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AN EVALUATION OF EC CEREAL POLICY INSTRUMENTS

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ABSTRACT

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The EC arable sector is analysed on the basis of information about the historical development of markets and prices and data as taken from the Farm Structure Survey. Two policy scenarios are evaluated with the help of a model for the EC cereal and compound feed raw material market. Projections for supply, demand, agricultural income, effects on consumers and taxpayers are made for the period 1988 to 1996. The set-aside instrument and the Maximum Guaranteed Quantities are evaluated against the background of these two scenarios. One of the main assumptions of the study, that yields will increase in the future as they did in the past, is examined and opportunities to extensify cereal production in the EC are analysed. On the basis of this information, the recently introduced regulation to extensify agricultural production is evaluated for the cereal sector. It is concluded that given the instruments the markets for arable products will only reach a reasonable equilibrium if yields increase less in the future than they did in the past, otherwise a substantial acreage reduction of arable land will have to take place, which will be very expensive. It is further concluded that research into the efficient use of fertilizers and agrochemicals, as well as information on the findings of that research to the farmers will be more important than a premium to extensify cereal production, as recent price changes will have an effect on the optimal level of these variable inputs.

Agriculture/Arable farming/Cereals/EC/Economic models/Policy/Extensification

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References

As cereals are the most important arable crop for food supply in the world, they have always attracted the attention of (agricultural) economists and politicians. Within the EC, the cereals policy is seen as a cornerstone of the Common Agricultural Policy (CAP). This fact is demonstrated again in the recent proposals of the Commission, concerning 'the development and future of the Common Agricultural Policy' in the EC; it is proposed to change the EC cereal policy instruments first and most radically.

In 1988, the Agricultural Economics Research Institute published a study concerning the EC cereal policy. This paper starts from that study and evaluates the expected effects of three recently introduced new instruments: Maximum Guaranteed Quantities for cereals, oilseeds and protein crops; the EC set-aside programme; and extensification.

This study was written in 1989 and published in France in September 1991 in 'Cahier d'Economie et Sociologie Rurales' under the heading 'Une évaluation des instruments de la politique céréalière de la CEE'. As it was originally written in English and it is expected that a number of interested policy-makers, businessmen, scholars and students are more familiar with the English than the French language, we decided to publish the original text as well.

The Director

The Hague, February 1992 L.C. Zachariasse

1. Introduction

What is the problem of the arable sector in the European agricultural sector? Is it the fact that farmers produce more than the market demands or is it its low degree of competitiveness compared to cereal exporters such as the United States of America, Canada and Australia? Or are the EC cereal prices simply too high and should they be decreased to lower supply, increase demand and stimulate competition? These are just some of the questions we will dwell upon in this study.

Like most socio-economic problems, the EC cereal surplus problem seems to increase in complexity the longer it is studied. Simple statements like this do not recognize this complex problem, however. The cereal policy is the cornerstone of the Common Agricultural Policy (CAP), therefore it cannot be considered in isolation from the other crops. It even has a strong impact on the intensive livestock and dairy sector. The consequences for the horticultural sector may be less, but even there they will not be totally absent. The income of the farmers in all those sectors are influenced by changing the cereal policy. A coherent analysis should also take into account the consequences for taxpayers, consumers and the industries dependent on the agricultural sector.

It is relatively easy to 'invent' a new instrument, to say that it is administratively simple and to show that it works on paper, just evaluating some effects that are esteemed to be worthy. Most of the time the budget costs are taken into account by economists, mainly for two reasons I suppose: 1) the level of budget costs seems to be favourite among politicians in this decade: the lower the better without discussion where the money is spent on! 2) for economists, it is relatively simple to calculate these costs, while the effects on farmers and consumers income are more difficult and questionable.

In this study I will try to give an integral picture of the consequences of two policy scenarios. The effect of the Maximum Guaranteed Quantities (MGQ's) for cereals, oilseeds and protein crops introduced in 1988 are evaluated against the background of these policy scenarios. The set-aside programme will be discussed and analyzed in the same setting, and we will go into the possibilities of extensifing agricultural production. The study will be closed with a discussion about crop production in the EC, taking into account future international and technological developments and conclusions about a desirable EC cereal policy.

2. Some exercises in EC cereal policy 1)

2.1 Figures from the past: market and prices

The 1989 EC cereal production will be about 160 million tons (The Commission decided 160.5 million tons), equal to that in 1985 and not very different from the levels in the years in between. Meanwhile, the number of hectares has declined, except in the last year. From the historical point of view, the EC cereal production seems to be rather stable.

During the last twenty years, the cereal yields have increased at about 2.3 to 2.6 percent a year in the EC-9. This is the combined result of farmers shifting their cropping plan from rye, barley and oats to higher-yielding wheat and maize and increased input of nitrogen and agrochemicals.

During the eighties, the area of cereals in the EC-9 declined by about 2 million hectares (8%), from more than 27 million hectares to 25 million hectares, due to changes in the agricultural policy for the arable sector. For cereals there was a restrictive price regime, and the oilseeds and protein crops were stimulated.

The internal market for cereals has shown a remarkable stability in the last fifteen years: about 110 million tons in the EC-9 and 140 million tons in the EC-12. The human consumption, industrial uses and seed categories show little variation. On the other hand, the demand from the feed sector shows variation, mainly caused by world market developments: prices and the ECU/Dollar exchange rate. Since 1984, the ECU price of maize on the world market has declined by more than 50 percent. This is enough to nullify the positive effect of decreased EC cereal prices, during these years, on their competitive strength in the EC feed market. But in effect the impact is even worse than that, because the EC lost about 8 million tons in the EC feed market.

Since the beginning of the seventies, the real prices for cereals and total crop production have declined as the figures in table 2.1 show. These figures indicate that there are differences between countries and that wheat prices declined slightly more than those for barley. But this difference in price development between both cereals is certainly not enough to stop the trend from shifting from barley to wheat, because yields per hectare grew much faster for wheat.

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1) This part of the article is based on Blom (1988a).

Table 2.1 Price developments of crop production, wheat and barley in the member states of the EC-9. Index: 1980=100

Year	B	DK	D	F	IRL	I	NL	UK
	CROP PRODUCTION a)							
1973	126.5	120.7	106.8	120.5	120.5	116.1	123.1	130.1
1983	110.5	102.0	92.9	99.9	85.4	92.1	100.0	107.9
1987	86.1	79.2	80.7	83.1	66.6	82.6	89.7	85.7
	WHEAT RELATIVE TO CROP PRODUCTION b)							
1973	102.9	97.8	111.3	102.8	139.5	101.6	110.1	104.1
1983	94.3	96.0	98.7	96.6	109.5	95.5	99.7	92.0
1987	94.2	86.6	86.8	90.4	106.1	83.2	83.8	84.6
	BARLEY RELATIVE TO CROP PRODUCTION c)							
1973	104.0	97.6	111.8	101.9	118.8	105.9	103.9	98.5
1983	99.6	98.3	100.1	100.4	111.9	97.4	104.4	93.6
1987	98.6	92.5	88.7	88.8	98.8	87.7	89.9	88.4

a) Index=(price index crop production)/(consumer price index);
b) Index=(price index wheat)/(price index crop production);
c) Index=(price index barley)/(price index crop production).

In the period 1973/1983, real cereal prices remained in balance with the prices for total crop production. Prices for crop production as a whole declined by about 2.5 percent per annum during this period. From 1983 onwards, cereal prices declined more than the rest of crop production. Real cereal prices have decreased by 3 to 3.5 percent a year from 1973 to 1987; this implies that since 1983 real cereal prices have declined by about 5 percent per year.

