ELSEVIER

Agricultural Economics 13 (1995) 39–49

AGRICULTURAL
ECONOMICS

Agriculture as a provider of public goods: a case study for Norway

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Accepted 4 July 1995

Abstract

A valid argument for support is that subsidies are remedies for market failures. Agriculture contributes positively to public goods as food security, landscape preservation and maintenance of population in remote areas. Using a numerical model we simulate what Norwegian agriculture would look like if the only purpose of supporting agriculture was to provide such public goods. This is compared to the consequences of the Uruguay round in GATT and possible future EU membership for Norwegian agriculture. Although the GATT agreement will change agriculture in the desirable direction, the agreement puts no substantial pressure on the current agricultural policy. EU membership on the lines laid down by the accession treaty between EU and Norway prior to the referendum in 1994 would have given a stronger impetus towards the optimal solution.

1. Introduction

In nearly all Western countries agriculture is heavily subsidized and protected. According to Organization for Economic Co-operation and Development figures (OECD, 1993), total support measured in producer subsidy equivalents (PSE) is somewhere in the area of 44% of the total value of production in agriculture as an OECD average. For Norway the figure is an astonishing 77%. That is, only 23% of total production costs is covered by the value of production evaluated at international market prices; the rest comes as support in one form or another. This is, together with Switzerland, Finland and Japan, by far the lowest score among the OECD members.

Winters (1989–1990) has reviewed the declared objectives of agricultural policy for a selected group of OECD countries. He rebuts most of them as valid justifications for intervention, but concedes some validity for landscape preservation and food security. Why agriculture globally is receiving such large support is an intriguing question for both political scientists and public choice oriented economists. One obvious reason is that the recipients of the support are a relatively small, well-identified and well-organized

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0169-5150/95/$09.50
SSDI 0169-5150(95)01152-8

group with well-defined common interests, whereas the costs are borne by the consumers at large. Consumers are usually badly organized, if at all; neither is it apparent to the individual consumer what costs he is actually bearing to support the farmers.

Economic theory tells us that public intervention may be desirable in the case of market failure. The widespread existence of agricultural support should then lead us to the question: Is there some market failure inherent in the agricultural sector which can justify some government intervention, and, if so, is today's level of intervention the correct one?

A fundamental theorem of welfare economics is that, under given assumptions, the allocation obtained in perfectly competitive markets is Pareto efficient. This theorem rests on three assumptions. First, that the marketed commodity is private. Second, that there is an absence of economies of scale, and, last, that there is an absence of external effects. A violation of any of these assumptions is an argument for the authorities to intervene, for example by subsidies. The question is, therefore, if such violations can be found in the markets for agricultural commodities. While agricultural products undeniably are private goods, an element of public good (e.g. food security) can be connected to agricultural production. As noted by Hanley (1991, p. 6), there is a close link between public goods and external benefits. Public goods can be thought of as stocks, whereas external benefits are flows. If current production of food contributes to food security, which is a public good, this is equivalent to saying that food production gives external benefits. There may also be other positive external effects, foremost in the form of landscape preservation and prevention of depopulation in remote areas. The basic question in this article is what would Norwegian agriculture look like and what levels of support would be necessary if the only purpose of supporting agriculture was to remedy such market failures.

In the next section we present a model for the agricultural sector in Norway. The base solution of the model is presented and compared to the actual situation as of 1990. In Section 3, the issues of public goods and positive external effects are discussed. In Section 4 we use the model to simulate an agricultural policy whose only purpose is to provide such public goods. The simulations indicate that the public goods aspect of agriculture can be provided at a considerably lower cost to society than is the case today. However, it may be difficult for Norwegian authorities to pursue such a policy. Historically, the Norwegian farming lobby has been able to influence political parties and they will presumably be able to block proposals in the Parliament to liberalize imports of agricultural commodities. Nevertheless, Norway may be forced to follow such a policy because of international pressure. In Section 5 we use the model to show the possible consequences of the GATT agreement for Norwegian agriculture. Finally, we also use the model to show the consequences of possible future EU membership, on the lines laid down by the accession treaty between EU and Norway prior to the referendum in 1994.

