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The state of nature in the shadow of contract formation: Adding a missing link to J.M. Buchanan's social contract theory

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Abstract. The social contract theory of J.M. Buchanan provides no clear-cut answer on the question which one of the multitude of possible Pareto-efficient contracts is chosen by individuals who shape a contract in an (imaginary) state of nature. This deficiency is remedied in this paper by adding the Nash-bargaining theory. It seems to be in line with at least part of Buchanan's reasoning. Whereas for Buchanan the configuration of contract depends unilaterally on the natural equilibrium of the state of nature, we are able to show that the parties' (rational) contractual expectations have repercussions for their behavior in the state of nature. That is why the location of the natural equilibrium proves to be heavily dependent on the chosen bargaining theory. The implication is that assessing the legitimacy of a given constitutional order or contract (on the basis of the natural equilibrium) depends on the particular bargaining theory chosen to solve the underlying constitutional distribution problem.

1. Introduction

There is a fundamental distinction in the contract theory of J.M. Buchanan between the "choice of rules" and the "choice within the rules" (Buchanan, 1977d: 287). Buchanan (1977a: 11) states: "I recognize that the rules of order are, and must be, selected at a different level and via a different process than the decisions made within those rules, ..." At other times, he speaks of the *constitutional* and the *postconstitutional* stages of decision.[1] We may think of them (1.) as the *analytic* stages of a complex decision problem or (2.) as its hypothetical stages *in time*.

With respect to (1.), the constitutional stage refers to "decisions ... over alternative rules or processes which define constraints within which subsequent choices over outcomes may be made", whereas the postconstitutional stage deals with the specific choices that have to be taken "within the constraints of well-defined operating *rules* (institutions)" (Buchanan, 1986a: 56). On the other hand, if we look at it from the point of view of (2.), the constitutional

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stage clearly precedes the postconstitutional one. First you have to arrange a compact before you can execute it.

Typically the social contract tradition derives the composition of contract out of a specific description of a state of the world that is free of any institutional constraints (the "state of nature"). In particular, the Virginia School has offered the *natural equilibrium* among individuals as a starting point. The latter's position delimits the *range* of possible agreements one of which may eventually become the voluntary (social) contract.

Yet this reasoning, which is described at length, first in Bush (1972) and then in Buchanan (1975), suffers from an important deficiency. There is non bargaining theory that explains which *specific* agreement satisfying the Pareto-criterion will be reached. By the same token, individual behavior in the constitutional stage remains obscure. The suggestion that there will somehow be a correlation between an individual's position in the state of nature and her position after the contract is agreed is nothing else than mere assertion.

Indeed that correlation hinges on the adoption of a certain bargaining theory. Here, the Nash-bargaining theory will do this job and fill the gap in Buchanan's theory. However, the addition of that missing link has important consequences: If the bargaining theory links the contractual outcome with the state of nature, the individuals' expectations about their contractual performance will tend to influence their behavior in the state of nature. Neither Buchanan nor anybody else has dealt with these repercussions so far in the context of a new contractarian approach. Instead, Buchanan and those who write along similar lines treat the natural equilibrium as independently given. In the conclusion we will consider the implications for Buchanan's concept of "renegotiation expectations".

2. Stages of the state of nature

As we proceed it will prove helpful to distinguish several stages of the state of nature. Besides the *constitutional stage*, for which the meaning given to it by Buchanan will continue to hold, we introduce a *preconstitutional stage* which refers to a world without contract and expectation of contract.[2]

Figure 1 presents an overview over the possible stages. *Chaos* is the first one. Here, the agents do not yet know that there is something to be gained by cooperation (there is "constitutional ignorance"). Moreover, the actions are not yet equilibrated. If they are – we may speak then of an "orderly anarchy" or a spontaneous order – the *preconstitutional stage* prevails. Things change drastically when the possibility of cooperation is perceived.[3] This knowledge characterizes the *constitutional stage* and causes a shift in the natural equilibrium as we shall see when we discuss the implications of the Nash-bargaining

