This paper argues that informal insurance systems may reduce the pressure on common property resources in traditional societies. A case study on traditional fishery in the kingdom of Tonga illustrates the argument. The paper suggests that in Tonga, the common property resource is not overexploited because of rules and regulations within the informal insurance system. The informal insurance system requires successful fishers to share their catch with other members of the community. This reduces their incentives to increase their fishing effort to a level which would endanger the sustainable use of the resource. Furthermore, the informal insurance produces a moral hazard effect, which reduces the fishing effort even further. We have thus identified a new mechanism which stabilises common property resources in traditional societies.

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1. Introduction

The (over)-use of common property resources has been subject to intense debate during the past decades. Despite the rich existing literature on the topic, we believe to have identified during field research in the Kingdom of Tonga a new - and indeed very interesting - mechanism which can explain sustainable use of common property resources within traditional societies.

Our mechanism thereby consists not of rules and regulations with regard to the resource use. In contrast, the sustainable resource use is due to the coexistence of common property resources and a system of informal insurance.

Searching for mechanisms which can stabilise common property resources we follow an interdisciplinary approach. Our team includes psychologists, ethnologists and economists. This combination of disciplines allows us to do on the one hand intensive field work and gather a large quantity of data, but also to develop explanatory models using psychological and economic methods. In the following the economic results and data from the field study are discussed.

2. Common Property and Informal Insurance Systems - Review

In their seminal works, Gordon (1954), Scott (1955) and Hardin (1968) have drawn attention to the common property problem. Today, it is clear, that common property resources do not necessarily lead to a "tragedy" (Hardin 1968). Runge (1981), Livingstone (1986), Bromley and Cernea (1989) are but a few examples of studies which show that traditional societies may well use natural resources both communally and sustainably. Thereby sophisticated rules and regulations (Bromley and Cernea 1989), but also norms (Runge 1981) play an important role.

However, Dasgupta and Heal (1979) show that even in the absence of rules and regulations common property systems - and even open access to resources - may be used in a sustainable manner. Furthermore, game theoretical models teach us that repetition and uncertainty can lead to cooperation in prisoners' dilemma situations in general (Güth 1992, Kreps et al. 1981) and within common property settings in particular (Mohr 1991, Braden 1985). Ostrom finally studies not only rules and regulations
within numerous common property settings, but relates these findings also to the game theoretical literature (Ostrom 1990).

Traditional societies frequently insure themselves by means of informal insurance systems against risks such as illness or unfavourable weather conditions. The wide dissemination and the effectiveness of such systems has become apparent only recently. Rosenzweig (1988) studies how transfer payments within kinship systems in India reduce income fluctuations. Urdy (1994) shows that the informal credit market in Nigeria has an insurance aspect and Rosenzweig and Wolpin (1993) discuss the insurance effect of the transfer of bullocks in India.

Thus, traditional societies are not only characterised by common property regimes, but informal insurance systems also play an important role. So far, however, there are no studies which discuss possible links between the two systems. Our research fills this gap. In fact, we argue, that in the kingdom of Tonga, the property system does not cause overexploitation of the natural resource because of the existence of the informal insurance system.

3. The Tonga Case Study

The field research is being undertaken on the two islands Lofanga and 'Uiha which are part of the Ha'apai-Group in the centre of the kingdom of Tonga. The Ha'apai-Group includes 62 islands squatted around an area of 10,000 sqkm and is the most traditional area of the Kingdom. Only 17 islands of the group are inhabited by a total of 8000 people. Agriculture and fishing are the main economic activities (Bender 1997).

In Tonga, the fishing grounds are used communally. Traditionally, every island community seems to have had the right to use their coastal zone exclusively. The coastal area was thereby used community. Approximately 100 years ago, these traditional use rights have been abolished. Since then, any Tonganese citizen has the right to fish anywhere in the kingdom. To the extent that fishers choose to fish within the coastal area of another island, we thus even have an open access situation.
In Tonga we have a property regime which includes elements of both open access and common property. On the one hand, access to the fishing grounds of any one island is not restricted to the island community any more, which is an open access feature. On the other hand, island communities feel to have the right to defend their coastal area against extensive fishing by members of other island communities. There are even reported cases of violence between members of different island communities due to fishing activities. Also, traditionally on all the islands of the Ha'apai group there are social institutions in place, which reduce the pressure on the fishing resource. Thus the island group as a whole could be seen as one large common property system.

3.1. Lofanga

Today, many island communities of the Ha'apai overuse the marine resources: the population density is reduced, some species are in danger of extinction. Nevertheless there are still islands where the system is in balance and where the resources are being used sustainable. An example is the island Lofanga. Here, the maritime resources are not overused and on Lofanga, the traditional societal structure is relatively intact. The traditional social structure thereby refers to both, the common property system and the informal insurance system.

Also Lofanga has seen technological change. In fact, on Lofanga the available fishing equipment is identical to that of neighboring 'Uiha, where extensive overfishing can be observed. We thus believe that not technological change per se leads to overfishing and that the traditional social structure can preserve sustainable resource use.

Looking at the traditional common property system on Lofanga, we do not find any rules and regulations with respect to resource use. There are no norms which would allow to fish only a certain quantity of fish per day or week, not to speak of any sanctions which would punish particularly greedy fishers. Quite to the contrary: fishers who fish large quantities are considered being "successful fishers" and acquire higher social status. Yet, fishers in Lofanga don't fish excessively.

