Economic impact of environmental measures on Hungarian farms

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Abstract

Hungary's imminent entrance into the EU calls for a support system aiming at combining agricultural production with nature conservation targets. Within the National Agri-environmental Programme (NAEP) for the Environmentally Sensitive Areas a payment system was set up, with which for each separate region the amount of support for every environmentally friendly farming prescription package (tier) was established through the support calculation methodology of the EU. This paper, based on the calculated amount of payment for tiers to analyse the influence of the packages on income in case of a mixed farm, and draws attention to how important it is to analyse the supporting system on the whole farm base within a production structure. The payment per package calculated by hand can be quite different from the amount which the farmer actually needs to sign up for a contract because of the influence of the packages within the farm system.

Key words:

National Agri-environmental Programme
Linear programming model
Payment system

Introduction

Today's agriculture means a lot more than simply producing goods. The rural areas are not only the scene of production, but also a biological and social living area, therefore it is also the role of the agriculture sector to sustain the diversity of the rural areas – not only it's production functions but it's aesthetics and biodiversity. This is why nature protection has to coexist with agriculture, and the agricultural production has to respect the aspects of environment and nature protection. This, however, can only be achieved if the producers are encouraged to comply with this system of rules. Therefore a system of economic controls and financial incentives should be developed that compensates for the loss of income resulting from the compliance with the environment- and nature protection aspects, and which honours the environmental and socio-regional achievements of the concerned agricultural business.

The study described here aims to analyse the environmental and economic effects of different kinds of measures taken by farmers during arable farming and animal production. These measures are collected in packages based on the Hungarian land use system which differentiate several kinds of zones for protecting the environment, nature and landscape. For this analysis a deterministic and static linear programming model of a typical Hungarian

mixed farm in an environmentally sensitive area (Dévaványa) is presented and tested. Special attention was given to the inclusion of the zonal based environmental packages. The objective function of the model maximises labour income. With this test the influence of the packages on the income of the farmers is measured and the amount of grant is calculated to motivate the farmers to implement a certain kind of environmental protecting activities.

Background of Hungarian Agri-Environmental Programme

Within the Hungarian Ministry of Agriculture and Rural Development, the Agri-environmental EU harmonisation Working Group analysed the legislative framework of '2078/92 EU agri-environmental regulation on the support of agricultural production methods that are environmentally friendly and aim at the preservation of rural areas as well as EU member States' experience within its implementation. As a result, the Ministry took legislative and institutional steps to introduce the Hungarian Agri-Environmental Programme (AEP). In the first step, a land zone study (II) prepared by the Institute of Environmental Management, Szent István University in 1997 evaluated the suitability of areas for agricultural production (i.e. agricultural potential) and environmental sensitivity, and made a comparison between these two sides in order to balance natural resources and to identify target areas for different agri-environmental schemes.

The schemes of the NAEP supporting environmentally friendly agricultural land use can be divided into two groups. The first group is made up of the so-called horizontal or national schemes, which cover the total area of agricultural land use. The schemes provide support for environmentally friendly cultivation and production methods (reduced use of fertilisers and pesticides, environmental farm plans) and nature oriented land use systems targeted at quality food production. Horizontal measures combine environmental protection (soil, water) with nature conservation targets. The second group are area specific regional or zonal schemes that target areas with low production potential but significant environmental and natural values. The target areas of these programmes can be small regions, which from a nature,- land,- or water protection aspect require some kind of special utilisation. The individual schemes support the introduction of land utilisation forms and production practices developed by regions. These schemes form the so-called network of Environmentally Sensitive Areas (ESA). (I)

The system of environmentally sensitive areas (ESA)

The zonal programmes provide opportunities for the execution of the following agri-environmental measures:

- arable land / grassland conversion,
- extensive breeding of native animal species,
- nature protection focused farming,
  - application of extensive, protection oriented production methods,
  - biotope / reconstruction (eg. wet biotopes) and maintenance,
  - establishment of biotope networks,
  - development of the living area of certain species,

- protection of coastal strips of water flows, protection of sub-surface water reserves
- small parcel (mosaic) farming with soil protection objectives,
- landscape reconstruction,
- application of soil protection methods etc.

In the dual - protection and production - determination, extensive non-production utilisation objectives often arise. The special regional programmes developed for these areas adress these objectives. The programs have to be developed for each region according to their specific needs (e.g. environmental objectives, employment, opportunities of rural tourism, special regional production potentials, etc.). The programmes aim at the support of low intensity production systems. A few examples based on potential: arable-grassland mosaic, traditional, small-parcel plant production, traditional vine and fruit production, flood-plain cultivation, herb production, extensive beef cattle production, sheep husbandry, fish-and reed production, etc.

