Agrekon

EDITORIAL COMMITTEE

REQUIREMENTS FOR CONTRIBUTIONS

Articles in the field of agricultural economics, suitable for publication in the journal, will be welcomed.

Articles should have a maximum length of 10 folio pages (including tables, graphs, etc.) typed in double spacing. Contributions, in the language preferred by the writer, should be submitted in triplicate to the Editor, c/o Department of Agricultural Economics and Marketing, Pretoria, and should reach him at least one month prior to date of publication.

The Journal is obtainable from the distributors: "AGREKON", Private Bag X144, Pretoria.

The price is 25 cents per copy or R1 per annum, post free.

The dates of publication are January, April, July and October.

"AGREKON" is also published in Afrikaans.

Contents

ERRATUM

Factor subsidies and certain policy implications*

by

W.L. NIEUWOUDT

University of Natal

I. INTRODUCTION

The economic structure of agriculture may be fully described in terms of the production function, the demand for products and the demand for and supply of production factors. If any of these basic relations are ignored, the result may be the implementation of an ineffective policy.

Various economists have studied the economic welfare aspects of certain instruments of agricultural policy. Wallace[1] and Nerlove[2] determined the social cost - in financial terms - of various product-price support measures. Groenewald[3] points out that economic interference in favour of the agricultural industry may affect the economic welfare of the whole community. In this discussion special attention will be given to the factor market, and the following question is raised: "What is the social benefit or social cost of input subsidies?"

II. THE SOCIAL COST OR BENEFIT OF FACTOR SUBSIDIES

Who benefits from a subsidy and by how much? Let us take the subsidy on fertiliser as an example. In Fig. 1 AB is the demand for and S_1S_1 the supply of fertiliser before the subsidy was introduced. At the equilibrium price P_1 farmers buy the quantity X_1 of fertiliser. Then the State subsidises fertiliser and the supply shifts to S_2S_2. The subsidy per ton of fertiliser is $P_2 - P_3$. If we accept that the supply of fertiliser is not entirely elastic, the new price of fertiliser, before the subsidy is deducted (P_2), will be higher than the old price (P_1).

The farmer is now paying a lower price (P_3) than previously (P_1) and is using more fertiliser (X_2) than previously (X_1). The farmer's share of the subsidy (EF) and the share of the supplier (DE) depend on the elasticity of the demand for and
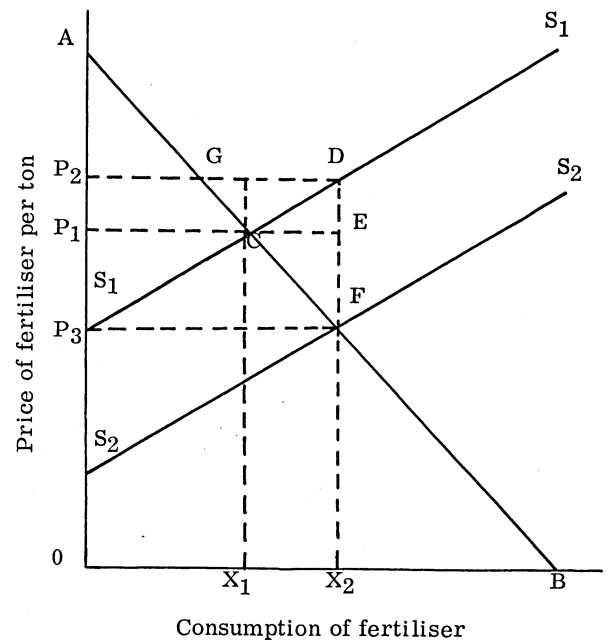

Fig. 1 - Effect of subsidy on factor market

supply of fertiliser. The more elastic the supply, the bigger the farmer's share, and the more elastic the demand, the bigger the fertiliser manufacturer's share. Allowing for a lag in price adjustment, the short- and long-term price elasticities of the demand for fertiliser are estimated as -0,75 and -2,50 respectively.[4] However, it cannot be taken for granted that the farmer's long-term share of the subsidy is smaller than the long-term share.

Does the community benefit from this subsidy? We can find out in the following way. The demand curve for fertiliser also reflects the value of the marginal product curve for fertiliser. This applies only in the case of a single firm (farmer) where fertiliser is the only variable factor[5]. But adopting the value of the marginal product curve as an approach to demand in the agricultural industry as a whole, has no effect on the conclusions. The

---

* The writer is indebted to Professor H.I. Behrmann and Messrs K. Archibald and R. Campbell with whom he had fruitful discussions on certain points. However, the writer takes full responsibility for the ideas expressed.

1) Wallace, T.D., 1962. Measures of social costs of agricultural programs. Jour. of Farm Econ., 44:580 - 597.

2) Nerlove, M., 1958. The dynamics of supply. John Hopkins Press, pp. 222 - 235.

