Is Certification a Promising Way to Ensure Sustainable Resource Use? An Analysis Based on the Concept of 'Self-Enforcing Contracts'

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IS CERTIFICATION A PROMISING WAY TO ENSURE SUSTAINABLE RESOURCE USE? –

AN ANALYSIS BASED ON THE CONCEPT OF 'SELF-ENFORCING CONTRACTS'

Abstract

In the past decade several certification schemes have been developed in order to promote sustainable resource use, especially in foreign countries where it is impossible to rely on direct enforcement of process standards. Based on the concept of 'Self-Enforcing Contracts' a model is developed simulating the simultaneous market equilibrium for certified natural resource units and physically identical units produced without observing certain environmental standards. The model along with some empirical evidence from tropical forestry yields that very likely certification will fall short in ensuring sustainable resource use. Basic natural resource management has to be primarily steered by governments and administrations, not by market forces.

Keywords: Renewable Resources and Conservation - Demand and Supply (Q21); Institutional Economics (B52); Externalities (D62); Illegal Behaviour and the Enforcement of Law (K42); Contracts and Reputation (L14)

1 Introduction

This paper deals with the perspectives of certification schemes labelling natural resources like timber, fish or agricultural commodities which have been harvested/produced in a sustainable way. This kind of certification - in environmental management also often referred to as ecolabelling - is rather a recent market based instrument. However, meanwhile its "potential value as an important mechanism in the efforts towards sustainable utilisation of resources has […] been recognised internationally" (Oloruntuyi, 2004, p.29).

During the last ten years ecolabels or seals signalling sustainable production have been developed for different fields of application, e.g. for imported flowers, for fish (MSC-label, cf. Oloruntuyi, 2004) and especially for tropical timber (cf. section 4, below). *Certification* is deemed to be particularly relevant to resources for which the management cannot be sufficiently governed by legal rules along with direct command and control measures, as in the case of deep-sea fishery or tropical forestry in politically unstable countries.

Especially Forest Certification has been developed to counteract overuse of tropical forests by means of market-economy instruments. So the questions arise, whether these market-economy instruments have been successful so far, how they work and whether they are appropriate to prevent future overuse of natural resources. My analysis of the latter question will be based on a concept from 'Economics of Information', the so-called Concept of 'Self-Enforcing Contracts'.

The paper is structured as follows: In **section 2** I will first present the main idea of ‚Self-Enforcing Contracts'. Afterwards I will deduce an algebraic model so that the concept can be applied to natural resource use issues. In **section 3** the main consequences resulting from the model are presented. **Section 4** gives a short overview of the current implementation of certification in the field of tropical forestry and, based on the results of section 3, gives some empirical evidence to answer the question of the title, namely whether certification is a promising way to ensure sustainable resource use, especially in countries with weak institutions. **Section 5** summarises and discusses the main conclusions.

2 The theory of 'Self-Enforcing Contracts' applied to natural resource harvesting

Usually process standards that ensure sustainable resource harvesting result in extra costs. Their amount depends on the specific natural conditions as well as on the prevailing economic and social circumstances. As a result, producers voluntarily complying with such standards need a price premium to cover these extra costs. If such a mark-up can be realised then the market mechanism may result in an optimal solution to environmental and social shortcomings.

But in contrast to the traditional neoclassical paradigm consumers are not completely informed about all the relevant products; moreover, they have to face opportunistic behaviour. This means that some producers may take advantage from cheating, by producing and selling commodities which do not meet the promised sustainability standards. Hence, due to poor information linked with opportunistic behaviour, an optimal market solution may not come about.

Depending on the specific market situation economic theory suggests different ways of overcoming market failure caused by incomplete information. However, as the market for certified natural resources (e.g. for certified timber) is characterised by frequent market transactions, by moral hazard (the possibility of cheating) and very often by the impossibility of exerting legal pressure on the suppliers the mechanism of 'Self-Enforcing Contracts' may ensure that certain 'sustainability standards' promised are really met.

The main idea behind is that some hidden inherent qualities of a product (so-called 'credence qualities', e.g.: the fact that the timber sold was produced without doing harm to people or to nature) are actually delivered, when valuable reputation is at stake. A supplier who promises a better quality makes a credible commitment by building up reputation, which he can lose acting opportunistically.

