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Multifunctional agriculture: some consequences for international trade regimes

Arild Vatn

Agricultural University of Norway, Aas, Norway

Summary

The debate over agricultural trade rules is marked by substantial disagreement. The paper starts by clarifying the positions. The apparent divergences stem largely from differences in assumptions—not least which relationships are assumed between the private and public goods involved. The paper analyses the implications for trade policy if private and public goods are interrelated in production and transaction costs are positive. It is shown that the core issue here is the trade-off between precision and policy-specific transaction costs. It is concluded that under the defined assumptions, it is not rational to opt for a single market for agricultural commodities.

Keywords: multifunctional agriculture, trade rules, precision, transaction costs, rights, efficiency

JEL classification: Q17, Q28

1. Introduction

Trade regimes, environmental quality and agricultural policy are all issues of high international significance and conflict. Whereas some claim that trade has the potential to reduce environmental degradation (win–win), others strongly oppose this view. A third position is to look at these issues as unrelated and treat them separately. Concerning agriculture more specifically, most economists maintain that reduced protection or national subsidies will result both in increased gains from trade and a better environment. Given existing policies, this sector provides the most typical win–win situation for combined economic growth and enhanced environmental qualities.

Even this conclusion is in part challenged, not least in the debate about ‘multifunctional agriculture’. This concept implies that several public goods or positive externalities are attached to agricultural production. It is argued that free trade could endanger the production of these goods, especially in the case of countries that have problems with competing in the international market for food commodities.

The various conclusions are typically based on different assumptions. The aim of this paper is to clarify how the assumptions we make influence conclusions concerning what become rational trade rules. More specifically, I want to offer insight into the effect of different trade regimes when a production process gives both private and public outputs.

The argument of this paper is that, in a situation where private and public goods are interconnected in production, as in multifunctional agriculture, and transaction costs are positive, it may not be rational to have free trade for the private goods while paying separately for the public ones. The transaction costs that are invoked by this solution may be higher than the gains in precision obtained by targeting each policy measure. Because restricting trade implies taking a stand between importers and exporters, the rights issue involved here is also addressed. Although economists do not have the authority to offer solutions in this matter, we can help to clarify how efficiency evaluations and rights issues are linked in such cases.

2. Trade and the environment

Environmental issues (e.g. externalities) are not a focus of the classical trade model. This is partly due to the assumptions normally invoked. Since Ricardo, it has been standard to assume only private goods, free competition in production, zero transaction costs, and non-mobile capital and labour inputs. In such a situation, free trade secures the highest level of economic growth for all parties (countries) involved. This is the doctrine of comparative advantage and minimal state involvement.

The more recent debate about the relevance and correctness of this model has focused on the structure of the economy; that is, the assumptions concerning a competitive environment and mobile outputs in conjunction with immobile inputs (e.g. Kaldor, 1980; Krugman, 1990). Although these assumptions are of importance in the case of the environment as well, the most significant issues for us are the assumption that all goods are private and the associated question of free disposal.

Most economists seem to accept that the free disposal assumption is not a valid description of actual world conditions. The special branch of environmental economics concentrates its energy on this issue (see, e.g. Baumol and Oates, 1988). The main focus is on internalising the effect of disposals that have negative effects on environmental amenities. Generally this is handled through (ambient) taxes or tradable emission quotas.

Concerning the issue of environment and trade, the dominant conclusion in the literature is to keep environmental policy detached from trade policy. According to Anderson and Blackhurst (1992: 19) 'the impact of trade and trade liberalisation on a country's overall welfare depends on whether the country's environmental resources are correctly priced, which in turn depends on whether appropriate environmental policies .... are in place. If they are, trade and trade liberalisation benefit the environment because the resulting increase in economic growth stimulates the demand for environmental protection and generates additional income to pay for it.' Thus, trade is only a magnifier, not a cause in itself.[1]

1 Various aspects of this issue that will not be treated here are found in Esty (1994), Røpke (1994), Anderson *et al.* (1995), Arrow *et al.* (1995), Anderson (1992), Ekins (1997), Rauscher (1997), Runge (1998), and Cole (2000). Much of the debate has been about the ability of the economic system to correct itself; for example, the 'environmental Kuznets curve hypothesis'.

The challenge for this position is to prove that there are no or at least not sufficiently large direct or indirect effects of free trade on the environment to favour regulation via trade rules themselves. Alternatively, one has to show that regulating the effects of trade is simpler and cheaper than regulating trade directly.

The answer to these issues depends on the type of relationships involved. Let us look at some aspects of relevance to agriculture. First of all, transport is of great importance for international trade in food commodities. To be able to internalise the environmental effects of transport, a global regime is needed. Whereas many countries have regulations within their borders, externalities arising from transport between countries are not taxed. This illustrates the problem with assuming rules for transboundary pollution to be in place.

Specialisation is, in the case of agriculture, a double-edged sword. It is the very basis for the potential gains from trade, but will also by necessity result in breaking local cycles of matter and energy. In the past few decades, we have experienced many effects from specialisation. A prime example is the huge amount of organic waste in areas with high animal densities where much of the production relies on imported feed. In principle, any town or city faces the same problem arising from a concentration of end-users.