The consequences of an ever-increasing EC cereal production and a stable internal demand are reflected in the EC cereal trade balance and the EC grain stocks (see table 2.2). Net cereal export of the EC-9 increased by 30 million tons in eleven years, and during the same period the internal cereal stock increased by 10 million tons. The latter fact is certainly not alarming if we take into account that the EC has become an important exporter of cereals. In that position the EC should be a reliable supplier of cereals and therefore a higher level of stocks is in accordance with this new role.

Table 2.2 Net EC cereal exports; x 1000 tons

Cereal	EC-9			EC-12		
	1975/76	1979/80	1986/87	1986/87	1987/88	1988/89
	NET EXPORT					
Wheat	2 357	6 152	14 386	7 240	6 370	4 070
Coarse gr.	-11 350	-5 886	7 905	19 760	19 630	31 930
Total	- 8 993	266	22 273	27 000	26 000	36 000
	STOCKS					
Wheat	7 900	8 200	12 100	16 400	16 200	
Coarse gr.	5 100	5 100	11 700	15 100	12 600	
Total	13 000	13 300	23 800	31 500	28 800	

Sources: Eurostat, crop production; Commission FAO, FOOD OUTLOOK (stock data for the EC-12).

2.2 Figures from the past: production structure

In 1983 the EC-10 had 6.5 million agricultural enterprises. On 4.6 million of these farms (72 %) there was some crop production. Cereal production was reported on 3.4 million farms (Eurostat, Farm Structure, Survey 1983). The number of specialized arable farms was not more than 1.4 million.

These figures make it clear that cereal production is a verywide spread activity in European agriculture. That means that any change in the EC cereal policy touches nearly the whole agricultural sector. This feature of European agriculture is often overlooked by outsiders when they advocate a two price system for the EC (cf. Gorter & Meilke, 1987). While the figures show that many farmers are involved in cereal production, a relatively small number are responsible for the bulk of the cereals produced, as is shown in table 2.3.

About 25 percent of the largest farms with cereals in the cropping plan have 75 percent of the cereal area. If we take into account that 55 percent of the cereal area on smaller farms is found in Greece and Italy with much lower yields than in the Northern countries of the EC, it will be clear that more than 80 percent of the cereal production comes from the 25 percent largest farms. It seems plausible to assume that about ten percent of the largest farms with cereals produce 50 percent of all cereals in the EC. Eighty percent of this production is located in three countries: UK, France and Italy (North).

Table 2.3 Distribution of farm enterprises and the area of cereals according to farm size classes; EC-10, 1983

Farm size class	Enterprises			Hectares		
	number x 1000	%	cum. %	number x 1000	%	cum. %
< 5 hect.	1 433	41.5	41.5	1 629	6.0	6.0
5 to 20 ,,	1 110	32.2	73.7	5 065	18.7	24.7
20 to 50 ,,	616	17.9	91.6	7 403	27.3	52.0
50 to 100 ,,	207	6.0	97.6	5 845	21.5	73.5
> 100 ,,	83	2.4	100.0	7 210	26.6	100.0
Total	3 449	100.0		27 152	100.0	
< 4 ESU *)	1 420	41.2	41.2	1 969	7.3	7.3
4 to 16 ,,	1 120	32.5	73.7	5 258	19.4	26.7
16 to 40 ,,	632	18.3	92.0	7 809	28.8	55.5
> 40 ,,	278	8.1	100.0	12 078	44.5	100.0
Total	3 450	100.0		27 114	100.0	

*) ESU (European Size Unit) = 1000 ECU Gross Standard Margin.

Twenty to forty percent of the smaller farmers (< 20 hectares) have additional income from outside agriculture; especially those younger than 55 years (40 to 50 percent).

There is still another characteristic of the production structure relevant for policy-makers: more than 20 percent of the European farmers are older than 65 years and about 50 percent older than 55 years (1983). This means that many farmers will have to decide within a few years about the continuation of their enterprise.

Many farms are too small to generate an income, as table 2.3 shows. Of course the minimum acceptable size will depend on the reference income in the region where the farm is located; it will be different in the South of Italy compared to the North of Germany. But nevertheless it is reasonable to expect that the number of farms will decrease remarkably in the next decade (30 to 40 percent).

The majority of agricultural enterprises are located in Less Favoured Areas (LFA's): 62 percent in 1983 in the EC-10. It is estimated that no more than 15 percent of the cereal production comes from LFA's (28 percent of the cereal area). Direct income support is already possible in these areas.

In short we can conclude that a relatively small number of farmers produce more than 80 percent of all cereals; that the modal EC farmer is more than fifty-five years old; thirty to forty percent of the younger farmers have an additional income from sources other than agriculture and the majority of farmers live in LFA's.

At first sight, these figures seem to be alarming if we think about the competitiveness of the EC in a world market perspective. But if unit costs per ton of wheat in the EC are compared with those in the USA, there is no reason for pessimism (Commission, 1985; Stanton & Neville Rolfe, 1986). The UK, Denmark and also Ireland and France seem to have lower or equal cost prices for wheat as farmers in the USA. Of course this position is dependent on the ECU/Dollar exchange rate, but with an exchange rate of 1.0 the larger EC cereal producers are capable of competing with the USA wheat producers. On top of this, the EC has the advantage of a more favourable location. Wheat from the USA has to be transported over long distances before it can be exported, while the EC farmers in Northern Europe are at a shorter distance from sea-ports.

The story is quite different for coarse grains. The unit costs for maize in the USA are 80 to 90 ECU per ton, while the costs of production for barley (the most important feed grain in the EC) are 120 to 125 ECU per ton in the UK. This means that the EC will only have a natural protection in this market as long as transport costs are at least 40 to 45 ECU per ton. This is also the main reason, further stimulated by the CAP, for the large imports of so-called cereal substitutes by the EC. These concentrates have to compete with maize in the world market or barley/wheat in the EC. We can even conclude that the CAP, with high threshold prices for coarse grains and no protection for cereal substitutes such as cassava and corn-gluten feed, has undermined the competitive strength of EC agriculture. As a consequence of this policy, the EC demanded less coarse grains, which, ceteris paribus, has resulted in lower prices for maize on the world market. This has stimulated the trade in and even production of cereal substitutes. Supplies that would otherwise have never appeared, have been created outside the EC.

2.3 The consequences of an unchanged trend

What will be the effect of ever increasing yields for cereals while the internal market is stagnant? Some simple calculations are presented to indicate the consequences. These calculations have been made for a period of ten years, starting in 1987, on the following assumptions:

- there will be 35.3 million hectares of cereals in the EC-12;
- the yields increase at 2.6 percent per annum;
- the internal market is 140 million tons;
- net exports are constant at a level of 20 million tons;
- the storage costs for cereals are 25 ECU per ton a year.

Table 2.4 The consequences of an unchanged development for the EC cereal sector during the period 1987-1997; EC-12

		1987	1990	1995	1997
Production	(mill. tons)	166	180	204	215
Import	,,	5	5	5	5
Int. Demand	,,	140	140	140	140
Export	,,	25	25	25	25
Change in Stock	,,	6	20	44	55
Opening Stock	,,	25	58	207	302
Storage costs	(mill. ECUs)	625	1 463	5 180	7 553
Surplus area	(1 000 hect.) *)	1 438	3 941	7 724	9 100

*) Surplus area = Change in Stock/Average Yield per Hectare.