3) Groenewald, J.A., 1964. The effects on national economic welfare of economic interference in favour of agriculture. S.A. Jour. Ec. 32: 283-293.

4) Nieuwoudt, W.L., 1970. An economic analysis of the demand for resources and the supply of output in South African agriculture. Unpublished Ph.D. thesis, University of Natal.

5) Friedman, M., 1957. Price theory, a provisional text. Aldine Publishing Co., pp. 172 - 190.

area below the demand curve to the left of a certain quantity is therefore the income to the farmer as a result of fertiliser applications. The area below the supply curve is the total cost of fertiliser production. In an economic welfare analysis the area below the supply curve could represent the social cost of production factors in the fertiliser industry. The farmer's total income increases from $OACX_1$ to $OAFX_2$ solely through the use of fertiliser and his expenditure on fertiliser changes from OP_1CX_1 to OP_3FX_2. The net increase in the farmer's income produced by the subsidy is therefore P_1CFP_3, which also constitutes his total share of the subsidy. The fertiliser manufacturer's total income increases from OP_1CX_1 to OP_2DX_2, and his net income, after increased costs have been taken into account, increases by the area P_1P_2DC, which constitutes his share of the subsidy. Put simply, the share of the subsidy marked CDF is paid out, but no one receives it and this share is therefore the net social cost of the subsidy to the community.

The next question is: Why does the State subsidise certain inputs? The writer's opinion is that the economic welfare of the community may be improved if production factors are subsidised when the value of their marginal product exceeds the price of the factor. It is not unreasonable to suppose that farmers do not fully appreciate the value of technological improvements such as hybrid seed for maize, artificial insemination and perhaps also fertiliser. Let us therefore assume that farmers underestimate the actual value of these factors and respond in accordance with the demand dd (Fig.2) and not in accordance with the value of the marginal product (curve MM).
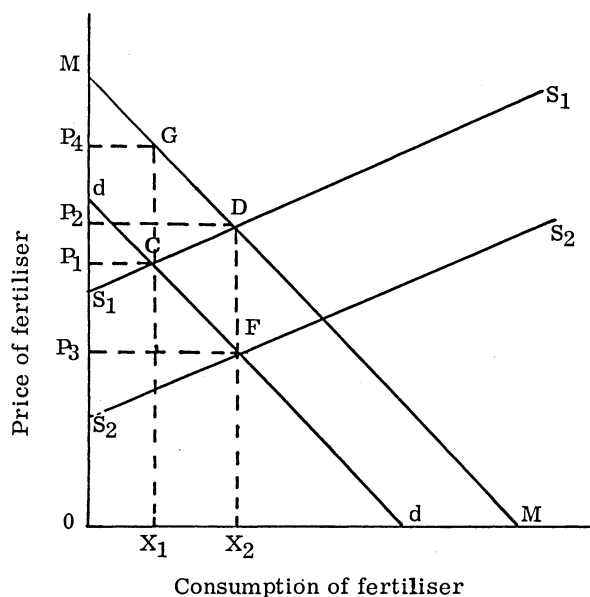

Fig.2 - Effect of a factor subsidy if the value of the factor is not yet realised

Farmers buy X_1 fertiliser at the price P_1. The State then subsidises fertiliser and the price the farmer pays drops to P_3 and the consumption rises to X_2. The profit the farmer makes as a result of using fertiliser now increases by the area P_1CGDFP_3. The fertiliser firm's profit rises by P_1P_2DC. Put simply, the area CDG reflects a profit for which the taxpayer has not paid. This

area therefore reflects the improvement in economic welfare. It is therefore concluded that the welfare of the community may be improved if a factor of which the farmers do not realise the value is subsidised. In the example in Fig.2 the actual value (value of the marginal product) is P_4, but the farmer is only prepared to pay P_1 for it. On the other hand welfare may suffer as a result of the subsidy if the farmer already realises the value of the production factor and is already using it at about the optimum level. If this is the case, the question arises why fertiliser firms are subsidised whereas the suppliers of other farming requisites are not.

A good subsidy may be an incentive to a farmer to make use of a factor such as fertiliser or hybrid seed if he does not realise the factor's value himself. If loss of welfare is to be avoided, the subsidy should gradually be reduced as the farmer comes to realise the value of the input. Economic analysis of fertiliser trials conducted in South Africa shows that the use of this factor is still below the optimum level. Calculation of the optimal use of resources in the agricultural industry shows that farming profits could be increased by the use of more fertiliser.[6] With the rapid increase in the consumption of fertiliser the gap between optimal and actual consumption is narrowing and the value of the subsidy is therefore decreasing. Use of fertiliser on a purely plant nutrient basis increased sixfold during the period 1952 to 1967.

69,6%[7] of the maize seed used by White farmers during the 1968/69 planting season was hybrid seed. In Natal and Griqualand East the percentage was only 47.