Although both the above points are relevant for most types of production, the danger of spreading diseases and foreign species is most typically linked to the food and animal sector through transport between regions. The recent outbreak of foot and mouth disease is a stark example. In this case, the externality may be directly associated with what is traded, and the volume of trade will directly influence the quality of the food production systems.[2] Furthermore, the issue has been raised of whether the high level of competition itself is a source of increased frequency of events of diseases and toxins in food. They may be a direct result of cost-reducing practices in an increasingly tough economic climate.

Countering these effects by the 'internalising of externalities strategy' may in practice be problematic in at least two respects. First, some time normally elapses after the adoption of a process that produces externalities before the problems it creates are observed and scientifically proved (e.g. many types of pollution, mad cow disease). Thus, by this latter stage, the investments undertaken under the assumption that no harm will be done may be huge. These investments will influence future remedial costs and will affect what is an optimal solution at the time the problem is scientifically recognised. Internalising externalities is thus no simple matter. What is an optimal solution will strongly depend on who in the end bears the burden of proof.[3]

Second, if it is trade itself that creates the externalities or impedes the production of public goods, it seems inappropriate to create a two-stage analysis, where one first generates the conditions for free trade and then afterwards

2 See, among others, Altecruse *et al*. (1997), Skjerve and Wasteson (1999) and Silverglade (2000).

3 See Vatn and Bromley (1997) and Vatn (2002) for an elaboration of the above arguments. The burden of proof issue is also touched upon in Section 5 under the issue of rights.

tackles the resulting external effects separately. We economists tend to handle too many issues or processes as if they were independent of each other. This is not least the case with environmental issues.

The aim of this paper is to look at one type of problem related to such a two-stage analysis: the situation where public goods and bads are produced together with private goods. When analysing this, there are two technical issues that come to the front: the issue of jointness or interconnectedness and the issue of transaction costs. If private and public goods are connected in production, the standard model of gains from trade does not apply.

3. Multifunctionality, costs and policy options

3.1. What is multifunctionality?

The concept of multifunctionality seems to have somewhat different meanings in the literature. The OECD uses the following definition: 'Multifunctionality refers to the fact that an economic activity may have multiple outputs and, by virtue of this, may contribute to several societal objectives at once. Multifunctionality is thus an activity oriented concept that refers to specific properties of the production process and its multiple outputs' (OECD, 2001: 11).

One should add that these outputs normally consist of a mix of private goods (food and fibre) and various public goods. It is this combination that creates special challenges for public policy. To complete the picture, the definition of multifunctionality should comprise not only public goods, but also public bads; that is, some of the functions or effects may have negative consequences for welfare. The following elements constitute a representative list of the various public aspects of a multifunctional agriculture:

(i) environmental effects: landscape (biological diversity, recreation, aesthetics), cultural heritage, pollution (changes in matter cycles, genetic pollution, etc.);
(ii) food security (availability in different situations);
(iii) food safety (quality and phyto-sanitary status);
(iv) rural concerns (rural settlement, rural economic activity).

It is important to acknowledge that the various goods[4] and bads are components of an integrated production system. They often appear as linked sets of functions. Although some of the listed aspects may also be produced independently of agriculture, we cannot envision an agriculture that does not affect the status of all elements in the above list. In this sense, all the listed public goods or bads are dependent on primary production. They are characteristics of the system as a whole. This certainly stems, to a large degree, from the fact that agricultural production is directly interlinked with the ecosystems it operates within and the space it uses. This works through the combined use of inputs. This is illustrated in Figure 1, which also forms the basis for the model to be formalised in Section 3.3.

4 In this paper the concept of a 'good' covers also what is often termed a 'service'.

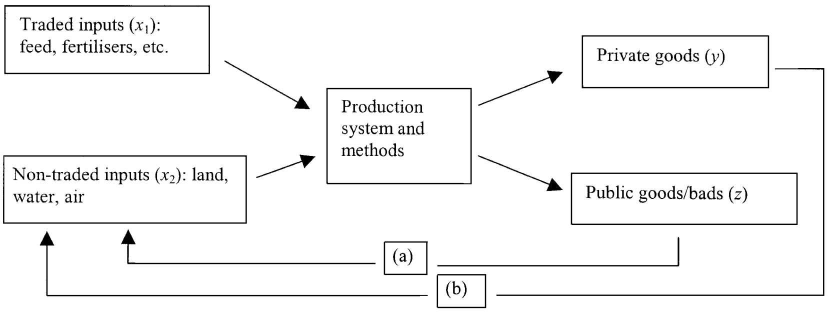

Figure 1. The linked set of inputs and outputs in the agricultural production system

On the input side, the figure distinguishes between inputs that are (easily) traded (x_1) and those that are not (x_2). The latter resources are typically local, and they are often public or common pool resources (such as water and air). Land is included in the category of non-traded goods. This is because land is often reallocated between productions without trade taking place.[5]

Inputs are combined in different production processes. Out of these come sets of outputs in the form of tradable goods (y), and public goods and bads (z). Given that matter cannot disappear, all resources that are put into the production process must in the end appear as outputs of one form or the other; that is, as a private good (commodity), a public good or a public bad (see also Baumgärtner, 1999).