2. The model

2.1. Description

The model is a partial equilibrium model of the Norwegian agricultural sector. It is partial in two ways. First, it is a sector model in the sense that prices and incomes outside the agricultural sector are treated as exogenous, thus differing from computable general equilibrium (CGE) models such as the WALRAS model (Burnieaux et al., 1989–1990). Second, world market prices are treated as exogenous by the small country argument. In this respect our model differs from multimarket commodity models like the MTM model (Huff and Moreddu, 1989–1990) and the grain, livestock products and sugar (GLS) model extensively used by Tyers and Anderson (e.g. Tyers and Anderson, 1987).

Our model is a price endogenous mathematical programming model of the type described in McCarl and Spreen (1980). A detailed technical description of the model is given in Brunstad et al. (1995). As the model assumes full mobility of labour and capital, it must be interpreted as a long run model. It is thus assumed that both redundant labour and capital are frictionlessly absorbed in other industries. To a certain extent this goes for land too, which alternatively can be used in forestry.

The model covers the most important products produced by the Norwegian agricultural sector — 14 final products and nine intermediary products. Most products in the model are aggregates. Primary inputs in the model are four: land (four different grades), labour (family members and hired), capital (machinery, buildings, livestock) and other inputs (fertilizers, fuel, seeds, etc.).

Supply in the model is domestic production and imports. Domestic production takes place on the model's approximately 400 different 'model farms'. The farms are modelled with fixed input and output coefficients, based on data from extensive farm surveys carried out by the Norwegian Agricultural Economics Research Institute, a research body connected to the Norwegian Ministry of Agriculture. Import takes place at given world market prices inclusive of tariffs and transport costs. Domestic and foreign products are assumed to be perfect substitutes. The country is divided into nine production regions, each with limited supply of the different grades of land. This regional division allows for regional variation in climatic and topographic conditions and makes it possible to specify regional goals and policy instruments. The products from the model farms go through processing plants before they are offered on the market. The processing plants are partly modelled as pure cost mark-ups (meat, potatoes and eggs) and partly as production processes of the same type as the model farms (milk and grains).

The domestic demand for final products is represented by linear demand functions. These demand functions are based on existing studies of demand elasticities, and are linearized to go through the observed price and quantity combination in the base year (1990). Most Norwegian demand studies are only considering own-price effects. Those that include cross-price effects (see, for example, Ervik and Olsen, 1977) find these to be negligible. This may, however, be due to lack of variation in the observed data set. In the model we have stipulated moderate cross-price effects between the meat products, while cross-price effects are neglected for all other products. The cross-price effects are assumed to be symmetric in accordance with the integrability condition (see McCarl and Spreen, 1980, p. 92). The demand for intermediary products is derived from the demand for the final product for which they are inputs. Exports take place at given world market prices.

Domestic demand for final products is divided among five separate demand regions, which have their own demand functions. Each demand region consists of one or several production regions. If products are transported from one region to another, transport costs are incurred. For imports and exports transport costs are incurred from the port of entry and to the port of shipment, respectively.

In principle, restrictions can be placed on all variables in the model. The restrictions that we include can be divided into two groups:

(1) Scarcity restrictions: upper limits for the endowment of land, for each grade of land in each region.

(2) Political restrictions: lower limits for land use and employment in each region, for groups of regions (central regions and remote areas), or for the country as a whole; maximum or minimum quantities for domestic production, imports or exports; maximum prices.

In the model, the economic surplus (consumer's plus producer's surplus) of the agricultural sector is maximized. This maximization is performed subject to demand and supply relationships and the imposed restrictions. Which restrictions are included depends upon what kind of simulation that is attempted. The solution to the model is found as the prices and quantities that give equilibrium in each market. No restriction must be violated, and no model farm or processing plant that is active must be run at a loss.

