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“Formalist Approaches to Pastoralism”

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FORMALIST APPROACHES TO PASTORALISM

by Harold K. Schneider

Before taking up the main theme of this paper, how the "formalist" perspective has been utilized in the study of pastoralism, I would like to try to clear up what I see as a longstanding problem, the meaning of the phrase formal economic anthropology, or what I prefer to call analytical economic anthropology. It appears that many people think that the term refers only to the use of refined quantitative techniques. That this is a misconception is well illustrated by the work of Fredrik Barth, who has probably contributed more to the development of analytical economics in anthropology than any other person, yet there is very little that can be called highly quantitative or mathematical in his work.

The analytical economic approach is essentially a point of view, a paradigm, which benefits particularly from the use of formal techniques such as, in its most sophisticated applications, the use of difference equations and calculus to analyze change. Barth's point of view, beginning with his paper on the Swat Pathans utilized this paradigm which, simply put, makes the fundamental assumption that the people whose behavior is being described and analyzed are striving to maximize or minimize something. That is to say, the approach is deductive rather than inductive. In the Swat case, it assumes that they attempt to maximize utility reckoned in terms of sheep, which constitute the main profit or loss. It is probably not even possible to prove that anyone is maximizing profit. Milton Friedman even argues that if you construct an experiment based on this assumption and your predictions are correct you still have not proved that the assumption is true.

By taking this position Barth was doing precisely what Newton was doing in developing his celestial mechanics when he posited a gravitational force, a force acting at a distance on bodies, in which it was assumed that bodies in effect try to maximize attraction. Differential equations (from the calculus, which Newton devised to do this job) were then used to calculate the motion of these bodies based on this attractational force. Leibniz, the parallel inventor to Newton of the calculus, is said by Westfall (1980) to have been quite unwilling to accept such an idea as forces attracting at a distance (i.e., with no

discernible mechanical connection between them) describing this as a belief in miracles, which means that Leibniz was therefore not a formalist physicist, and which demonstrates that you can be highly quantitative in your approach without being a formalist.

Barth used game theory in his Swat study, which he almost immediately abandoned (as have most economists because it has turned out to have little practical value for most economic problems) in which he explained the epiphenominal appearance of segmentary lineages in Swat as the outcome of a game played by Swats to maximize gains and minimize losses in the struggle for the best agricultural land. In his study of Basseri nomads in Persia he uses implicitly, and rather naively, a microeconomic model in which he tries to show that herdsmen, who are apparently trying to maximize profits, incur increasing costs as their sheep herds grow, profits decline at the margin and eventually the costs exceed benefits, causing them to sell out and move to town. Put another way, Barth is using a production function model, one of the most fundamental models in analytical economics, which can be described as follows (Figure 1):

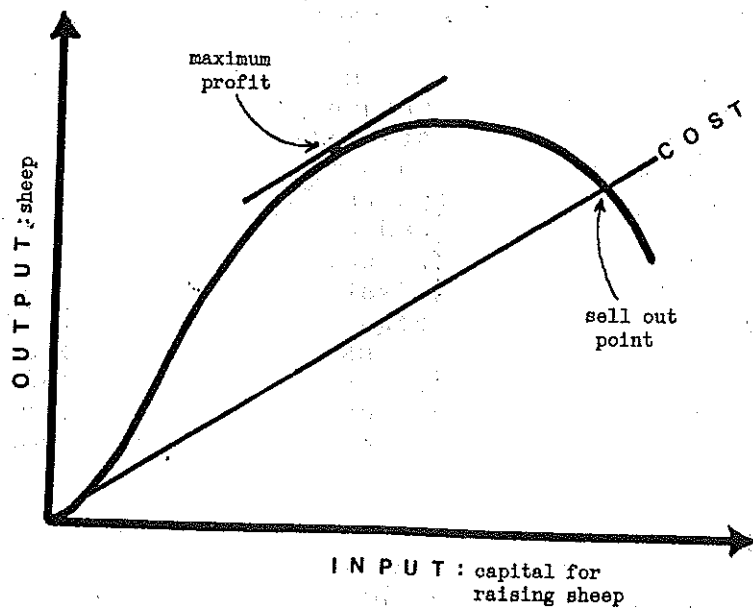


FIGURE 1

The horizontal axis represents units of some factor of production, such as herding labor and the vertical axis is the return to this input. The cost of the input is represented here for simplicity's sake as linear, increasing by the same amount as each new input is added. It could represent, for example, the

