118th EAA Seminar

"Rural development: governance, policy design and delivery"

Ljubljana, 25-27 August 2010

ENVIRONMENTAL PAYMENTS IN CONFLICTING SITUATIONS BETWEEN NATURE PROVISION AND COST MINIMIZATION: A POLITICAL ECONOMY APPROACH

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Paper prepared for presentation at the 118th seminar of the EAAE
(European Association of Agricultural Economists),
`Rural development: governance, policy design and delivery´
Ljubljana, Slovenia, August 25-27, 2010

Abstract:

We analyze an emerging conflict within the second pillar of the rural development policy of the EU: a conflict between nature friendly farmers, who want to participate in high nature value (HNV) agriculture, and commercial farmers, who feel negatively impacted by supporting nature. We see a link through competition for land between nature provision in agriculture and cost minimal production (CMP) of commercial farmers. The idea is to model this conflict using a political bargain approach and make a contribution on how to solve the conflict by new institutions such as payment sharing. The power of groups is analyzed and we analyze what governments can do.

Keyword: conflict, political economy, and nature provision

1 Introduction

In this paper we analyze a conflict which is newly emerging between farmers (farmer groups) of different orientation and which is concerning positive and negative effects of payments. Rural development and payments, for instance, for the environment, in many regions of the EU are nowadays characterized by a conflict between two types of farmers: (1) modernizing (business friendly) farmers, who seek to minimize costs in their production through expanding their operation and capturing economies of scale, and (2) more ecologically oriented (eco-friendly) farmers who seek to maximize payments by providing nature elements and restricting themselves to traditional or eco-farming methods. The conflict is perhaps also at political levels between large and small farms.

The first group (type of farmers) wants to increase farm sizes, re-structure fields (large vs. small) and opt for landscape modifications, i.e. in most "rational" modes; in particular, for reaching cost effectiveness. We can call the group of farmers who seek cost minimal production through minimizing concerns for environmental issues: CMP. These farmers refer to EU rural policies as seeking support for the proliferation of a farming system which is competitive by international standards. Making farm business more productive (modern) and competitive seem to be the only policy which is relevant for them. Farmers can be regarded strongly business oriented and think, that expanding business (become even bigger), is the only chance for them to stay competitive. As a group they are internationally oriented. The second group (farm type) promises to maintain cultural landscapes (i.e. small vs. large fields), to improve the basis for bio-diversity, and wishes that farms work ecologically sounder. We call them high nature value oriented farmers: HNV.

The issue is that the two groups of farmers frequently live in the same area and start blocking each other, at least politically. For example, an interesting case has been the "bird initiative" operating within the flora fauna habitat regulation in the province of Schleswig-Holstein in Germany (Kumetz, 2008). The case clearly shows a deep split between farmers. No longer being personally or socially connected and represented by a uniform farmer lobby, political fighting has started between CMP and HNV farms. Especially through political and public awareness campaigns and interventions HYV and CMP farmers seek support through parties and the general public (see: pro-eiderstedt, 2008 and Landtag Schleswig-Holstein 2004 in the internet); i.e. through campaigns for changing public opinion, mostly CMP, farmers try to accomplish interest of a broader public for their resistance against environmental programs. Assuming that the public is supportive for farm survival, the modernizing, i.e. CMP, group of farmers wants to bloc environmental programs. They see them as a threat to survival. There is a danger that environmental programs, as part of the second pillar of the EU, become impeded (in particular such as EU flora-fauna-habitat initiative, but also national programs for landscape re-creation).

For understanding the issue the specific situation of rural development policies within a country-side faced with land scarcity has to be understood; notably as regional competition for land. In fact, the issue has to be seen in the contexts of land use changes associated with expanding CMP farms. For example as Schleupner and Link (2008) showed on the above mentioned peninsula, Eiderstedt, arable land as been expanded primarily for maize production, used for dairy cows. The aim to have a competitive farm sector as well as a more ecologically oriented and sustainable farming sector has to be put into a real perspective of rural economies with land scarcity. Moreover there are different strategies of different farmer groups with respect to access to land and income. The reason for conflict between HNV and CMP farmers is that each side fears increased land scarcity and increased land price (or prices for renting land) due to environment payments. Indeed, payments which do not help them have become a big concern for expanding farmers.

Rural development policies which support farmers and impact on structural change (in particular, those policies which are environmentally oriented) are more and more face with farmer groups with diverting interests. An argument is: receiving payments enables 'less efficient' farms to survive and these farmers are considered as impediments by 'efficient' farmers. For instance, CMP farmers want to expand business by land purchase; but if they have to rent land at higher land costs which makes them less competitive. Though not officially expressed (officially solidarity prevails) modernizing (CMP) farmers urgently hope that less efficient farmers (those farmers who eventually farm ecologically sounder: HNV) leave business. Mostly payments for nature conservation and designation of areas for Flora-Fauna-Habitat or Natura2000 are considered detrimental for business. Farmer groups start frequently campaigning against environmental programs for competitive reasons. Under the presumption that payments for environmental programs increase costs (which includes land prices), CMP farmers seek to bloc regional initiatives which could otherwise help HNV farmers to survive and provide nature.

From the point of view of improving environmental governance and designing policies for cultural landscapes (which shall optimize nature provision especially in environmental sensitive areas) this conflict creates big problems. However, it should be evident that environmental measures will create always problems (Gawel, 1995) since there are diverging interests. Indeed direct payments linked to conservation measurements have become less accepted by farmer groups. This is observable from the agri-media appraisal on the relevance of future payments as part of income support (Preusse, 2010). Many CMP farmers are not linking the likelihood to receive payments to environmental services. By politically blocking different initiatives which are launched by the EU and national ministries, CMP farmers can, for example, hinder constructions of ecological mains structures (eco-networks), bloc special area payments, etc. Increasingly governance of environmental initiatives depends on a sensitive treatment of payments (Hodge, 2007). This may include provisions to solve conflicts based on interest discrepancies. The major question, at hand, is how can we understand the political economy in rural areas and underlying issue as well as how can we more clever design policies fostering co-operation and solve issues?

2 Background

In the paper we argue that there should be indirect payments to the CMP farmers by HNV farmers to appease them: in principle, indirect payments mean compensation (sharing of payments) for increases in land rents and for not fully exploring economies of scale. However, such rules of a new game imply that HNV farmers concede payments based on threats and the government complies. This may not sound fair, but under current conditions of blocking initiatives, HNV farms most likely have no other chance, if they want to develop. So compromising would improve their situation. The design of effective measures as 'payments for getting ecological services' -

under conditions of political economy- will remain a problem, if political interferences of lobby groups exist. We should try to de-escalate conflicts by understanding and suggest modeling rules.