Outputs may be joint, complementary or competing. *Jointness* implies that when an enterprise produces more than one output, inputs cannot be assigned specifically to each output. Thus, the production function includes all outputs as a function of the inputs (Frisch, 1971; Gravelle and Rees, 1981). Jointness can cover both goods and bads, which in principle can be both private and public.

In the case of *complementarity*, the production of one good contributes an element of production, which is joint with this first good and required in the making of a second good (Heady, 1952).[6] This is illustrated by the arrows (a) and (b) in Figure 1. The effect on the joint production factor could, in principle, be both negative and positive. A classical example in agriculture is the production of hay, which contributes positively to soil fertility (joint product with hay), hence increasing future grain productivity (complementary product). Complementarity occurs normally within certain ranges. Beyond these ranges the two products *compete* over the common factor of production.

We have made a distinction between private and public goods. There are at least two reasons why a good may be considered public.[7] First, it may be

5 Although for some inputs, such as fertilisers, measures (e.g. taxes) can be directed at the point where the resource is traded, this possibility is restricted in the case of land. The implications of this will be discussed later.

6 Heady (1952: 222) offers two more definitions, one of which is a variant of the one used here.

7 In this paper I use the concept 'public' for denoting that the good is available to all; that is, nobody is excluded. Whether the good is rival in use or not is not considered.

found politically or ethically correct to provide a good to everybody free of charge. Second, it may be too costly to demarcate the good so that it is only accessible to those who pay specifically for it. The costs of transacting are simply too high. It is this latter aspect that is of interest here.

A substantial part of transaction costs are related to the costs of demarcating a good. The idea to be developed here is that it may be much easier (less costly) to apply a policy instrument to traded inputs or outputs (i.e. private goods) than to apply one to the associated public goods or bads. This has not least to do with the costs of demarcation and the associated costs of observation and control. Concerning Figure 1 this implies that the least costly points of instrument application will be the traded input x_1 or the traded output y. On the other hand, such solutions may be too imprecise compared with measures directly attached to the public good one wants to secure or promote. To develop this reasoning, a clarification of what is meant by transaction costs and precision is needed.

3.2. Precision and transaction costs

Arrow (1969: 48) has defined transaction costs as the 'costs of running the economic system'.[8] Dahlman (1979) operationalised this concept by separately identifying costs of information gathering, contract making and control. In most policy analyses, transaction costs (TCs) are not explicitly considered; that is, they are implicitly assumed to be zero. This is strange, because if TCs are zero, it is impossible to discriminate between different economic structures—like free competition or oligopoly—on the basis of efficiency (Williamson, 1985; Eggertsson, 1990), and we do not need any public policies except those defining the rights structure (Coase, 1960).

There are two technical reasons for being interested in multifunctionality. First, if goods can be jointly produced, there is potential for reducing production costs (Schumway *et al.*, 1984; Hoel and Moene, 1993). Second, treating goods as bundles will often imply reduced TCs. The famous Tinbergen conclusion that there should be at least one policy measure for each policy objective (Tinbergen, 1950) demands zero TCs. If TCs are positive, we have a trade-off problem between TCs and the precision of the policy (Vatn, 1998).

What is then meant by precision? In a policy situation like the one envisaged here, costs can be divided into two components. First, we have the costs of producing a certain public good, such as a particular landscape. Second, we have the policy-specific transaction costs. These are the costs involved when establishing and running the policy (i.e. information gathering, contracting and controlling). A precise solution is reached when the standard condition for optimality is met in the production of the good (i.e. marginal cost equals marginal gain). Furthermore, loss of precision can be measured as the net gain foregone by a deviation from this standard optimality condition.

The policy-specific transaction costs (for the rest of the paper termed transaction costs) depend on the level of precision. They are in a way the 'costs of

8 Cited in Williamson (1985).

being precise'. As an example, an optimal state for a landscape may be defined in terms of production costs involved and utility obtained. Achieving such a state may require several policy measures directed towards changing the qualities of the landscape. The efforts involved in meeting information requirements, specifying new incentives, formulating contracts and policing them have to be weighed against the potential gains for each element involved. In doing this, one has to make a trade-off between the gain of transforming the landscape as near the 'ideal' as possible and the increased transaction costs involved. Whereas the marginal utility of increased precision would be expected to fall as precision increases, marginal transaction costs would be expected to grow. All costs considered, it would not be reasonable to expect a precise policy to be optimal. In our example, this may imply that paying a flat subsidy per hectare to maintain an open landscape may be a better policy than to pay a specific price for each element of the landscape because the gain in reduced TCs is greater than the loss in precision.