Besides the common property system, which is interestingly characterised by the absence of any rules and regulations, we observe an intact informal insurance system. The system works through the sharing
of fish: A successful fisher gives away part of his fish to people he meets at the harbour. He might give
away some more fish to people he meets on his way home. At home then, he will share his fish with his
kinship according to certain rules. Thereby elderly members of his family will be privileged
beneficiaries.

Fishers thus face the obligation to share part of their catch with their neighbours, friends and even
strangers who have no fish of their own that day. These rules of sharing constitute an *insurance* against
various risks such as illness or bad luck: those who have not caught fish on any one day can be certain to
receive some fish from someone else (insurance payment). The giving away of fish, in turn, is the
payment of the *insurance premium*.

The selection of the beneficiaries is partially random, partially according to rules and regulations. The
random selection of beneficiaries ensures that the system includes the whole island community and is not
restricted to kinship or family, which improves the insurance against non-correlated risks.

Important to note: traditionally, the informal insurance system constituted the only possibility to insure
the various risks identified above. Within the Tonganese culture, no means to conserve fish is known.
Only with the introduction of electricity and cooling systems, some conservation is possible - although
the cooling equipment is rarely used on Lofanga. The rules of sharing are an integral part of the
Tonganese culture. Also, money, which allows individuals to save resources in order to dissave in the
case of temporary income reductions, was not common.

3.2. 'Uiha

In order to contrast the situation of Lofanga, we also look at 'Uiha, an island where overfishing is being
observed. In 'Uiha, some fishers have formed groups of five to eight fishers which devote much more
time to fishing than before and sell their fish commercially. The members of these clubs are less
integrated into the traditional insurance system, sell a larger percentage of their catch and are found not
to rely on help from outside their fishing club.

4. Linkage between Common Property and Informal Insurance
Our hypothesis is that the coexistence of informal insurance system and common property system leads to sustainable resource use. From a theoretical point of view, there are various reasons why this should be so. The first idea which springs to mind is that the two systems are linked via cross default clauses, which lead to a stabilisation of one or even of both systems.

Both the common property system and the informal insurance system can be seen as prisoners' dilemmata. Within the common property system, each and every fisherman may have an incentive to fish more than is optimal for society as a whole. Within the informal insurance system, in turn, those fishers who have caught large quantities of fish may have an incentive not to share the fish with those who are in need of the "insurance payment" and should have the right of receiving part of the catch, after having "paid" their insurance premium in the past (for the incentives of cooperation within informal insurance systems see Coate and Ravallion 1993).

If now two prisoners' dilemmata are linked via cross default clauses, one or both systems might be stabilised (Mohr 1995, Lohmann 1997). Possible reasons for the stabilisation effect are: one system might be more stable than the other or the default incentives are not correlated.

However, on Tonga we cannot identify any such cross-default clauses. Neither are breaches of the rules of the insurance system sanctioned in the common property system (for example by excluding the delinquent from the fishing community) nor is non-cooperation within the common property system sanctioned within the informal insurance system. The lack of the latter sanctioning process is also due to the fact that there appears to be a complete absence of rules regulating the resource system - thus there is no such thing as non-cooperation which could be sanctioned somehow in the other system.

Yet, the informal insurance system appears to stabilise the common property system. We have in fact identified two very simple mechanisms which foster sustainable resource use: one is the obligation to pay an insurance premium, the other is the right to receive an insurance payment.

Paying an insurance premium on the income achieved by means of fishing has the same effect as paying a tax. Since Pigou (1923) we know that economic activities which cause negative external effects should be taxed, so as to reduce this activity. The system of sharing (or informal insurance system) on Lofanga
can thus be seen as a traditional form of "green taxes", which reduce the fishing effort of the individual fisher.

The "green taxes" in Tonga thereby are progressive. If a fisher catches just as much as he needs for personal consumption, he is allowed to keep all of his catch (no insurance - or tax payment). Only if the catches more than he needs for his personal consumption, he will need to share. As there are no technologies being used for conserving fish, the personal consumption is more or less fix and the "tax rate" increases with the quantity of fish caught. The progression of the tax rate assures that no fisher will, as a result of the tax, be forced to fish more than he would otherwise do in order to satisfy his own consumption needs.

Secondly, receiving an insurance payment in the case of illness or bad fishing luck, may lead to reduced fishing effort. This is so, because the effort level of the individual fisher is not clearly observable - the classical problem of moral hazard within insurance markets, where the effort level of the insurance taker is not observable. As a result, fishers have an incentive to reduce their effort devoted to decreasing the likelihood of damages - which is in our case a bad catch.

The field study does in fact produce strong evidence in support for the (theoretical) postulate of an moral hazard problem. We have asked the fishers of Lofanga, whether they find that some people have become somewhat lazy because of the fact that they receive insurance payment in case they have caught no fish themselves. An overwhelming majority of the fishers indicate that indeed some fisher have become lazy and rely on the insurance payment.

Both, the "tax" effect and the moral hazard effect of the informal insurance system reduce the incentives for the individual fisher to engage in fishing effort. If the aim of the community was to increase income (and fishing effort) they would need to change their insurance system. The insurance premium and also the insurance payment would need to be reduced.

The members of the fishing clubs on 'Uiha have introduced just these reforms: they have withdrawn somewhat from the informal insurance system. As a result, they now fish approximately five times more
than the fishers on Lofanga and are able to increase their income substantially. However, the costs of the change are high, as the long term sustainability of the resource is now endangered.

5. Conclusion

We have identified an explanation why the common property system of Lofanga does not lead to overfishing, although the technological possibilities of overfishing are available and although there are no explicit rules of resource use within the common property system.

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