The results appear in table 2.4. The production, according to these calculations, will be 215 million tons in 1997, and stocks will increase by more than 50 million tons per year. If nothing is done, stocks will increase to over 300 million tons in 1997, but the costs will be prohibitive (7.5 milliard ECU). To prevent this, 7.9 million hectares of average-quality land should be taken away from arable farming (10% of total arable land). Taking into account that the less fertile soils are taken away from production, it may be necessary to find alternative uses for 15 percent of all arable land.

2.4 Two different price scenarios and the consequences

The central element in the current EC cereal policy is to lower prices of cereals and other arable crops. Also, the recently introduced Maximum Guaranteed Quantities are just a more institutionalized way to lower these prices (see section 3). In this section we will trace the impact of price reductions. After a short introduction of the model used and the main assumptions of the study, the effects on supply, demand, prices and cereal stocks as well as on farmers' income, consumers' welfare and the EC budget are evaluated.

2.4.1 The model and the assumptions

The results presented in this section are mainly generated with the Cereal and Compound Feed Raw Material Market Model (CCM Model). This hybrid market model has been developed by the author within the Agricultural Economics Research Institute (LEI-DLO), The Hague. The current model was built in the beginning of the eighties and contains only the EC-9 countries. A new version for the EC-12 is available since 1990. The CCM-model is a policy simulation model. The results should not be seen as a forecast but as a reliable and consistent way of evaluating policy scenarios.

On the supply side, the development of the total area of arable land is based on a recent trend (+ 0.11% per annum during 1983-1986). Changes in the cropping plan of year t are, in the model, determined by changes in the Gross Revenues per hectare in year t-1. The cropping plan is determined in two steps with the help of a translog production function (cf. Christensen et al., 1973). In the first step, the land is allocated to the main categories of arable crops: cereals, potatoes, sugar-beet, oilseeds, fodder crops and the remaining (e.g. protein) crops. The assumed supply elasticity for cereals is 0.5 and in the eighties there is evidence for the EC-9 that this level is realistic. In the second step, the cereal area is allocated to the different cereals: soft wheat, rye, barley, oats, maize and the remaining cereals (e.g. durum wheat). The supply elasticity of wheat is assumed to be 1.0. The other price and cross-price elasticities are derived from these two elasticities in a consistent way.

On the demand side, four outlet categories are distinguished: direct human consumption, feed, industry and seed. The feed category consists of two separate outlets: direct use on the farm or on another farm and use in compound feed. Table 2.5 shows the importance of each category.

Table 2.5 Internal cereal demand by outlet category; EC-12; 1988/89; (mill. tons)

	Outlet category						
	losses	human cons.	industry	feed		seed	total
				direct	compound		
Demand	0.9	36.4	10.4	51.3	31.0	5.4	135.4

The demand functions for all categories, except the compound feed industry, are of a log-linear type, and the volume depends on the price, the price of substitutes, the prices of other goods and services and income development (cf. Deaton & Muelbauer, 1980; the Stonemodel). The demand for cereals by the compound feed industry is simulated with the help of linear programming models (LP models) for 19 different regions in the EC-9 and nine types of compound feed per region: 3 for cattle, 3 for pigs, 3 for poultry. The compound feed sector produces 100 million tons of compound feed per year (EC-12) and the input of cereals is 31 million tons (see table 2.5). This is the only cereal outlet in the EC that is highly sensitive to price changes.

World market prices are assumed to decrease by 2.5 percent per year during the period considered and the ECU/Dollar exchange rate is kept constant at the October 1987 level (1.15). The forecasts for the development of the EC population is according to Eurostat figures (Review, 1976-1985). Real per capita income of European citizens is assumed to increase at one percent per year.

The EC cereal prices are determined by the Commission and are therefore exogenous to the model. Furthermore, assumptions were made about price development for other arable crops. Table 2.6 illustrates two price scenarios.

Table 2.6 Assumptions concerning price developments for arable crops; % per annum

Crop	Base Run Policy	Market Oriented Policy
Cereals	-2.50	-4.50
Potatoes	-2.25	-3.75
Sugar beet	-2.75	-4.00
Industrial crops a)	-3.00	-4.00
Fodder crops	c)	d)
Remaining crops b)	-2.00	-3.00

a) Mainly oilseeds; b) Mainly protein crops; c) Gross Revenues 0%; d) Gross Revenues -2%.

The yield increases for the different agricultural crops are based on historical trends. For cereals this figure is about 2.5 percent per annum. For the other crops it is: potatoes 2.0%; sugar-beet and pulses 2.5%; and oilseeds 3% per year. Under the BRP the Gross Revenues remain more or less unchanged.

2.4.2 The consequences for the cereal market

The consequences for cereal supply and demand of the BRP and MOP scenario are shown in table 2.7. Under the assumptions of the BRP, the forecasts for cereal supply are 15 million ton lower than those presented in table 2.4 (unchanged development). The projected increases in cereal stocks are also lower under the BRP scenario than the former projections. This is also caused by an increased demand for cereals by the feed sector in the Southern countries of the EC (Spain) as a consequence of an increasing demand for intensive livestock products. It is not a result of a higher proportion of cereals in compound feed, because EC cereals prices decreased under this scenario as much as those in the world market.

If cereal prices are decreased by 4.5 percent per annum, cereal supply will be about 5 million tons lower in 1996/97 compared to the BRP scenario. As a consequence of increasing the proportion of cereals in compound feed, total demand for cereals increases with 6.2 million tons compared to the BRP scenario. This substitution resulted from slight changes in the price relationship between cereals and other compound feed raw materials (see section 2.4.4). The cereal stock will increase much less as a consequence of a lower supply and an increased demand, but there remains a surplus. Even under the MOP scenario, the cereal stock will be about 125 million tons in 1996/97. If this policy decreases the number of hectares of arable land, the effect on the balance sheet will even be more significant.

Table 2.7 Supply and Disappearances of cereals under the BRP and MOP scenario (million tons)

	1988/89	BRP		MOP	
		1991/92	1996/97	1991/92	1996/97
Supply					
Hectares (mill.)	34.8	34.5	34.1	34.0	33.3
Yield (ton/hect)	4.8	5.2	5.9	5.2	5.9
Production	167.0	178.3	200.4	175.9	194.9
Demand					
Consumption	36.2	36.1	35.9	36.1	36.0
Industry	10.4	10.3	10.3	10.4	10.3
Seed	5.5	5.4	5.3	5.3	5.1
Feed	87.3	90.2	94.3	93.7	101.0
Net export	20.0	20.0	20.0	20.0	20.0
Losses	2.0	2.0	2.0	2.0	2.0
Total demand	161.4	164.0	167.8	167.5	174.0
Change in Stock	--	14.3	32.6	8.4	20.5
Opening Stock	25.0	63.1	183.0	53.1	124.6

2.4.3 The effect on supply of other arable crops

As the cereal area decreased slightly, other arable crops have become more important, because the total number of hectares arable land did not decrease. The effect on the production of other arable crops is shown in table 2.8.

Given the assumed price development for potatoes and sugarbeet, the production will be stable or decline slightly. This is in accordance with the quota regulation for the sugar market and the very inelastic demand for potatoes. Both oilseeds and protein crop production increase substantially. The consequences for the budget are evaluated in section 2.4.7 and the impact of the MGQ's is discussed in section 3.