Participation in the programmes is voluntary. Every eligible farmer can join the national schemes, naturally only those can join regional (zonal) schemes who produce in the region or area in question. Therefore the precise geographical delineation of the target area is essential. The farmers, after becoming acquainted with the requirements, sign a 5 year contract in which they assume the obligation of keeping to the terms of the contract (the 'rules' of production that are set out in the scheme in question). In return the farmer receives an annual support payment of the contracted period (on a hectare or livestock unit base).

The support payment covers the loss of income due to the measures applied, the possible extra costs and contains a further 20% incentive to make the scheme attractive and the environmentally friendly farming practices competitive. The amounts of payments will be determined for the individual schemes, using the support calculation methodology of the EU. The establishment of a training, demonstration and extension network is planned to improve the understanding, updating and implementation of the schemes by farmers. (I)

Model specification and data used

To analyse the effects of different zonal packages on income of farmers and the environment a linear programming model is used for a typical mixed farm in the Dévaványa plain pilot area. The pilot area is divided into smaller parts (zones) according to the various habitat types. There are different farming prescription packages (tiers) in the various zones that were designated on the basis of the following principles:

Zone I. Areas with general nature conservation objectives
Zone II. Areas especially important for the great bustard
Zone III. Brimstone wort habitats
Zone IV. Areas of small game and partridge
Zone V. Important nesting areas of strictly protected birds of prey

One may join the support system of ESA-s in each management type. Tiers related to a different management type than the considered area are available only after an uptake of a

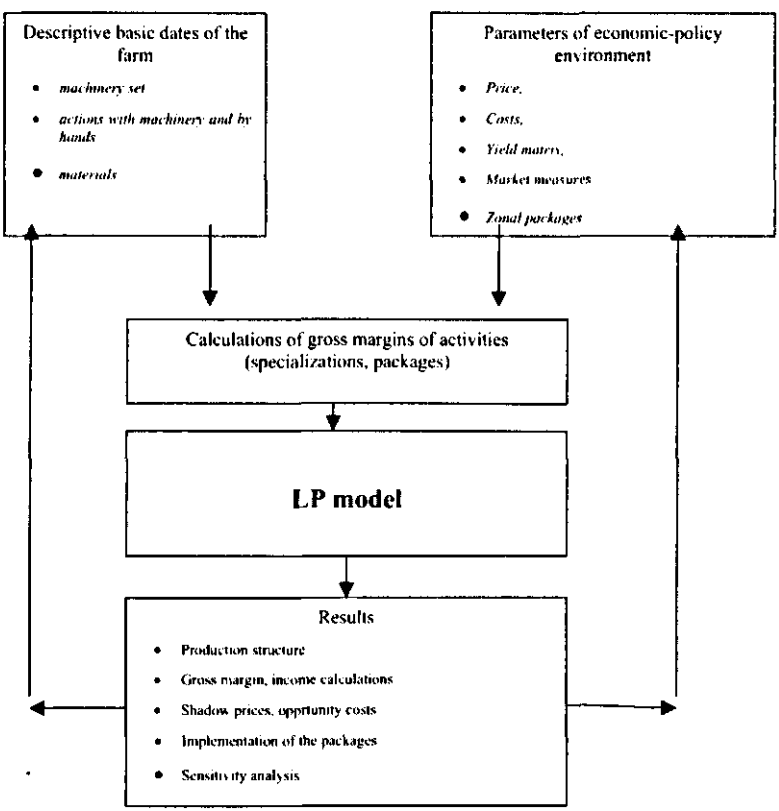
conversion program. If a farmer wants to sign up for a 5-year grassland ESA on arable lands, he can do so only after implementing the appropriate conversion program. The relevant investments may be supported by special grants.

General conditions of joining includes the conversion of arable lands into grasslands and the maintenance of so converted grasslands for a minimum of 10 years in the pilot area. Once the grassland is established, one of the grassland packages may support its maintenance, depending on the use and location of the grassland. (IV)

General structure

The general structure of the model is shown in Table 1. The linear programming model uses a basic set of descriptive data of the farms and the parameters of their economic-policy environment to calculate the gross margins of activities in order to maximise income of the farmer.

Table 1. General structure of the model



Linear programming presents a collection of relevant technical opportunities by separate activities in a matrix. The rows of the matrix form the constraints that represent the technical relation between the activities. Given the objective function, the solution procedure determines the optimum solution considering all activities and restrictions simultaneously. New production techniques and packages can easily be incorporated by means of adding new activities to the model.

The objective function of the LP model is maximise income of the farmer. The products of each activity and the costs or the gross margins per unit of activity are summated and produce the gross farm result. These results include: returns, variable costs and fixed costs. The fixed costs follow from the fixed assets of the farm, of the barn and fixed machinery. The final outcome is the labour income of the farm which is determined by subtracting the other fixed costs from the gross farm result. The labour income is the financial compensation for labour and management that is left after all other costs have been paid.