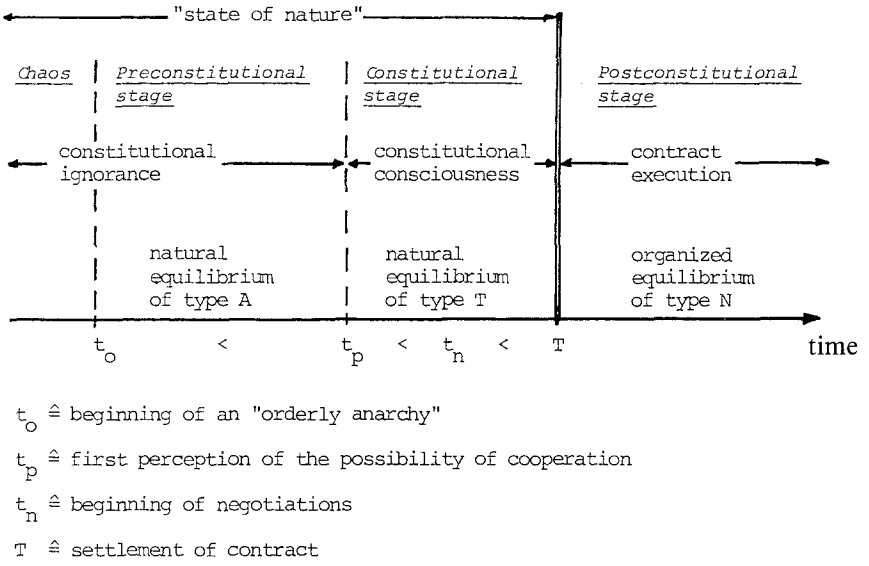


Figure 1. Stages of the state of nature

theory. We will argue that expectations about the outcome of contract negotiations will influence behavior in the state of nature so that we have to ascertain a systematic difference in behavior between the constitutional and preconstitutional stage. Buchanan does not discuss that point; for his theory simply holds that $t_o < t_p = t_n = T$.

3. The model: A typical day in anarchy

We start by describing a typical day in anarchy which reflects the Hobbesian idea of "war, as is of every man, against every man" (Hobbes, 1957: 82). The story we are going to tell will constitute the background of a two-person-several-strategies game that resembles the prisoner's dilemma structure. We will speak of it as a "natural" game, because the individual sets of strategies are not restricted by institutional (normative) as opposed to natural constraints. Each individual has basically the choice among several combinations of the following activities: production (p), attack (a) and defence (d). Note that this model – counter to the "manna-models" of Bush (1972) and Buchanan (1975)[4] – takes production explicitly into account. In addition, their single action parameter "military effort"[5] is split into two different variables (a and d).

Now consider an individual i who has decided to perform all of these three activities during her day. After a more or less hearty breakfast that consists of

the consumption of the complete stock of goods available to the individual the struggle for existence begins anew. During the morning, i produces x and piles it up in her hoard. At noon, i builds traps. Afterwards she devises her plans of attack, which she executes under the cover of darkness. Having slept the rest of the night, i consumes next morning the booty of her attacks plus the stock of goods in her hoard that have not been ravaged by her counterparts.

Certainly this story tells only one of the great number of possible courses of action in anarchy. As we shall see each activity may be expanded at the cost of others. But we will use this blueprint as an approximation in order to be able to formulate a two-person natural game. Two elements of the story are crucial for the derivation of the relevant payoffs:

1. We assume that an individual who plans to go out in search of plunder executes the attack at the end of the relevant period.
2. The stock of goods at the beginning of each period is taken to be zero.

Then the daily consumption of i (that is x_i) may be expressed by the following equation:

$$x_i = x_i^p (p_i) + x_i^a (a_i, d_j, p_j) - x_j^a (a_j, d_i, p_i)$$

$$\text{with } x_i^p = p_i; \quad x_i^a = \begin{cases} p_j, \text{ for } a_i > d_j \\ 0, \text{ for } a_i \leq d_j \end{cases}; \; x_j^a = \begin{cases} p_i, \text{ for } a_j > d_i \\ 0, \text{ for } a_j \leq d_i \end{cases}; \tag{1}$$

where

$x_{i,j}^p \mathrel{\hat{=}}$ x due to direct production by i, j (for simplicity we have assumed a linear production function);
$x_{i,j}^a \mathrel{\hat{=}}$ x due to attack by i, j.