2.2. The base solution

The actual domestic production and net imports of the main agricultural commodities in the base year (1990) are reported in the first column of Table 2. Observe that the level of support given to Norwegian agriculture is extremely high (19.2 billion NOK or 2.4 billion ECU). Since agriculture employs about 85 000 man-years, the support per man-year is about 225 000 NOK (28 000 ECU). Observe also that Norway is close to self-sufficiency in most products, except for grain. The arctic climate conditions do not permit production of sufficient quantities of high-quality grain for bread-making.

We have simulated the actual policy by allowing import quotas corresponding to actual imports in the base year, and implementing the actual system of subsidies. The results from this simulation, which are reported in the second column of Table 2, are close to the actual situation.

3. Public goods in agriculture

Standard examples of public goods are defence, the juridical system and general police protection. In this section we argue that agriculture too in certain respects provides services to the community that have the character of public goods.

3.1. Food security

Given the choice between foreign products at world market prices and domestic agricultural products at cost prices, Norwegian consumers would to an overwhelming extent choose cheaper foreign products, and most of the industry would be wiped out. This may cause problems for the population if a crisis should arise. Blockade in connection with war or international conflict is the traditional example of a crisis. Lately increased risk of ecological crises and man-made disasters like the Chernobyl fall-out have also been used as examples.

Ballenger and Mabbs-Zeno (1992) define (national) food security as:

$$P[(\text{production} + \text{stocks} + \text{imports} + \text{aid}) \geq \text{needs}] \geq X$$

where P symbolizes probability, X is the minimum acceptable likelihood and 'needs' is the subsistence level. Naturally, it is difficult to measure the subsistence level. The closest we come is to specify a crisis menu. Table 1, which is taken from a government report (Norges Offentlige Utredninger, 1991, p. 142), gives an example. This menu provides 2600 kcal per person per day, and also gives sufficient vitamins, minerals and proteins. Compared to normal consumption the menu involves higher consumption of vegetables in proportion to animal products. Consumption of milk, meat and eggs is reduced, while the consumption of grain and potatoes is upheld or increased. In addition, the crisis menu makes allowance for the fact that consumption of fish, of which Norway has a huge export surplus, can be considerably increased.

Table 1
Crisis menu compared to actual consumption in 1990

	Consumption 1990	Crisis menu
Grains	373.9	335.0
Potatoes	340.9	460.6
Cow milk	1560.0	837.4
Goat milk	26.5	15.3
Meat	182.3	62.8
Eggs	51.0	16.7
Fish	167.5	335.0

Values are expressed in million kg per year.

The crisis menu shows the minimum annual quantities of agricultural products that must be available for consumption in times of crisis. Stockpiling and remaining import possibilities will make it possible to reduce production below this level. Thus a crisis of relatively long duration can be withstood with lower levels of production than those indicated in Table 1.

Production in normal times does not have to be equal to the necessary production during a crisis (see Gulbrandsen and Lindbeck, 1973, Chapter 7). Some switching of production when the crisis has arisen will be possible. A crucial condition for switching of production is, however, that the necessary factors of production are available, especially tilled land but also agricultural skills, animal material and capital equipment.

Using the model we have calculated how much land and labour is necessary to produce the quantities of food required by the crisis menu. This is in line with the approach of Gulbrandsen and Lindbeck. To account for possible reductions of transport capacity during the crisis, the factor requirements have been distributed regionally in proportion to the resident population giving regional minimum requirements of land and labour input. The calculation shows that the necessary quantities of food required by the crisis menu can be produced by about 55% of today's acreage and 46% of today's employment. The interpretation is that these levels of factor inputs must be kept continuously available if agriculture is to be able to produce the quantities of food required by the crisis menu, if or when the need arises. In addition to keeping land and labour available, the fact that it takes time to build up an adequate animal stock must be taken into account. This limits the extent to which the current production of animal products can be reduced in relation to the quantities required by the crisis menu.