(1) We derive a problem statement based on actors and interactions. (2) We obtain and investigate interest functions and show how co-operations could be reached. In particular, we show how to create co-operation instead of conflict by internal sharing arrangements. (3) As an innovation, a political economy bargain model is employed which is based on a diffuse property right setting including the possibility of CMP farmers to be compensated. Actually CMP farmers may ask for overcompensation. In a bargain for compensation both sides will try to get as much as possible out of money retrieved from government. The result is pending on power which we will model. (4) The paper seeks to advance towards a conflict resolution, including power. The delivery is less nature though a politically more accepted solution. By suggesting that a payment assignment may help to realize an agreement, a "solution" is found that accommodates HNV-, CMP-farmers, and the government. Hereby we assume that a government has to deliver "NAT"ure or makes a cost-benefit-analysis including the bargain. We outline a bargaining model referring to regulations (rules) there CMP farmers have a right to negotiate on money and we specify the share (rule) of compensation for indirect effects of payments. It shall encourage mutually respected agreements (rules) on a sharing of payment/costs (i.e. HNV farms concede money to 'CMP farms').

It is the objective of the paper, (1) to analyze nature provision from a political economy viewpoint in rural development frame characterized by conflicts and to show how designing a power oriented, political economy approach helps to understand interests and exchange (Zusman, 1976); (2) to incorporate stakeholder interests and externalities with respect to effects of nature provision in a bargain model; and (3) to show how the model can be analytically solved. (4) The paper refers to a compromise which is built on reciprocity and "more optimally" achieved nature provision in environmental sensitive areas. Notify that the instrument of payment is used by many local governments to gain acceptance for the designation of sensitive areas and pursuing of restrictions on farming through contracting for nature. (5) The administration shall influence the bargain through setting rules on payments sharing and payments should be area based. The compromise requires an understanding beyond the exchange of technical details for nature conservation and it involves an explicit process to find better solutions as well as commitments by multiple players in rural areas. Solutions are defined as willingness to accept nature provision by different farmer types, given the current status of a power in rural communities. (6) On the methodological side we show how to derive power by a special exchange type and how power can be influenced by governance of payments. (7) A broad aim is to get more nature provision and offer promise.

As a main result, our investigation into conflicts of payments between HNV and CMP agriculture and its political economy will reveal that a payment sharing (money conceded to CMP farmers from HNV farming) may mitigate conflicts. Then we (the reader) may infer how, as practical application in land allotment for HNV agriculture, negotiations will improve payment concepts, i.e. make them working without blocking. This will help policy makers to avoid falling into traps of political resistance and ignoring power of lobby groups in the second pillar. As a secondary result the paper provides an outline how to measure political power of the two groups (CMP and HNV farms) and how public administration can work with agreements on payment sharing in regions.

3 Concept and outline

The model is structured around two entities: a commercially oriented, modern farm sector (CMP) and an environmentally oriented, traditional farm sector (HNV). The entities are now further characterized. The commercial farms follow a strategy of cost minimisation using economies of scale and they strongly depend on more land which they want to rent to reduce unit cost. It is pre-

sumed that, in a competitive environment, only large farms can survive. Then, as we frequently observe, some farmers take the opportunity to think about HNV agriculture as an opportunity to quit the treadmill of investment, reduction of unit costs, growth and getting ever fewer revenues from market products. They take the opportunity to acquire payments from governments for nature provision and offer reductions in farming intensity, notably, on land which is then farmed under environmental regulations. This land is not leased to CMP farms which would be the alternative if the farm quits operation or becomes part time. However, it is not the intention of this paper to look in farm conditions and discuss effectiveness, ecological benefits, off-farm, etc.; rather we resume that a government provides HNV farmers compensation payments and that nature is a negative variable in their production costs, but they survive. As innovation it is suggested that payments are shared according to a sharing agreement "α" on the budget received for the area. Furthermore, the government is optimizing the difference between values of nature as obtained from willingness to pay minus the budget needed, ending in net values from eco-system services. For the planning we can assume that budget costs are proportional to the natural value $B=\gamma N$. The offered nature N (which might be an eco-net or EMS) is also shared in terms of cost which will be showed soon, since nature affects both farm types. Sharing nature can be simplified as proportion of land which is devoted to nature. Then, we start with the institution of a bargain rule.

3.1 Nature and payment sharing as regulations and its effects

In a community of CMP and HNV farmers the perspective on nature prevalence and complying with nature as well as the idea to get payments may be quite opposing: HYN farmers ask what payment to get? And deliver nature. CMP farmers do not want nature and payments. The interests are opposite. However, if there is an institution of sharing payments, the CMP farms may change their opinion. Even a small share in the deadlock of regional development due to caring for nature could be considered "fair" as CMP also give up intensity (economies of scale and land scarcity). Basically we assume that the CMP farms want to avoid nature provision because nature reduces scopes and profits. For example, if still present riparian buffer strips or hedges between fields should be preferably completely removed. In contrast, HNV farms tolerate a large nature share in their lands and they even would eventually accept more (increased with payment). Indirect payment to CMP farms is an option, though HYVs will surely say we need higher payments. Because (1) they work with eco-system services derived from nature (an indirect effect of reducing costs in HNV farming systems such as pollination in orchards, natural pest control, etc.) or (2) because they, for instance, receive better prices for their produce and have (3) economies of scale, HNV farming partly pays off. Also depending on skills, HNV prevalence is considered "natural" and products sell at markets for quality. Extra payments from governments are motivating nature production, but are not the sole determinant of nature production for the HNY farmers.

In case of CMP farmers, nature is nowadays a disturbing category. They are afraid of increased costs due to "nature". Only compensation payments can motivate them to tolerate nature in their landscape. In the last decades almost every farm practice has become productivity oriented and nature is disturbing. For example, fragmented landscapes, high water tables, nature elements such as shrubs, etc. disturb machine use and increase costs. CMP farms furthermore control their production by pesticides and artificial fertilizer, so the demand for ecosystem services (in their opinion) is almost nil. In contrast, one of the biggest issues in their eyes is that land prices are a major cost component. Land prices are determined by land scarcity. The allotment of land for nature conservation and a consecutive "inverse" allocation ("land to bad tillers") to HNV farms is threatening their corresponding profitability of farming. Giving subsidies for nature production will increase relative profitability of nature friendly (HNV) farmers: "These farms will survive and do not rent out land to us CMP farmers". Increases of land prices can be expected. We model this aspect soon by showing the effects in the objective functions and derive behavioural function. For this we have to differentiate and formally present the behaviour of HNV and CMP famers.