3.3. Production costs and policy options

To produce insights that are relevant to trade policy, we need to formalise the analysis. Let us start with the problem of precision. We consider the following model developed on the basis of Figure 1:

$$\text{Max } U = U(y_i, y_n, z_1, z_2, z_3, \text{TC}) - p_y^w y_i \tag{1a}$$

$$\text{s.t.} \quad y_n = y_n(x_{11}, x_{21}) \tag{1b}$$

$$z_1 = z_1(y_n), \qquad z_2 = z_2[x_{12}, x_{22}(y_n)], \qquad z_3 = z_3(x_{13}, x_{23}) \tag{1c}$$

$$x_{jk} = r_{jk} \qquad (j = 1, 2) \quad (k = 1, \ldots, 3) \tag{1d}$$

where U is social welfare; y is a private good, where the subscript i implies imports and the subscript n implies national production in country n; p_w^y is the world market price for y; z_1 is a public good jointly produced with y_n; z_2 is a public good where one input is joint to the production of y_n (complementarity) (this input can affect the quality of z_2 negatively or positively); z_3 is a non-joint public good; TC is transaction costs following from the type of policy used; x_{jk} are inputs, where $j = 1$ implies tradable goods, $j = 2$ implies non-tradable goods, and k differentiates between different inputs of category j; and r_{jk} are resource constraints.

Functions (1a)–(1c) are assumed to be concave and twice differentiable. We observe that there is no complementary slackness or free disposal, as resources either end up as the private good y or the public good or bad z.[9] We observe also that z_1 is a public good jointly produced with the production of the private good in country n (y_n). Furthermore, z_2 is a public good that is complementary to y_n. There is thus a joint input involved, x_{22}, which may influence the quality of z_2 either positively or negatively. The formulation in (1a)–(1d) should then cover the most important relationships involved when discussing multifunctional agriculture.

9 This implies that I consider all resources to be involved in the production of the goods, even though they are not necessarily altered by this production; for example, parts of the landscape.

The interesting issue here involves the various effects on the public goods from producing y_n. Let us start by disregarding the transaction costs. On the basis of the first-order conditions, the following has to hold for an optimum:[10]

$$\frac{\partial U}{\partial y_n} + \frac{\partial U}{\partial z_1}\frac{\partial z_1}{\partial y_n} + \frac{\partial U}{\partial z_2}\frac{\partial z_2}{\partial x_{22}}\frac{\partial x_{22}}{\partial y_n} = \lambda \tag{2}$$

where λ is the Lagrangian multiplier for the production constraint on the private good in country n (constraint (1b)); that is, marginal cost per unit of production in optimum. This expression says that the cost of producing the private good in country n should equal the sum of the marginal utilities of the private good y_n itself, plus the marginal utility it gives through the joint good z_1, plus the marginal utility or disutility it gives by producing x_{22}, which is an input into the production of z_2. As earlier emphasised, the expression $\partial x_{22}/\partial y_n$ of equation (2) may be either positive or negative, indicating that production of y_n may reduce or enhance the utility of z_2 via its effect on x_{22}.

How can the conditions under (2) be attained? The following optimisation problem can be defined for a firm producing all three types of public goods:

$$\begin{aligned}\operatorname{Max}\pi = {} & p_y y_n(x_{11}, x_{21}) + p_{z_1} z_1[y_n(x_{11}, x_{21})] + p_{z_2} z_2\{x_{12}, x_{22}[y_n(x_{11}, x_{21})]\} \\ & + p_{z_3} z_3(x_{12}, x_{23}) - C_n(\cdot)\end{aligned} \tag{3}$$

where p is the price of the various goods (indexed according to type of product), $C_n(\cdot)$ is the cost function for producing y_n, and z_1, z_2, z_3 along with $x_{11}, \ldots, x_{23}$ are its arguments.

Assuming the private good y_n to be of equal quality to y_i and world market prices for y to be inelastic with respect to demand from country n, the price for the private good p_y should equal the given world market prices p_y^w. Furthermore, as z_1 and x_{22} are joint products of y_n, they are delivered for free and may not demand any payment in optimum. Certainly, if x_{22} has a negative impact on z_2, some incentive corrections are warranted. Let us look more closely at these issues.

Let us start with the simplest situation, that is, with a joint public good (z_1). The social maximisation problem in (1) changes to

$$\operatorname{Max} U = U(y_i, y_n, z_1, \mathrm{TC}) - p_y^w y_i \tag{4}$$

subject to (1b)–(1d) with similar adjustments. The firm's problem in (3) changes to

$$\operatorname{Max}\pi = p_y y_n(x_{11}, x_{21}) + p_{z_1} z_1[y_n(x_{11}, x_{21})] - C_n(\cdot). \tag{5}$$

To be concrete, z_1 could be food safety; that is, the degree to which a national food production has a direct effect on keeping up the quality of a

10 For a complete exposition showing the derivations, see Vatn *et al.* (2002).

country's production system.[11] It could also be food security,[12] or it could be rural economic activity to the extent that producing food must engage rural resources. Given that y_n is considered the primary part of the two goods y and z_1, the latter can be regarded as delivered for free. The amount of y_n may, however, be too low to secure optimality.