cost of feeding herders. The model then shows that as the sheep herd grows the return on inputs at first increases at an increasing rate (one gets a higher and higher number of sheep for each additional unit of labor and rises above the cost curve almost immediately). Then the return begins to decline, although the point of maximum profit (determined by a line tangent to the production curve and parallel to the cost curve) is yet to be reached, until finally it declines at an increasing rate so that it finally crosses the cost line (i.e., starts bringing negative returns for each additional input - this phenomenon is common to most production operations) prompting the sell out.

In his Darfur study Barth attempts to show how Fur managers allocate their resources (the utility maximizing assumption being again inputed in the analysis). He uses a flow diagram, which is a simple way of representing this but it can be done better with linear programming, a technique developed during World War II to help managers make the best use of their resources for war production. The technique can show not only what is the best way to allocate resources but how the allocation process must alter with a change in production possibilities. Joy (1967), whose chapter followed Barth's in Themes in Economic Anthropology, shows with a simple model the logic of linear programming (Figure 2).

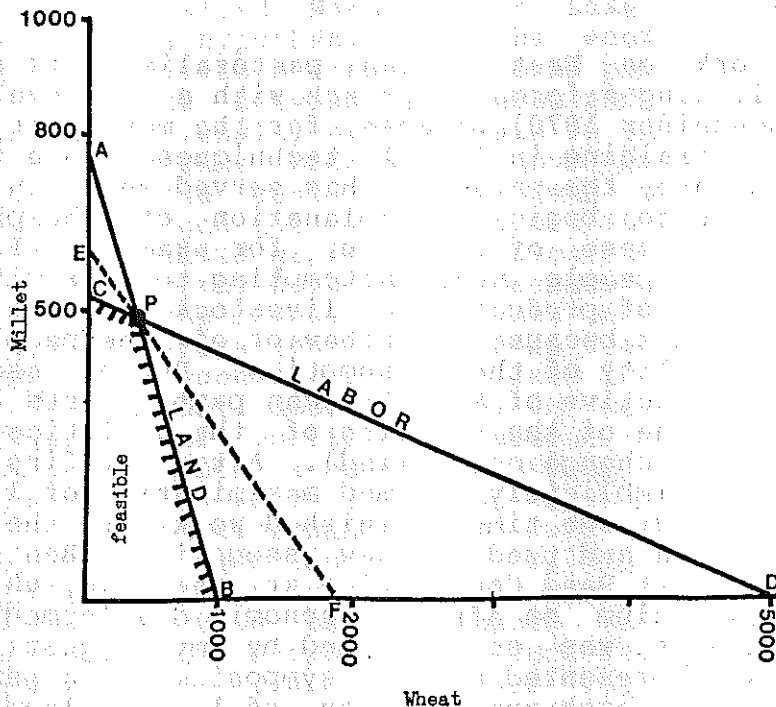


FIGURE 2

If one can grow both millet and wheat, which should be raised or which combination? If the only two constraints one must consider are the land and labor available one plots how much millet can be grown with available land and how much wheat can be grown with available land and connects these two points on the graph with a line (here represented as a-b). One does the same for labor and creates another line (c-d). The shaded area now shows the only feasible combination of these two crops that can be grown with available resources. If one broadens Joy's model and adds a profit line (e-f), which shows how much any combination of these crops could be sold for, it follows that where the profit line is tangent to these feasible areas, p is the maximizing mix of production the so-called "objective function". (The same technique can be used to show how to minimize some variable such as cost or, as in this case, the amount of labor used).