Table 2.8 The arable production under the BRP and MOP scenarios

	1987 mill. ton	Index: 1987=100			
		BRP		MOP	
		1991	1996	1991	1996
Potatoes	40.5	98.8	92.1	95.9	86.6
Sugar-beet	97.0	95.2	84.6	101.8	106.1
Oilseeds	10.0	109.5	127.6	114.6	143.3
Pulses	3.5	130.0	194.1	147.8	244.3

2.4.4 Price development for arable crops and concentrate feed

As a result of the assumed policy scenarios, all prices for arable crops decline. In the concentrate feed market, EC cereals compete with imported concentrates. When EC cereal prices go down, prices of these concentrates will also decline. The extent to which this will happen is simulated with the CCM model.

In 1996/97, real prices will be 20 to 25 percent below those in 1987 under the BRP scenario. If the MOP scenario is followed, real prices will be 25 to 35 percent lower than in 1987. In The Netherlands, wheat prices will fall from 163 ECU in 1987 to 128 ECU in 1996/97 under the BRP scenario and to 105 ECU in case of the MOP. Table 2.9 shows price indices for different arable crops in 1991/92 and 1996/97.

Table 2.9 Price indices for arable crops under the BRP and MOP scenario (1987/88=100)

Crop	BRP		MOP	
	1991/92	1996/97	1991/92	1996/97
Cereals	90	78	82	64
Potatoes	91	82	86	71
Sugar-beet	89	78	85	69
Oilseeds	88	76	85	69
Pulses	92	83	89	76

It was assumed that world market prices for cereals (and other concentrates) decrease by 2.5 percent per annum in the period considered. So, ceteris paribus, in 1996/97 world market prices are 80 percent of their 1987 level. Table 2.10 shows the prices for some concentrates as simulated by the CCM model.

From these results it can be concluded that in the BRP scenario all cereal substitutes show a price development similar to EC cereal prices. It appears also that soya meal prices develop independent of the EC cereal prices. The MOP scenario makes this tendency even more clear. But from this scenario it can also be concluded that cereal substitute prices do not follow the EC price developments totally. These comparatively small changes in relative prices will result in an increased cereal use in the compound feed industry. On the other hand, it stresses the huge influence of the ECU/Dollar exchange rate in this volatile market.

Table 2.10 Price indices for some concentrates under the BRP and MOP scenarios 1987/88=100

Concentrate	BRP		MOP	
	1991/92	1996/97	1991/92	1996/97
Soya meal	92	81	91	80
Corn Gluten Feed	89	77	85	68
Tapioca	90	79	85	70
Citrus pulp	89	77	87	72
Wheat bran	90	79	85	73

2.4.5 Agricultural income

Price decreases on the scale as under the MOP scenario will leave no farmer unaffected. With the help of information from the Farm Accountancy Data Network (FADN, 1983/84) the effects on the net value added of different farm types were calculated. Only the effects of price decreases for the arable products were evaluated, with the following formula:

$$NVA1/NVA0 = GRA1/NVA0 * \{(GRA1/GRA0) - 1\} + 1 \qquad (2.1)$$

where:

NVA1 = Net Value Added in period 1
GRA1 = Gross Revenues from the Arable sector in period 1

The initial values for NVA0 and GRA0 come from FADN and the index GRA1/GRA0 is a result from the translog production function. The final result (NVA1/NVA0) is an index for the development of the net value added for a certain farm type. As can be seen from the formula, farms with relatively a small proportion arable crops will be, ceteris paribus, less effected by decreasing prices. (GRAO/NVAO will be relatively small). This is also the case for farms with a relatively high net value added.

To calculate these income consequences, we made the heroic assumption that all costs will remain equal in real terms to those in the base period (1983/84). This is true, as volumes do not change and price increases are equal to the inflation. The results of this exercise appear in figure 2.1. Only the effects of the MOP scenario are shown, because the negative income effects of the BRP scenario are negligible and are therefore not reported.

Of course the more specialized arable farms face greater losses than the mixed types. Farmers in the UK will have a stronger position than those in France, Italy and Germany. The Dutch arable farms seem also to be competitive, but this is mainly caused by their strong position in the potato market. The specialized cereal farmers in the Netherlands (about 400) are not represented in the FADN, but they will certainly show a loss of net value added of more than 30 percent. Denmark seems to have a weak position in the specialized arable sector. On the other hand their position is strong in the mixed livestock sector.

Farm type	% Decrease of NVA		
	0-15	15-30	>30
11 Cereals		UK	DK,D,F,IRL,I
12 Oth.arable		B,NL,IRL,UK	DK,D,F,I
43 Mixed dairy	B,DK,F,UK,D	I	
62 Mixed arable		B,UK	DK,D,F,I
81 M.ar./pasture	B,DK	IRL,NL,F,I,D	
82 M.ar./oth.an.	DK	B,NL,F,UK	D

Figure 2.1 EC-member countries, devided according to the measure of decrease of net value added on farms with more than 2 hectares of cereals MOP scenario; 1996/97 compared to the 1987/88 situation

The presented results may give too pessimistic a picture of what will really happen, because the model does not take into account that about one third of all farm enterprises will be ended during the period evaluated. From 1975 to 1983 the average number of hectares per farm increased by one percent per annum. If, as a consequence of the MOP scenario, this rate of increase rises to 1.5 percent it is expected that the net value added will undergo a positive effect of in the order of 15 to 25 percent in this period. It is assumed that fixed costs, except those for land, remain unchanged and that the variable costs will increase proportionally.

Nevertheless, net value added decreases seriously throughout the whole arable sector and farmers who have to pay rent on land, interest on borrowed capital and wages for hired labour are most vulnerable to a MOP scenario. The average solvency rate of arable farmers is high (70 to nearly 100 percent) in all EC countries except Denmark. In Denmark this figure is 55 to 65 percent for specialized arable farms and cereal farms respectively. Logically, it might be expected that especially the younger farmers will have a less favourable solvency compared to the average.

2.4.6 Positive income effects

Due to the MOP scenario arable farmers are confronted with income losses, but consumers and other users of arable products pay less as a consequence of lower prices. The positive income effects have been calculated in the following way:

$$I1 = 0.5 \sum_{j=1}^{J} (P0 - P1)*(Q1 + Q0) \qquad 2.2$$

where:

P1 is the price of product j in period 1
Q1 is the volume of product j in period 1
I1 is the income effect in period 1
j=1,...,J are cereals, potatoes, sugar-beet, oilseeds, pulses and compound feed (as far as it is non-cereals).

The results appear in table 2.11.

Table 2.11 Costs reduction and positive income effects as consequences of the BRP and MOP scenarios. Figures compared to the 1987/88 situation; (mill. ECU)

	Seed (a)	Feed (b)	Remain.int. use(c)	Sub total (d=b+c)	Net export (e)
BRP					
1991/92	143	2466	2429	4895	128
1996/97	287	5212	5050	10262	353
MOP					
1991/92	235	3869	3666	7535	409
1996/97	465	7982	7503	15485	1293

A small part of the positive effects revert to the arable sector as lower seed prices. Most of the lower feed prices will be transferred to the consumer, as prices for meat and eggs will be decreased. So the sub-total(d) gives a reliable indication of the positive income effects for the European consumer. Therefore we conclude that the consumer will gain about 10 to 15 milliard ECU per year in 1996/97 under the BRP and MOP scenario respectively. Some of the positive effects will appear as lower budget costs as the export restitutions on cereals will decrease. This is one of the effects reported under net export. The net export effect is also positively influenced by lower prices for imported oilseeds.

2.4.7 The EC budget for the agricultural sector

The last effect we have to take into account is the effect on the EC budget. Prices have been decreased, cereal production has increased and oilseeds and protein crops have increased their share. What is the total impact of those different effects on the EC budget? An overview of the main results is given in table 2.12.