3.2 High Nature Value farming

Our approach uses the optimization of a representative farm in each sector (HNV and CMP) as a starting point from which we derive behavioural functions. Land in each sector is a constraint and shadow prices can be derived. The derivation of shadow prices gives land demand functions. By land demand we link sectors. The land market is specified explicitly and both shadow prices equate. Shadow prices reflect the scarcity of land on a rental market for land. The technologies differ, but nature is a component in each production or cost function: "+", "-", vice versa. For a political economy modelling different versions of interests, i.e. objective functions, are to be specified. We commence with the objective function in case of the co-operative solution. On the revenue side we state that a HNV farmer receives a payment based on nature prevalence "N" and a price "ρ" which he shares with CMP farms as percentage, being α. CMP farmers become "partners".

In this case, the parties have agreed to share the government payment (which is assumed to be legally approved). Apparently sharing will reduce payments to "pro" nature (HNV) farms. Their objective function shall also include a price effect on produce which is correlated with nature p_n. Revenue is then given by the two components: market return and government payments received.

$$\Pi_n = p_n q_n + (1-\alpha_n)\rho_n N - C_n \qquad (1)$$

where: p_n: rice for products of HNV farms (mark up)
q_n: products of HNV farms
α : share in payment
N : n ature (criteria for payment)
ρ_n : per unit payment of nature
C : costs

For a further delineation we will assume that the cost function is a quadratic function in which nature takes two aspects: (1) Nature is land consuming. Land for farming is reduced (we assume that nature is imbedded in buffer strips, hedges, wetlands, etc.); (2) Nature is positive for yields in eco-farming "+", for it reduces costs of pest control, etc. For the first aspect we look at the share of nature in the traditional sector which is α. For the second it decreases unit costs. Nature, in total, is responsible for cost change. As a matter of clarification: We could model organic farms competing for land with conventional farms. But in other cases it might even conventional, farms which are willing to deliver nature elements for nature production. For farmers, typically, a cost function has a land constraint. This constraint is amplified by nature prevalence whereas a productivity factor is expanding production. So as a result a cost function can be presented such as:

$$C_N = \gamma_{10}Q_N + .5\gamma_{11}Q_N^2 - \gamma_{12}\alpha N \; + .5\gamma_{13}\alpha_{10}^2 N^2 + \gamma_{14}(L_N - \beta\alpha N) + .5\gamma_{15}{}^2(L_N - \beta\alpha N) + \gamma_{16}Q_N(L_N - \beta\alpha N) + \gamma_{17}N(L_N - \beta\alpha N)$$

where: L_n: land used by HNV farms (2)

In function (2) two aspects regarding nature are incorporated: (1) Nature reduces the production potential for those farmers who engage in nature. However, things may be more complicated. Farmers who engage in environmental programs normally do not have only costs. For example, if a farmer produces beef from suckler calves they can better market their produce if they convince customers that the production is natural. To accommodate such aspects in detail it would mean that different categories of quality enter the objective function. To keep things simple we assume that we have a negative effect on the costs and a positive effect on the profit (revenue-costs). The problem for modelling is to put such aspects in a revised objective function. In principle one can take the net effects and combine them in a profit function. The argument is that HNV farmers will have less cost to produce (sell) and higher revenue from quality products (for example beef).

Defining nature as reducing area, we take a proportional factor (β) between nature and farm land. Hereby we maintain the concept of land as a restricting factor in the cost function.

Taking the explicit cost function (2), the specification (1) is used to derive nature provision and food production of HNV farmers. This will be done later in combining individual objectives of HNV and CMP farmers in a collective bargaining approach. For the moment we focus on the interaction as "partners vs. opponents". Basically using the above cost function which is a quadratic delineation we can derive a linear land demand function for land. For this we apply Sheppard's lemma that the shadow price is equal to the inverse demand for a limiting factor.

$$\lambda_N = \gamma_{14} + \gamma_{15}(L_N - \beta\alpha N) + \gamma_{17}(L_N - \beta\alpha N) + \gamma_{15}(L_N - \beta\alpha N) + \gamma_{16}\alpha Q_N + \gamma_{17}\alpha N \quad (3)$$

This function will be used to establish the equilibrium at the land market equating shadow prices.

3.3 Modern and Commercial Farming

For the commercial, modern, CMP farmer nature also reduces land but now with a total negative impact and by nature inclusion their productivity declines. We assume that α is the share of N which the CMP farmers take. Note, the sharing of revenues is the opposite of sharing in land (wish). Having specified objective functions, profits are revenue minus costs including nature:

$$\Pi_c = p_c Q_c + \alpha\ \rho_n N - C_c \quad (4)$$

where: …$_c$: CMP farms

and the cost function is now specified as

$$C_c = \gamma_{20}Q_c + .5\gamma_{21}Q_c^2 + \gamma_{22}(1-\alpha)N\ + .5\gamma_{23}(1-\alpha)N^2 + \gamma_{12}L_C + .5\gamma_{12}{}^2 L_C + \gamma_{16}Q_c L_C + \gamma_{27}1-\alpha)N\ L_c \quad (5)$$

This objective function can then be optimized, i.e. also for the land demand. For CMP farms the meaning of nature and land constraints in the cost function is different from nature farmers: Nature is, in their opinion, by any chance increasing their costs because it eventually requires more pesticides to combat pests, reduces land, etc.; and land is constraining them most. Nature conservation activities indirectly affect them as compared to more directly affecting HNV farms, still producing as traditional farms. As an example: if a bird promoting scheme is propagated by nature conservationists (see Eiderstedt) birds can not be controlled on HNV land only, rather they move to CMP fields. Nature is considered harmful. Because, birds will also feed on land of commercial farms, their yields will go down and unit costs per ha will increase. The unit costs, in contrast, decrease with land expansion. Nature shall be, by definition (details see below), increasing in total cost as negative effect.