Barth, then, while working at an almost impressionistic level contributed fundamentally to the introduction of analytical economic concepts into social anthropology and two of his most important analyses were done with respect to pastoral people, the nomadic Basserri, and the Fur, whom I would define as pastoral (or agropastoral) because of the apparently high ratio of cattle to people in their society, despite the fact that they are also agriculturalists.

My own work on East African pastoralists is similar to Barth's in utilizing a formal approach with a low level of formal techniques (Schneider 1970) because, for the most part, I did not have sufficient training in formal techniques to use them. But, as in Barth's case, the paradigm has served well in suggesting alternative ways to begin an explanation of the phenomena I observed. In the case of the Turu, for example, I explicitly assumed that the people were attempting to maximize profit, measured in terms of production of livestock (cattle, sheep and goats). I did this because the behavior of the people strongly suggested the utility of the assumption. But my assumption of the maximizing objective of East African pastoralists has changed over the years (one of the benefits of the analytical approach; one is allowed to change one's mind). After my first fieldwork with the Pokot, I implicitly assumed maximization of livestock as a food resource. By the time I finished work with the Turu I had abandoned that idea and used the new assumption. Benton Massell, an econometrician at Rand Corporation at the time, who took part with me in a symposium on African economic development organized by M.J. Herskovits, was so intrigued by my suggestion that he took the data I presented at the symposium on a sample of 29 people showing for each availability of labor, land, livestock and fertilizer in relation to grain production and analyzed it

using the so-called Cobb-Douglas function to test whether my claim was plausible (Massell 1963). The Cobb-Douglas function determines mathematically the kinds of results depicted by the curve representing Barth's Basseri theory only using more variables (so the results cannot be represented graphically). He concluded (to his surprise, I think) that the behavior was rational (i.e., it corresponded to predictions using an assumption of maximization) in the aggregate but not on an individual level. That is to say, he concluded that the mix of these factors of production in relation to output was an optimal mix for maximizing profit but only with respect to the whole group, not with respect to any particular individual. I have never been quite sure what to make of this. Perhaps the explanation is that since any individual at any time may be in the process of getting it all together, of getting his marginal productivity to equal his marginal cost (which theoretically is the maximizing solution), it is not to be expected that any individual will have reached this goal at any particular time. But statistically, in the aggregate, this would smooth out and so the overall picture might be expected to approach the theoretically predictable optimum, if the theory is correct.

Today, some better trained young people are improving on the use of formal methods. Peter Little, a member of this panel, is representative of this group. Little (1983) studied the Il Chamus (usually called Njemps) near Lake Baringo in northern Kenya testing the hypothesis that the economy of the Il Chamus could best be understood with a regional perspective by analyzing the terms of trade between Il Chamus and Tugen, from whom Il Chamus have traditionally bought grain in exchange for livestock. His study showed that because of government grain pricing and buying policies the cost to Il Chamus of buying grain with livestock from Tugen got so high that it became economical to move toward increased grain production and a run on irrigable land began by wealthy herd owners because grain can be produced on such land at the lowest cost. This movement, Little argues, is causing a polarization of wealth as wealthy herders are able to gain and keep control of such land while also maintaining their herds. A most important tool in reaching this conclusion was multivariate or multiple regression analysis, a technique which shows how much a certain outcome, in this case grain yields, varies with various inputs, such as labor for weeding, harvesting, canal maintenance, or cash (capital). The basic structure of this technique can be illustrated as in Figure 3. The scattered data or coordinates (the dots on this graph) represent the relation between inputs (x), such as a certain amount of cash, and outputs (y), such as grain yields, for a given observation. (In multivariate regression the analysis relates more than one x to the output). The analysis plots the

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coordinates and then calculates a curve which will fit the observations as closely as possible and which represents a function ($y=f[x]$) such as "output of grain is a function of inputs of capital". The technique also calculates a correlation coefficient for the fit, which shows how well $y=f[x]$.