3.2. Preservation of the agricultural landscape

The non-market value of the agricultural landscape is a notion that seems to be gaining common acceptance. To preserve this value the agricultural landscape must be maintained according to certain criteria. Such criteria might include keeping the waterways open, securing a certain biological variety and keeping the landscape accessible to the public to a certain extent.

There is obviously some willingness to pay for the preservation of the agricultural landscape. However, serious measurement problems are involved. A method often used is the Contingent Valuation Method (see Mitchell and Carson, 1989). Based on this method a Swedish study by Drake (1992) found that the more intensive the land use the less is the willingness to pay. Drake found that the willingness to pay for landscape preservation in the form of production of grain and comparable products is 860 SEK (123 ECU) ha^{-1}; for grazing on arable land and cultivated pastures the willingness to pay nearly doubles to 1643 SEK (237 ECU), whereas wooded pastures bear a price tag of 2076 SEK (299 ECU). A German report (Hampicke, 1990) measures the willingness to pay farmers for securing biological variety and preserving the wild life. Hampicke estimates a willingness to pay of approximately 1000 DEM (500 ECU) ha^{-1}, which is larger than the largest of Drake's alternatives.

Some government intervention is necessary to make this willingness to pay effective. The most accurate instrument in this respect is probably subsidies based on acreage provided that the land is tilled according to certain criteria. Some of the German states give subsidies to farmers along these lines. Baden-Würtemberg gives subsidies for landscape protection (Agra-Europe, 1992) as also does Bavaria (Agra-Europe, 1993). In both states certain rules have to be followed. Subsidies may reach the level of 600–1000 DEM (300–600 ECU) ha^{-1} if the rules are obeyed.

3.3. Prevention of depopulation in remote areas

Prevention of depopulation in remote areas has traditionally been an important political goal in Norway. Apart from the national defence argument, this may be rationalized as follows. If the density of the population in an area drops to very low levels, the cost per capita of providing basic infrastructure may become prohibitively high. As long as total depopulation is undesirable, this is an argument for keeping the population density above some critical level. The most efficient way of achieving this goal would seem to be some general income support to all inhabitants in remote areas or a general wage subsidy to all industries, and not support confined to a single industry. Indeed, Winters (1989–1990, p. 251) writes: "The equation of rural with agricultural has been a major fallacy in thinking about the long-term future of rural communities". However, in many remote areas agriculture is the only source, or one of very few feasible sources, of employment. For this reason the goal of maintaining population in remote areas may possibly justify some wage support to agriculture in remote areas. Subsidizing the use of labour in agriculture for this reason will of course also help to achieve food security even if the latter goal could be achieved in a more efficient way by supporting agriculture closer to the large population centres.

4. Production of public goods — model results

In this section we present a model simulation illustrating how the public goods can be provided in the most efficient way. Following the discussion on food security in Section 2.1, regional floors on land use and employment equivalent to 55% and 46% of today's national levels are imposed in the model. To take care of the livestock requirements, it is further required that the level of animal production must not fall short of the level necessary to supply the crisis menu. If a crisis occurs, current import of grain will have to be replaced out of stocks for the time that is needed to cultivate the land such that sufficient grain can be produced. Assuming that 4 years are needed to make enough land available to supply the quantity of wheat and coarse grains required by the crisis menu, the necessary stocks need to be approximately two times current imports. In the model, the stocking costs are included by adding 2 years' stocking costs to the import price of grain. As regards landscape preservation, it is assumed that the goal of food security dominates so that no separate requirement is necessary to take care of landscape preservation. We will return to this assumption later when the results from the simulation are discussed. In the model, maintenance of population in remote areas is made operational by requiring somewhat arbitrar-

Table 2
Production of the most important products and main input levels in Norwegian agriculture