Therefore, a desired performance "will be implicitly enforced […] if the individual facing termination expects to earn a future quasi-rent stream the present discounted value of which is greater than the immediate short-run gain from breaching the contractual understanding. The contractual relationship is then said to be within the self-enforcing range. The self-enforcing range is determined at any point in time by the capital value of the expected quasi-rent stream compared to the short-run gain from breach" (Klein, 1985, p.595).

Thus, a self-enforcing agreement is one which an opportunistic partner fulfils as long as he benefits more from continuing the agreement than from ending it. Hence, he credibly signals a better quality by acquiring a certificate and by asking for a price premium which indirectly enforces the desired standards. The principle and the first model of self-enforcing agreements were put forward by Klein and Leffler (1981). Below, based on an approach by Stiglitz (1989), I will develop a resource market model in order to demonstrate under which conditions the mechanism of self enforcing contracts may assure a sustainable natural resource use.

Today's net price obtained by an honest resource supplier is given by P_S (e.g. the price for certified timber from sustainable forestry) minus C_S, the annual marginal costs of sustainable production. In the case of forestry, C_S includes all costs for environmentally adequate planting of seedlings, selective logging, opportunity costs of the forest land etc. as well as the transaction costs linked to certification. The costs C_S may also contain charges incurred when preventing smallholders from slashing and burning, e.g. by establishing alternative income possibilities or, in general, charges incurred when taking care of the interests of the local population.

On the other hand, resource owners face the difference between the common market price P_M (independent from the way of harvesting) and the lower marginal costs C_M of environmentally and socially harmful resource harvesting. $P_M - C_M$ are the opportunity costs of the resource resulting from the fact that its overall stock cannot be increased without limits, so that usually the resource owners will realise a scarcity rent.

Now, whether an opportunistic supplier complies with promised 'sustainability standards' or not, depends on the net present values of today's and future profits related to his actual behaviour. The net present value in case of complying with the sustainability standards ($NPVC$) is given by the price-cost-difference today plus the sum of price-cost-differences in future, which have to be discounted at a rate d according to the resource supplier's time preference:

$$NPVC_n = P_S - C_S + (P_S - C_S)(1+d)^{-1} + (P_S - C_S)(1+d)^{-2} + \ldots + (P_S - C_S)(1+d)^{-n}. \qquad (1)$$

Assuming constant annual net prices $P_S - C_S$ and the number of years n approaching infinity ($n \rightarrow \infty$) the net present value when complying can be written as:

$$NPVC_{\infty} = \quad P_S - C_S + \frac{P_S - C_S}{d} \ . \tag{1a}$$

Now, apart from moral concerns it might be a good bargain to get the high premium price P_S for resource units harvested at the low costs of a 'robber economy' C_M. Consequently an opportunistic supplier will also consider the net present value resulting from violating the promised standards (*NPVV*). Assuming again that all prices and costs are constant over time and that n approaches infinity, the corresponding *expected* net present value gives:

$$NPVV_{\infty} = P_S - C_M + (1-w)\frac{P_S - C_S}{d} \ + \ w\frac{P_M - C_M}{d} \ , \tag{2}$$

where w is the probability of being discovered when cheating today. In this case the opportunistic supplier will merely obtain the common market price P_M in all the following years, resulting in the constant rent $P_M - C_M$. Otherwise, if the violation of standards is not detected (which happens at a probability of $1 - w$), he will keep the option of realising the rent $P_S - C_S$ in the following years.

This approach is different from Stiglitz (1989), because in his model a contract breach is detected at any rate (i.e. $w = 1$). Moreover, in his model P_M just equals C_M, since - in contrast to natural resources - for a typical 'man-made' commodity perfect competition finally leads to a market equilibrium without any scarcity rent (for a 'Self-Enforcing Contract'-model *including* the probability of being discovered when cheating but again no rent for the low quality product cf. Vetter and Karantininis, 2002).

