the European CMEA countries is the particularly vigorous effort for self-sufficiency. It can be established, in fact, that a fundamental requirement in each country is that domestic demands for all products which can be produced in the respective country should be met to the greatest extent possible from domestic production. It can be observed in each country that the concrete treatment of agriculture and food production depends also

upon the state of the balance of payments. In those countries where natural conditions are favourable for agricultural production, the utilization of this sector for augmenting foreign currency receipts figures among the economic political targets. This effort is particularly vigorous in the case of Hungary, Bulgaria and Rumania, where the maximization of foreign currency receipts of the food production sector is one of the most important economic political tasks.

FUTURE TRENDS IN AGRICULTURAL POLICY

Concerning the details of the expected agricultural policy for the forthcoming years pertinent information is not easily available. Each of the countries in question has certain conceptions about the development of agriculture for a longer term, which includes the period lasting until 1990 and, in some cases, even until 2000. According to the practice of the CMEA countries, however, the Five-Year Plans represent the documents in which those decisions are fixed which are intended to be actually implemented. The present concrete plan period in each country started on January 1 1981. The development of agriculture according to available plan documents will receive more attention in each of the respective countries than previously. Moderate increases (8-10 per cent) in agricultural production are planned in Czechoslovakia and in the GDR. In the Soviet Union the total growth target is 12-14 per cent for the five-year period with the production of 238-243 million tons of grain annually. The targets are the most ambitious in Bulgaria and Rumania, where a 20-25 per cent development of production is aimed at.

Based on conclusions reported at various forums as well as upon the characteristics of the economic situation and on the analysis of the actual result of the current plan period in the respective countries, it is probable that the rate of general economic growth in the European CMEA countries will be more moderate in the forthcoming five years (or very likely in the next ten years) than it has been in the previous periods. The growth rate of agriculture will probably come nearer to the rate of general economic growth, but it will remain at the relatively moderate level of the late 1970s. It is also probable that, as a consequence of problems related to the balance of payments, efforts toward food self-sufficiency will increase and a greater stress will be laid thereby on the development of agriculture.

In connection with slower economic growth, it may be presumed that agricultural investments will increase to a smaller extent than they did so far and it is improbable that the share of agriculture will grow within the total of investments. The increase of grain and meat production will continue to be stressed to the greatest extent within agricultural development. Efforts for the establishment of a production structure better adapted to world market demands will certainly be confirmed in the food-exporting countries, and this will presumably further consolidate the role of the grain economy.

In CMEA countries, so-called direct and indirect policy instruments are

used to realize the targets given by the national plan and to manage agricultural production. In general it can be remarked that the application of direct means of economic management is the determinant in the majority of the countries. It is not probably that the basic nature of the government management system will be changed, but serious efforts to improve the efficiency of the system can be expected. It is most likely that economic incentives and indirect means will be applied more intensively to improve the efficiency of the government economic management of agriculture. The further growth of domestic producer and consumer prices of agricultural products seems to be unavoidable. The modification of the low food price policy might have an impact upon consumers' demands, too, and the wider range of price incentives will probably increase the overall efficiency of agricultural production.

The production potential of the so-called 'household farming' of cooperative farm members and industrial workers is far from being utilized in most of the countries. Production can be increased through this channel without government investment. Encouragement of the utilization of these reserves seems to be an economic necessity in the present situation. The increased support of household and individual agricultural production is a new characteristic of agricultural policy in several CMEA countries, including the Soviet Union, but its effect in the increased development of this sector has not shown itself so far. The further support of these activities can definitely be forecast and it is also very probable that the household sector will contribute to the fulfilment of the national target to a larger extent, especially in the forthcoming 5-10 years.

ALTERNATIVE SCENARIOS OF AGRICULTURAL GROWTH IN CMEA COUNTRIES

To forecast the future development of agriculture in the European CMEA area mathematical modelling was used as a basic methodology. Based on the CMEA model in the food and agriculture model system of the Food and Agriculture Programme of the International Institute for Applied Systems Analysis (Laxenburg, Austria), a mathematical model of the area was constructed. The model is actually a *descriptive, recursive simulation model*, which describes the food and agriculture of the area as a disaggregated part of an economic system closed at the national, as well as the international level.³ The model, which is eventually a system of interconnected models, is structured according to the major elements of the centrally planned food and agriculture systems.