To illustrate, let us look at the optimal use of x_{11}. According to the first-order conditions, the social optimum following from equation (4) is defined by

$$\left(\frac{\partial U}{\partial y_n} + \frac{\partial U}{\partial z_1}\frac{\partial z_1}{\partial y_n}\right)\frac{\partial y_n}{\partial x_{11}} - \mu_{11} = 0,$$

where μ_{11} is the Lagrangian multiplier for the resource constraint on x_{11} (constraint (1d)). The private optimum is characterised by

$$\left(p_y + p_{z_1}\frac{\partial z_1}{\partial y_n}\right)\frac{\partial y_n}{\partial x_{11}} - \frac{\partial C_n}{\partial x_{11}} = 0.$$

Society's constraint on the resource x_{11} implies $\partial C_n/\partial x_{11} = \mu_{11}$, and the social optimum is reached when

$$p_y + p_{z_1}\frac{\partial z_1}{\partial y_n} = \frac{\partial U}{\partial y_n} + \frac{\partial U}{\partial z_1}\frac{\partial z_1}{\partial y_n}.$$

Given $p_{z_1} = 0$, and $\partial U/\partial y_i = \partial U/\partial y_n = p_y^w = p_y$, this can be attained only if $(\partial U/\partial z_1)(\partial z_1/\partial y_n) = 0$, which implies that the marginal utility of the public good z_1 is zero at the given level of y_n. The probability of this happening decreases the less competitive country n is in producing y, as the level of the joint public product z_1 then will be low. Paying $p_{z_1} = \partial U/\partial z_1$ for z_1 and assuming profit-maximising behaviour, that is,

$$p_y^w + p_{z_1}\frac{\partial z_1}{\partial y_n} = \frac{\partial C_n}{\partial x_{11}}\bigg/\frac{\partial y_n}{\partial x_{11}} = \frac{\partial C_n}{\partial x_{12}}\bigg/\frac{\partial y_n}{\partial x_{12}},$$

will restore equality between private and social optima.

As z_1 is a public good, it is costly both to observe and pay for it. Actually, the TCs for direct payment may in some situations be prohibitively high.[13] Because the private and the public goods are jointly produced, increasing the price for y_n from p_y^w to $p_y^w + p_{z_1}(\partial z_1/\partial y_n)$ will, however, yield exactly the same resource allocation. It is an equally precise measure. The point is that it will involve lower TCs than paying directly for the public good z_1, as a market for y_n already exists and necessary information is available.

Introducing the complementary good z_2 adds some important aspects, both because the relationship between y_n and z works via the input factor x_{22} and

11 It is not necessary that the health status of a country's agriculture must be better than that in other countries for this to hold. It is as much a question of introducing new risks.

12 To the degree that continuing production produces increased security.

13 See Section 4 for a more thorough discussion of the TC issue.

because the influence on z_2 can be either positive or negative. As an example, z_2 could be surface or ground water and x_{22} nitrates originating from the production of grain, etc. Another example could be cultural landscape, where x_{22} could be agricultural fields. Finally, the public good could be biodiversity, with x_{22} including species that are endangered or protected by agriculture. Whereas agriculture in the case of surface or ground water is assumed to influence the public good negatively, the effect is positive in the case of the landscape. In the case of biodiversity, the effect may shift from positive to negative beyond a certain level of y_n (Dragun, 1998).

What will be an optimal policy in this case? Concerning the formulation of the firm's problem, equation (3) would change to

$$\text{Max}\,\pi = p_y\, y_n(x_{11}, x_{21}) + p_{z_2} z_2\{x_{12}, x_{22}[y_n(x_{11}, x_{21})]\} - C_n(\cdot). \tag{6}$$

Unlike the case involving the joint public good, there is no simple conclusion in this case. Precision will be lost if one only pays for or taxes y_n as compared with more direct measures. Let us assume both $\partial z_2/\partial x_{22}$ and $\partial x_{22}/\partial y_n$ are positive. Paying for the public good z_2 by increasing the price for y_n will secure optimality (precision) concerning the use of the production factors x_{11} and x_{21}. Paying $p_y = p_y^w + p_{z_2}(\partial z_2/\partial x_{22})(\partial x_{22}/\partial y_n)$ for y_n thus secures equality with the marginal social cost of using x_{11} and x_{21} in producing x_{22} jointly with y_n. There is, however, no mechanism ensuring that the use of the input factor x_{12} in producing z_2 ($p_{z_2} = (\partial C_n/\partial x_{12})/(\partial z_2/\partial x_{12})$) is optimal, as the firm does not meet p_{z_2}. This loss of precision must, however, be weighed against the reduced TCs following from paying only via y_n as compared with paying directly for z_2. Another alternative could be to pay via a change in the price of x_{12}, which should also be a low-cost opportunity as x_{12} is a private good. There is a problem here, however, if this input also is used for other outputs and they do not yield the same type of associated public goods.

If $\partial z_2/\partial x_{22}$ is negative (and $\partial x_{22}/\partial y_n$ still positive), corrections may be undertaken by reducing the price of y_n if taxing the negative externality directly is too costly (high TCs). The reasoning parallels the case with a positive external effect via x_{22}. Also in this latter case, there is the possibility of regulating via a traded input. One may restore optimality at the margin by taxing the input factors x_{11} and/or x_{21}, which in equation (6) are the source of the problem.