Applying the same derivatives for the land demand (towards the constraint) using the CMP cost function (5) a demand function (6) can be derived.

$$\lambda_c = \gamma_{12} + \gamma_{12}\ L_c + \gamma_{16}Q_c + \gamma_{27}1-\alpha)N\ + \gamma_{28}\rho_n \quad (6)$$

Taking the two land demand functions (3 and 6) and equating them we get a shadow prices as land costs depending on N. It can be specified as the rent price and the equilibrium is specified.

$$\lambda\ = \gamma_{12}^* + \gamma_{12}^*\ N\ + \gamma_{13}^*\ L_t + \gamma_{14}\alpha\ + \gamma_{15}\rho_n \quad (7)$$

Hereby we receive the interconnectivity we were looking for and can re-specify opportunity costs. Since there is a price for land which depends on nature, total land and sharing as well as payment per hectare, this price can enter the interest functions. We define land costs as rented land multiplied by shadow price. The equilibrium means that the shadow prices of both land constraints equate. In this framework, either we can presume ownership of land or CMP farms tend to lease land. However, land has opportunity costs and these opportunity costs are part of interest functions as they are to be delineated. A new interest function is specified which contains a planned nature and sharing arrangement. With this change a bargaining can be started.

4 Bargaining

4.1 Scope

On the bargaining we firstly work for a clarification of three issues: (1) receiving nature, (2) sharing of money and (3) showing how sharing is documented in interest functions. As we have already stated, profit functions represent the interest of the two parties and the land market provides connectivity. We call the profits now "interest" because they depend on strategic behaviour of the potential partner, i.e. α and N in a cooperative (hopefully) or a non-cooperative game (as threat). Profits are converted into functions which depend on bargaining variables N and α of sharing. It means interest functions are dependent on willingness to payment of the government for nature. This conditionality of the bargain on the payment enables us to clarify on the governance, later.

$$I_n^{HNV} = p_n q_n + (1-\alpha_n)\rho_n N - \lambda_n L_n - C_n = p_n q_n + (1-\alpha_n)\rho_n N - \gamma_{01,n}^* N_n - \gamma_{02,n}^* \alpha_n - \gamma_{03,n}^* \rho - \gamma_{11,n}^* \alpha_n^2 - \gamma_{12,n}^* N_n^2 - \gamma_{13,n}^* \alpha_n N_n - \gamma_{11,n}^* \rho_n^2 - \gamma_{11,n}^* \rho N_n - \gamma_{11,n}^* \rho - \gamma_{11,n}^* \rho\alpha \quad (8a)$$

and

$$I_c^{COM} = p_c Q_c + \alpha\ \rho_n N - \lambda\ L_c = p_c Q_c + \alpha\ \rho_n N - \gamma_{01,c}^* N_n - \gamma_{02,c}^* \alpha_n - \gamma_{11,c}^* \alpha_n^2 - \gamma_{12,c}^* N_n^2 - \gamma_{13,c}^* \alpha_n N_n - \gamma_{11,c}^* \rho_c^2 - \gamma_{11,c}^* \rho N_c - \gamma_{11,c}^* \rho\alpha \quad (8b)$$

Next, taking the concept of Zusman (1976) that a bargain, beside interest, has the aspect of power (superiority) and of compromise (optimal solution), we obtain the power from a non-cooperative game perspective and compare it with a cooperative game. A non-cooperative situation is a blocking of agreement. For instance, a most powerful situation is that one player becomes the agent and the other, the principal, and vice-versa (see below). In our case the game is additionally structured by the fact that outside money shall facilitate it. In principle we model the effect by adding a constraint that the two parties know that the budget size is determined exogenously. As Zusman (1976) has shown such a game is an optimization of a power weighted joint interest function:

$$I = I_n^{HNV}(N,\alpha,\rho) + \lambda(.)\ I_c^{COM}(N,\alpha,\rho) + \mu[N\rho - B] \quad (9)$$

In principle, we can see the problem of finding N and α as a bargain which is comparable to an optimisation of equation (9). The issue is that in such case the external budget is an additional, pending and limiting factor. The bargaining is on a nature prevalence, N, which suits both parties (see below) and on the distribution mechanism of benefit sharing α (suggested as innovation, solved). Hereby we can consider the two parties as cooperating. From an institutional (e.g. regulatory) point of view the nature providers, HNV farmers, are accepting the "power" of commercial farmers. Then the concept is a group payment such as a budget for nature and the farmers have to bargain. For that budget a government receives a wished service.

Finally, we have to close the model by balancing the provision and request from the side of the farm communities and the government. If we consider the result dependent on the budget

$$N^s = N^s(B, \rho) \tag{10}$$

and specify a demand, given by a willingness to pay derived in a preference investigation

$$N^D = N^B(B, \rho)) \tag{11}$$

this fits into the frame of bargaining. Note, in (11) the budget is an aggregated willingness to pay:

$$B = \beta_0^* + \beta_1^* N \ + \beta_2^* \rho \Leftrightarrow N \ = \beta_0 + \beta_1 B + \beta_2 \rho \tag{11'}$$

Equation (11') as demand serves to make the budget constrain operational in modelling. Further on, in the special case of β_0=0, β_1 is the marginal value of nature and gives the price. The price is exogenous and the above problem can be easily solved because the budget constraint is fulfilled if $\rho = \beta_1$; technically it means that the "price is equal to the marginal willingness to pay (WTP)".

As a remark: a deviation from that simple concept would imply that the community has an influence on the perception of citizens and can optimize on the "price: "ρ", to be paid. Then there are two options. One is a triangular bargain, which is rather complex to model. The other is a contingency that the community (CMP and HNV farmers) is the "agent" and the government is principal. The second option, firstly, requires the solving of the dependency of N on ρ (the WTP) and then, secondly, the decision of the principal on maximizing the principals (public welfare).

4.2 Bargain Outline

To convey bargaining as a modelling concept, we will now outline what a bargaining offers in terms of measurement and will show how it can be modelled. The aim is to get a power indicator λ for equation (9). Power is crucial to solve equation (9) and hence the cooperation. Our content related understanding is that of developing a compromise among the actors knowing power. For that we refer to a political economy bargaining of Zusman (1976). The introduction of a bargaining model is theoretical and is a step to simulating potentials for a compromise. In that regard we briefly reiterate the theoretical background of bargaining. As can be shown in Fig.1, a bargaining starts from the limited allocation of property rights (as opposed to markets) and depicts power

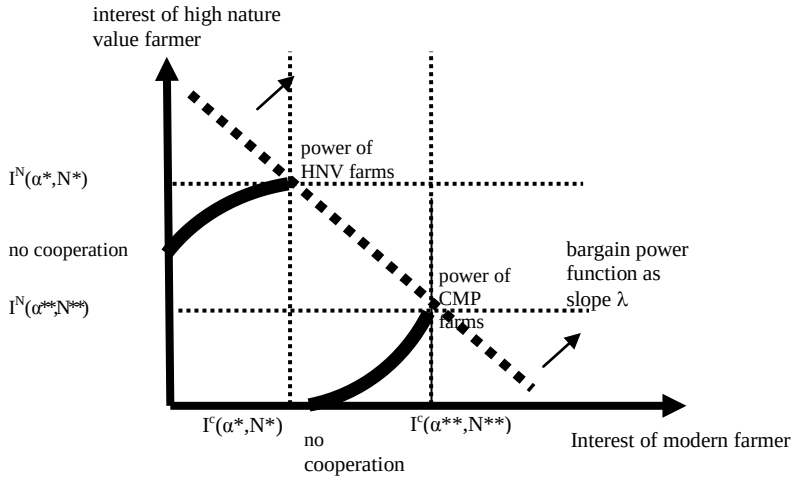

Fig. 1: Political Bargain Model and Power Measurement

derived from individual objectives (interests) in collaborating units as a game (Harsanyi 1993).