In the model we assume that the most important long-range government policy objectives as the required growth rate of the overall economy, and private consumption as well as the share of agriculture in total investment, are fixed according to actual data of CMEA countries. Production is modelled by a nonlinear optimization model, consumption and trade are described by a special equilibrium model, government objectives are

adjusted by using heuristic routines. The product list of the model conforms to the commodity coverage of AT 2000, but certain commodities are aggregated (food and agricultural commodities in the model: wheat, rice, coarse grains, sugar, vegetables, bananas, citrus fruit, other fruit, vegetable oil, cocoa, coffee, tea, cotton, other non-food products, rubber, other feeds, beef and veal, mutton and lamb, pork, poultry meat, dairy products and eggs). The rest of the economy is represented in the model by one aggregated commodity. The model and its parameters are structured according to the Soviet Union and the smaller CMEA countries, and in practice is run according to two submodels which have identical structures. In the model FAO population and demand projections are used and it is fundamentally based upon data available at FAO.⁴

In the modelling experiment we assume moderate rates of economic growth according to FAO's AT 2000 Normative Medium Scenario. On that basis, two basic scenarios were calculated by the model, namely a *Constant SSR (self-sufficiency ratio) Scenario*, where SSRs of 1975 are kept as minimum requirements in production modules, and a so-called *Free Trade Scenario* where most of the restrictions on self-sufficiency ratios are released. To help to delimit the spectra of production possibilities starting out of the two basic scenarios, several other model versions have been computed, mainly by running the Soviet Union and Eastern European submodel separately. The major questions of these investigations were related to the impact of migration from agriculture; various levels of investment in agriculture; different balance of payment situations; changes in feeding efficiency, and so on.

The two basic scenarios and related calculations give reliable information on the possible lower and upper range of production. First of all, it is necessary to point out that the future course of agricultural development in CMEA countries will largely depend on the national situations. Efforts to satisfy growing consumer food demands and to increase or maintain the level of self-sufficiency can be considered the main driving forces of future growth. Of course, changes in international market conditions might also have some influence. High prices on the world market might represent an additional reason for developing agriculture to save foreign exchange in the importing countries and to utilize export potential in a surplus situation. Low international prices first have an influence on exporting countries, which in this situation might restrain agricultural development and invest more in other areas. However, the CMEA countries' reaction to world market changes will be much more moderate and lagged than that of other developed countries.

Our two basic scenarios are very similar so far as the projected overall growth of agricultural production is concerned. In contrast to the relatively moderate growth of the overall economy, a substantial growth of agricultural production can be projected (2-3 per cent annually). It can be expected that growth of production will be greater than that of domestic demand, parallel to the increase of SSR's of the most important agricultural commodities. This development reflects the fact that very substantial production reserves

exist in the area, especially in the Soviet Union. In our opinion, the significant investment allotted to agriculture in recent years will bear fruit in the forthcoming period, and even a moderate food surplus can be forecast by the end of the century. Domestic food demands are forecast according to FAO projections in our scenarios. On the whole, the CMEA region expects a relatively moderate growth of both domestic food demand and consumption. Regarding the total calorie consumption, each CMEA country has already reached a level of 3,000 calories daily. A further increase is not desirable, but the inner structure of consumption will change. During the forthcoming period the structural change of food consumption will be determined by the fast-growing consumer demand for meat and meat products, as well as for fruit and vegetables.

