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LOWER INPUT FARMING ACHIEVED THROUGH POLLUTION TAXES

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1. INTRODUCTION

In the industrially developed world the technological capacity to produce foods has outstripped the ability to consume it. With a stabilising population little elasticity is therefore left in the demand for food and surplus problems are growing. At the same time the increasing intensity of agricultural production has resulted in a deterioration of environmental values. The combined problems of surplus production and high intensity has resulted in economic pressures to reduce output and public pressures to reduce the intensity of some agricultural production systems.

The purpose of this paper is to investigate a number of policy measures aiming specifically at controlling the application of fertilizers and pesticides, i.e. inputs which are considered to be environmentally damaging at the level of intensity at which they are used now.

2. THE MARKET SOLUTION

The conventional economic approach to these problems would be to suggest a reduction in guaranteed prices for agricultural produce. The resulting deterioration of price relations would reduce the optimum level of inputs so the land would be farmed less intensively. The income problems created by this approach could be solved by direct income transfers to farmers - it is argued.

In other words, allocative efficiency should be ensured by reducing administered prices to the market level and the distri-

butive aims of agricultural policy should be solved by direct income transfers to farmers over the State or EC budget. A variant of this scheme is found in von Meyer (1987) who suggests acreage-based direct payments to farmers as a compensation for the public goods "produced" on agricultural land.

There is little doubt that guaranteed prices for unlimited production is an inefficient way of generating income support to agriculture. On the other hand, the market prices/direct income transfer scheme suffers from two weaknesses:

- 1) The tax proceeds needed for direct income support can probably not be generated without economic costs (in the form of distortions) unless a lump sum tax is used.
- 2) Demand for environmentally damaging inputs such as nitrogenous fertilizers and pesticides is rather insensitive to changes in output prices. Accordingly, a more market-oriented price policy would primarily lead to a retirement of poorer land rather than a significant reduction in the overall intensity of agricultural production.

Therefore, price reductions are probably insufficient as a means of achieving a significant overall reduction in both input and output levels. In the following we shall investigate policy measures aiming specifically at controlling the application of environmentally-damaging inputs like nitrogenous fertilizers and chemical sprays.

3. INPUT INTENSITY IN DANISH AGRICULTURE

Over the past 30 years there has been a dramatic increase in input intensity in Danish agriculture - particularly with respect to inputs like nitrogenous fertilizers and pesticides. Thus, total nitrogen applied per hectare has increased by approximately 180 per cent and nitrogen in commercial fertilizers by no less than 350 per cent from the mid 1950'ties and up till now.

Pesticides did not become an input of importance in Danish agriculture until the 1950'ties. At present the arable part of the Danish agricultural area receives about 2.5-3.0 pesticide treatments on the average per year. When measured by the number of treatments pesticide application has doubled in Denmark from 1974 till 1986.

Environmental research has probably not yet given an exact picture of the environmental aspects of high intensities of nitrogenous fertilizers and pesticides. Nevertheless, the public and the political system in Denmark and many other European countries demand a reduction in the intensity of these inputs. Thus, action plans set up by the Danish Minister of the Environment demand a 30 per cent reduction in the use of nitrogen in inorganic fertilizers by 1990 and a 50 per cent reduction in the use of pesticides by the mid 1990'ties. This raises the question of how a reduction in intensity should be enforced.

4. INPUT LEVIES AS MEANS OF CONTROLLING POLLUTION

Taxation as a means of controlling pollution was first suggested by A.C. Pigou (in "The Economics of Welfare", 1920). By levying a uniform set of taxes on polluting activities, society can introduce a set of prices for the private use of social resources such as the use of air and water for the discharge of wastes. Thereby, the social costs of pollution are internalised to the polluters and cost-minimizing firms will cut back on emissions until the marginal cost of a further reduction equals the common tax. Thus, assuming a cost-minimizing behaviour by all relevant firms, a uniform tax on polluters will achieve a preselected standard for environmental quality at minimum aggregate costs which direct controls on emissions probably will not (see e. g. Baumol and Oates 1971, and Fisher, 1981, pp. 184-189).

Non-point source pollution like nitrate leaching and the side-effects of pesticides cannot be controlled by a tax on emis-

sions. Instead, the polluting input can be taxed, i.e. nitrogenous fertilizers and chemical sprays.

4.1. The Effects of Taxing Nitrogenous Fertilizers

Danish studies indicate that total nitrogen use (including utilized nitrogen in animal manure) would be reduced by 20-25 per cent if the average nitrogen price was increased by about 150 per cent (compared to the 1986 price level) (see Rude, 1987, and Dubgaard, 1987A). This is equivalent to a 25-30 per cent reduction in the use of nitrogen in inorganic fertilizers - i.e. close to the political target mentioned above. A 150 per cent nitrogen tax would reduce land rent by about 25 per cent on good soil and considerably more on poorer soils. A tax reimbursement scheme would therefore have to be implemented if a significant reduction of farmers' income should be avoided.