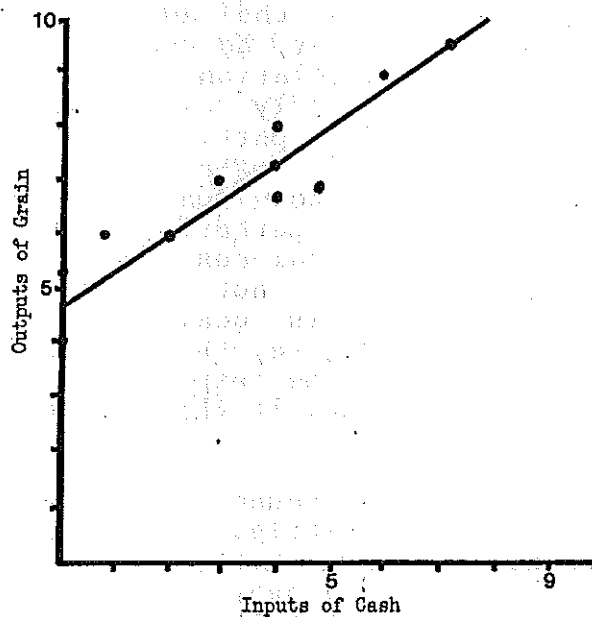


FIGURE 3

Obviously this is a very valuable tool because field workers are constantly imputing functional relationships to the things they observe, such as my own observation for the Turu that the amount of expense a Turu herder will devote to agriculture is an inverse function of the number of cattle he has. Regression analysis is a basic tool in formal analysis since its purpose is identification of functional relations, as in Barth's Basseri production function. But like most formal techniques it requires a lot of numerical data and is only as good as the data. For the field worker it means careful, regular and large scale observations the collecting of which can be very arduous indeed. It is a far distance from the relaxed kind of ethnography we sometimes used to do.

The direction in which this is leading is suggested by a recent book by Crotty (1980), an agricultural economist who took an interest in African cattle (although his book models pastoralism, or livestock raising, in Europe, South America, Southeast Asia and India as well). His work deserves to be mentioned because it is very anthropological in the sense that it

comes closer to the realities of pastoralism, such as taking account of the consumption of blood from living animals, than is usually the case with agricultural economists and developmentalists. (On the other hand, he is still an economist, from a different culture, a point I will develop further shortly.) He created his model for use in a variety of cultural contexts (e.g., when modeling Indian behavior he takes into account the fact that most Indians won't eat meat). It assumes that herders are utility maximizers and seeks to determine what constitutes maximizing behavior under varying cultural circumstances. In the African case he is unusual for accepting the idea that cattle act as money, and combines this with analysis of other values, such as the production of cattle for blood, meat and "prestige" or gratitude (obtained through feast giving), producing the model in Figure 4 which determines the optimum time to slaughter male animals thereby maximizing the utility of a mix of these different values.