In particular we need corner solutions to establish the slope λ. How to proceed? For the envisaged problem we assume that rights are either with HNV farmers (for example extensive beef or sheep farming) or CMP farmers as opponents (dairy farming). For the moment the interests are roughly defined as: (1) "Maximizing net gains" (having highest returns from programs for HNV or for CMP farms looking at net compromise of accepting some nature: see below in detail). In Fig. 1, there are four corner solutions: (1) "no cooperation" of the CMP farms and (2) "no cooperation of the HNV farms"; (3) supreme power of the CMP farms $I^C(\alpha^{**},N^{**})\hat{}I^E(\alpha^{**},N^{**})$ and (4) supreme power of ecology-promoter (HNV farms, $I^n(\alpha^{*},N^{*})\hat{}I^n(\alpha^{**},N^{**})$. These power situations serve as a reference point for a final situation explained at a later stage. The crucial point is that a political bargaining model works along the concept of exchange of rights; in the beginning rights exchange are as thought experiment. I.e. rights on sharing and on nature are exchanged and one has to specify interest function and criteria for exchange. In our case we refer to a nature imposed on CMP farmers. It is assumed that cooperation (in a theoretical game) shall reduce the costs for CMP farms. We have to think on modes of exchange. Diagram 1 only supplies the structure.

In Fig. 1 the four points need to be qualified. The non-cooperation situations (at x and y axis) shall reveal defection in a political game. A non-cooperation (on the x-axis) is a status-quo where no HNV farming occurs. It is complementary to a political situation in which CMP farmers' are cost minimizing and bloc HNV. Because these farmers do no receive a share which compensates them for increases in costs, they defect and argue against higher land prices from HNV: `Being well established they can successfully suppress HNV farms.' For HNV agriculture it is a situation of no-existence which means that additional income can not be accrued due to blocking. Apparently, for modelling, the alternatives (1 to 4) are virtual ones in regard to strategic behaviour; but we need them to find power coefficients. Alternatives (3) and (4) are indicating principal-agent solutions (Furubotn and Richter 1998). Alternatives (1) and (2) are blocking ones. In (3) we assume that the CMP farmers are principals and use HNV farmers as mean to receive money. Because the region is in a better ecological shape, they gain from allowing nature provision N and assure for them the highest α in the game. In this case nature is determined by the HNV farmers and the CMP farmers decide on the sharing arrangement. By the sharing of payments the CMP farmers make the best out of a co-operation with ecological farmers. Note the government does not control bargaining. In principle CMP farmers can politically dictate (control N provision by receiving money) to the HNV farms α. HNV farmers are officially the providers, though they serve as a source of income for the CMP farms. How provision and sharing is organized/justified is another topic, beyond; it is a matter of practical insight. We deal with modelling only, here.

In (4) the alternative is that the HNV agriculture dictates the terms of co-operation. In this case an agreement from the CMP farmers is perceived as a response to conceding shares in the payment. The HNV farming knows the "response" (conceding) function of CMP farmers and builds it own decision on that. In empirical application we even can apply a participation constraint to get a fixed payment involved. The two points of power are observed in Fig. 1 as corner solutions.

4.3 Bargain and positions

For a further understanding of the bargaining we briefly have to clarify on the positions reflecting power. Several positions can be potentially held in the bargaining. As outlined, the HNV farming community has an interest in nature provision. Though they need money as payments to supplement income, nature also is important; we assume, they can compromise on money given to the commercial farmers. Overall we assume a surplus from nature provision. The political economy exchange of rights is about "nature" for "money" conceded to CMP farmers. To give-up a right, here, money for nature (sharing: i.e. α is a loss for the HNV farmer) is compensated by receiving

the right to nature. Though it seems, a right to nature provision is not obvious; if the power is with CMP farmers, they will suppress it. Payments for nature at a remaining rate (1- α) may ease tensions. In this regard we define the bargaining as an exchange in which there is an interest on both sides. Practically, the important issue for cooperation is to create interest on the side of CMP farmers. This is not easy in politically tedious cases. It includes the position of lifting the blocking of nature introduction in a farm community as a whole. As an economist working with interest functions we think that money makes it easier for CMP farmers to accept and accept nature. At least, a justification for money is, as discussed above, the fear of CMP farmers for increased land scarcity, which might be the result of introduction of nature elements and regulations on land use. A proposition is: if CMP farmers are participating in payments (in terms of bargaining) they will concede rights (even if these are claimed rights, not true ones). Thereby the legal situation is hitherto an open one (in the example: Eiderstedt, Germany, a pro-nature non-governmental organization, NABU, appealed recently to court on that (Die Welt, 2010). Our reference could be to a right of CMP farmers, for instance including a right on a ditch removal, low water tables, drainage, etc. (Gönnert et al. 2007). That may change, if courts rule in favour of nature and governance allows water table to rise: Interests depend on rights. However, the interest functions of the CMP farmers are mirroring the interests of the HNV farmers; but not as straight as opposite position.

In our case CMP farmers concede some "factual" right to have no nature in their landscape to HNV, if they participate in public money depending on their political strength. Apparently, for the practical application of the concept CMP and HNV farmers (beside the definition of compensations as sharing of money received from government) have jointly to specify the type of nature provision which is expected by the government and which is agreeable in the community. Partners need to have a joint understanding. From a modellers point of view a detailed and concrete description of the bargaining and type of potential agreement on nature (amount of landscape elements, frogs, etc.) which suits both sides is difficult do predict. It is normally not possible to define "nature" as outsider. A practical solution is to concentrate on the issue of land use (occupation by nature). As been frequently discussed ecological main structures or eco-nets (Jongman and Pungetti, 2004) may provide scope for detailed nature production planning. The puzzle is to identify the real and eventually perceived, negative impacts on CMP farming. However mostly it is land occupation what counts. An extension would be to include impacts of landscape design such as sizes of fields (an important aspect of CMP farming) on farms into minimize costs. A feasible way, in the author's opinion, is to index nature or to accomplish change as farm operation. It must be something translated into land use. This could mean that a variable like ecological food print (but now from the side of farmers who fear to be deprived) can be constructed.