	The actual situation	The base solution	Production of public goods (optimal solution)	The GATT solution
Production (net imports) (million kg or litres)				
Cows milk	1836.8	1850.0	838.0	1630.0
Goat milk	26.5	21.9	19.4	22.5
Cheese (white type)	65.6 (−23.6)	68.7 (−25.2)	0.0 (60.2)	57.1 (−11.2)
Cheese (brown type)	18.4 (−3.6)	17.1 (−4.0)	12.9	17.1 (−4.0)
Butter	25.6 (−9.4)	22.5 (−5.6)	6.9 (19.5)	17.8 (−0.9)
Milk powder	34.2	30.4	0.0 (42.9)	30.4
Drinking milk	740.0	740.0	696.5 (104.1)	740.0
Beef and veal	81.5 (−6.3)	78.8	41.4 (63.7)	78.8 (1.1)
Pig meat	82.2 (−1.5)	79.7	13.0 (102.4)	79.7 (1.4)
Sheep meat	22.7 (−1.5)	25.7	15.0 (11.6)	25.7 (0.2)
Coarse grains	822.5 (171.9)	773.9 (171.9)	293.3 (68.9)	773.8 (134.7)
Wheat	151.3 (222.7)	145.2 (217.8)	41.6 (350.4)	145.2 (218.2)
Potatoes	340.9 (6.2)	342.1	345.7	342.1
Eggs	50.5 (0.5)	52.1	17.0 (44.2)	52.1 (1.3)
Employment (1000 man-years)	85.3	71.7	33.0	58.5
Remote areas	54.3	51.9	26.0	46.7
Central areas	31.0	19.8	7.0	11.8
Land use (million ha)	0.95	0.70	0.38	0.66
Economic surplus (billion NOK)		9.6	21.9	12.2
Total support (billion NOK)	19.2	19.1	7.0	16.3
Border measures	7.6	7.5	0.0	6.9
Budget support	11.6	11.6	7.0	9.4

1 NOK = 0.125 ECU.

ily that the number of man-years in agriculture in remote areas shall not fall below 50% of today's level of employment.

The model will maximize economic surplus from agriculture subject to the floor restrictions on tilled acreage, production of animal products and employment, assuming free import to world market prices. The necessary budget support then follows endogenously from the shadow prices of the restrictions. An acreage subsidy will be generated if an acreage floor is binding, wage subsidies will be generated whenever employment floors are binding whereas a binding production floor will generate price support.

The results of the simulation are presented in Column 3 of Table 2. Observe that it is optimal to have a production in normal times that differs from the requirements of the crisis menu (Table 1). A comparison between the optimal solution and the base solution shows that the public goods aspect of agriculture can be provided at considerably lower cost to the society than is the case today. Compared to the base solution, economic surplus increases by 12.3 billion NOK (1.5 billion ECU), while agricultural support measured as PSE decreases by 12.1 billion NOK (1.5 billion ECU). The dramatic increase in economic surplus is mainly due to cheaper imported products substituting inefficient domestic production and increases in consumption as a result of lower prices. A further explanation is that more accurate and adequate instruments are used to secure required levels of public goods.

Looking more closely at the simulation results, it should be noted that the level of activity in Norwegian agriculture is considerably decreased. Employment and land use are reduced to their floors everywhere. The climatic conditions for growing grain in Norway are unfavourable, and grain production is therefore dramatically reduced. The production of potatoes, on the other hand, is maintained. Potato production is both land and labour intensive, relative to other agricultural products, and therefore benefits from both wage and acreage subsidies. In addition, the comparative disadvantage of potato production is probably smaller than for most other agricultural products. Production of animal products is reduced to the floor levels. The only exception is the production of beef. Extensive beef farming requires a substantial acreage, and thus benefits from acreage subsidies. To a large extent, it replaces grain production in central areas.

In passing, it is interesting to note that this switch from grain production to grazing will greatly enhance the recreational value of the landscape according to the study by Drake (1992). This happens even if no separate requirement for landscape preservation is included in the model simulation. On the other hand, the acreage subsidies in the different regions range from approximately 6000 NOK (750 ECU) ha^{-1} to 12000 NOK (1500 ECU). These figures vastly surpass the willingness to pay for landscape preservation indicated by both Drake's and Hampicke's studies. This corroborates our assumption that the goal of landscape preservation is dominated by the other goals.