Beside of the labour income in the final outcome production structure of the optimized model is shown which includes or not the activity of the certain packages. Part of the solution is the marginal product values (shadow prices and opportunity coasts). In this model the value of the shadow prices play the most important role. It shows the amount of money the non-entered activity should 'produce' more in order to be incorporated into the model. Sensitivity analysis can be made to test the influence of the individual packages on the income of the farmer and to the production structure of the farm.

After the programmes and packages have been in effect for a while the results of those packages will have a feedback effect on the basic dates of the affected farms and in case of unwanted side-effects should have an effect on the economic-policies themselves.

Model test and results

To test the influence of the packages on the income of the farmer an average mixed farm in size (200 ha), production costs and yields in Devavanya pilot area were implemented and tested. The main profile of the farm is raising dairy cattle, growing fodder (like grass, alfalfa, silage maize) and cash crops (like winter wheat and corn).

In order to analyse the effect of certain packages two scenarios should be regarded more closely. For easier overview in both cases we assumed that the whole area of the farm is situated in the protected Zone 1 (areas with general nature conservation objectives).

In the first case (basic situation) the farmer decides to continue his farming traditionally, without implementing any packages. He behaves as if his area is a non-supported area. In this basic situation the farmer's income is optimised without the interference of the packages. His main activities in the chosen pilot area would be the raising of livestock and the growing of cash crops. The total income is 16.124.000 Ft.

In the second scenario we assumed the farmer signs the contract to implement certain kind of packages. In this area for this type of mixed farm the farmer can chose from 8 different packages (SZ1-7, SZ9) in case of arable farming and 3 packages (GY1-2, GY-9) in case of

grassland. To analyse the influence of the packages on the production structure of the farm the next 3 packages are included into the model as separate activities:

- SZ1: alfalfa establishment and production;
- SZ6: fallow;
- GY2: grassland management with grazing.

These packages are the new activities, which compete with the traditional activities. In case of alfalfa the model chose between the traditional alfalfa production method and (SZ1) alfalfa establishment and production, which incorporates certain measures to protect nature. In case of fallow, the situation is a bit different because its incorporation into the model depends on the crop type it replaces. In the third case the grassland management of the GY2 package is build into the model as an activity to make a comparison between a traditional method of grassland management with grazing and a supported one.

Above mentioned three packages were first built separately into the basic model and afterwards all together. In the model the shadow prices show up as a result, they show the amount of money the government has to support the farmers with if they want them to implement the needed packages. In these cases the results of the model are as follows:

1. SZ1: in this case the production structure after maximising income of the farmer is involved with this new activity, because of the payment (46.800 Ft/ha) the total income is 17.267.000 Ft which is more than in the basic situation. The minimum amount of support is really easy to calculate from the shadow price of the basic alfalfa activity (22.886 Ft) and the subsidy given for SZ1 activity. The difference (23.914 Ft) is the minimum, and with the added 20% incentive (4.783 Ft) totally 28.700 Ft should be provided to the farmer.
2. SZ6: If the fields are left fallow the compensation of the loss of income differs with the type of crop the income comparison is made with. To calculate the minimum amount of support with the above mentioned method, in case of for example winter wheat the annual support should be 26 % more than payment calculated by hand + 20% incentive and in the case of corn 12 % more + incentive. With more cash crops available in certain rich areas, the compensation might have to be considerably higher than on marginal grounds with less potential.
3. GY2: in case of grass with grazing, the minimum amount of support with the incentives should be about 10% less then it is calculated manually for Devavanya pilot area.
4. Finally to measure the influence of all above mentioned packages on the income of the farmer these are incorporated into the model. The final result is 17.132.000 Ft, the production structure including SZ1 and GY2 activities due to which the total income is higher than in the basic situation.

Under influence of the above mentioned packages the production structure of the farm will change because the competitive packages will influence the income ratio of the farmer. Some of the packages, in their present form, are not as competitive as others so the government might have to create some extra inducements onto the less profitable packages that they want the agricultural community to implement. In case of the SZ1 and GY2 packages turns out to be the most feasible while for the rest of the packages some more support would be needed to make them economically attractive.

Similar calculations can be made in case of the other protected zones. With this method for various kinds of farms within exact regions, the minimum amount of support can be calculated for each combination of packages.

Conclusion

Within Hungarian Agri-environmental Programme for the Environmentally Sensitive Areas a payment system was set up. The amount of payments is determined for the individual schemes using the support calculation methodology of the EU. This payment system calculates the support on a hectare or units of livestock basis for individual packages without taking into account the production system of the farm. In real life the farmers will incorporate these packages into their farm production structure in which the influence of the packages on the other activities and total income of the farmer are considered and not just one specialised activity. With this method it is possible to analyse the amount of payments for these packages. The shadow prices and opportunity costs show, support or refute the amount of payments for the individual schemes.

Because of the general nature of the current model it is not yet useable in all real world situations, but it can give a reliable indication of the effects connected to management decisions. With some more development the system could be a considerable asset in evaluating the financial consequences of nature conservation and environmental protection packages.

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