Comparing equations (1a) and (2) every risk-neutral opportunistic producer will comply with the sustainability standards as long as $NPVC_{\infty} > NPVV_{\infty}$, or as long as

$$P_S - C_S + \frac{P_S - C_S}{d} \ > \ P_S - C_M + (1-w)\frac{P_S - C_S}{d} \ + \ w\frac{P_M - C_M}{d}. \tag{3}$$

Rearranging this inequation yields the fundamental condition for compliance:

$$\Delta P \ = \quad P_S - P_M \ > \ \left(1+\frac{d}{w}\right)\left(C_S - C_M\right). \tag{3a}$$

In Institutional Economics such a restriction is referred to as a ‚No-milking-Condition'. It establishes that an *opportunistic* producer must realise a mark-up ΔP that not only covers his extra costs $C_S - C_M$, but even exceeds them. Otherwise he would breach the implicit agreement to deliver natural resources harvested in a sustainable manner. Inequation (3) can also be written as

$$P_S - C_S \ > \ P_M - C_M \ + \ \frac{d}{w}\left(C_s - C_M\right). \tag{3b}$$

Notice that in contrast to a situation with anonymous suppliers the right hand side of inequation (3b) may further decrease in case of big food or timber processing companies having to fear considerable damages to their image when cheating. This effect then would lower the necessary rent $P_S - C_S$.

Condition (3b) also illustrates that in a bilateral monopoly situation (one buyer and one supplier with scope for bargaining) there are two alternative ways to indirectly enforce desired process standards: either *paying a higher price premium* - which is simply an income transfer from the consumer to his supplier, so that no additional social costs are incurred - or *increasing the monitoring intensity* (which raises w). Of course, the latter entails socially relevant transaction costs, which finally

will affect the charges to be paid for certification so that the costs C_S will increase. Therefore - seen from a welfare point of view and given high monitoring costs - it might be better to grant a higher price premium instead of raising the probability of detection.

In the following, considering a polypolistic situation with a significant share of opportunistic suppliers, the overall market equilibrium for two markets will be modelled: a market for sustainably harvested resource units q_S, and a market for physically identical units q_M in which consumers do not care about the origin of the product (for example the 'market for conventional timber'). Such an equilibrium implies that the following six model equations must hold:

'No-Milking-Condition':

$$P_S - C_S = P_M - C_M + \frac{d}{w}\left(C_S - C_M\right); \tag{3c}$$

System of two demand functions:

$$q_S = -v_S \ln P_S + z_S^{\,M} \ln P_M + u_S; \tag{4a}$$

$$q_M = z_M^{\,S} \ln P_S - v_M \ln P_M + u_M; \tag{4b}$$

Two supply functions (aggregated marginal cost functions):

$$C_S = C_S^{*} + h\, q_S; \tag{5a}$$

$$C_M = C_M^{*} + g\, q_M; \tag{5b}$$

Resource availability restriction (e.g. forest land restriction):