Similarly for x_j. Then according to (1) the individual's consumable stock of goods may exhibit the following patterns: p_i, p_j, $p_i + p_j$ or zero. Next, for convenience, we assume the following linear utility functions

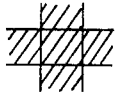
$$u_i = x_i, \; u_j = x_j \tag{2}$$

and the resource endowments

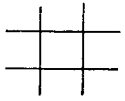
$$R_i = R_j = 6. \tag{3}$$

Finally, in order to keep the analysis simple, the strategy sets of i and j are presumed to consist of nine strategies. They are based on the idea that the agents

i \ j	s^1 "p"	s^2 "a"	s^3 "p a"	s^4 "p v"	s^5 "p a a"	s^6 "p a v"	s^7 "p v v"	s^8 "p p a"	s^9 "p p v"
s^1 "p"	6 6	0 6	0 9	6 3	0 8	0 8	6 2	0 10	6 4
s^2 "a"	6 0	0 0	3 0	3 0	2 0	2 0	2 0	4 0	4 0
s^3 "p a"	9 0	0 3	3 3	3 3	2 3	2 3	3 2	4 3	7 0
s^4 "p v"	3 6	0 3	3 3	3 3	0 5	3 2	3 2	3 4	3 4
s^5 "p a a"	8 0	0 2	3 2	5 0	2 2	2 2	2 2	4 2	6 0
s^6 "p a v"	8 0	0 2	3 2	2 3	2 2	2 2	2 2	6 0	2 4
s^7 "p v v"	2 6	0 2	2 3	2 3	2 2	2 2	2 2	2 4	2 4
s^8 "p p a"	10 0	0 4	3 4	4 3	2 4	0 6	4 2	4 4	4 4
s^9 "p p v"	4 6	0 4	0 7	4 3	0 6	4 2	4 2	4 4	4 4



set of dominated strategies



set of iterated undominated strategies

Nash-equilibrium

Matrix 1. A 2×9-natural-game

may divide their resource endowments into two or three parts and allocate those to the different activities. The reader may think of "bounded rationality" as the reason why the agents consider only a limited number of "typical" strategies, i.e. they want to keep the decision problem manageable. Therefore the relevant strategy sets are described as follows:

$S_i = S_j =$

	p =	a =	d =	The strategy's name is:
s^1:	R	O	O	"p"
s^2:	O	R	O	"a"
s^3:	R/2	R/2	O	"pa"
s^4:	R/2	O	R/2	"pd"
s^5:	R/3	2R/3	O	"paa"
s^6:	R/3	R/3	R/3	"pad"
s^7:	R/3	O	2R/3	"pdd"
s^8:	2R/3	R/3	O	"ppa"
s^9:	2R/3	O	R/3	"ppd"

(4)

Then, on the basis of (1) to (4), Matrix 1 depicts the normal form of the natural game Γ^n (S_i, S_j, U_i, U_j). A discussion of the tuple (s_i^6, s_j^8) will suffice as an example for the determination of payoffs: At the outset, individual i produces two, j four units of x. Whereas individual i's defense activity level of two rebuffs the attack of j (which equally has a value of two), individual j has no resources left to resist the attack by i. Therefore, j looses his stock to i and at the end of the "game" i comes out with six and j with zero units of x.

Obviously, Γ^n is a non-cooperative non-zero-sum game with no unique solution. In fact, s^7 and s^2 are dominated by other strategies. And a further analysis of the payoff structure reveals that there are four candidates for a "natural equilibrium": (s_i^3, s_j^5), (s_i^5, s_j^3), (s_i^3, s_j^3) and (s_i^5, s_j^5). In a setting, where no binding agreements are possible these equilibria constitute the potential outcomes since the individuals have to rely on self-enforcing strategies if they want to avoid deceptions. This requirement is only met by the Nash-equilibria as described above.[6] The candidates all show the same pattern: The spontaneous order that emerges consists of a combination of direct production and attack. With Ellis we may speak of "anticipatory violence".[7] And this would seem to support Hobbes's contention that in a similar world life would be "solitary, poor, nasty, brutish, and short" (Hobbes, 1957: 82).