A further aspect which needs to be mentioned under special conditions is the connectivity between actively providing HNV farmers and negatively impacted CMP farmers. Things could be even more broadly modelled as watershed or regional problem. For example, if HNV farms rely (in nature provision) on a whole watershed and the corresponding water tables goes up (as in joint wetlands), a reduced drainage of HNV farmers will decrease the yields of the CMP farmers. Unless they spend more money on draining CMP farms suffer. Installing devices for separating the systems are also expensive. Again, we see increases of costs. For the increases and specifically links between an envisaged nature and cost increase for the CMP farmers (as a result of common property problems), we need to model interactions as close as possible to local concerns: i.e. what are yield decreases, further pest control costs, or investments, etc.? As suggested one can reverse the idea of an ecological food print and classify it in a participatory approach. Food print reflects costs as additional land which is needed by CMP farmers to reach low costs at levels expected.

5 Deriving the Power Function

5.1 Corner solutions

As said, corner solutions (Fig.1) serve to get information on the groups' power in bargaining. Corner solutions indicate options for defection. They might be chosen during the bargain. In principle, they present threats of non-cooperation (Zusman 1976). Cooperation means that the interaction (agreements on terms N and α) between the partners (increase) maximizes welfare of conflicting groups (increases of nature in our case). Bargaining has, at least, two corner solutions (see in Fig 1). Since, in the corners, the power is either held solely by the CMP farmers or by the HNV group, special modelling has to be applied. Having sole power on each side means incentives are offered by the powerful group. Incentives are offered in a process of individual profit maximization by a principal to an agent (Furubotn and Richter, 1995). The question is who would be the principal and agent in an exchange. A principle-agent-constellation is one in with the principal is second and the agent first in modelling. The principal reckons a responds to incentives by the agent. Both ways of specification work out in exchange between lobbying groups (CMP farmers and HNV farmers), so we simulate both. Scenarios of different combinations (regarding power held by groups) can be modelled by contingent maximization. Then, for joint modelling, a mixed power situations is characterized by the slope of achievable interests. We start our investigation with modelling a CMP lobby group as principal and HNV promoters as agents and vice versa.

CMP Farmers: principal and HNV farmer: agent

Here we deliberate on the case of the HNV farmer as agent and the CMP farmer as principal. A response function of the HNV farmers (12) is specified as an optimization for the case that the share in the budget (received by the community as a matter of collective regulation) is fixed by the CMP farmers. To get the response we have to find the first derivative of the interest function of the HNV farms. The response by "N" at given "α" is: (12); it is considered as incentive:

$$\partial I^N(\alpha, N)\big/\partial N = (1-\alpha_n)\rho_n - \gamma^*_{01,n} - \gamma^*_{12,n}N_n - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho = 0 \qquad (12)$$

From the partial optimization in (12), a response function (13) shows the offer of "N", if "α" is given, i.e. leaving money with HNV farms, but also for CMPs. CMPs decide on that sharing later.

$$N_n = \gamma^{*-1}_{12,n}[\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho] \qquad (13)$$

This response is inserted into the objective function of the principal (CMP); and he makes a decision on sharing α, which is done by the CMP calculus and serves for his secondary optimization:

$$I^c_c = p_c Q_c + \alpha\ \rho_n\gamma^{*-1}_{12,n}[\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho] - [\gamma^*_{01,c}\gamma^{*-1}_{12,n} - \gamma^*_{13,c}\alpha - \gamma^*_{11,c}\rho][\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho]$$
$$- \gamma^*_{02,c}\alpha_n - \gamma^*_{11,c}\alpha_n^2 - \gamma^*_{12,c}\gamma^{*-1}_{12,n}[\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho]^2_{nn} - \gamma^*_{11,c}\rho_c^2 - \gamma^*_{11,c}\rho - \gamma^*_{11,c}\alpha \qquad (14)$$

Objective function (14) is now solely a function of "α". It can be optimized towards the optimal outcome of the game on α-N, which rests with the CMP farms. The CMP group (farm) optimizes:

$$\partial I^c(\alpha, N)\big/\partial N = 2\rho_n\gamma^{*-1}_{12,n}[\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho] - [\gamma^*_{01,c}\gamma^{*-1}_{12,n} - \gamma^*_{13,c}\alpha - \gamma^*_{11,c}\rho]\rho_n$$
$$- \gamma^*_{02,c} - \gamma^*_{11,c}\alpha_n - \gamma^*_{12,c}\gamma^{*-1}_{12,n}[\alpha_n\rho_n - \rho_n - \gamma^*_{01,n} - \gamma^*_{13,n}\alpha_n - \gamma^*_{11,n}\rho] - \gamma^*_{11,c} = 0 \qquad (15)$$

From (15), where α** is obtained, also N** can be determined by inserting into (14). In this case the CMP farmer group is the principal (superior poser) and the HNV group is the agent which gives the lower right corner case.

HNV farms: principal and CMP farms as accepting: agent

Now we have to deal with the CMP farmers as agents. It gives us the upper left corner. Notice an increase in the "α", as participation, increases the profit of the CMP farmers and they comply.

$$\partial I^{c}(\alpha, N) \Big/ \partial \alpha = \rho_n N - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\alpha_n - \gamma^{*}_{13,c}N_n - \gamma^{*}_{11,c}\rho = 0 \qquad (14)$$

However, the compliance is built on N which is later decided by the HNV farms. The HNVs, then, need the response information from CMP, i.e. their compliance (acceptance of N at α level of). In other words and broadened, (14) gives a response function as N accepted (as compromise) of the CMP farm lobby group for nature if they receive a payment as share of nature expenses.

$$\gamma^{*-1}_{11,c}[\rho_n N - \gamma^{*}_{13,c}N_n - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho] = \alpha_n \qquad (15)$$