$$q_M = Q - k\, q_S \tag{6}$$

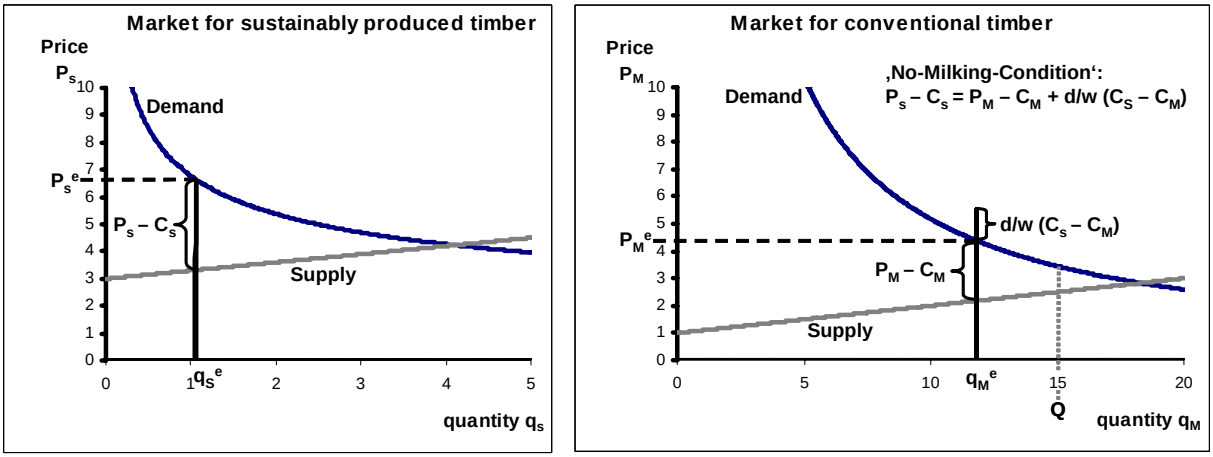
with

d	= *discount rate of the resource supplier,*
w	= *probability of being detected when cheating,*
P_S	= *price for the certified product from sustainable resource use,*
q_S	= *resource (e.g. timber) units annually harvested in accordance with the desired sustainability standards,*
C_S	= *marginal costs of sustainable production,*
P_M	= *market price for the resource independent from its way of production*
q_M	= *resource (e.g. timber) units annually harvested without complying with sustainability standards,*
C_M	= *marginal costs of production in case of 'robber economy' ($C_M < C_S$),*
C_S^{*}, h, C_M^{*}, g	= *parameters of the supply functions,*
v_S, v_M	= *price elasticities of demand,*
$z_S^{\,M}$, $z_M^{\,S}$	= *cross price elasticities of demand,*
u_S, u_M	= *parameters of the demand functions,*
Q	= *maximum amount of annually harvestable resource units (proportionate to the resource base - e.g. the forest land - available),*
k	= *ratio at which units q_S can be 'transformed' into units q_M ($k > 1$).*

All parameters and variables listed above are greater than or equal to, zero. As the totally available resource base is strictly limited within the model, there is a maximum quantity of overall annual production. Taking the example of tropical timber production in a benchmark situation when only conventional timber is harvested this quantity is given by $q_M = Q$.

Now, when some suppliers switch from conventional to sustainable harvesting the corresponding rise in the production of certified wood will be less than the decline on the common timber market, because every hectare of conventional forest converted into certified area will yield less timber, at least as long as certification really requires higher standards like more set aside land, reduced-impact logging etc. Consequently for every unit of q_S, society has to renounce to k ($k > 1$) units of q_M. In the case of forestry a parameter $k > 1$ also means that opportunity costs of forest land entering C_S are greater than the corresponding opportunity costs included in C_M.

Figure 1 shows for a given set of parameters the overall market equilibrium along with the rents contained in both sides of equation (3c). In the example outlined the ratio d/w is equal to 1.0; this corresponds e.g. to a discount rate d and a detection probability w both accounting for 10%.



*The parameters (cf. equations (3c) to (6)) underlying the market equilibrium represented in the Figure are: $d/w = 1.0$; $C_S^* = 3$; $C_M^* = 1$; $h = 0.3$; $g = 0.1$; $v_S = 3$; $v_M = 1$; $z_S^M = z_M^S = 0.5$; $u_S = 5$; $u_M = 3$; **$Q = 15$**; $k = 3$. – P_S^e, q_S^e and P_M^e, q_M^e are the equilibrium prices and quantities. – Further explanations in the text.*

Figure 1. Simultaneous market equilibrium for sustainably produced timber and for conventional timber in case of a large amount of tropical forests

Whereas demand for conventional timber in *Figure 1* is thought to be relatively inelastic ($v_M = 1$), the demand for sustainably harvested wood is represented to be more elastic ($v_S = 3$). Because in case overall resource scarcity increases more and more responsible consumers will very probably completely renounce to purchase the corresponding commodities.

In this context notice that public procurement policies play an important role in determining tropical timber demand since many administrations have introduced or are about to introduce rules for the 'green' procurement of wood products (cf. Atyi and Simula, 2002, p.18). It is likely that in a situation of strongly increasing scarcity of tropical forests public authorities with limited budgets(!) will probably completely stop purchasing tropical timber.

3 Consequences resulting from the theoretical model

Already when merely considering the ‚No-Milking-Condition' (3) some major conclusions can be drawn. First of all, from inequation (3b) it follows that the *reputation rent* $P_S - C_S$ an opportunistic supplier should obtain to make him comply with the desired standards, must be the higher

(i) the higher the common scarcity rent $P_M - C_M$ for the resource in question,

(ii) the greater the extra costs $C_S - C_M$,

(iii) the higher his personal discount rate d and

(iv) the lower the probability w of getting caught when cheating.