Let us look at x_{11} to illustrate. At the optimum, $\partial y_n/\partial x_{11} = p_{x_{11}}/p_y$ where $p_{x_{11}}$ is the price for x_{11}. If one does not want to decrease the price of p_y because of the positive effects on a joint public good (e.g. food security), the negative effect of this higher price on pollution (reduced quality of z_2) can be countered by increasing the price on x_{11} correspondingly. Compared with reducing the price of y_n, increased precision may even be obtained by taxing x_{11} instead. This is the case if there exists a substitute for x_{11} in producing y_n. TCs should be similar in the two cases, as both y_n and x_{11} are marketed goods, making a tax on the input the preferred solution. Compared with 'the ideal' (taxing the emissions) precision is certainly lost in both cases. The increased TCs connected to this solution may, however, make this option inefficient.[14]

Turning to z_3, the only option is to pay directly for the good, or the commodity input (x_{13}) if the latter does not create side effects on other uses that counteract the reductions in TCs obtained by paying via the marketed input. In this case the question is only whether the value of z_3 is high enough to pay for the combined production and transaction costs.

The above illustrations show that if jointness or complementarity is involved, it is not rational to use direct payments as a universal rule for the public good elements of a multifunctional agriculture.[15] It may be more reasonable to pay via the joint private good. The immediate implication of this is that free trade in private goods could impede the least-cost solutions. There are, as we have seen, two issues of specific interest: (i) the degree to which a country's agriculture is internationally competitive; (ii) the level of TCs associated with the various policy options. Let us now go more thoroughly into the latter issue.

4. Multifunctionality and transaction costs

Although targeting is, for very good reasons, a strongly appreciated characteristic of any policy (WTO, 1995; OECD, 2001), we also recognise that it has a cost. Maximum targeting (i.e. full precision) is normally not a rational goal.

What we need to understand better is what causes TCs to vary. Thus far we have simply assumed that TCs increase when one goes from paying via the (associated) private good to paying directly for the public good. According to Williamson (1985: 52): 'The principal dimensions with respect to which transactions differ are asset specificity, uncertainty and frequency. The first is the most important and most distinguishes transaction cost economics from other treatments of economic organisation, but the other two play significant roles.'

The concept of asset specificity relates mainly to the qualitative aspects of a good. Ordinary commodities are homogeneous in quality. These goods are 'non-specific' in Williamson's terms. At the other end of the scale, we have goods that are 'idiosyncratic'; that is, goods that are specific to the transaction such as the construction of a new building or the creation of a park. In these cases, all TC elements will increase in magnitude compared with homogeneous goods. Information costs are large, not least because there is little prior experience of what is exactly transacted. Contracting is complicated. The qualities of the good to be transacted have to be defined for each single transaction. Finally, the control of what has been delivered is also demanding.

Concerning the other two factors, Williamson attaches more weight to frequency than to uncertainty. The main point is that each transaction

14 For a formalised evaluation of this issue, see Vatn (1998).

15 Following Baumgärtner (1999) these types of interrelationships will, as a result of the laws of thermodynamics, always be involved.

Table 1. Expected level of transaction costs for different goods and types of transactions

	Characteristics of the transaction and the good involved				
Policy measures:	(A) attached to commodities		(B) applied to other elements than commodities		
Asset specificity:	Low		Medium		High
Frequency:	High (A1)	Medium (A2)	Medium (B1)	Low (B2)	Low (B3)
Transaction cost elements					
Information	Low	Low to medium	Medium	Medium to high	High
Contract	Minimal	Minimal	Medium	Medium to high	High
Control	Minimal to low	Low to medium	Medium	Medium to high	High
Total TCs	Minimal to low	Low to medium	Medium	Medium to high	High

demands start-up costs. The more repetitive the transactions are (the higher the frequency) the less important these costs become per unit. Partly, this has to do with the fact that there are fixed transaction costs that can be spread over more transactions.[16]

Translating Williamson's ideas to agricultural policy needs some adaptation, as we are dealing with non-market transactions and some of the important goods are public ones. Still, policy measures can be attached to private goods for which markets (payment systems and market information) already exist. Thus, when analysing the level of TCs in agricultural policy, the issue of whether markets for relevant commodities already exist is of importance. We should therefore add this factor to Williamson's list.

An evaluation of the various elements is found in Table 1, where variations in TCs are explained by the characteristics of the transaction and the goods involved.[17]

If the policy instrument can be attached either to commodity inputs or outputs (category A in Table 1), much of the necessary information will already be available and control and contracting costs will most probably be very low. In this case, asset specificity must by definition be rather low, otherwise commodity markets for these goods would not exist, as a result of high TCs. Following the same reasoning, the frequency of transacting is expected to be high to medium. If policy instruments are not attached to commodities (category B), this implies a shift to a situation where payments

16 According to Williamson, increased frequency also implies increased trust. The issue of trust is in itself an important question concerning choice of policy instruments. There are clear indications that the type of policy instruments used influences the trust that is created and the acceptance of various policies. This is an important issue that cannot be covered by the current exposition. Vatn (2001) offers some discussion and references to relevant literature.