There is a tradeoff between food security and employment in remote areas. This tradeoff arises because the best agricultural land tends to be located in the proximity of the large population centres. To achieve food security at the lowest cost, production must to a large extent be concentrated in these areas, as this will minimize both production and transport costs. To spread out production to more remote areas extra costs will be incurred. This tradeoff is illustrated in Fig. 1. Point A corresponds to the solution given in Table 2.

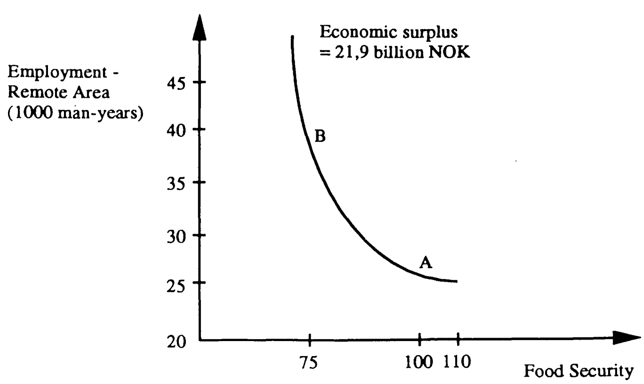

Fig. 1. Tradeoff between food security and employment.

Assume that the requirement of food security is reduced by scaling down the floors of land use and employment by 25%. Employment in remote areas can then be increased without changing the economic surplus (Point B). We have performed several simulations along this line, and the curve drawn into the figure is based on these simulations.

5. GATT agreement

The simulation in the preceding section shows that the level of support is probably much higher than what can be defended by reference to the public good argument. This means that taxpayers and consumers lose more than the producers gain. Despite this, substantial changes in agricultural policy have proved to be very difficult to achieve. This is probably due to the great influence of farmers' organizations in politics, bureaucracy and research.

The recently approved GATT agreement on agriculture in the Uruguay round will, however, force Norway, albeit slightly, to change its agricultural policy in the direction suggested by the above simulation. The agreement, which is documented in GATT (1991, 1993), binds the participants to reduce agricultural support and protection over an agreed period of time. All support defined as so-called 'yellow support' must be reduced nominally by 20% from the average aggregate level in the period 1986–1988 before 1999. Forms of support that have no or minimal effect on production or trade (so-called 'green support') and direct payments under production-limiting programmes (so-called 'blue support') are excempt from reductions.

All border measures on imports must be translated into tariffs. The tariffs are computed as the difference between domestic and world market prices in the reference period. The average of the computed tariffs must be reduced by 36% between 1993 and 1999. For the most important agricultural products, Norway is commited to reducing its tariffs by 15–30%. Tariffs for marginal agricultural products (not included in the model) and products not produced in Norway (e.g. tropical products) will be reduced by a higher percentage such that the arithmetic average will be in accordance with the 36% in the agreement. In line with the agreement, low-tariff quotas assure that at least 5% of the consumption levels of the various commodities as of 1986–1988 will be imported. Norway is finally required to reduce export subsidies by at least 36% compared to the level of support in 1986–1988. Furthermore, for the commodities that receive export subsidies the quantity of export has to be reduced by at least 21%.

In the model simulation it is assumed, based on Norway's concessions, that total support to Norwegian agriculture must be reduced from 19.1 billion NOK (2.4 billion ECU) to 16.3 billion NOK (2.0 billion ECU) in real values. Of this a maximum of 10.3 billion NOK is yellow support. Column 4 in Table 2 gives the results from the GATT simulation described above. Compared to the base solution, economic surplus increases by 2.6 billion NOK (0.3 billion ECU), while the total support is reduced by 2.8 billion NOK (0.3 billion ECU). Employment and land use are reduced by 18% and 6% respectively. To a large extent the volumes of production of the most important commodities are maintained, with the exception of milk, which has to be reduced by about 10% to fulfil the requirements concerning export subsidies.