Recent trials in Natal show that hybrid seed could yield over 100 bags per morgen if given enough fertiliser, whereas the standard varieties have yielded a maximum of 45 bags per morgen over the past 15 years in the same trials. Griliches[8] tried to express quantitatively the way in which farmers accept a new technological development such as hybrid seed. He found that acceptance shows a logistic or growth pattern. Seed costs are a small percentage of total costs and according to the available facts a subsidy on hybrid seed could increase welfare and efficiency.

As an instrument of policy, therefore, subsidies could increase efficiency instead of encouraging misallocation.

III. FACTOR SUBSIDY AND RESOURCE ALLOCATION

During the three years 1968 to 1970 the Department of Agricultural Economics and Marketing spent an average of R14,9 million on fertiliser subsidies per annum. Other examples of factor subsidies are rebates on transport, stock feed and

6) Nieuwoudt, W.L., *op. cit.*, p. 117

7) Maize Board. Report on maize for the financial year ended 30 April 1969, p.37.

8) Griliches, Z. Hybrid cord: An exploration in the economics of technological change, published in "Readings in the economics of agriculture". Fox, K.A. and Johnson, G. George Allen and Unwin Ltd., 1969, pp.221 - 243.

grazing, loans at lower interest rates, assistance under the Soil Conservation Act and money spent on research. Little can be said against the subsidisation of agricultural research (salaries of research workers, cost of running experimental stations, etc.) in South Africa. The cost is often non-recurring whereas the benefit is felt for several years. For instance, the development of a maize variety that increases production by 1% means an additional income of about R2,5 million a year for the maize industry. In the U.S.A. some economists have rightly blamed research for low producer prices following increases in production that result from research. The demand for agricultural products in the U.S.A. is inelastic, however, and increases in production therefore usually lead not only to lower prices but also to a drop in farm income. About 45% of the Republic's agricultural production is exported, and since the Republic cannot influence the world price of most agricultural products to any significant extent, the demand for its agricultural products is more elastic than in the case of the U.S.A. In South Africa, therefore, agricultural research may increase farm income (real basis) and make the industry more competitive.

Loans at lower interest rates may increase efficiency in cases where lack of capital is preventing farmers from using the full potential of their farms or making the best use of their managerial ability, sometimes because they cannot offer sufficient security to get the capital they need. As we saw in II, welfare will increase if production is pushed up to the optimal level. However, if loans at low interest rates are too freely available and less deserving farmers make use of them, producers could be encouraged to exceed the optimal level of production. Such loans could then promote a misallocation of resources. Loans stimulate the demand for resources that can be bought with the money, such as tractors, machinery[9], implements and land. Often, therefore, this results in a rise in land prices.[10]

Subsidies on soil conservation works may increase economic welfare because in organising their production programmes farmers often aim at the best short-term or medium-term profit. Subsidies on soil conservation works could increase the welfare of both the present and future generations because the period for which profits are maximised would be considerably extended. In South Africa, with its uncertain rainfall and fast-flowing rivers, it is essential to encourage soil conservation. But, as in the case of other subsidies, it is possible to spend too much; using the benefit-cost method to determine the merits of various projects is one way of preventing overspending. A project could then be undertaken if the present value of future primary and secondary benefits exceeds the present cost.

A subsidy on fertiliser may encourage farmers to plough marginal soils and grow crops there. It is doubtful whether it would serve the interests of soil conservation to use certain soils in the Northern Transvaal, the Southern Free State and the North-Western Cape for crops. Product prices that are too favourable also encourage the cultivation of crops outside their natural cultivation areas. As early as 1935 Leppan[11] was concerned about the balance between the field crop and livestock industries being disturbed. Whereas a factor subsidy increases the optimal use of that factor in respect of all products, product-price support stimulates the optimal use of all factors in respect of that product. A factor subsidy encourages production and this may lead to lower prices and incomes if the price elasticity of the demand for the product is less than one. This is probably the case with uncontrolled products such as vegetables. With a long-term elastic demand for fertiliser, such as the writer postulates, the farmer's expenditure on fertiliser will increase if the factor is subsidised. Fertiliser subsidies may therefore have a depressive effect on the income of vegetable farmers. According to Orchard[12] farmers in the maize areas are taking more out of the soil in the form of N, P and K than they are putting back. If this is so, a subsidy may lead to the restoration of soil fertility rather than to an increase in production.

According to Heady[13] agricultural policy may be subdivided into development policy and compensation policy. Factor subsidies that stimulate production fall under development policy. The aim of compensation policy is to raise product prices and farm income by limiting the supply or creating markets for products. These measures may therefore cancel each other out. In the sugar, wattle bark, wine and milk industries production is being restricted. Whereas a subsidy on inputs moves the production supply to the right, production restrictions may move the supply to the left.