Alternatively, crop prices could be reduced. However, to generate a 20-25 per cent reduction in nitrogen rates crop prices would have to fall by about 40 per cent (see Dubgaard, 1987A). This would result in economic losses to farmers 4-5 times higher than in the taxation alternative and a considerable amount of land would go out of production. Consequently, a balance between production and demand of agricultural produce would no doubt be reached long before output prices would actually have fallen by 40 per cent, and the land still in use would probably be farmed at a higher intensity than socially desirable. Accordingly, a tax on nitrogen would be a more appropriate measure than reductions in output prices if the purpose is primarily to reduce the intensity of nitrogen application.

4.2. The Effects of Taxing Pesticides

Pesticides are not a homogeneous group of products. There are great variations in the amount of active ingredients per treatment for different types of pesticides and likewise considerable variation in prices per unit of active ingredient. This makes it difficult to design a tax scheme for pesticides which

would not overpenalize certain pesticides or underpenalize others. For example, a flat rate tax per kilo active ingredient would rest on the (implicit) assumption that adverse environmental effects of pesticides vary in proportion with the amount of active ingredient used. This is probably not so. Suggesting an ad valorem tax, on the other hand, one would assume that the more expensive pesticides would be the most damaging which seems to be quite unrealistic.

The taxation scheme assumed in the following is in essence a tax on the number of pesticide treatments or the pesticide application intensity. The practical implementation of such a tax would be to levy a flat rate per labeled dosage tax on all pesticides.

In a study by Dubgaard (1987B) the effects of taxing pesticides were calculated for a tax rate of 200 DKr. per labeled dosage per hectare for all pesticides. This would result in an increase in the average pesticide price of about 120 per cent.

The estimated effect of levying a tax of 200 DKr. per labeled dosage is a reduction in pesticide application of about 45 per cent which would be quite close to the target reduction in pesticide application set by the Minister of the Environment.

A tax of that size would reduce gross margin in crop production by about 10 per cent. As for nitrogen crop prices should be cut substantially to achieve a similar reduction in pesticide application and farmers' economic losses would be much higher.

5. PUBLIC SUPPORT TO ORGANIC FARMING IN DENMARK

In the search for measures for improving the rural environment organic farming has gained political momentum in Denmark over the past few years and in 1987 a Bill was passed to promote organic farming in Denmark.

5.1. Definitions of Organic Farming in Danish Legislation

Basically, Danish legislation describes organic farming in accordance with IFOAM¹⁾ standards, i.e. an agricultural production system which avoids the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives.

Yet, organic farming is not solely defined in terms of the allowable inputs. Organic farming aims to work as much as possible within a closed system relying primarily upon animal manure, green manures, and legumes to supply plant nutrients, and on crop rotation, mechanical cultivation and biological pest management to control weeds, insects, and other pests. With respect to animal welfare it is the aim to give livestock conditions of life that conform to their physiological needs.

5.2. Support to Conversion

In percentage terms the organic sector has been rapidly expanding over the past few years. But even so, no more than about 0.2 per cent of the agricultural area in Denmark has been converted to organic farming so far.

The new Danish legislation guarantees subsidies to the development of organic farming and to conversion of land from conventional to organic farming. About 90 million DKr. has been allocated to these purposes over a four year period.

The conversion support given to the individual farmer is a once-for-all subsidy of 2600 DKr. per hectare of the area cropped. Farmers receiving the conversion subsidy are bound to convert the whole farm to organic methods within a four year

1) International Federation of Organic Agricultural Movements.

period. Besides, the organic methods practised must be in accordance with a set of official minimum standards specified by legislation.

Studies, which have been conducted so far, indicate that the factors of production receive about the same remuneration in organic and conventional farming - after a conversion period of some length (see for example AID, 1988). During the conversion period returns will be somewhat lower in organic farming. Consequently, the indications of the present profitability of organic farming does not give much reason to believe that the costs of conversion will be an economically advantageous investment without support.

There is not much empirical evidence to tell to what extent the conversion subsidy now introduced in Denmark will affect the conversion rate. However, the amount obtainable is probably of minor importance compared to the likely conversion costs and risk.

5.3. Subsidies to the Development of an Infrastructure for Organic Farming

Part of the budget allocations to organic farming will be used to finance field experiments, the establishment of organic demonstration farms, enlargement of the organic advisory service, marketing of organic produce, and education.

Relatively high marketing costs are no doubt a major obstacle to the expansion of organic farming. In many parts of the country organic farmers would have difficulties finding market outlets for their produce in realistic transport distance from the farm. The extension of channels through which organic produce can be sold may therefore have a considerable influence on the rate of conversion to organic farming.

The law from 1987 aims specifically at supporting the creation of collection, processing and marketing systems for organic

products. Development projects may receive a subsidy of up to 40 per cent of "extraordinary" costs. A number of dairies are now establishing production lines for organically produced milk and slaughterhouses are preparing for a production of organically produced pig meat and beef.