The projected growth of agriculture assumes that the substantial level of investment in agriculture will be maintained. As some of the results of our calculations indicate, agricultural development is closely related to the share of agriculture in total investment. The amount of investment allotted to agriculture determines the improvement of production equipment and physical resources of production in general. We expect about a 13.5 per cent share of agriculture in total investment in the smaller CMEA countries. Model runs with lower figures indicate that, considering the pressure from the consumer side and the need for foreign exchange, lower levels of agricultural investment are not very likely. These results also demonstrate that by increasing agricultural investment, the government can significantly increase agricultural output. In the Soviet Union the share of agriculture will probably fall below the present level, but it will remain relatively high; we expect about 20 per cent, surpassing the contribution of agriculture to total national income. The investigation of the possible levels of agricultural investment indicates that an agricultural share of less than 15 per cent would seriously threaten the realization of major government objectives. Substantial investment in agriculture must also continue in order that the fluctuations in yields and the unfavourable impacts of weather conditions on agriculture be reduced. On the whole, agriculture has to remain at the top of the government preference list.

Labour will still remain a very important factor of agricultural development in the region. Migration from agriculture toward industry and other branches of the national economy will undoubtedly continue. Migration which is not associated with investment to compensate for the departing labour can limit production growth, especially that of labour-intensive products. Our calculations indicate that the estimates of FAO on agricultural population can be considered as one of the possible future trends. For the Soviet Union, the FAO estimates 7.5 per cent of total labour force in agriculture in 2000, and for the other CMEA countries about 15 per cent. Having made calculations with several possible migration levels and after comparison with other developed countries, we have come to the conclusion that migration from agriculture in the Soviet Union will most likely be somewhat less and in other CMEA countries somewhat more than FAO projections. Our projection is a 10 per cent share of agriculture in total

working population in 2000, and this is the figure used in the basic scenarios.

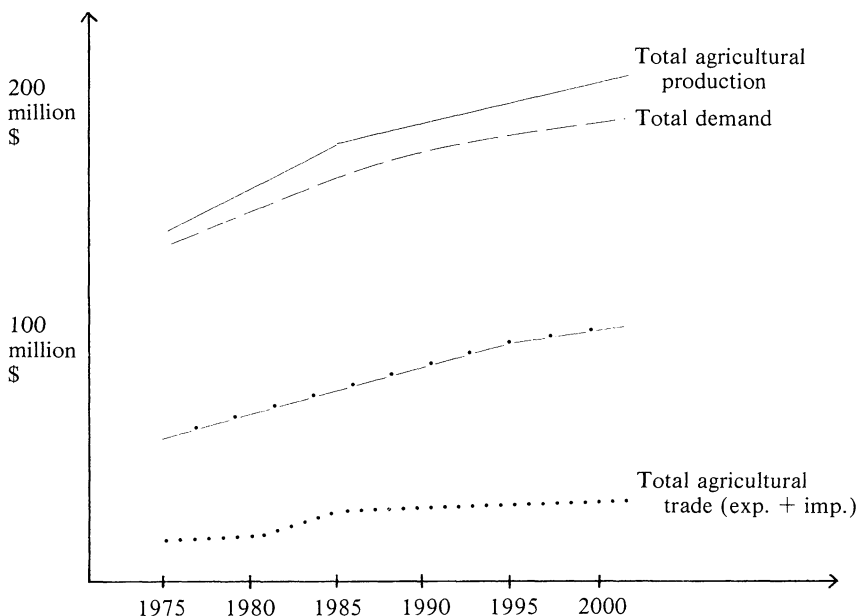


FIGURE 1 *General indicators of Constant SSR Scenario*

CONSTANT SSR SCENARIO OF AGRICULTURAL DEVELOPMENT

In this scenario the actual SRRs in 1975 of the Soviet Union and the smaller CMEA countries were considered in both submodels as minimum requirements. Analysing the results presented in Table 4 one should remember that upper bounds were not given in the model. Therefore, production growth above the minimum requirements was allowed (see Figure 1). This scenario shows the very considerable agricultural potential of the region. As one can see in Table 4, production of various commodities grows at least parallel to demand or even faster; SSRs, therefore, remain stable or show a continuous increase up to 2000. On the whole the overall food SSR increased. This scenario reflects the realization of the existing long-range policy objectives in CMEA countries aimed at self-sufficiency in food production. The projected food SSR for 2000 is 1.01; practically all cereals are produced domestically, and the substantial surplus of wheat allows an increase in meat production above the projected, relatively moderate level.