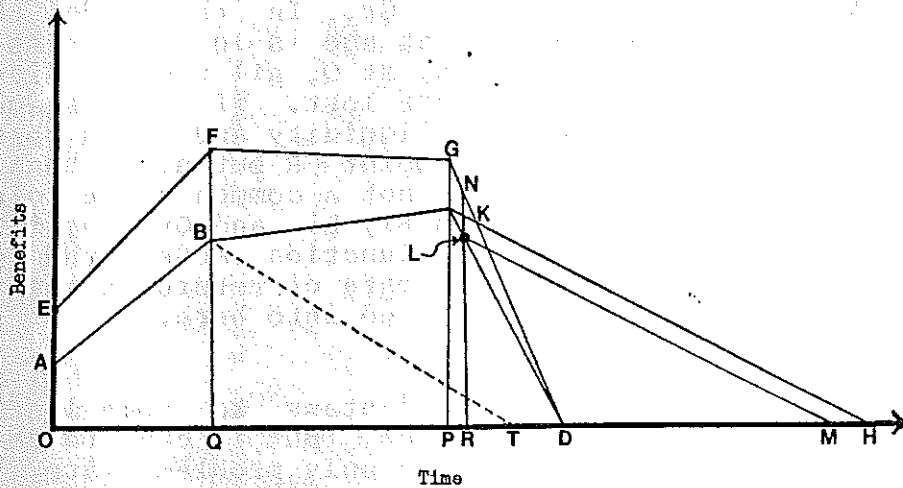


FIGURE 4

This model is typical of the kinds of models economists employ for both theoretical and practical purposes to deal with the problem of how to produce. It attempts to draw logical conclusions about how an actor will or should act in order to maximize utility from the way variables are related. If the model is simple enough, as here, the relations can be represented geometrically. Labeling this a simple model should be taken relatively. This model is already so complicated that Crotty explains it might be impossible to operationalize it.

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The problem Crotty poses here is one that could occur realistically only among people like some East Africans who value livestock for the blood they produce in addition to their values as money and sacrificial objects. It would be tedious to try to follow the reasoning employed by Crotty in all its detail and it would take too much time, so I will try to simply give the gist of it. It is identical to the way economists utilize similar models for other kinds of production. The fundamental message is that if you can represent some real values as quantities (such as blood benefits [henceforth B] over the lifetime of a steer - OABCD; or gratitude benefits [henceforth Gr] - such as RLM; or monetary liquidity benefits [henceforth Li] - OEFGD), and if the quantities are plotted geometrically, the solution to maximizing the mix of those values so as to obtain the greatest utility is to find a decision point, such as the decision to stop producing and so cause supply to cease increasing, (here R) which will create the greatest geometric area under a curve. In Crotty's model the question is when one should slaughter a steer so as to get the best mix of B, Li and Gr. In this model the age at which to do it is R (whatever that age is in real terms). If the steer is slaughtered earlier, say at Q, all the benefits it could bring for the rest of its life are lost. If it is slaughtered at between T and D, more of its liquidity and blood benefits are obtained than at the maximizing point R but no Gr benefits. And although R is the solution it is not a common sense solution. In fact it occurs at a point when B, Li and Gr benefits are all declining. In all production function models the maximizing solution is at a point where the rate of return on the investment is declining, for reasons I can't go into here.

All this must sound like fantasy to some listeners not familiar with analytical economics. But it can be demonstrated that the reasoning is sound. The only problems are (1) whether the facts are right (e.g., I am not sure how Li declines with age; I don't believe it does so in the manner depicted by Crotty [FGD]), and (2) whether one claims that the people are really oriented to maximize these values or only hypothesizing that they might be in order to test the hypothesis. There is also the problem, of course, that as in all science the model simplifies reality. This may not prevent predictions if the simplification is not too far off reality, but it may also lead to nonsense.

Nevertheless, working out such a model before doing research by using what facts are available can give a very fine precision to field work, leading the researcher to attack problems which are well defined. When I worked with the Turu in Tanganyika I knew that there was a strong tendency to slaughter steers at about the age of seven. But I never attached the significance to

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this that I would have if I had had the benefit of Crotty's mode of reasoning.

Although Crotty is pointed in a direction that is rather anthropological, as an anthropologist I find that most economists, including Crotty, are still too unfamiliar with the facts to construct models that don't seem peculiar. Crotty, for instance, has accepted the fact that cattle act as money. And he represents it in his model as liquidity. Liquidity refers to the ease with which some good can be exchanged for another. Money must be highly liquid to function as money and facilitate exchange. Bread is not very liquid much or most of the time; one could not exchange it for much with another person unless he is hungry. If cattle has high liquidity, how does the model deal with the fact that a man who sufficiently desires a wife will abandon the blood and gratitude benefits to exchange it for her? In reality there is no doubt in my mind that steers are given up for the purpose any time after at least Q and the benefits obtained achieve greater utility in most cases than keeping the cattle longer for their blood and gratitude benefits. On the other hand, I also think Crotty's model could be revised to accomodate my criticism. Probably the best way to do this would be to convert all the values into monetary units (cattle) and then construct a model that shows maximization of profit reckoned in cattle.