As a way of approaching the optimal solution in Section 4, the GATT scenario is a small step in the right direction. However, the agreement puts no substantial pressure on the current agricultural policy. The tariffs on most products are still in the range of 300–400%, and the reductions in support are modest.

6. EU membership

As a result of the referendum in November 1994, Norway has at present chosen not to join the EU. However, Norway is now the only North European non-member state, excepting tiny Iceland. Future Norwegian EU membership can therefore not be ruled out. In this section we present results from a model simulation in which

Table 3
Wholesale prices in Denmark and Norway

Product	Denmark	Norway
Drinking milk	4.88	7.89
Cheese	30.14	48.65
Butter	27.29	23.37
Beef and veal	20.71	34.77
Sheep meat	28.90	33.45
Pig meat	11.92	32.85
Eggs	8.32	18.39
Wheat	1.12	2.67
Coarse grains	1.16	2.28
Potatoes	1.20	2.38

The Danish prices include transport costs to Norway. NOK-1992 per kg or litre. Source: Brunstad et al. (1994).

we give Norwegian farmers conditions as follow from the accession treaty of 1994.

If Norway becomes an EU member, it is a reasonable assumption that the market prices in the EU inclusive of transport costs will form a 'roof' above which the Norwegian market prices cannot rise. As Table 3 shows, the EU prices for most products are considerably lower than today's Norwegian market prices, especially for pig meat, eggs and grains, but also for drinking milk and cheese.

The current Norwegian market prices are, overall, higher and the structural payments more extensive than in the EU. Without additional support Norwegian farmers will face large adjustment problems if Norway becomes a member of the EU. However, in the accession treaty Norway was allowed to give permanent, national support on today's level to so-called northern agriculture. Eligible for such support are regions covering 53% and 60% of today's land use and employment in Norwegian agriculture. The support should be linked to factors such as land use and number of animals, and not directly to production. The rest of Norway (i.e. the regions in the central south), was in principle obliged to adapt to the ordinary support system of the common agricultural policy (CAP).

Table 4
Production of the most important products and main input levels in Norwegian agriculture under EU conditions

	The base solution	Production of public goods (optimal solution)	The EU solution [a]
Production (million kg or litres)			
Cows milk	1850.0	838.0	1002.0
Beef and veal	78.8	41.4	72.0
Pig meat	79.7	13.0	0.0
Sheep meat	24.7	15.0	20.0
Coarse grains	773.9	293.3	108.0
Wheat	145.2	41.6	0.0
Potatoes	342.1	345.7	181.4
Eggs	52.1	17.0	0.0
Employment (1000 man-years)	71.7	33.0	41.1
Remote areas	51.9	26.0	37.0
Central areas	19.8	7.0	4.1
Land use (million ha)	0.70	0.38	0.42
Economic surplus (billion NOK)	9.6	21.9	16.4
Total support (billion NOK)	19.1	7.0	8.6
Border measures	7.5	0.0	1.5
Budget support	11.6	7.0	7.1

[a] In the EU solution a somewhat different version of the model is used, eg. the base year is 1992. The economic surplus presented above is scaled to take this into account.
1 NOK = 0.125 ECU.

In the simulation, which is presented in Column 3 of Table 4, no restrictions are assumed on import from other EU members, and the import prices are as given in Table 3. It is assumed that structural payments, included in the CAP, and additional support, according to the accession treaty, are paid to the farmers. Finally, the prices of inputs are adjusted to the EU level. A more detailed description of the assumptions and the results of the simulations are given in Brunstad et al. (1994).

As the results indicate, the production of most products will decrease considerably. For pig meat, eggs and grains, the reduction will be especially large. The extra national support allowed in the accession treaty will, however, make it possible to maintain employment and land use in most remote areas. In central areas, however, agricultural activity will decline strongly.