Obviously for $w = 0$ inequation (3) is not to satisfy, which means that in case of poor monitoring possibilities the mechanism of ‚Self-Enforcing Contracts' cannot work.

Altogether the theoretical model has five important implications which matter in a world of imperfect information and opportunistic behaviour. As the *necessary* premium ΔP required to prevent cheating has to cover at least the extra costs $C_S - C_M$ (cf. the right hand side of (3a))

(C.1) the premium ΔP has to be the higher the more the costs C_M can be forced down or the more external costs can be shifted onto the general public, i.e. the weaker the respective state is. Accordingly

(C.2) the premium ΔP has to be the higher the greater the site specific costs - contained in C_S - to prevent resource degradation (e.g. degradation of forests which have been made accessible for sustainable timber use).

Furthermore, the premium has to be the higher the greater the discount rate d is. This is due to two factors: First, the costs C_S usually increase with d - since costly preventive measures have to be taken now -, whereas the costs in case of 'robber economy' show a tendency to decrease along with d, because the relevant costs arising from damages like soil erosion will merely be taken into account later if at all. In this sense the discount rate has got an indirect minimum premium increasing effect. Second, - as the interest factor in the 'No-Milking-Formula' illustrates - the discount rate also directly affects the necessary premium: For every opportunistic supplier

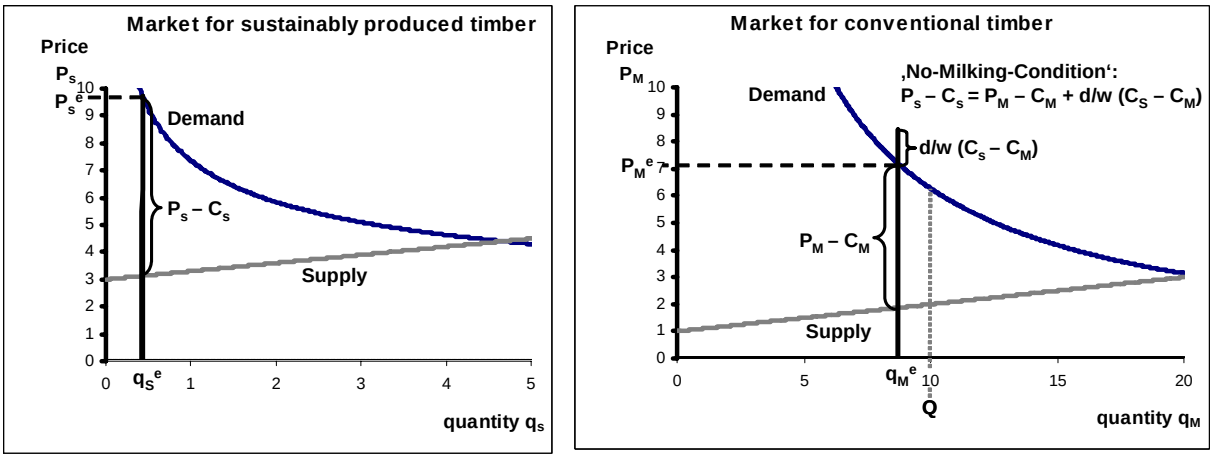
(C.3) the premium ΔP has to be the higher the greater his time preference respectively his personal discount rate d divided by the detection probability w.

On the market a higher premium results as soon as part of the suppliers switches from sustainable to conventional resource harvest. Thus increasing the ratio d/w in the model underlying *Figure 1* from 1.0 to 2.0 while keeping all else equal leads to a rise of q_M by 7% from 11.8 forest units to 12.6 units. On the other hand a low ratio d/w of 0.02 - e.g. corresponding to $w = 1$ and $d = 0.02$ which may prevail in a rather safe country with efficient institutions - entails a decline of conventionally cultivated forest area by 10% (from 11.8 to 10.6 units) when compared with the benchmark situation of *Figure 1*.

In developing countries the rate d is often relatively high because of lacking credit markets whereas w may be low due to corruption and lacking transparency. Furthermore the applied discount rate d usually increases along with a declining level of wealth and as a result of political instability, especially when companies or resource owners have to face a great risk of future expropriation. In general, the individually applied discount rate rises in case of an increasing short term perspective.