It has to be concluded that under none of the simulated policies will the budget costs be reduced. This is mainly caused by the huge cereal stocks that are created. Therefore the total budget costs for cereals will increase substantially. The outlays for oilseeds remain more or less constant even while production has increased by 30 to 40 percent. The budget costs for protein crops will increase by 65 to 75 percent from a relatively low level. The production of these crops increases by 100 to 150 percent.

Table 2.12 Budget costs for the arable sector under BRP and MOP scenario; (mill. ECU)

	1987/88	BRP		MOP	
		1991/92	1996/97	1991/92	1996/97
Cereals *)	2690	3468	6255	2993	4410
of which:					
Exp.rest.	2925	2665	2355	2350	1790
Storage	625	1578	4575	1328	3115
Oilseeds	4044	3859	3847	3828	3766
Pulses	422	510	706	534	742
Total	7156	7837	10808	7355	8918

*) Cereals = exp.rest. + storage costs - import levies.

2.4.8 Some preliminary conclusions

The exercises show that a reduction of cereal prices reduces but does not solve the surplus problem. It seems unrealistic to expect a stabilization of the cereal production or an expansion of demand that is large enough to absorb the increased production.

The MOP scenario might be seen as a continuation of the EC cereal policy from 1985 to the introduction of MGQ's for the major arable crops. This policy will result in a rapidly increasing production of oilseeds and protein crops. Under the assumed scenario, the budget costs for these crops increase only slightly.

The income effects of the MOP scenario for the arable sector are considerably negative. This will make it politically difficult to continue such a policy if no additional measures are taken. Taking into account that the EC consumers will face huge benefits in absolute terms from the MOP scenario, it seems reasonable to raise funds for additional measures.

3. The consequences of the MGQ's

The EC introduced Maximum Guaranteed Quantities for the first time in crop year 1988/89. The regulation implies that prices will be lowered in this (oilseeds or protein crops) or the next year (cereals) when production is higher than the MGQ. An overview of the regulation is given in table 3.1.

If more than 160 million ton cereals are produced, the intervention price for cereals will be decreased by 3 percent in the next year. In the year they exceed the MGQ, an extra co-responsibility levy has to be paid of the same order as the MGQ is exceeded to a maximum of three percent. The prices of oilseeds and protein crops are decreased by 0.5 percent for every percent higher production than the MGQ in the same year as the MGQ is exceeded.

Turning the argument around, we can state that the following quantities of oilseeds and protein crops might be produced in 1991, given the realized price reductions (see table 3.2).

Table 3.1 MGQ regulation

Crop	MGQ (mill. tons)	Penalty	Period
Cereals	160.0 (EC-12)	3% n.y. (1)	1988/89-1991/92
Oilseeds			
Rape	4.5 (EC-10)	0.5% (2)	1988/89-1990/91
Sunflower	2.0 (EC-10)	0.5% (2)	,, ,,
Soya beans	1.3 (EC-12)	0.5% (2)	,, ,,
Protein crops	3.5 (EC-12)	0.5% (2)	,, ,,

*Table 3.2 Admitted production of oilseeds and protein crops under the BRP and MOP scenario; 1991 , x 1000 tons *)*

CROP	BRP	MOP
Oilseeds		
Rape	5535	5860
Sunflower	2460	2600
Soya	1600	1700
Protein crops	4050	4300

*) Calculations are based on the price reductions shown in table 2.9.

Those figures are generally lower than the production simulated with the model. So the introduction of the MGQ's for oilseeds and protein crops will result in a smaller production than simulated. The production of potatoes, sugar-beet and fodder crops will not expand for well known reasons. Potato prices will decrease severely when supply is increased and there is a quota system for sugar and milk, therefore production will not be expanded.

If the production of oilseeds and protein crops are at the levels reported in table 3.2, about 1 million hectares of arable land will return to cereal production. Cereal production will be about 5 million tons higher in 1991/92 than reported in table 2.7. It can therefore be concluded that after the introduction of MGQ's in the arable sector, there are no crops left for arable farmers to escape from ever-decreasing cereal prices.

A second conclusion can be that the EC has implicitly chosen to expand its production of cereals instead of oilseeds and protein crops, which will have serious international implications as more and more cereals have to be exported unless other outlets (bio-ethanol) or acreage reduction are realized.

4. Set-aside: a solution to surpluses?

From the exercise in section 2 it was concluded that even a very restrictive price policy will not result in a reasonable market equilibrium. One way to cope with the ever-growing surplus is the recently introduced set-aside regulation. In most of the member states, the regulation was introduced in the crop year 1988/89. Germany had already had some experience before the regulation was imposed upon the member states by the EC.

In general, the set-aside scheme aims to withdraw arable land from surplus crops. Farmers can choose between different options: fallow or green fallow, with different set-aside premiums. They have to sign a contract for at least five years and a minimum of 20 percent of the eligible area should be brought under the scheme.

In 1988, the first year of the set-aside regulation, less than 0.5 million hectares were fallowed under the set-aside scheme, of which 170,000 hectares in Germany and 150,000 hectares in Italy. This poor result can be explained by the late introduction of the regulation and the fact that farmers have no experience with such a regulation. With respect to the latter argument, social acceptability will play an important role.

Another reason is the relatively low premiums offered to farmers. That raises the question of what should be paid to a farmer to make the set-aside scheme attractive? Of course that is the amount of money a farmers forgoes if he does not produce the crop that would otherwise be produced. This will depend on the Gross Revenues of this crop and the costs the farmer will save by not producing it. The difficulty with the question is twofold: 1) what type of costs will be saved? and 2) what is the level of these costs and the Gross Revenues?

By definition, the variable costs are saved if a crop is not produced. This means that there are no outlays for seed, fertilizers and chemicals. Also, the interest on the working capital is not forgone. But as small farmers will hire a contractor for some activities, especially harvesting, the larger farmer will do it on his own. For this reason the Gross Margin will be higher on larger farms than on small ones.

Sometimes it will be possible to save some of the fixed costs, e.g. on very large farms where a combine harvester is intensively used the depreciation and maintenance costs will be somewhat less. It might also be possible to save on hired labour. On the other hand, depreciation and maintenance costs on buildings and overhead costs, e.g. specific taxes on land, will remain unchanged. So it is certainly not possible to save on all fixed costs.

Looking from the perspective of opportunity costs of the different production factors is another approach that may explain the level of the set-aside premium. Capital, labour and land might have other possibilities for exploitation. Under the variable costs we take into account the interest on the working capital, and no other capital will become available as a consequence of taking part in the set-aside scheme. As far as hired labour is concerned, this factor is taken into account under the variable costs (contractor) or the fixed costs. If the farmer or his wife have a possibility to find off-farm work and can spend more hours on that as a consequence of taking part in the set-aside scheme, they will compare these earnings with the money foregone. Also, an older farmer who prefers to work less will calculate a high marginal earning for the extra hours saved by not producing. These farmers will be prepared to accept a somewhat lower set-aside premium. The opportunity costs for the land are very low in most cases, because the farmer is not allowed to use it for many other crops. If he may use it, e.g. green fallow, the premium will be lower. One of the exceptions is forestry. But that is a rather radical change from a farmer's point of view, and it has to be done in a longer term perspective than the five year period of the set-aside scheme (Blom et al., 1989). A drawback of forestry in some cases, especially in the Netherlands, is that the area no longer takes part in the rotation scheme.