Although the farmers in the central areas will suffer from EU membership, it is seen that the economic surplus increases substantially. In this figure the Norwegian net contribution to the EU budget, which is calculated to be positive, is not taken into account. As for the public goods aspect, both employment and land use in remote areas are at higher levels than in the optimal solution. In the more central areas a switch from intensive grain production to extensive grazing will help maintain and in some respects even increase the value of the landscape. Concerning the food security aspect, there will be sufficient tilled land and skilled agricultural labour on the national level. However, the regional distribution differs somewhat from the optimal solution, as not all the regional floors are met. As an EU member, however, it may be more relevant to consider the total EU food security. In this respect food security will presumably increase if Norway joins the EU, as integration in the EU will reduce the risks of being cut off from imports.

7. Conclusion

In the Introduction it was pointed out that the level of support for Norwegian farmers is extremely high. Support for an industry may be defended if market failures can be detected. In the case of agriculture we have argued that the aspect of public goods and external effects can be found. Consequently, agriculture can meet certain needs which call for special support. The size of the agricultural industry needed to meet these requirements was computed and was found to be substantially lower than the present size of the industry. In other words, the size of agriculture is way out of proportion to the needs of society.

Because of the influence of the farming lobby, it is difficult to pass proposals for lower agriculture support. In this paper we suggest that pres-

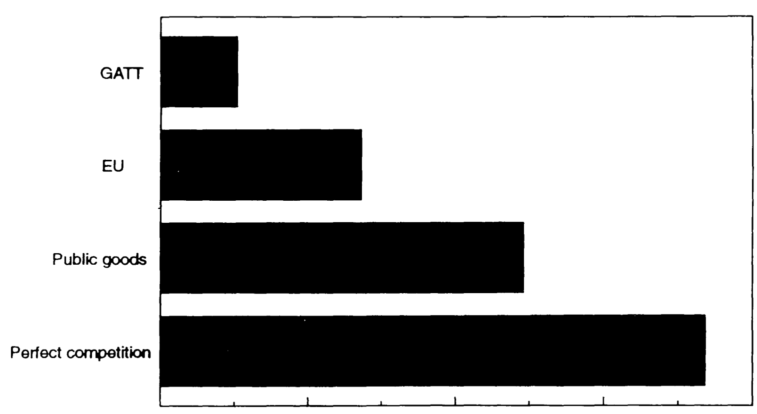

Fig. 2. Change in economic surplus from base solution (billion NOK).

sure through international agreements can do some of the job. In particular, we analyse the consequences of the GATT agreement and possible future EU membership.

The main conclusions are summarized in Fig. 2. Implementation of the GATT agreement will increase the economic surplus by 2.6 billion NOK. The specified levels of public goods can be provided, but the level of support is still 9.3 billion NOK higher than what is required for an efficient provision of public goods. Thus the GATT agreement, when fully implemented, will carry us a small step in the right direction, but there is still a long way to go. EU membership on the lines laid down by the accession treaty between the EU and Norway prior to the referendum in 1994 would increase the economic surplus by a further 4.2 billion NOK compared to the GATT solution. Due to the provisions for extra national support according to the accession treaty, the stipulated levels of public goods can be provided. EU membership would therefore have given a stronger impetus towards the optimal solution.

If we have no requirements about the level of public goods and we allow commodities to be freely imported, perfect competition prevails. According to Fig. 2, the economic surplus is then 6 billion NOK above the economic surplus in the public goods case. This difference can be interpreted as the necessary costs of providing these goods.

Acknowledgements

We are indebted to Agnar Hegrenes, Michael Hoel, Kjell Gunnar Salvanes, the editor and two anonymous reviewers for useful comments on earlier versions of this paper. Parts of the research for this paper were carried out while the authors were visiting Institut für Agrarpolitik, Marktforschung und Wirtschaftssoziologie, Universität Bonn, and Institut für Finanzwissenschaft, Wirtschaftwissenschaftliches Fakultät, Humboldt-Universität zu Berlin. Financial support from the Norwegian Research Council is gratefully acknowledged.

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