17 The issue of uncertainty is ignored, as it does not add much to the analysis here.

Table 2. Transaction costs for different types of policy measures, measured as percent of payments (subsidy or tax); Norwegian data, 2001

(A) Policy measures attached to commodities		(B) Policy measures applied to other elements than commodities	
A11: Price support on milk	0.24	B11: Acreage payments	1.0
A12: Tax on fertilisers	0.09	B12: Livestock payments	2.3
		B13: Subsidy for reduced tillage	6.8
A21: Tax on pesticides	1.1	B21: Acreage support organic farming	18.3
A22: Price support on home-refined dairy products	12.3	B22: Conversion support organic farming	29.0
		B31: Support for preserving cattle breeds	66.3
		B32: Support for special landscape ventures	53.9

Source: Vatn *et al.* (2002).

are directed towards the public good component itself. Asset specificity will increase, whereas frequency will tend to decrease.

The table gives the expected levels of TCs in categorical terms. Certainly, defining what is low or high is a difficult task. This seems to be a problem facing all studies undertaken in this field (see, e.g. Falconer and Whitby, 1999). In Vatn *et al.* (2002), empirical evidence on the hypothetical relationships in Table 1 is documented. The data are from Norway. We have used TCs as a percentage of support paid as the indicator of TCs. As the amount of subsidy paid will influence this measure, the results must be treated with care. Table 2 is structured on the basis of Table 1. In Table 2, the TCs cover the cost for the Ministry, for the involved regional and local authorities, for market agents (wholesalers, retailers) when such agents are involved, and for farmers. Although the number of policy measures in each category is low, the overall picture obtained supports the presented hypotheses rather well. Some comments are necessary.

The level of TCs for the two measures under A1 is, as expected, very low. There is some variation between the two measures, however. This is partly explained by the characteristics of the two administrative systems involved. The fact that the measure A11, the price support to milk production, is regionally differentiated also makes a difference, as this brings in extra information and control costs.

Moving to A2, we observe increased costs and rather substantial variation. The pesticide tax (A21) is categorised under A2 because the number of products involved is large, giving low volumes per product or transaction (frequency). Farm-produced dairy products (A22) have high TCs. They are given the same support as milk sold to dairies (A11). The explanation for the high level is mainly that these products are sold in very low quantities. Actually, this support scheme does not fit well with the assumption that low-frequency transactions cannot occur in category A.

The support schemes under B also follow the expected pattern fairly well. For both acreage (B11) and livestock payments (B12), we observe rather low control costs. This is mainly because the number of transactions (the frequency) is very high, again indicating that the distinctions made in Table 1 do not fully take account of the existing variations in frequency. The data behind the figures show low control costs. This may indicate either great level of trust, or a low priority given to monitoring.

Concerning the acreage support schemes for organic farming (B21), some TCs concerning data collection and control are excluded, because these costs were also necessary for the purpose of marketing the products. In the case of conversion support (B22), however, these costs are included because the products from these farms are not yet accepted as organic and thus not marketed as such.

Turning to the support schemes under B3, the typical 'high-precision' cases, we find that they are very low in frequency. The special landscape support scheme (B32) is generally attached to goods that are site-specific. The percentage is still lower than for the scheme for preserving cattle breeds (B31). This is explained by the fact that the level of support in this latter case is much lower per transaction than in the case of the landscape support scheme.

The picture given in Table 2 is broadly supported by Eklund (1999), Falconer and Whitby (1999), and Falconer *et al.* (2001), although these authors do not structure their analyses in the way we have done. Both asset specificity and frequency have strong impacts on TCs: medium to high asset specificity combined with low frequency make these costs high. The results in Table 2 show that one cannot simply exempt transaction costs from the analyses of multifunctional agriculture. This is the case whether policies are equally precise or not. This implies that keeping trade policy and the policy for public good provisioning separate is, under the assumptions made here, not a rational policy. It is highly probable that, especially for countries or regions where the cost of producing food commodities is rather high, it is more efficient to have prices at some distance above the world market to support the supply of public goods than to make all payments in a direct form. This, however, raises another issue: the rights of each country to define what it considers to be the best policy option.

5. Multifunctionality, rights and efficiency

Rights define which interests are to be protected, and thus which resource allocations can finally be termed efficient. In welfare theory the focus is on the efficiency issue, with rights (or endowments) taken as given. The specific distribution of rights is a normative issue outside the scope of economics. However, in most institutional reforms such as defining environmental policies or setting rules for international trade, the foremost concern is about defining or redefining rights (Bromley, 1989). Still, the issues are very often cast in efficiency terms. This is bewildering.

Let us start with a simple example, the problem of defining what is a positive or negative externality. Trying to clarify this on pure physical grounds has failed (Coase, 1960; Vatn and Bromley, 1997). Whether A is presumed to restrict neighbour B's possibilities when A lets his trees grow or B restricts A's possibilities when insisting the trees be felled is a question of defining the rights of each party. Whether the trees or the access to sunshine is to be protected cannot be defined on the basis of physical characteristics. It is only through defining rights to resources that it becomes clear what is a harm or a sacrifice (Bromley, 1991).