We can conclude from this discussion that the Gross Margin can be seen as an upper limit for the premiums to pay. The level of the Gross Margin is influenced by the organization of the farm. Ceteris paribus, the smaller farms will have lower Gross Margins as a consequence of hiring contractors. In general, the net value added will be too low as a premium level, because only on the very large farms will it be possible to save some of the fixed costs by taking part in the set-aside scheme. The opportunity to find off-farm work will play a minor role in the decision to take part in the set-aside scheme, as well as the possibilities to use the land for other purposes.

To determine the necessary levels of a set-aside premium, we have calculated Gross Margins for wheat and barley for the different EC member states on the basis of two sources: costs prices for these cereals (Commission, 1985) and FADN data. The information was updated to 1987. The Gross Margin could easily be derived from the costs prices. On the other hand it is more complex if FADN data are used, as direct costs per hectare were calculated and subtracted from the Gross Revenues. This means that not only direct costs on cereals are taken into account. To minimize this fault we derived the Gross Margin from 'cereal type' arable farms only. But this leaves us with errors from not using the direct costs for the different cereals, because in general direct costs for wheat are higher than those for barley. The results are therefore biased: Gross Margins for wheat will be too high and those for barley too low.

The Gross Margins as calculated on the basis of both sources as well as the set-aside premiums for the first year (1988/89) appear in table 4.1. In general, the Gross Margins calculated on the basis of costs prices are higher than those from the FADN data. This can be caused by the fact that we took average direct costs and subtracted these from the Gross Revenues for wheat and barley respectively. Because the remaining crops such as potatoes and sugar-beet will have higher direct costs, the Gross Margin can be calculated too low. Nevertheless, the results from both sources correspond reasonably well, and we should keep in mind that the variation in the Gross Margin within and between farms is considerable.

The gap between the set-aside premium and the Gross Margin seems to be large in countries such as Belgium, Denmark, France and possibly the UK. Germany and Italy offer a premium that is close to or even higher than the Gross Margin. Both countries reported a substantial area brought under the set-aside scheme. For the crop year 1989/90 premiums will be raised in some countries: France + 25% and in the Netherlands to the maximum admitted level of 700 ECU per hectare.

Table 4.1 Gross Margins for wheat and barley and set-aside premiums per hectare in ECU's for the EC member states

Member State	GM FADN		GM costs prices		Set-aside Premium
	wheat	barley	wheat	barley	
B			820	680	170-420
DK	950	330	840	640	137
D	770	430	680	530	300-600
GR					100-200
E					103-300
F	550	305	710	600	130-350
IRL	590	300	740	470	120-350
I	490	390	340	340	380-550
NL			880	720	300-600
UK	710	310	890	630	270-300

To prevent surpluses as foreseen under the BRP and MOP scenarios, a substantial area has to be taken away from production in

1996/97; 8.3 million hectares under the BRP and 5.0 million hectares under the MOP, taking into account a slippage effect of 35 percent, which is not a very high figure (Blom, 1988(b)). The costs of the programme will vary between 2.6 and 3.7 milliard ECU under the BRP and 1.1 to 1.7 milliard ECU under the MOP. The higher figures are based on the Gross Margin for barley from the cost prices and the lower estimate result from calculations with the Gross Margin for barley on the basis of the FADN data. These will be the total costs of the programme: the EC and the member states outlays. Although they are high, they are less than the projected increase in storage costs (see table 2.13). Nevertheless, the total budget costs for the cereal, oilseeds and protein crops will increase with respect to the 1987/88 situation. But this increase is small in relation to the consumer gains.

Is it a good and reliable instrument for the future? Maybe, but it has weaknesses. Even before the introduction of the set-aside scheme, 10 percent of the arable land was already registered as fallow. Can this be taken into production while bringing the exploited area under the programme? If so, the slippage effect will increase considerably and the programme will become very expensive.

From a societal point of view, it does not seem very reasonable to idle land in a community where land is scarce; it can be used in many other ways. A relatively small number of hectares under the set-aside scheme can be defended by referring to it as a certain way of stockholding: a safety measure.

A third weakness of the programme will be that within the member states certain regions will participate in the scheme while other ones will not. Especially the marginal regions will be taken out of production. It is not so sure that this result is politically feasible.

While the set-aside programme may become attractive for the economically marginal regions, it is not for those regions that are marginal from the environmental point of view; areas with high inputs of fertilizers and agrochemicals. It will become difficult to explain to consumers and taxpayers why in some parts of the Community arable land is very intensively exploited, resulting in unacceptable environmental effects, while they have to pay for idling land in other parts. An explanation in the narrow context of cost calculation will certainly and rightly not convince them, because not all the costs and benefits are and can be taken into account. Therefore it is promising that the Commission has given farmers a possibility to extensify. In the next section we will dwell for a while on this subject.

5. Extensification: the economics and the surplus problem

5.1 Introduction

Regulation 4118/88 introduces the possibility of financial support for farmers who extensify their production. It aims for a lower production level compared to levels reached with intensive production methods. Public opinion is very keen on environmental issues. In many countries, politicians of the established parties are being confronted with new colleagues in all sorts of 'green parties'. Therefore the environment will receive a more prominent place on the political agenda.

Especially in the Northern EC countries, intensive production methods in the arable sector are one of the topics. For some time, there has been a lively debate in the UK on nitrate levels in drinking water and the link to farmers' practices. The ample use of agrochemicals in arable farming not only increases production per hectare but threatens many animal and plant species that seem not to be useful for crop production. Of course this is nothing new (Carson, 1971), but recently public attitude has changed. Farmers' practices will be monitored more critically by the public, and in the near future measures will be taken to constraint input.

In this section we will try to give some evidence of different practices in different parts of the EC with respect to the use of fertilizers and agrochemicals. On the basis of this information, an efficiency index will be constructed to indicate the costs of the extensification programme. Furthermore, the possibility of a profitable extensification for farmers without any programme will be evaluated.

5.2 Data and assumptions

The information presented is based on FADN data for cereal farms (1986). As there are no specialized cereal farms for The Netherlands in the FADN, LEI-figures were used (Douma & Poppe, 1988). The latter figures are data per crop, in this case winter wheat. The FADN data are averages for specialized cereal farms of a certain size class and a specified region. Taking the cereal farms only, we try to estimate the input of fertilizers and agrochemicals for cereal production.

All groups taken into account have more than 60 percent cereals in their cropping plan, and on 80 percent of the farms more than 75 percent of the area is allocated to cereal production.

The average costs in ECU per hectare for fertilizers and agrochemicals were calculated separately. Furthermore the costs of these inputs per ton of cereals (wheat and/or maize) were calculated.

In a second stage of the analysis the costs and the benefits of fertilizers and agrochemicals are calculated, assuming a relationship between the inputs and the outputs. Technical data on this subject are rather poor, but there is evidence that generally speaking yield levels and yield increases can be explained very well by the level of these inputs. Genetic improvement accounts for half or more of the yield gains in well-watered rainfed areas, but the rest can be explained by management factors, especially fertilizers and chemicals (Cimmyt, 1989). Also the analysis of Weindlemaier (1978) shows a strong link between nitrogen use and yield gains, although we have to keep in mind that genetic improvements and the amount of fertilizer use, are interdependent. Table 5.1 shows some figures for fertilizers used in the agricultural sector, the increase in fertilizer application from 1960/65 to 1980/85 and the price ratio between nitrogen and wheat.