Continuing past trends, growth in animal husbandry is faster than that of crop-growing. The substantial meat surplus will most probably be consumed

TABLE 4 *Agricultural output and SSRs of CMEA countries – Constant SSR Scenario*

	1975		1990		2000	
	Total Output	SSR	Total Output	SSR	Total Output	SSR
Total cereals ¹	254369	0.93	390056	10.98	437650	0.99
Wheat ¹	108868	0.93	151725	0.98	166508	1.00
Rice ¹	2135	0.75	3837	0.79	5182	0.80
Coarse grain ¹	143366	0.92	234494	0.97	265959	0.99
Total meat ¹	22945	1.11	33830	1.38	37505	1.32
Beef and veal ¹	8551	0.99	13604	1.35	14744	1.32
Mutton and lamb ¹	1159	1.02	1845	1.49	1991	1.43
Pork ¹	10564	1.25	14357	1.49	15816	1.42
Poultry meat ¹	2671	1.07	4024	1.12	5042	1.04
Milk and milk prod. ²	129507	1.00	203398	1.13	221520	1.14
Sugar ¹	11798	0.75	16109	0.88	19268	0.95
Vegetable oil ¹	4937	1.11	6258	1.05	7361	1.06
Citrus fruits ³	135	0.11	135	0.08	135	0.06
Other fruits ³	26753	1.09	41032	1.25	45598	1.16
Vegetables ³	17847	0.99	24069	1.01	26740	1.02
Cotton ¹	7662	1.00	1847	1.20	12105	1.20
Other non-food ³	1135	0.90	2139	1.40	3104	1.74
All agr. comm. ³	138890	1.00	205560	1.10	230409	1.11
Total volume of ³ agr. trade	7491	5.4	22249	10.8	23196	10.1

¹ in thousand metric tons

² in milk equivalent

³ in million 1972 US \$

to a great extent domestically, since the projected 66 kg/caput consumption leaves enough room for further increases and there is no question that consumer demand will also exist for higher quantities. The projected level of grain production, 437 million metric tons, seems to be optimistic, but not totally unrealistic. The SSR in this respect grows continuously and the present grain deficit of the area disappears. The volume of agricultural trade (see Figure 1) grows faster than production, but still remains at a relatively low level (10 per cent of the output). Beside tropical fruit, coffee and citrus fruit, rice, sugar, and tea have SSRs considerably lower than 1. On the other hand, fruit, cotton and most of meat products have a considerably higher SSR than 1.