In view of the *necessary* price premium, finally the question arises as to which price difference $\Delta P = P_S - P_M$ *can be realised* on the market. Hence, the simultaneous market equilibrium for both resource markets - for sustainably and for conventionally harvested resources - is of interest. *Figure 1* shows this equilibrium, where the 'No-Milking-Condition' just holds and where no producer will switch any more from one production system to the other. Notice that in reality some honest and/or unselfish producers may apply a very low discount rate and they even may renounce to the opportunity costs $P_M - C_M$ of the timber, but as far as the overall market equilibrium is concerned only the decisions of the opportunistic suppliers operating 'on the margin' matter.

Obviously compared to a situation where $q_M = Q$ certification tends to increase prices for non-certified wood. Unfortunately this makes environmentally and socially harmful timber harvesting and also illegal logging more attractive in case certification is really successful. This is already quite problematic. However, we should go a step further, considering a rather critical benchmark situation when in the beginning - without any certification - the resource base is already relatively scarce (i.e. a low Q, cf. *Figure 2*).



The parameters (cf. equations (3c) to (6)) underlying the market equilibrium represented in the Figure are: $d/w = 1.0$; $C_S^* = 3$; $C_M^* = 1$; $h = 0.3$; $g = 0.1$; $v_S = 3$; $v_M = 1$; $z_S^M = z_M^S = 0.5$; $u_S = 5$; $u_M = 3$; $\mathbf{Q = 10}$; $k = 3$. – P_S^e, q_S^e and P_M^e, q_M^e are the equilibrium prices and quantities. – Further explanations in the text.

Figure 2. Simultaneous market equilibrium for sustainably produced timber and for conventional timber in case of a low amount of tropical forests

Then, assuming the same system of demand functions as before, in the equilibrium of *Figure 2* much less forestland is 'saved' by certification when compared to *Figure 1* with more forest in the point of departure (compare the two differences $Q - q_M^e$ in both figures). Whereas in *Figure 1* 21.2% of the entire forest land available is environmentally and socially well managed, in *Figure 2* this share only accounts for 13.0%. The reason is that in *Figure 2* there is an important scarcity rent from the beginning, at $q_M = Q$. In addition, now there is a steeper slope of the demand function for conventional timber. Consequently

(C.4) the premium ΔP which can be realised is ceteris paribus the lower the less resource units are still available.

Unfortunately the last conclusion means that a certification scheme is the less suitable to prevent resource bases from degradation the more critical the state of the resource in question already is.

The fifth conclusion refers to the role of the demand for sustainably harvested resources. It is quite clear that in case it is weak or in case it goes down - maybe due to an economic crisis in the developed countries - the equilibrium brought about by market forces results in more conventional and less certified products. Eventually to a large extent the success of certification in ensuring sustainable resource use abroad depends on demand, since obviously

(C.5) the premium ΔP that finally will be realised is the lower the less consumers are willing to buy certified products.

However, very likely the *effective* demand for certified products will be insufficient given peoples' real preferences, because nobody can be excluded from enjoying the external benefits from environmentally friendly resource use. As in many other fields of environmental protection a *social dilemma* occurs: For an individual consumer it may appear profitable to buy cheap products while the other consumers provide for public goods like biodiversity preservation or carbon dioxide storage, e.g. by purchasing certified timber.

Besides, as certified and non-certified timber differs only in its way of production but not in the qualities related to direct use, there is no additional private benefit a customer draws from the consumption of the more expensive wood products. In contrast, people paying higher prices e.g. for organic vegetables usually hope to get healthier food and thus to increase their private utility.

4 Empirical evidence: the example of tropical timber certification

What are the consequences resulting from conclusions (C.1) to (C.5)? Is it realistic to believe certification can play a major role in counteracting overuse of tropical forests?

The basic idea of certification in tropical forestry was born in the early 1990s as an alternative to the boycott of tropical timber and may be described as follows: Wealthy consumers who are worried about environmental and social matters pay a premium price for credibly labelled timber from well managed forests in order to allow for sustainable forestry even in remote regions of the world where they cannot exert political influence. Obviously this idea is particularly relevant for developing and emerging countries in the Tropics with an important forest sector. European citizens hardly have any means to directly enforce social standards or environmental protection measures in such countries.