When subsidies are under discussion, it is often asked whether the farmer buys more fertiliser because it is subsidised. Nieuwoudt[14] has found that of all the factors that may affect the use of fertiliser, the price is the most important. This tallies with the findings of other research workers.[15][16][17] Other factors that also have an

9) Nieuwoudt, W.L., op. cit. It is estimated that a 1% drop in the interest rate stimulates the demand for farm machinery by about 1,4%.

10) Behrmann and Collett show that a drop in the interest rate causes land prices to rise. Behrmann, H.I. and Collett, B.H. Prices of agricultural land in South Africa, 1939-1966. Agrekon, Vol. 9, No.3, 1970, pp. 33-39.

11) Leppan, H.D., 1935. The Union's farming resources. J.L. van Schaik Ltd., Pretoria.

12) Orchard, E.R., 1969. A scientific approach to fertility management for maximum productivity. South African Journal of Science. Vol.65, No.6, pp. 169-172.

13) Heady, E.O., 1962. Agricultural policy under economic development. Iowa State Univ. Press, Iowa, pp. 14 and 15.

14) Nieuwoudt, W.L., op. cit.

15) Griliches, Z., 1958. The demand for fertiliser: An economic interpretation of a technical change. Journal of Farm Economics, 40: 591-606.

16) Hayami, Y., 1964. Demand for fertilizer in the course of Japanese agricultural development. Journal of Farm Economics, 46: 766-779.

17) Metcalf, D. and Cowling, K., 1967. Demand functions for fertilizers in the United Kingdom, 1948-1965. Journal of Agricultural Economics, 18: 375-385.

important effect on purchases of fertiliser are the prices of field crops and horticultural products, net farm income, capital assets of farmers and land prices. Withdrawal of the fertiliser subsidy would therefore not necessarily reduce the total consumption of fertiliser, because improvements in the farmer's financial position stimulate consumption. The writer also estimates that the present subsidy increases consumption by about 400 000 tons. How this subsidy affects the allocation of resources relative to each other is a difficult question. According to the above study the cross-elasticity of land prices and fertiliser consumption is +1,2 and the cross-elasticity of capital assets and the consumption of fertiliser about +1,6, which is indicative of a substitutionary relation between land and fertiliser and a complementary relation between fertiliser and capital assets. A 1% increase in tractor numbers is associated with a 0,8% increase in fertiliser consumption. These two inputs have shown a parallel consumption pattern since the Second World War. It is estimated on the basis of a production function suitable for the agricultural sector that additional expenditure of R1,2 million on fertiliser could replace farm labour worth at least R1,4 million, if production remained unchanged.[18] However, an increase in the consumption of fertiliser may also lead to an increase in the demand for labour, as in the case of fruit farmers, where larger crops require more labourers for harvesting.[19] Factor subsidies could therefore affect not only the use of resources within the agricultural sector but also the allocation of resources to agriculture and other sectors.

There is a tendency in developing countries for the proportion of the resources allocated to agriculture to drop, partly as a result of the low income elasticity of the demand for food and increased production. Consequently food prices do not rise as rapidly as the prices of the products of the non-agricultural sector; the value of the marginal product of resources in agriculture drops in relation to their value in the non-agricultural sector and resources move from agriculture to other sectors. Subsidies can merely retard this process.

According to McCrone[20] the real purpose of agricultural subsidies in Britain is to safeguard the income of farmers and none of the other arguments, such as safeguarding the balance of payments, can be economically justified. According to him the considerable cost of subsidies should be cut and the industry made more competitive. The subsidy policy should also be aimed at helping to make the industry more competitive.

Economic arguments are not always of decisive importance and security, political and socio-economic considerations should be taken into account. At this point the problem becomes a matter of value judgement that falls outside the scope of this article.[21]

IV. CONCLUSION

As an instrument of policy agricultural subsidies may promote either efficiency or the misallocation of resources. The economic welfare of the community may be increased if production factors whose value is not realised by farmers are subsidised. However, the welfare of the community may be reduced if inputs are subsidised beyond their optimum level of use. For instance, it is possible to subsidise fertiliser completely so that farmers find it economically advantageous to produce at the level of maximum production. From the point of view of prosperity, therefore, subsidies are justified only if agriculture is in a non-Pareto optimal position.

18) Nieuwoudt, W.L., op. cit.

19) Heady showed that factors may be economic complements although they are technical substitutes. Heady, E.O., 1960. Economics of agricultural production and resource use. Prentice-Hall Inc., pp. 194-195.

20) McCrone, G., 1961. The economics of subsidising agriculture. University of Toronto Press.

21) Brand, S.S. and Tomlinson, F.R., 1966. Die plek van die landbou in die Suid-Afrikaanse volkshuishouding. S.A. Jour. Econ., 34: pp.26-49.