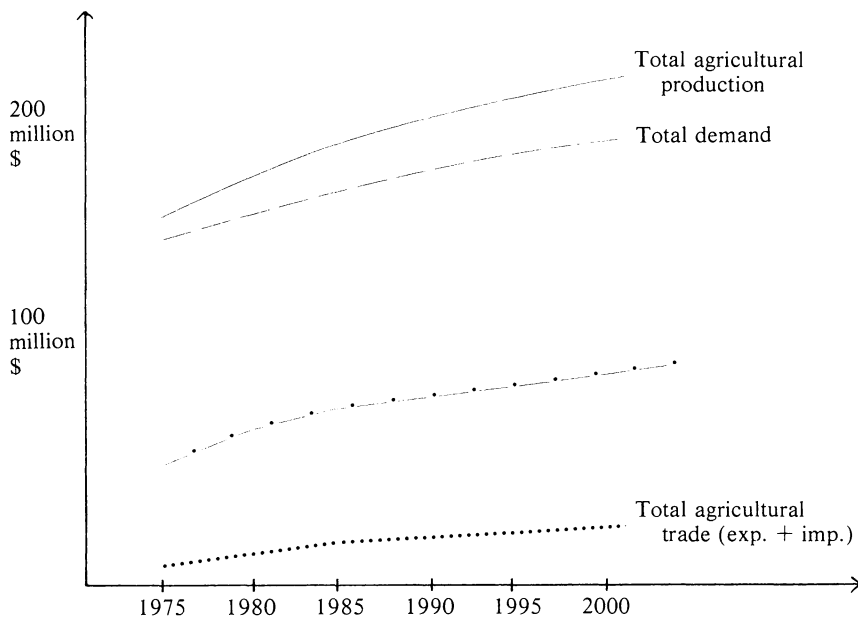


FIGURE 2 *General indicators of Free Trade Scenario*

FREE TRADE SCENARIO

This scenario reflects a less constrained production development than that of the Constant SSR Scenario. Constraints on minimal levels of producing various commodities have been removed, and the structural changes and developments were limited only by available resources. As Figure 2 shows, the overall agricultural growth is somewhat higher in this case, but the basic patterns of development are not different than those of the Constant SSR Scenario (see Table 5). Without restriction on the SSRs of the commodities, the relative role of animal husbandry becomes higher than at Constant SSR Scenario (SSR of meat is 1.40). The development of animal husbandry is based partly on imported feeds. The Free Trade Scenario, which releases the restrictions of agricultural production, obviously leads to a faster growth of agricultural trade of the area.

The fastest-growing area of agriculture in this scenario is animal husbandry. Production growth rates lead to substantial increases in the SSRs of animal products, generally to levels greatly in excess of domestic needs. The meat surplus seems to be substantial, even if consumption above the projected level is expected. Meat production is partly based on imported

TABLE 5 *Agricultural output and SSRs of CMEA countries – Free Trade Scenario*

	1975		1990		2000	
	Total Output	SSR	Total Output	SSR	Total Output	SSR
Total cereals ¹	254369	0.93	378740	0.93	420710	0.93
Wheat ¹	108868	0.93	147969	0.95	158439	0.94
Rice ¹	2135	0.75	1722	0.36	955	0.15
Coarse grain ¹	143366	0.92	229049	0.93	261316	0.94
Total meat ¹	22945	1.11	35043	1.42	39998	1.40
Beef and veal ¹	8551	0.99	14002	1.39	15581	1.39
Mutton and lamb ¹	1159	1.02	1895	1.53	2097	1.17
Pork ¹	10564	1.25	14974	1.55	17024	1.52
Poultry meat ¹	2671	1.07	4173	1.16	5295	1.09
Milk and milk prod. ²	129507	1.00	209886	1.15	23507	1.17
Sugar ¹	11798	0.75	14710	0.80	16968	0.84
Vegetable oil ¹	4937	1.11	5834	0.99	6636	0.96
Citrus fruits ³	135	0.11	135	0.08	135	0.06
Other fruits ³	26753	1.09	40074	1.22	44978	1.12
Vegetables ³	17847	0.99	22413	0.94	23455	0.89
Cotton ¹	7662	1.00	15437	1.68	20680	2.06
Other non-food ³	1135	0.90	2247	1.47	3374	1.89
All agr. comm. ³	138890	1.00	206124	1.10	232410	1.10
Total volume of ³ agr. trade	7491	5.4	30794	14.9	41592	17.9

¹ in thousand metric tons

² in milk equivalent

³ in million 1972 US\$

feeds. By reducing meat surplus, grain self-sufficiency could be reached. In addition to animal products, a surplus can be expected for cotton, other-food and other fruit products. The SSR increases especially for cotton production. On the import side, rice plays the leading role (SSR only 0.15), but there is also a deficit in sugar, vegetables, vegetable oil and tea, and it is obvious that tropical and Mediterranean products must be imported. In the Free Trade Scenario the agricultural trade of the area shows a significant increase. In 2000 agricultural trade (export and import) amounts to 17.9 per cent of output, which does not seem to be a totally unrealistic figure. Obviously, the realization of this trade potential largely depends on to what extent trade restrictions in other countries (for example, meat import restrictions of the EEC) are relaxed.