As far as tropical forestry is concerned, the most prominent certification scheme - considered by NGOs to be most independent and rigorous in its requirements (FERN, 2004) - is the *Forest Stewardship Council (FSC)* which was founded in 1993 (for an evaluation of existing schemes cf. FERN, 2004). Involving representatives of forestry and environmental organisations as well as labour unions and other interest groups, the FSC develops minimum standards for an ecologically and socially well managed forestry also respecting the rights of indigenous people (e.g. standards in order to avoid soil erosion, loss of biodiversity or conversion of natural forests into plantations). In case the standards are observed the Council awards a label to products coming from the corresponding forest sites. For this purpose the FSC accredits independent national certification bodies that regularly monitor the compliance with the standards and the traceability of the certified wood products along the entire chain of custody.

The total area of tropical forest decreased from almost 1.98 billion hectares in 1990 to 1.86 billion hectares in 2000, which means an average annual loss of about 12 million hectares. This loss is mainly caused by conversion of forest land into agricultural land. Barbier (2004, p.1352) by a recent statistical cross-country analysis found that “agricultural export share, growth in agricultural value added and rural population growth are positively associated with agricultural land expansion”.

In 2004 only about 4.8 million hectares of Tropical Moist and Dry Forest had been certified based on FSC standards (calculated based on UNEP/WWF, 2004). This certified area only accounts for 0.34% of *utilisable* tropical forests worldwide; thus it does not even equal half of the average yearly losses. Besides FSC and *MTCC* (the *Malaysian Timber Certification Council*, certifying more than 4 million hectares), the standards of which are “not sufficiently performance-based to allow for a credible consumer label” (FERN, 2004, p.27) there is no other important tropical forest certification scheme (FERN, 2004, p.29).

Will the share of FSC certified forest land further increase in the long run? – This could only happen when the two timber markets in *Figure 1* are not yet balanced, i.e. as long as the rent $P_S - C_S$ still exceeds $P_M - C_M + d/w\ (C_S - C_M)$ for a significant number of sites. How far away from the simultaneous market equilibrium, where the ‚No-Milking-Condition’ (3c) just holds, a current situation is, cannot be measured at first glance.

In principle, one way to approximately answer this question would be to estimate for specific forest sites the right hand side of inequation (3a) - that is first to calculate the extra costs $C_S - C_M$, second multiplying these extra costs by an adequate factor $(1+d/w)$ - and then to compare this value - the *necessary* premium - with the price premium ΔP obtained in the market. Only when the observed premium exceeds the necessary premium is the respective certified area likely to further increase in the future.

Trying to assess extra costs respectively the *necessary* premium means looking on the *supply side* of the problem: One attempt for forests in the United States has been made by Taggart (2000) who estimated a range of price premiums between 33% and 210% (of stumpage prices), necessary to cover direct and indirect certification costs, when timber harvest was to be reduced by 25% in order to make it sustainable. As similar calculations for tropical forest sites are not available and assumptions concerning the ratio *d/w* have to be made anyway, we may rely on some qualitative considerations based on the observed share of certified tropical forests.

As mentioned above this share is low and especially in tropical Africa it is extremely low: merely 0.4 per thousand of the corresponding area is endorsed by the FSC, which applies particularly to tropical rain forest (calculated based on UNEP/WWF, 2004). Anyway, given the conclusions (C.1)

and (C.2) above, this result is not astonishing, since due to political instability extra costs $C_S - C_M$ are the highest in countries like the Republic of Congo.

Moreover, even if in the future the share of certified forests increased in such countries the premium necessary for ongoing indirect enforcement would be relatively high because both the high ratio of discount rate and detection probability as well as the low costs of ‚robbery economy' (low costs C_M) would contribute to the profitability of unsustainable forestry (cf. conclusion (C.3)).

Hence, the negative impact of consequences (C.1) to (C.3) is particularly relevant for many developing countries. Unfortunately these countries are just those for which indirect enforcement by means of reputation rents is thought to replace direct enforcement by legal measures.