4. Framing the social contract

4.1. The coordination problem

Matrix 1 may also be depicted in form of the utility space in Figure 2. Here,

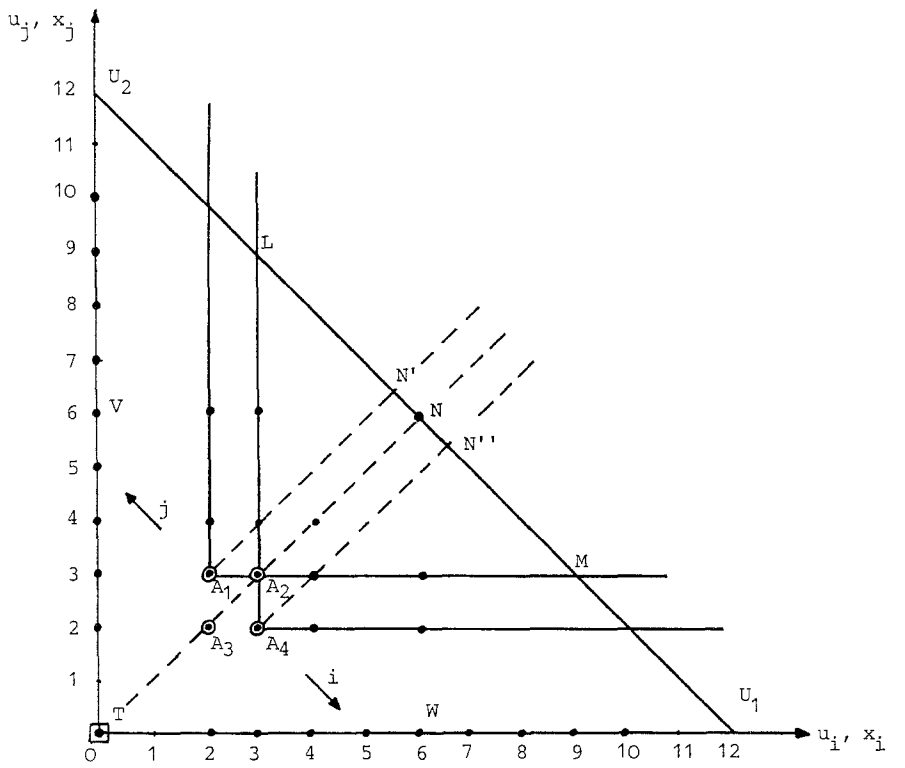


Figure 2. A graphical presentation of the payoff structure of the natural game

$\overline{U_1\ U_2}$ represents the utility frontier that could be reached if both agents adopted strategy s^1, i.e. devoted their resource endowments completely to the production of x, and if transfers of x were possible. Evidently, the natural game does not lead to a point on the utility frontier; instead either A_1, A_2, A_3 or A_4 will be realized. The reason for this is an underlying incentive structure with respect to which military expenditures, though globally unproductive, are individually rational. We will see, that A_1 to A_4 represent the potential outcome of the earlier mentioned *preconstitutional* stage. As soon as the agents become aware that they could change their lot through the visible hand of collective action, consisting of an enforceable agreement to refrain from military expenditures, things change drastically. This knowledge characterizes the *constitutional* stage. Starting e.g. from A_2, clearly both agents have an interest in a "disarmament agreement" (Buchanan, 1975: 59) which in our case proves to be a pact of non-aggression.

Unfortunately, such an agreement defining behavioral rights for the first time, is not sufficient in order to reach a point on the utility frontier. Two problems have to be overcome:

1. *The enforcement problem*: If one agent refrains from military activities, the other agent has no incentive to do the same – on the contrary she has an incentive to attack. Buchanan (1975) and earlier Gunning (1972) have dealt at length with that problem and have introduced the "protective state" as "enforcer of contracts". We will not deal with that problem further and simply assume that there is a *sanction matrix* which, added to the matrix of the *natural game*, leads to an *effective game* where cooperation is an equilibrium outcome.
2. *The constitutional distribution problem*:[8] As general disarmament sets free resources which can be devoted to production, the economy consisting of i and j is able to produce a greater amount of consumable x than before. In this case any disposal of that surplus presupposes an agreement (which is part two of the social contract) on how the property rights concerning that surplus are going to be distributed. But starting from any natural equilibrium there is a whole range of sharing rules which follow the Pareto-criterion (compare the points on $\overline{LM}$ in Figure 2 in the case of A_2) and nothing tells us a priori which point of the relevant Pareto-region on the utility frontier both agents will agree to choose. In the worst case the temptation of both agents to hold out for favorable terms for one's own sake may preclude the disarmament agreement.[9]