Table 5.1 Fertilizer applied and nitrogen/wheat price ratio for the EC member states

	Country										
	B	DK	D	GR	E	F	IRL	I	NL	P	UK
	kg. nutrients/hectare										
Wheat 1985		256	298		92	286			212	125	278
All crops 1980/85	521	248	421	158	72	304	735	168	781	74	352
	growth rate % per annum 1960/65-1980/85										
All crops	0.7	2.1	1.5	5.3	3.4	4.2	5.2	5.3	1.9	2.9	3.6
Nitrogen/ Wheat price	3.0	3.3	4.0	1.2		4.6	3.4	2.0	3.1	2.2	3.3

Source: Cimmyt, 1989; except information for Ireland: FAO, Fertilizer Yearbook.
Price ratios for DK,D,NL, calculated on the basis of FAO, Fertilizer Yearbook and Eurostat, Price Statistics.

It is no surprise that the level of fertilizer use is two or three times higher in the Northern EC member states than Southern ones. Differences within countries such as Italy and France are obscured by the countries' averages. In the Southern part of the EC, water is a more limiting factor and a higher level of fertilizer application will not result in higher yields.

Is the use of these variable inputs efficient in all parts of the EC? It is not easy to answer this question. Fertilizers and agrochemicals are relatively cheap, but nevertheless 20 to 40 percent of the Gross Revenues is spent on these inputs. From research in the Netherlands, where a normal and integrated arable farming system are compared, it is concluded that more than 40 percent can be saved on fertilizers and chemicals by losing ten percent of the output (Meijer & Lalkens, 1988). Rickard (1986) reports comparable figures for the UK. The implications of these findings and the consequences for the extensification regulation will be evaluated with the efficiency index E, defined as follows:

$$E = dG/dC \qquad 5.1$$

where:

- dG is the change in Gross Revenues as a consequence of a change in input of fertilizer and chemicals;
- dC is the initial change in input of fertilizer and chemicals.

dG and dC are defined in monetary terms and assume constant real prices. If $E=1$ the farmer is indifferent because he loses as much as he gains from a change in variable inputs. When $E<1$ the farmer will gain from lower input levels and the opposite is true for $E>1$. From an economic point of view we expect $E=1$, because in that situation marginal revenues are equal to marginal costs. This index evaluates the efficiency only in a very narrow economic sense. So we do not take into account the costs involved in the application of fertilizers and agro-chemicals, such as labour and machinery. Therefore if $E=1$ a farmer has an economic incentive to decrease these inputs. From an environmental point of view we may use very different measures, but we can at least indicate if a farmer will lose very much by being forced to use less fertilizers and chemicals.

5.3 Use of fertilizers and chemicals in the EC

The input of chemicals varies much stronger than that of fertilizers. Chemical use varies from less than 10 ECU per hectare in Spain to over 150 ECU in Schleswig-Holstein (D), The Netherlands, Ile de France (F), Champagne-Ardenne (F) and Piemonte (I). Fertilizer application is below 100 ECU per hectare only in some Italian regions: Calabria, Puglia and Basilicata; Greece, in Castillo-Leon (S) and Castillo-la Mancha (S). In most areas of the EC it varies between 100 and 250 ECU per hectare. In some French and Italian regions more than 250 ECU per hectare is spent on fertilizers: Champagne-Ardenne (F), Aquitaine (F), Veneto (I) and Friuli-Venezia Giulia (I). There is no simple correlation between fertilizer and chemical application. In some cases a low level of chemicals combines with high fertilizer use. However, it is never the other way around.

Fertilizer and chemical application in ECU per hectare is a bad yardstick, because price differences and exchange rate obscure the real use of these variable inputs. From an economic and ecological point of view, it is relevant to know how much is used per ton of cereals. There is no possibility to calculate in quantities, but the value input per ton has been calculated (see figure 5.1).

No representative cereal farms for Belgium, Luxembourg and Portugal are available. From the presented information, it can be concluded that the supposed intensive production in the Northern European countries is mainly a chemical intensive production,

Input	Regions
Fertilizers	
> 50 ECU per ton	Aquitaine (F), Veneto (I), Friuli (I), Aragon (S), Castilla la Mancha (S), Castilla Leon (S).
< 50 - >30	Bayern (D), France (except Aquitaine), Italy (except Veneto and Friuli), Ireland.
< 30	Germany (except Bayern), The Netherlands, UK, Denmark, Greece.
Agrochemicals	
> 20 ECU per ton	Schleswig-Holstein (D), Ile de France (F), Champagne-Ardenne (F), Picardie (F), Haute Normandie (F), Centre (F), Bourgogne (F), Piemonte (I).
<20 - >10	Germany (except Schleswig-Holstein), The Netherlands, Alsace (F), Poitou (F), Aquitaine (F), Midi Pyrenee (F), Lombardia (I), Veneto (I), Friuli (I), Emilia-Romagna (I), Marche (I), Denmark, UK.
< 10	Toscana (I), Umbria (I), Lazio (I),

Figure 5.1 EC regions according to the input of fertilizers and agrochemicals per ton of wheat
Source: FADN.

while the fertilizer input is relatively low. It is somewhat surprising to see that the most intensive fertilizer users are all found in the Southern part of the EC. The results may be a bit biased as a consequence of the method we used, as some of the Southern EC regions are important maize producers. Nevertheless, even if we take this into account the figures indicate that fertilizer input per ton of cereals is relatively high. It seems that looking for possibilities to extensify should not be limited to the North of the EC.

5.4 The economics of variable input reduction

What is the effect of a reduction of variable inputs on the Gross Margin and how costly will it be to stimulate farmers to adopt the extensification programme? These two related questions will be analysed with the efficiency index E as explained in section 5.2. Eight scenarios are analysed: four with an intervention price of 160 ECU per ton of cereals, and four with an intervention price of 140 ECU per ton in order to indicate the effect of cereal prices on the intensity of production. It is assumed that the input of fertilizer and chemicals is reduced by 50, 40, 30 and 20 percent respectively. In all cases, cereal output will decrease by 10 percent. We shall call them scenario I, II, III, and IV respectively.

Under the assumptions of scenario I, it is in nearly all cases economically attractive to decrease inputs for wheat production. If the intervention price is 160 ECU, there are some small farms in Denmark, the Scottish cereal farms and some size classes in Greece that will not reduce their inputs (E>1). In all other cases E<1. Maize producers in the South of Italy and Greece will not reduce their inputs in both cases (E>1).

Scenario II, which is closest to the findings in The Netherlands, shows efficiency indices smaller than one in many cases. Only in Niedersachsen (D), Nordrhein-Westfalen (D), Lazio (I), the small farmers in Denmark and most cereal farmers in The UK and Greece will not decrease their variable inputs for wheat production. If prices are decreased to 140 ECU per ton, only Greece will use the same level of fertilizers and chemicals. Maize production in Italy and Greece will remain as intensive as it is, but at cereal prices of 140 ECU per ton the Northern producers in Italy will gain by producing less intensively (E<1).

A thirty percent reduction of variable inputs, scenario III, might be profitable for farmers in France and some Italian regions (Piemonte, Lombardia, Veneto and Friuli) and also in Spain producing wheat. At a lower cereal price the following regions will join the former ones: Bayern (D), the remaining Italian regions, Ireland and the larger farms in Denmark. The efficiency index for wheat is only substantially above 1 (>15%) in the following regions (low price case): Niedersachsen (D), Nordrhein-Westfalen (D), Lazio (I), Greece, the UK and the smaller farms in Denmark. Maize production remains inefficient in the North of France (E<1). Under the assumptions of scenario IV there is no economic incentive to lower variable inputs.