To asking what premiums may be *obtained* in the long run means to consider the *demand* for certified timber (cf. conclusion (C.5)). Again, prospects are bleak because - according to recent market surveys - on the average people in Europe, Northern America and New Zealand are not willing to pay *considerable* premiums; those willing merely announced mark-ups up to about 25%. "In general a majority expresses a willingness to pay more, but the amount is limited" (Rametsteiner, 2000, p.112).

Following a study from UN-ECE and FAO in 2001 "the demand for certified products is mainly driven by marketing factors: competitive advantage, image risk aversion, and offering options for consumers. On the other hand, market development is constrained by limited demand, lack of supply, lack of premiums, and limited industry involvement" (Atyi and Simula, 2002, p.17).

Assuming a potential share of certified wood in the tropical timber market of 20% in Europe and of 10% in America and if "it is assumed that annual sustainable harvest is about 1 m^3 per hectare [the corresponding 1995] demand could be satisfied by [merely] 2.3 million hectares of certified forests" (Rametsteiner, 2000, p.145).

Even more important in this regard: Only about 4% of tropical timber harvest are exports to the western world, so that developed countries' demand for certified wood products cannot play a major role in overall tropical timber consumption.

Consequently, in the long run sufficient premiums for large timber quantities are not likely to be reached, especially when a future increase in timber scarcity results in even higher necessary mark-ups (cf. conclusion (C.4)). Thus, on the basis of the above model considerations and the - albeit sparse - empirical evidence we can expect only low shares of certified forest areas, especially in insecure tropical countries.

5 Main conclusions and discussion

Via the mechanism of ‚Self-Enforcing Contracts', certification may assure sustainable resource use most likely when production takes place under stable political conditions as they exist in Western Europe. Here on the one hand the costs of 'robber economy' are elevated because of the existing legal standards together with good law enforcement. On the other hand due to overall legal security resource owners' discount rates are relatively low whereas at the same time the probability of being detected when not complying with standards is high. However, in such an environment there is hardly any need for indirect enforcement by means of reputation rents, since there are other, even stronger, institutions that will enforce well managed resource use.

Moreover, certification will assure sustainable resource harvest best if the resource in question is not yet extremely short in supply, the better consumers are informed and the more they act unselfishly. In this context publicity campaigns to increase demand for certified timber could be helpful. Nevertheless, compared to premium food products the mechanism of 'Self-Enforcing Contracts' has got a tendency to be less effective, since the desired environmental and social process qualities are immaterial credence qualities featuring the character of public goods.

Consequently, the initial question, whether certification is a promising way to ensure sustainable resource use, especially in countries with weak institutions, clearly has to be given a negative answer.

Of course, in those cases, where a price premium is actually reached certification is most welcome for the respective region or site, helping local people to earn their livelihood in a sustainable way. However, seen from a global perspective it is not sufficient. There is strong evidence suggesting that markets for certified products cannot be an efficient institution to ensure the preservation of natural resource bases.

As the example of tropical forestry shows, overuse and degradation can hardly be stopped simply by means of certification. Here policy makers should not cherish any illusions, recognising instead that resource management has to be primarily steered by governments and administrations, not by market forces. Based on a game theoretical analysis Erikson (2003, p.291) finally concludes that it "seems that a modest degree of idealism cannot replace environmental legislation".

Markets are the most efficient institutions for many allocative issues, but trusting in markets for governing sustainable resource use can be counterproductive by just pretending to offer a solution for preventing resource degradation.

Instead of relying upon timber market forces it is much more important to improve forest legislation and to reduce corruption as well as illegal logging. Hence, the European Commission's strategy aiming at "partnership agreements" on Forest Law Enforcement, Governance and Trade (FLEGT) with wood producing countries (COM, 2003, p.23) should be broadly implemented as soon as possible.

As far as the developed countries are concerned, it is also useful to grant specific development aid, inter alia creating new income sources, which prevent exhaustive resource use. Above all, in view of the worldwide public good aspects related to the preservation of tropical forests it is economically justifiable to spend public money for leasing conservation concessions (cf. Wilson, 2003, p.172). Other promising instruments are so-called 'debt for nature swaps', that is to couple debt release with the debtor's commitment to conservation measures. By the way, the use of such publicly financed instruments makes sure that all wealthy citizens who benefit from positive forest externalities - and not only those buying labelled products - will contribute to its preservation.

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