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To some people one of the bothersome things about formal analysis is that different researchers may be at odds in their analyses, and unfortunately, since we are all human (i.e., have a vested interest in the success of our research, sometimes differences of opinion become somewhat acrimonious. For example, students of East African pastoralism today differ with respect to assumptions about the maximizing goals of herders, most taking the position that the herds are managed to maximize food benefits. Others, like myself and Crotty, take the position that they are managed to maximize their utility as repositories of value as well as food. But such differences of opinion should be accepted as normal. It is not so much what assumptions are made but which can be proved by use of formal techniques which test their predictions. I am the first to admit that my assumptions have not been adequately tested. On the other hand, some assumptions seem more reasonable than others. Naturally, I think mine are the more reasonable given the facts.

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There is another aspect of Crotty's work that should be discussed, the fundamental, probably paradigmatic, difference between the person trained as an economist and the person trained

as an anthropologist. Reading analyses like Crotty's often raise the anthropologist's hackles. In the apparently overwhelming desire to model human behavior the economist is far more willing to simplify reality than the anthropologist, whose training weds him/her more to the facts. In its worst form this leads the economist to end up modeling for its own sake, creating theoretical toys having no relation to reality, a "malady" the opposite of the anthropologist's who sometimes goes in the direction of refusing (at least overtly) to make any assumptions about anything. For the anthropologist, who wishes to employ analytical economics in his work, this poses a problem for which a strategy must be developed. The best solution seems to be to follow the lead of agricultural economists who are more like anthropologists in their commitment to analyzing the real world.

One other formalist who works with pastoralists who should be mentioned is Tim Ingold. Ingold's research has been with Skolt reindeer herders in northern Finland. Modern Skolt herders are faced with an unusual problem compared to Africans, Basseri, and most other herders. In recent time, since 1960, the former relatively intensive system of reindeer herding became impossible due to various factors including increasing overgrazing and the use of snowmobiles (Ingold 1980). The herds are now very scattered and "herding" has become extensive, what Ingold calls "predatory pastoralism." In trying to understand current husbandry practices Ingold has utilized probability theory (including game theory, which seems to have utility here). By statistically examining the costs or risks involved in trying to stake a claim on their reindeer at the few times when they are corraled, Ingold decided that the present day emergency of Skolt "big men", who are extroverted, "noisy, reckless gamblers" (Ingold 1980, 113), unlike their former counterparts, is due to the fact that the only people who can now profit from reindeer herding are people who "thrive on risk." They employ a strategy of "expected utility" in which they calculate the probability of being able to get control of their animals and offspring during the next roundup against the chance of losing both. They are like slot machine players in Las Vegas (probably more like blackjack players, which requires some skill). The rest of the Skolts employ a "minimax" strategy, maximizing return in combination with minimizing loss which leads them to conclude (according to a logic which Ingold works out formally) that the best course of action when one of their animals is identified is to slaughter it. This, as he says, is clearly a formula for the abandonment of reindeer husbandry.

So far formalists have been slow to apply their techniques to behavior other than the exchange of material goods (material

for material or $m \times m$). They have ignored what I call social exchanges, the exchange of some kind of behavior (such as political clientship) for some good or some other kind of behavior ($m \times b$, $b \times b$). When a chief allows a subject to approach him he is giving the subject an opportunity to speak to him and perhaps exert some influence over him in exchange for some show of deference. Or when a chief in East Africa allowed Arab traders in the 19th century to enter his area in exchange for guns he was exchanging permission for guns. It seems to me that there is no reason why behavior cannot be subjected to formal analysis just like other goods and such people as Blau (1964), a sociologist, Boulding (1973), an economist and Bennett (1968) an anthropologist have asserted as much. My own more recent works have taken this direction and are derived from the area of macroeconomics, more specifically, from monetary theory as suggested to me by the works of Paul Einzig, an economist.