FUTURE PERSPECTIVES IN PRODUCTION OF CEREALS

The grain sector, especially the feed grains together with other feeds, form the main bottleneck in agriculture of the CMEA countries at present. Efforts to increase meat production in order to meet fast-growing consumer demands, together with a relatively low level of feed conversion rates, are expressed by the overall negative grain balance of the region. The main reason for excessive feed consumption is a physiologically unbalanced composition of rations, mainly a lack of digestible protein. Significant losses in nutrients and vitamins, caused by the not yet consistently high technical level of harvesting and feeding, but especially by the lack of adequate storage facilities, also exert a negative influence on feeding efficiency. According to OECD estimates, the increase of digestible protein content in one kg of unit feed from the present 85-86 grams to 105-110 grams could in itself be sufficient to improve the feed conversion ratio by 25-30 per cent. This could save about 20-25 million tons of grain in the Soviet Union alone. The region has all the production potential to be self-sufficient in grain production, and the importance of the increase in meat production assures that the investments required to improve feeding efficiency will also be forthcoming. Our scenarios forecast 420-430 million metric tons of grain production for the year 2000. It is most likely that the actual development will follow the line of the Constant SSR Scenario. The domestic food grain needs will definitely be satisfied by domestic production, as well as the feed requirements necessary to produce enough meat to reach the projected level of meat consumption and/or export, but the area might once more become a net exporter of limited quantities of grain. But we should mention that, given the apparently low capital productivity in agriculture, it is highly unlikely that most of the CMEA countries, and especially the Soviet Union, will put more capital into agriculture than is necessary to gain full SSR in grains. Substantial grain import, as in the Free Trade Scenario for the production of meat for export, is not likely to happen, except under a very favourable market situation or if investment levels fall well below expectations.

In our commodity classification protein feeds do not appear as a separate product. The CMEA area has a deficit in this respect. As was referred to above, the relatively low feed conversion rates are partly due to the lack of proteins. Therefore, even though the computed results do not show it, fast increasing demand can be expected for protein feeds in the area. The projected growth of vegetable oil production will cover consumer needs and some surplus might occur. Considering production possibilities and the given natural conditions in the area, the deficit in protein feeds is not likely to disappear until 2000. So far as cereals are concerned, rice has the lowest projected SSR. In the Free Trade Scenario, rice SSR drops continuously and most of the domestic requirement is imported. When irrigation projects and climatic conditions in Soviet Middle Asia are taken into account, the actual trends will probably be closer to the Constant SSR Scenario, where rice SSR is about 0.80. Some rice deficit of the area, about 1 million metric tons of import seems definitely to be a realistic forecast.

DEVELOPMENT OF ANIMAL HUSBANDRY

Meat production and animal husbandry will be the fastest-growing area within the CMEA agriculture. Both basic scenarios, as well as the related calculation, project considerable growth. The existing meat surplus of the area (SSR 1.11 in 1975) is associated with a moderate level of consumption. The need for foreign exchange in these countries encourages meat exports and limits imports and domestic supply. The production of enough meat for increasing domestic demand is the focus of agricultural policy in the area. This policy assumes the domestic production of feeds as well. One of the most important constraints on future meat production is the growth of domestic feed production.

- Producing meat along the lines of our relatively moderate demand projections seems to be the lower boundary of expected production. In case of unexpected difficulties on the feed side, the import of feeds can be expected, rather than significant meat imports.
- If grain production develops favourably, it will at first result in the increase of domestic meat consumption and only in the case of further opportunities can meat production for export be considered probable.
- Improvement in feeding efficiency can be expected and, if it is accomplished, it can advantageously influence the overall meat production potential.

Along with feed availability, the development of animal husbandry depends on further capital inputs and investments, as well as the availability of the labour force in agriculture. Our computations clearly demonstrate that meat production reacts very sensitively to the level of agricultural investment. Reduction of agricultural investment makes itself felt first in meat production. This is not very surprising and leads to the conclusion that the realization of a meat surplus projected by our two scenarios is rather uncertain when seen from the point of view of present investment trends. Available labour force represents a very important constraint on production growth, but particularly in animal husbandry. Calculation results, even the comparison of the two basic scenarios, indicate that there is serious competition between the labour-extensive and labour-intensive branches of agriculture. Labour can really become a limiting factor during the second half of the projected period. Larger outmigration than that projected by the basic scenarios may result in the fall of production growth in cattle and pig husbandry as well as in fruit production. In place of these activities, a grain surplus and a further increase in poultry production can be expected.