4.2. The constitutional distribution problem, or: The need for a bargaining theory

So, starting, e.g., from A_2, which of the Pareto optima along $\overline{LM}$ will the agents actually choose? Whereas there is complete harmony of interests concerning the choice of the tuple (s_i^1, s_j^1) – that is, the efficient allocation of resources – the individuals' interests in the "division game" over the extra-amount of x are completely opposed. Buchanan does not discuss that point. Instead, he simply opts for the "direct-production position", here point N, because of its "Schelling point characteristics".[10] For him, N is only left by transfers if the natural equilibrium comes to be located in the areas VNU_2 or WNU_1.[11]

But in opposition to that line of reasoning there are several indications, especially in Buchanan's work, which obviously presuppose a much closer dependence of the contractual outcome on the individual position in anarchy. In particular, Buchanan seems to affirm a direct correlation between the relative positions in the constitutional and postconstitutional stage. He asserts (Buchanan, 1975: 25):

The specific distribution of rights that comes in the initial leap from anarchy

> is directly linked to the relative commands over goods and the relative freedom of behavior enjoyed by the separate persons in the previously existing natural state.

And with respect to an eventual unequal wealth distribution in the natural equilibrium, he adds (ibidem):

> To the extent that such differences exist, postcontract inequality in property and in human rights must be predicted.

Similar views are expressed by Buchanan in his discussion of the legitimacy of an existing rights structure in relation to the so-called "renegotiation expectations".[12] In this regard he explains (Buchanan, 1975: 196):

> Under any legal-constitutional order that defines individual rights, there must be a relationship to the expected structure of individual claims in the 'natural equilibrium' of genuine anarchy. As the latter distribution shifts, the relative strengths of claims under existing legal order may shift, giving rise to potential ranges of agreement for constitutional redefinition.

Also Bush (1972: 14f.) hypothesizes:

> ... the natural distribution ... is an important determinant of the final distribution. ... As in the traditional bilateral exchange problem, the final distribution of income cannot be determined. All that can be said is that a Pareto redistribution *relative to the natural equilibrium* is possible ...

Therefore it should make a difference to the contractual outcome whether the natural equilibrium is given by A_2 or A_3 rather than A_1 or A_4 or some other point in the utility space of Figure 2.

We argue, that the Nash-bargaining solution embodies a kind of reasoning as represented by the previous citations.[13] Indeed it may be said that individuals acting on the premises of rationality and fairness may – from a contractarian perspective – agree, in the constitutional stage, to its basic axioms[14]

a) Pareto-optimality;
b) interpersonal non-comparability;
c) symmetry; and
d) independence of irrelevant alternatives.

According to Nash the only rule that conforms to these axioms says: Find a point (u_i^N, u_j^N), where this tuple stands for a point on the utility frontier, that

maximizes the product of $(u_i^N - u_i^T)(u_j^N - u_j^T)$, where (u_i^T, u_j^T) stands for the payoffs in the status quo, i.e. the state of nature. Then obviously, the final distribution of property rights depends on the location of the status quo. In the case of A_2 or A_3 the agents would therefore come to agree on N, in the case of A_1 on N′ and in the case of A_4 on N″. That is the *relative* position in the state of nature determines the final distribution of property rights.

Certainly, agents *expecting such a correlation* will bring their behavior into line with that fact. This has significant consequences. Formerly, in the preconstitutional stage (of "constitutional ignorance"), individuals were interested in their absolute well-being measured in x. On this basis we derived the *natural equilibrium of type A* (i.e. A_1 to A_4). Now, with the knowledge of the possibility of cooperation and how it might be brought about, A_1 to A_4 lose the quality of being natural equilibria, because the agents become interested in their relative endowment with x since that alone will determine their postconstitutional position. So, in the constitutional stage, i will try to realize a status quo position below $\overline{TN}$ in Figure 2 whereas j will urge for a position above that line. In that respect pure conflict prevails so that the agents find themselves in a zero-sum game concerning the relative position of T.

In that game again $S_i = S_j$ are the relevant strategy sets. But it should be clear by now, that the payoffs in Matrix 1 become subject to modification in the constitutional stage. In order to derive the payoff structure of Γ^T (S_i, S_j, U_i^T, U_j^T) we now determine the coordinates of the Nash-bargaining solution N depending on T in the utility space of Figure 2. Note that N is given by the intersection of $\overline{U_1 U_2}$ with $\overline{TN}$. As $\overline{U_1 U_2}$ is given by the function

$$u_j^N = 12 - u_i^N \tag{5}$$

and $\overline{TN}$ is given by

$$u_j^N = u_i^T + (u_j^T - u_i^T) \tag{6}$$

we get the coordinates of N after equating (5) and (6) and solving for u_i^N and u_j^N respectively:

$$\begin{aligned} u_i^N &= 6 + \tfrac{1}{2}(u_i^T - u_j^T) \\ u_j^N &= 6 - \tfrac{1}{2}(u_j^T - u_j^T) \end{aligned} \tag{7}$$