These results corroborate the findings in The Netherlands and those in the UK, because the figures indicate that it is in many cases profitable to use the amount of fertilizers and chemicals as reported even when thirty percent reduction in inputs reduces yields only by 10 percent. In The Netherlands we expected on the basis of our calculations a 35 to 40 percent reduction in variable inputs to decrease yields by 10 percent. The figures for the UK indicate a possible 40 percent reduction of fertilizers and chemicals to reach the same decrease in yields.

Before discussing the implications, some remarks have to be made about the analyses. In the first place only data for 1986 were analysed. Therefore the results are influenced by accidental circumstances, such as the weather. A three year average will give a more reliable picture. In the second place we made an expost analysis, while the farmer has to decide ex-ante. If farmers are using too much variable inputs it might be explained as a form of insurance; he does not know the weather in advance, so he will be sure that a maximum yield is possible under all circumstances. In the third place, a drawback of the analysis is that no variable inputs for the different crops are available. This is only partly overcome by using data from cereal farms.

The analysis shows that it is important to know the link between yield and variable inputs. If findings in The Netherlands and the UK are representative for cereal farming practices in Northern Europe, there will be a strong incentive to lower input levels. Even in the case that a thirty percent reduction of inputs reduces yields by 10 percent, it is attractive to do so. The more so if we take into account that a ten percent reduction of the wheat yields in the Northern EC member states, including France, will decrease cereal production by at least 5 million tons. During the last two years this would have resulted in a production volume of less than 160 million tons. As a consequence cereal prices would not have been decreased.

Even if the individual farmer does not gain from using less inputs, there is a very strong case to expect that they will do as a group. In that case they form a 'latent' group in terms of Olson (1980): a group without having coercive power. Together they are able to get a public good (a higher cereal price) but for an individual it will always be profitable not to diminish variable or even to increase inputs as long as E>1. In principle COPA (Comité des Organisations Professionelles Agricoles) could play a positive role in saving the environment and stop decreasing farmers income at the same time. But of course the organization will not be able to control such a change in attitude among farmers.

On a national scale, farmers' attitudes can be influenced by research and extension services. Farmers should have a better understanding of the relationship between inputs and outputs in arable farming and more specifically in cereal production. On the EC level, the extensification regulation is introduced and will stimulate farmers to decrease their output. The amount of money per hectare or per ton of cereals necessary to attract farmers to the programme has been calculated in the following way:

$$dY-dC = (E-1)*dC = PRhect \quad (5.2)$$

where:

PRhect is the premium per hectare necessary to compensate for the farmers' losses from producing less intensively

and

$$PRton = PRhect/dYton \quad (5.3)$$

where:

PRton is the premium per ton of cereals not produced necessary to compensate for the farmers' losses from producing less intensively.

dYton is the decrease in yields as consequence of using less inputs.

If E=1, in the case farmers are efficient users of fertilizers and chemicals PRhect is zero and no compensation seems to be necessary to lower yields per hectare somewhat, say up to 10 percent. Well informed farmers, stimulating a different attitude with respect to the environment will be the most important instrument to promote a more ecologically efficient way of producing. As a by-product, prices will remain at the same level and surpluses will disappear.

If E<1, in case farmers are using too much variable inputs, PRhect is negative and farmers should be better informed about the economics of production in their own situation. No financial incentives from the EC or national governments are necessary other than for research and extension services.

If E>1, it is still profitable for farmers to increase variable inputs and yields per hectare. PRhect will be positive and the level of compensation will depend on the gains foregone by not increasing the yields, that means the level of E and the cereal price. Given the definition for E and a given price for cereals, we can derive the following equation:

$$PRton = (1 - (1/E))*Pcer \qquad 5.4$$

where:

Pcer is the price for cereals

As long as the cereal price for farmers is about 150 ECU, an efficiency index of 1.5 indicates that 50 ECU has to be paid for every ton of cereals not produced. The premium per hectare will depend on the expected increase in yield, given the value of E and the cereal price.

Economists expect farmers to produce in an economically efficient way. Data from the FADN compared to findings in The Netherlands and the UK seems to indicate that the assumption is confirmed. Therefore it might not be expected that E>1 in many cases. The possibility of E>1 has more relevance in relation to time as technological developments go ahead. For the future, research should be directed to production systems that are more ecologically friendly and economically competitive instead of high yields per hectare only.

6. Implications for the future

If the economics of cereal production show a trade-off between variable inputs such as fertilizers and agrochemicals as is observed in The Netherlands and the UK, lower prices will stimulate lower inputs and consequently lower output. Or it will be no longer economically attractive to expand inputs, which will result in stable or much less increasing yields.

Under such circumstances, costly set-aside programmes to reduce production can be held at a minimum level. Nevertheless, prices should be kept under pressure for at least two reasons: 1) farmers will be stimulated to use less variable inputs or not increase them; 2) the import of feed will not be further stimulated so the internal demand can be kept at the same level or increased.

There seems to be less need for the stimulation of alternative uses for agricultural products in the non-food/non-feed sector, as suggested by Rexen and Munck (1984). But it should be kept in mind that technological development will go ahead and that the observed possible reduction of inputs will only be a solution for some time, maybe the next decade. In the long run, it is expected that yields will increase again with a somewhat different technology. This will give time for research into possible alternative uses for agricultural products in the non-food/non-feed markets, and it should rank high on the research agenda. Given concern about the environment, special attention should be paid to the positive role that the use of agricultural products instead of synthetic ones can play with respect to the environment. From this point of view, research with respect to agricultural production systems that are more friendly to the environment is also important.

Lower prices will also be in accordance with the negotiations under auspices of the GATT about a more liberalized world market for agricultural products. So there are several arguments in favour of a continuation of a restrictive price policy for cereals. On the other hand, it will be more difficult for farmers to compensate income losses as a consequence of lower prices in case yields are no longer rising. Consequently there is a strong case for compensating income losses not by increasing prices but through direct income support, for instance by giving a lump sum per hectare of arable land.

7. Conclusions

If cereal yields increase in the future as they did in the past, a restrictive price policy, implemented by means of MGQ's and supplemented with the set-aside programme, will only result in a reasonable market equilibrium if at least 6 to 9 million hectares are brought under the set-aside scheme in 1996. The costs of such a programme will be 2 to 3 milliard ECU per year.

Since 1985 cereal production in the EC has been rather stable and yield increases have been zero or very low. The weather influences yields from year to year, but five years with low yields from the perspective of the trend is quite exceptional. The effect of price development on the use of fertilizers and agrochemicals may play a role in this development. If farmers were efficient users of those variable inputs in 1983 and there is evidence they were, they have had a strong incentive to lower them since than, as cereal prices has been decreased by at least 25 percent in real terms.

If a rational reaction to lower cereal prices is a decrease or non-increase of variable inputs and a consequent decreasing or stable yield, the income effects of a restrictive price policy are more negative than in the case of assumed increasing yields. No price losses are compensated by higher quantities.

If farmers are still efficient users of fertilizers and chemicals there is little need for an extensification premium as lower Gross Revenues resulting from lower input are compensated by decreased costs. Research and extension services seem to be more important to inform the farmer about optimal resource use.

As a restrictive price policy has the effect of using not more or even less fertilizer and chemicals, it stimulates an optimized use of these resources with respect to the environment. This argument and the fact that consumers gain substantially by decreased cereal prices while farmers face severe income losses, might be a good reason for giving a lump sum per hectare of arable land taking into account the average yield per hectare and the size of the farm. That will be a straightforward income measure, but as it seems now the extensification programme will have the same effect.

Research into the link between input and output in real farmers' practices should be stimulated in order to decide on what sort of world we live in and to take the right policy measures in time.

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