5.4. Economic Justifications for Subsidizing Organic Farming

Lower yields and greater labour requirements mean that total costs per unit of output are generally higher in organic farming than in conventional agriculture. In a free, competitive market organic food will be produced to the extent consumers are willing to pay the price premium needed to cover the extra costs of production. However, if we accept the claim that organic methods are more environmentally favourable than conventional farming, the equilibrium reached in the market will not be a socially optimal allocation of land and other resources between organic and conventional farming.

In the absence of pollution taxes the market price of agricultural commodities does not reflect the full social costs of food production, i.e. the internal as well as the external costs. Consequently, the optimum allocation of resources between two branches of agriculture with different external costs per unit of output cannot be achieved through the price mechanism alone. Provided that organic methods are more environmentally favourable than conventional farming, the equilibrium output of organic produce reached in the market will be below the social optimum and the output of conventional food will be above the social optimum. Thus, the decision by the Danish Parliament to subsidize organic farming may well be in agreement with the social interests of society. Yet, taking externalities into consideration an annual acreage-based subsidy might be more appropriate than the once-for-all subsidy to conversion now being introduced.

However, from an economic point of view it would probably be more efficient to attempt to internalize the pollution costs

of such inputs as nitrogenous fertilizers and chemical sprays. This would reduce the use of polluting inputs to a socially acceptable level for agriculture as a whole.

There is not much reason to believe that the social optimum is identical with non-use of inorganic fertilizers and chemical sprays as in organic farming. It seems more reasonable to assume that the socially optimal input level of agricultural chemicals would be somewhere between the present level and non-use - at least if external costs are associated with pollution of the environment only.

However, organic farming need not to be socially justified by lower pollution costs alone. An important aspect of organic farming is food quality and human health.

In contrast to environmental costs and benefits the perceived superiority of organically produced food is a feature attached to the saleable output from organic agriculture. If the idea of consumers sovereignty is accepted in this context, the evaluation of the subjective properties of organic produce (associated with food quality and health) can be left to consumers individual choice between alternative products. Thus, provided that external costs are internalized, a socially acceptable allocation of resources between organic and conventional farming may be achieved through market forces without the use of subsidies.

Accordingly, pollution taxes levied on agricultural chemicals would help solving not only the environmental problems associated with high input levels in general, it would also create a better balance between the sectors of the agricultural industry which use different levels of environmentally damaging inputs.

6. CONCLUSIONS

There is little doubt that the present level of intensity in conventional farming exceeds the social optimum for a number of

environmentally-damaging inputs - such as nitrogenous fertilizers and chemical sprays. This is due to the fact that in general there are no quantitative restrictions on the use of such inputs. Nor are the external costs internalized through pollution taxes.

Taxation of nitrogenous fertilizers and pesticides would be an efficient way of reducing intensity of environmentally-damaging inputs in agriculture. Nevertheless, most governments in the European Community and elsewhere would probably prefer not to use input levies for fear that the competitive position of the nation's agricultural industry would deteriorate. To make input levies more acceptable in the EC for example they would probably have to be introduced at the Community level.

At the national level approaches to the control of the adverse effects of agricultural inputs will most often be "second-best" solutions - primarily subsidies to environmentally-favourable practices. This is a violation of the Polluter-Pays Principle. For the EC as a whole it is a rather inefficient way of dealing with agricultural pollution. There is a need, therefore, to establish a common policy aiming at a general reduction in the level of environmentally-damaging inputs in agriculture. This could be achieved by a common input pricing policy using input levies to ensure that prices paid by farmers for inputs would cover not only private costs but all external costs as well.

Yet, a reduction of nitrogen and pesticide inputs to a socially acceptable level might not be sufficient to solve the surplus problems in the EC. A combination of price cuts and input levies might be necessary to solve the combined problems of surplus production and high intensity of certain inputs. Another approach could be a combination of quotas or set aside and input levies.

But, it is not likely that a policy focussing on output prices and output regulation alone could solve the combined problems of surplus production and high intensity. As mentioned before,

it is more likely that a drastic reduction in output prices would lead to a major abandonment of land (which would not be desirable for a number of social reasons), with the land still in use being farmed at a higher level of intensity than socially acceptable. An integrated approach to the surplus and environmental problems facing modern agriculture is therefore necessary.

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It is more likely that a drastic reduction in output prices would lead to a significant increase in output. This is because the demand for agricultural products is inelastic, and a reduction in price would lead to a proportionally larger increase in quantity demanded. This is particularly true for staple crops like wheat and corn, which have a high degree of inelasticity. Therefore, a policy of price support or price floors would be more effective than a policy of price ceilings in increasing agricultural output.

As of now, the world is facing a serious food crisis. The price of food is rising sharply, and many people are going hungry. This is a result of a combination of factors, including a decline in agricultural production, a rapid increase in population, and a shift in the composition of the world's population towards more developed countries. The price of food is a key indicator of the state of the world's food supply, and it is essential to understand the factors that influence it in order to develop effective policies to address the crisis.

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