As can be seen by (7), Γ^T is a constant-sum game with $u_i^N + u_j^N = 12$. Its payoff matrix may be derived by application of (7) on every tuple (u_i, u_j) in Matrix 1. Matrix 2 is generated using a linear transformation of the utility indices given by (7) (i.e. subtract 6 from every utility index) and contains the zero-sum payoff structure of Γ^T whose solution can unambiguously be derived by

i \ j	s^1 "p"	s^2 "a"	s^3 "p a"	s^4 "p v"	s^5 "p a a"	s^6 "p a v"	s^7 "p v v"	s^8 "p p a"	s^9 "p p v"	MAXIMIN
s^1 "p"	0	-3	-4,5	1,5	-4	-4	2	-5	1	-5
s^2 "a"	3	0	1,5	1,5	1	1	1	2	2	0
s^3 "p a"	4,5	-1,5	0	0	-0,5	-0,5	0,5	0,5	3,5	-1,5
s^4 "p v"	-1,5	-1,5	0	0	-2,5	0,5	0,5	-0,5	-0,5	-2,5
s^5 "p a a"	4	-1	0,5	2,5	0	0	0	1	3	-1
s^6 "p a v"	4	-1	0,5	-0,5	0	0	0	3	-1	-1
s^7 "p v v"	-2	-1	-0,5	-0,5	0	0	0	-1	-1	-2
s^8 "p p a"	5	-2	-0,5	1,5	-1	-3	1	0	0	-3
s^9 "p p v"	-1	-2	-3,5	1,5	-3	1	1	0	0	-3,5
MINIMAX	5	0	1,5	2,5	1	1	2	3	3,5	

Matrix 2. The 2×9-threat-game

using the Minimax theorem. It is given by the strategy pair (s_i^2, s_j^2) with the payoff tuple (O, O). We call it the *natural equilibrium of type T* which holds in the constitutional stage. Consequently the contract – due to the symmetry of the game – leads to point N on the utility frontier.

5. Conclusion

This paper presents a game-theoretic exposition of a Hobbesian state of nature. We distinguish a *preconstitutional stage* of the state of nature, characterised by the fact of "constitutional ignorance" and therefore by a natural equilibrium of type A. It is based on the individuals' intentions to maximize their individual consumable stocks of goods in anarchy. But as soon as the possibility of cooperation comes to be known – we now speak of the *constitutional stage* –, it is prone to lose the attribute of equilibrium. This has been overlooked by the new contractarian analysis of the Virginia School, especially by Bush (1972) and Buchanan (1975), because of their failure to present an adequate bargaining theory. Indeed, something has to be said about how the gains of cooperation – a greater stock of consumable product – are actually to be distributed. Adopting the idea offered by Bush and Buchanan, that there is a correlation between the relative positions of the individuals in the constitutional and postconstitutional stage, leads ultimately to the Nash-bargaining theory. Then clearly the behavior of people who expect such a correlation will be different from what it would be in the absence of such expectations. Specifically, a new equilibrium, that of type T, will be realized in the state of nature as individuals will only be interested in their respective relative positions as suitable jumping-off positions for the subsequent negotiation of the contractual agreement. In this sense, T may be interpreted as "threat-point".

It should be clear by now that there is no unambiguous natural equilibrium in the state of nature preceding a contract. Expectations about the method of distributing property rights to be established by the contractual arrangement might influence individual behavior in the state of nature and induce a shift of the natural equilibrium. What Bush and Buchanan presented as a one-way dependence – the natural equilibrium determines the final distribution of rights – turns out to be a question of *mutual* interdependence.

This result has strong implications for Buchanan's way of evaluating the legitimacy of an existing set of rights and the potential for constitutional reform. For this purpose, Buchanan – by way of a though experiment – makes "a detour into anarchy and out again" (Buchanan, 1975: 85) assigning central importance to the location of the natural equilibrium in the utility space combined with the individual renegotiation expectations. But since the natural equilibrium depends on expectations about how the contractual agreement is

going to be shaped, this procedure is subject to major criticism.