On the whole, the almost 40 million metric tons meat production in 2000 shown in the Free Trade Scenario is almost certainly the upper limit of foreseeable development. Actual growth will more likely follow the Constant SSR Scenario and is expected to be around 33-36 million metric tons. Substantial surpluses of meat will probably not appear on international markets. Export can be expected from the smaller CMEA countries, but not exceeding the level of 4-5 million metric tons, which is double the

present export quantity. The internal structure of meat production is not likely to change remarkably. Growth is fastest in poultry production, but beef and mutton and lamb production have almost similar rates of increase. Pork production increases at a somewhat lower rate. SSRs increase in each case, except for poultry, where demand growth exceeds the rate of production development.

NOTES

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² The analysis made by the CMEA Agricultural Model was used as explanatory and background material in the Agriculture Toward 2000 project of FAO (see Csáki, 1982). The support of Dr. J.P. Hrabovszky and Dr J. O'Hagan of the FAO to this work are also acknowledged.

³ The Food and Agriculture Model System of IIASA see Keyzer (1980), Fischer and Frohberg (1980), and Csáki (1981).

⁴ The detailed description of the model is given in Csáki (1982).

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DISCUSSION OPENING – HIROYUKI NISHIMURA

Professor Csaki's paper is a fine well-organized work and brings us important information. The author presented an interesting paper concerning agricultural modelling work at the last conference (Csaki, 1981). Since that time I have been looking forward to hearing his results and their interpretation.

With respect to the present paper, I am sure that it has brought us a meaningful suggestion concerning a quantitative approach. I agree that this kind of analytical tool plays a significant role in the planning and management of food and agriculture. However, regarding the interpretation of the study results, I have to confess that I do not have any special knowledge of the CMEA member countries, other than a general knowledge of the theoretical approaches.

Professor Csaki's paper gives a broad picture of how policy can affect the development of agriculture. Although most parts of his presentation are specifically related to CMEA member countries, some of the issues and policies discussed are relevant to the further development of techniques applicable in the planning of other regions.

The paper intends to show the limits and potential of agricultural growth of the area by using a mathematical model. The basis of the analysis is the CMEA Agricultural Model. The model is consistent and comparable with the IIASA's Food and Agriculture model system.

The fundamental characteristics of the IIASA model are: (a) a descriptive character; (b) a recursive simulation technique; (c) linear and non-linear; programming, and econometric methods used in the subsystems.

An aggregated CMEA model was constructed based on the IIASA's model and on experiences resulting from the Hungarian Agricultural Model. The CMEA model is designed to apply to the centrally planned countries. In it, similarly to the general structure and the Hungarian Agricultural Model, the main underlined assumptions are as follows: (a) long-term government objectives are taken as exogenous variables; (b) the central decisions on the production structure of agriculture are transferred directly to producing enterprises. Thus a producer's decision model is not included. The major policy goals in agriculture are to secure an adequate enough consumption level for farm products, which was determined by the national plan.

The important characteristic of agricultural policy in the CMEA countries appears to be the particularly large effort for self-sufficiency. The other characteristic which Professor Csaki observed is the state of the balance of payments.

While care was needed with regard to the underlying assumptions of such large scale models, the approach covered and interpretation of the study results in the paper seem very interesting. It could provide a valuable basis for future research.

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DISCUSSION – RAPPORTEUR: RAMESH SHARMA

Four participants from the floor commented on the paper by Professor Csaki on three issues: uncertainty aspects, private versus state farms, and pricing assumptions. It was asked whether elements of uncertainty and producer decision models were incorporated in the model. Another speaker asked about trends in production from the private and household sector compared with that of the large state farms, and if these aspects were included in the model. On the free trade scenario of the model, assumptions for pricing in the CMEA countries are important and a question raised was whether these prices relate to world prices or were they centrally planned?

In response Professor Csaki replied that free trade generally means trade within the CMEA countries. He pointed out that as these countries are centrally planned, uncertainty and producer decision models are not considered. The model cannot shed much light on separate production from the private and household sector, but this sector is closely related to the public sector. He reckoned that these models are as useful to CMEA countries as they are for market economies.

Participants in the discussion included J.P. Hrabovszky, M.G. Chandrakanth, J.F. Martin and W. Henrichsmeyer.