(15) is solved for α and this quasi-"incentive constraint" prevails for the HNV farmers; and thus the ecology promoter lobby group as composed of the HNV farms has an objective function

$$I^{HNV}_n = p_n q_n + (1-[\rho_n N - \gamma^{*}_{13,c}N_n - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho])\rho_n N - \gamma^{*}_{01,n}N_n - \gamma^{*}_{03,n}\rho - \gamma^{*}_{11,n}[\rho_n N - \gamma^{*}_{13,c}N_n - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho]^2_n - \gamma^{*}_{13,c}N_n - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho]^2_n - \gamma^{*}_{12,n}N^2_n - \gamma^{*}_{11,n}\rho^2_n - \gamma^{*}_{11,n}\rho N_n - \gamma^{*}_{11,n}\rho + [-\gamma^{*}_{02,n} - \gamma^{*}_{13,n}N_n - \gamma^{*}_{11,n}]\gamma^{*-1}_{11,c}][\rho_n N - \gamma^{*}_{13,c}N_n - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho] \qquad (16)$$

The HNV farm lobby (now as the principal) optimizes towards the appropriate nature N*:

$$\begin{aligned}\partial I^{N}(\alpha, N) \Big/ \partial N = {} & \rho_n - \gamma^{*}_{13,c} - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho])\rho_n - \gamma^{*}_{01,n} - \gamma^{*}_{03,n}\rho - \gamma^{*}_{11,n}[\rho_n - \gamma^{*}_{13,c} - \gamma^{*}_{13,c}N_n \\ & - \gamma^{*}_{02,c} - \gamma^{*}_{11,c}\rho] - \gamma^{*}_{12,n}N_n - -\gamma^{*}_{11,n}\rho + [-\gamma^{*}_{02,n} - \gamma^{*}_{13,n}N_n - \gamma^{*}_{11,n}]\gamma^{*-1}_{11,c}][\rho_n - \gamma^{*}_{13,c} = 0\end{aligned} \qquad (17)$$

Having solved for N* the corresponding result for "α*" is from inserting N* in (15); it gives α *. By the analysis the corners can be defined and we receive the power function in the game.

5.2 Discussion on Non co-operation and government role

In the envisaged bargain (game) a special facet is prevalent through a need to define the non-cooperation. Normally, as depicted in Fig. 1, the non-cooperation is specified as business as usual. In the special case of our bargaining, which is rather politically oriented (i.e. in which groups try to win public support and use threats of non-cooperation as reference), things are more complicate to verify. Things such as campaigning and protests look as disguising realities for outsiders and support in voting is envisaged. But campaigning serves to create power and shows non-cooperation. For instance, taking a position that a designation of an area for bird protection will mean that the government will hold rural development and let farms die, this can be frequently found. It comes from the generic hypothesis of a contradiction between HNV farming

and competiveness (Pretty, 2002). Under such conditions a non-cooperation game is combined with questions whether campaigner gain with a certain probability from obtaining public support.

In the case of nature conservation in a cultural landscape the protest of CMP farmers can be linked to a game which is performed with a politically economy modelled governance unit. Alternatively the government can be represented by even a bureaucracy. Obligations and probabilities to enforce regulations come into perspective (Gawel, 1995). Because, in our case, the focus is on a game (modelling) within a farm community on payment and nature, we have to see the government as another player. Games become interlinked and it is necessary to complement the analysis. So far the approach was limited. It took the reference of non-cooperation as modulated by a neutral government; but, technically, a second game must be modelled with the government. For a technical outline it may be sufficient to qualify interests of the CMP and HNV farmers as been linked to a neutral government (see above). To extent the approach we need a second layer game. This should be a game between the government and the farmers, especially the CMP farmers. It is to be superimposed on the currently presented game. I.e. the presented game is contingent on the second layer game. That new game is taking another perspective, since it is also pending on the presented game. Seeing the payment sharing as a mode to reduce interest intrusion, our presenting is a game with the government; though of importance is the understanding which bargain for nature conservation with farmers will be successful. In particular with a majority of farmers who oppose regulations or measures to improve the environment, probabilities on participation and willingness to commit to nature of HNV farmers as well as the strength (determination) of government to foster nature will matter. As a conclusion for model application: a most convenient way is to calculate those interest functions incl. government (as dependent on governance and regulations) which are most likely to occur and to simulate. A second best mode is to impose regulation first and see what power will result. Then one can amend the regulation in a second game.

5.3 Power coefficient

Now, since we have received a discussion on the reference points or corner solutions for cooperation, built on hierarchical approaches (principal-agent) as well as we have clarified on the non-cooperation, we can continue to find the power function. In the corner solutions, one has two sets of "α" and "N", i.e. : (1) α* and N* for the CMP farmers as principal and HNV farmers as agent, and (2) α** and N** for HNV farmers as principal and CMP farmers as agent. These two corner solutions (feasible solutions) allow us to specify the references for the power weights. Weights are endogenous to the problem. In numerical terms the reference $t^n=I^n(\alpha^*,N^*)$ and $t^c=N(\alpha^{**},N^{**})$ serve as the potential interests in the game (cooperation) as outlined above. They are references which are needed for specification of a power coefficient. We follow Zusman (1986) in (18).

$$\lambda = [I^c(\alpha^*, N^*) - t^c(\alpha^r, N^r)] \Big/ [I^n(\alpha^{**}, N^{**}) - t^n(\alpha^r, N^r] \qquad (18)$$

Then a formal outlay of the bargain in terms of a to-be-optimized "joint" welfare function can be specified, i.e. if the corner solutions are well defined. The power coefficient (λ) is gradient of the slope of a joint welfare function of CMP and HNV farmers as lobby groups (Fig.2). For that exercise the above introduced function can be used as (19)

$$I^W = p_n q_n + (1-\alpha_n)\rho_n N - \gamma^*_{01,n} N - \gamma^*_{02,n}\alpha - \gamma^*_{03,n}\rho - \gamma^*_{11,n}\alpha^2 - \gamma^*_{12,n}N^2 - \gamma^*_{13,n}\alpha N - \gamma^*_{11,n}\rho^2 - \gamma^*_{11,n}\rho N - \gamma^*_{11,n}\rho - \gamma^*_{11,n}\rho\alpha +$$
$$\lambda(.)\,[p_c Q_c + \alpha\ \rho\ N - \gamma^*_{01,c} N - \gamma^*_{02,c}\alpha - \gamma^*_{11,c}\alpha^2 - \gamma^*_{12,c}N^2 - \gamma^*_{13,c}\alpha N - \gamma^*_{11,c}\rho^2 - \gamma^*_{11,c}\rho N - \gamma^*_{11,c}\rho\alpha] + \mu[N\rho - B] \qquad (19)$$

and we get by taking the derivatives to n, α and μ:

$$\partial I^w(\alpha,N)/\partial N = (1-\alpha\ )\rho\ -\gamma^*_{01,n}-\gamma^*_{12,n}N\ -\gamma^*_{13,n}\alpha\ -\gamma^*_{11,n}\rho+\lambda(.)[\alpha\ -\gamma^*_{01,c}\rho\ -\gamma^*_{12,c}N\ -\gamma^*_{13,c}\alpha\ -\gamma^*_{11,c}\rho]+\mu\rho=0$$
$$\partial I^w(\alpha,N)/\partial \alpha = -\rho_n\alpha\ -\gamma^*_{02,n}-\gamma^*_{11,n}\alpha\ -\gamma^*_{13,n}N\ -\gamma^*_{11,n}\rho+\lambda(.)[\rho_n N-\gamma^*_{02,c}-\gamma^*_{11,c}\alpha\ -\gamma^*_{13,c}N\ -\gamma^*_{11,c}\rho]=0$$
$$\partial I^w(\alpha,N)/\partial \mu = N\rho-\beta^*_0+\beta^*_1 N\ +\beta^*_2\rho=0 \qquad (20)$$

For which we can make ρ, α, N endogenous variables instead of μ (fix it) and solve the problem (even if some things are not linear they can be linearized). By taking the derivatives (20), the game is predicable. Notify this optimization gives the "optimal bargain between the two parties"; and α and N are the result. The bargain depends on the willingness to pay which is given by ρ, as been indicated by the `budget equals willingness to pay´ for a nature element in budget constraint.

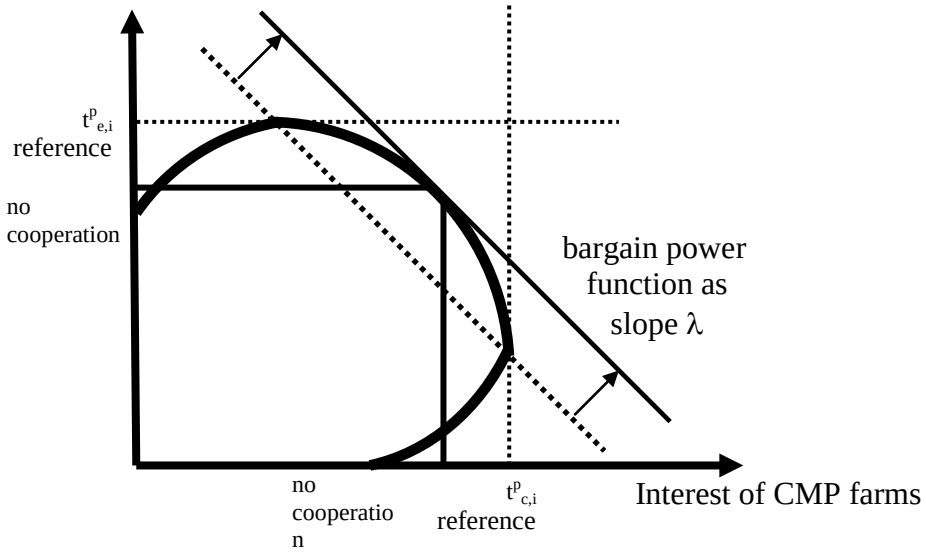

Fig. 2: Results of Bargaining for co-operation

So the government can decide on ρ, knowing the shadow price μ. In the Fig. 2 the optimization is graphically presented. By the cooperation the two partners can reach a higher value of their interest functions, though the level will be influenced by the power.

6 Extension of the model and role of government

The dependency and interdependency of the bargain on "ρ" which is the premium given by the government, must be further discussed. It is a pending question, how to construct a government behaviour which optimizes (relates) the provision of N as a control variable. A first option is to take a reduced form of (20) having ρ exogenous, which is calculable as: N is function of ρ. Hereby we get the shadow price. Then the objective of the government may be that it maxims the difference between willingness to pay as money received and the budget as money spent which is based on "ρ" setting. Alternatively one can equate the willingness to pay and the budget assuming that the government represents the citizens and no cost or profits of the government are involved. This would be a rather technical solution and it implies that the government behave likes a

principal who is maximizing on behalf of citizens the financial returns or citizens' welfare. An eventually more appropriate solution is that one think about an individualized objective function of a government unit represented as a bureaucracy. Then dependent on N, we see a budget constraint (willingness to pay minus expenditure) as a condition to be fulfilled; but the real objective is rather to link nature to finance and control it. As a consequence the personal employed in controlling provision matter. This corresponds to a suggestion of Niskanen (1971) in defining most appropriately the behaviour of a bureaucracy. The bureaucracy maximizes the willingness to pay which is the area under the utility function given the recovering of a budget.

Secondly, the government could influence the bargain actively as it may impose restrictions on the type of land use or commissions a change in the condition of farming. A change in the condition of farming "z" (such as change water table in wetlands) impacts on costs and benefits in the bargain and changes the power function. In that regard the weighted welfare (interest of farms) is expressed by the interaction with government. For example we can perceive the result as:

$$I^W = [I_n^{HNV}(N,\alpha,\rho,z) + \lambda(.)\ I_c^{COM}(N,\alpha,\rho,z)] + \phi(.)\ I_c^{GOV}(N,\alpha,z) + \mu_1[N\rho - B] + \mu_2[f(N,\rho) - h] \quad (21)$$

The equation (21) is a composed interest function which includes a budget constraint and a technology constraint z. The technology is related to land use criteria (water tables, eco-nets, planning, etc.) As secondary conditions for optimizing ρ, α, N and z, constraints are determined endogenously. To keep things simple we could also argue that the derivative for the government policy "z" is a way to optimize in a game. This implies that the farmers accept that z being paid.

6 Summary

This paper discusses the conflict between commercial, modernizing and profit oriented (CMP) farmers on the one side and high nature value providing (HNV) farmers on the other side. The issue is introduced touching on an example from Northern Germany for bird protection which has created tensions between CMP and HNV farmers and the government as well as has become part of political campaigning for modes of (non)supporting HNV farms and instead modernization. The argument is that in case of support for HNV farms, CMP farmers will face higher costs, indeed, costs of renting land, because HNV farmers are less efficient and occupy land. HNV farms shall not stay in business and block land transfer to CMPs which will reduce competitiveness.

A next step was the introduction of a political economy bargaining model. This model was outlined with regards to the definition of the interest functions as well as a short introduction to the background and mechanism for finding a political power function. Finally the model was solved and we discussed necessary extensions, especially towards a practical inclusion of the interest of government in the bargaining process, modelling it when governments are differently behaving.

7 Literature

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