First we have to concede that the Nash-bargaining theory certainly represents only one (though the one Buchanan seems to have in mind) of the great number of more or less equally reasonable bargaining theories with differing outcomes. Moreover, our analysis gives strong support to the suggestion, that the location of the natural equilibrium (of type T) depends to a substantial degree on the bargaining theory (e.g. the Nash-bargaining theory etc.) which is assumed. Therefore, the answer to the question of legitimacy also turns out to be dependent on the bargaining theory chosen. Even worse, taking the individual resource endowments as given, almost any set of rights might be open to justification on the basis of some suitable bargaining theory. Hence, without a positive theory of bargaining which tells what really matters in the process of negotiation, the concepts of "natural equilibrium" and renegotiation expectations" seem too weak to explain legitimacy or to forecast specific contractual changes.

Notes

1. See for example Buchanan (1975: X and 28–33), Buchanan (1977d: 289), and Buchanan (1986a: 55f). The distinction goes back to Buchanan and Tullock (1962: 7 and 120) where they speak of the "constitutional" and the "operational" level of decision.
2. Buchanan too has used the term "preconstitutional", but in another context. There, he classifies his own theory as "preconstitutional" since "a preconstitutional state of anarchy is postulated, and hypotheses are then derived concerning the types of property rights that might emerge" (Buchanan, 1977c: 186). He then labels Rawls' theory as "constitutional". The standard neo-classical theory shows up as "postconstitutional" theory.
3. For our purposes we do not need to explain how this knowledge comes about. Certainly, further insights could be reached by adding a learning theory. In this case, some interesting questions arise: Do all agents become aware of the possibility of cooperation at the same time? What if some become aware before others? Why didn't they all know already? What if some people never learn?
4. Bush (1972: 7) postulates an "initial distribution" of the utility yielding product. Similarly, Buchanan (1975: 23) assumes: "... and quantities of this product simply 'fall down' in fixed proportions to each of the two persons at the onset of each period of consumption." The same view is adopted in Bush and Mayer (1974) and Buchanan (1977b: 89).
5. Bush (1972: 57) speaks of the "level of effort expended by individual i in taking income from individual j and protecting his own income from individual j." Buchanan (1975: 57) calls it the "defense-predation effort".
6. This way of reasoning is to be found in Friedman (1983: 32 f. and 214 f.) and Harsanyi (1986: 116 and 124 ff.).
7. See Ellis (1971: 675). This fact is also expressed by Hobbes (1957: 81): "... there is no way for any man to secure himself, so reasonable, as anticipation; that is, by force, or wiles, to master the persons of all men he can, so long, till he see no other power great enough to endanger him: and this is no more than his own conservation requireth, ..." Tullock (1966/7: 230) also described such a natural equilibrium when discussing "the economics of theft". He wrote: "Over time the interaction between the investment in locks, the payoff on lock picks

and the investment in nitroglycerine and safes would come to equilibrium. This equilibrium, however, would be extremely costly to the society in spite of the fact that the activity of theft only involves transfers."

8. It must be categorically distinguished from the "postconstitutional 'political redistribution'" (Buchanan, 1986b: 273).
9. The distribution problem, though without reference to the Bush-Buchanan model, has already been described by Tullock (1974: 2 f.) and Cooter (1982: 17 ff. and 23). Cf. also Sugden (1986: VI).
10. See Buchanan (1975: 60 f.). Note that a "direct-production position" does not fit into the context of a "manna-theory". "Focal-point"-solutions have been introduced by Schelling (1960: 57 ff. and 68 ff.).
11. I.e. one individual prefers anarchy to N. Cf. Buchanan (1975: 61 ff.).
12. Buchanan (1975: 75, cf. also 85 f.). A game-theoretic exposition is given in Buchanan (1977b: 88 ff.). There, for a shift in the natural equilibrium to have an impact, the new natural equilibrium has not necessarily to make somebody worse or better off as compared to her position under the prevailing set of rights. A relative shift suffices. Obviously, this contradicts Buchanan's view as described by note 11.
13. Cf. Nash (1950) and Nash (1953). In Buchanan (1977b) the author adopts – without further comment – a symmetrical sharing rule. In our model, it is a result of applying the Nash-bargaining theory.
14. The central importance of the Nash-bargaining solution has been recently supported by van Damme (1986) and Binmore, Rubinstein and Wolinsky (1986).

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