Given zero transaction costs, rights do not influence resource allocation (Coase, 1960).[18] If B wants sun more than A wants trees, that is, if B is willing to pay more for sun than A for the trees, they will be cut independently of who has the initial right. In a situation with positive transaction costs, as in any real-world circumstances, this is not so. As trading, setting up agreements and so on is costly, the distribution of rights is crucial in defining which resource use becomes efficient (Randall, 1974; Bromley, 1991). Scheele (2001) discusses this issue explicitly for agriculture and the environment, showing the need for defining a baseline politically. First, from the (necessarily normative) definition of that baseline, it becomes possible to evaluate whether an activity implies a positive or negative change; for example, whether the Provider Gets or the Polluter Pays Principle should be used.[19]

Similarly, the question of where the burden of proof lies in cases with uncertain consequences is also a fundamental rights issue. Is it the producer who must demonstrate that no negative externalities arise from production, or must the potential victim establish he will be harmed? The way responsibility is defined may have immense effects on production choices and resource allocation, especially in a complex world with high transaction costs (Vatn, 2002).

The inherent problem, especially in international trade, is how to define rights between countries or agents in different countries. Here, there is no common authority structure like a parliament to define a common social welfare function, specifying when something is harmful to others. This issue has to be determined on the basis of bargaining between states.

First, one should recognise that independent states are not equal in reality. This is important, especially concerning developing countries. More fundamentally, however, a right must be based on an authority structure that is common to all states, that is, some sort of 'super state'. As there is no such common norm, we observe that efficiency arguments 'intrude' into the arena as a legitimate, even determining, argument concerning which rights should exist. However, this is doomed to end in circularity and confusion. We observe this in the debate about 'trade distortions'.

18 To be precise, a population with homogeneous and homothetic preferences must also be assumed for this conclusion to hold, otherwise the income distribution inherent in any rights distribution will influence resource allocations.

19 Scheele (2001) uses 'good agronomic practice' as the reference point. This concept illustrates that it may be hard to define such a point. It can still not be exempted form.

A trade regime giving country A the right to export its products freely to country B and vice versa may be set up based on the argument that both countries will gain from trade. When, for example, country B realises that the external effects of that trade are such that it incurs negative effects, it may want to change the regime. Should that issue be determined on the basis of who gains the most from either institutional structure or should each country be given a right to define some standards to protect itself? Certainly, this is a very difficult issue when no common authority structure or social welfare function exists. It is, however, logically wrong to determine the outcome on the basis of who is willing (or able) to pay the most for a specific rights structure and then call it efficient. This reasoning is and always will be circular.

6. Conclusions

This paper has focused on multifunctional agriculture—a situation where goods have both private and public attributes, or where private and public goods are interrelated in production. In a world with positive transaction costs, two observations have been made for such situations. First, free trade does not seem to give an optimal solution. This is especially the case when countries are not equally competitive in the private goods market. Second, because of the effect of transaction costs, policy measures directed at the price of private goods may be an important part of a regime aimed at efficient supply of desired levels of the involved public goods. Regional variations in production costs and the varying relationships between private and public goods world-wide may thus justify differences in the price even for private goods.

The prime technical issue involved here is the trade-off between precision and transaction costs. Positive transaction costs make it interesting to search for policy measures that exploit jointness in the production processes between private and public goods. The prime value question is to determine whose right should be defended when countries have conflicting interests: the one protecting its public goods or the one that faces reduced export possibilities.

The insights from this paper have two consequences. Properly conducted, economic analysis may give less support to the creation of a single market for food commodities than is often believed. However, the paper also presents a more stringent way to evaluate the legitimacy of existing national policies. Certainly, it offers a basis for critical analysis also in that respect. Further work is, however, needed to make the ideas more operational.

Many important issues could not be covered in this paper. One issue that is only touched on is the need to study the combined effects of sets of policy measures more systematically. In a complex system of private and public goods or bads such as agriculture, many synergies and conflicts are involved, which should be an integral part of a full assessment.

Another issue is the behavioural assumption underlying this paper. I have assumed farmers are profit-maximisers. They may, however, also derive direct utility from the public goods involved. This may influence their behaviour in a non-negligible manner. Farmers' choices may furthermore be influenced by the type of policy measures used. This is a question that has received far too little attention from agricultural economists.

Finally, sectors other than agriculture can deliver (some of) the goods provided by multifunctional agriculture. Possibilities and problems related to this issue demand their own thorough study. Many solutions have been proposed. Still, when comparing agriculture with other sectors, one should remember that joint production is a way of keeping total costs down. One must look at the whole set of goods together rather than just comparing the supply of single goods one at a time. It is important to adopt a systems perspective when studying multifunctionality.

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Corresponding author: Arild Vatn, Department of Economics and Social Sciences, Agricultural University of Norway, Aas, Norway. E-mail: arild.vatn@ios.nlh.no