In the second edition of his Primitive Money Einzig starts by designating various items found in various cultures over the world as money, items which function just as our money does, as repositories of value and media of exchange. Thus salt is money in some places, woodpecker scalps in others, blankets or cloth in others, and livestock in Africa. Einzig then notes that the way people relate to each other, i.e., the way they engage in exchange behavior, will be affected by the money supply. If the supply is large (determined by some defined measure) there is more opportunity for exchanges which are what Boulding calls "economic exchange," i.e., exchanges in which the encounter is short, maybe even instantaneous, as when one pays a dollar for a pound of tomatoes and after the transaction the grocer and his customer have no further claim on each other. Such exchanges are also usually $m \times m$. Where the money supply is relatively low, a situation is created in which what Boulding calls "grants" ($b \times m$) can dominate. In this case we have a chief allowing someone to farm a piece of land in exchange for deference to the chief's authority. Such a relationship is likely to be long-term, at least one farming season.

Einzig then suggests that a chief would favor "monetary policies" which would keep the money supply low in order to force people into grants relationships with him but not so low as to bring about disaffection. Einzig thinks of all societies within which there is "primitive money" as hierarchical, having chiefs or authorities of some kind. His theory, however, can be extended to egalitarian pastoral societies, and I have tried to do that. Such societies are ones in which the money supply is large (in East Africa it can be calculated that the supply moves from too low to challenge chiefly authority to demise of chiefly

authority when the ratio of cattle to people becomes one cow per person or more).

This is about as far as this approach has been taken. The next step is to employ formal techniques from economics having to do with money supply, a formidable task. It will require not only getting control of monetary models but getting much better data on herd sizes, the dynamics of herd growth and decline and the social concomitants of this data. However a start has been made thanks to the work of Dahl and Hjort (1976), who have developed simulations of herd dynamics for East Africa and whose work is being improved on by others. We now have the potential to develop a monetary theory of social dynamics in pastoral societies.

"Lying with statistics" is a term familiar to all of us, and probably used by all of us (except statisticians). While some people may "lie" with statistics it seems more likely that most simply insert biases into the structure of their formal analysis unwittingly making the results serve their interests. The calculations of how many "poor" people there are in the United States is a case in point. These have ranged from as low as 5% to over 30%. But it all depends on how poverty is defined, a fact frequently forgotten when the calculations are used to make public policy. One may "lie" with formal methods too and in the application of formal methods to pastoralism there seems to be a great deal of this kind of thing. In Africa there have been numerous formal analyses which have shown that the tragedy of the commons, in which rangeland is destroyed by overgrazing because "everybody's business is nobody's business", is a pervasive problem demanding intervention (see, for example, Konczacki 1978). These analyses, in my view, are based on false assumptions, such as Konczacki's that Somali build up herds in excess of their subsistence needs as insurance against drought and disease which periodically kill off large numbers of animals. Konczacki's point of view, like so many developmentalist's favors the power of the national government and so to me seems in some way motivated by a desire to cater to the center of power.

But the charge can be leveled at anyone. It is probably not possible to keep some degree of bias out of formal analysis. Westfall (1973) tells us of how Newton fudged his analysis of the physics of sound by inventing a condition called "crassitude" which raised the velocity of sound and so brought his model into better conformity with reality. Formal methods, properly used, are a powerful tool. But they can also be misused and are particularly dangerous because the "scab of symbols", which

Thomas Hobbes called the system of algebraic notation (Westfall 1980), is often difficult to penetrate by one not well acquainted with a particular technique.

Are there any other formal methods that have been used in pastoral studies other than the ones I have mentioned? If we depend on the menu employed by economists the answer would seem to be that in general terms all that have been found useful have been mentioned in this paper, with one exception. (There are, of course, infinite variations within the general methods.) Calculus, with its ability to determine rates of change with differential equations and so analyze curves like the production function curve to determine such things as the maximizing point is central. It's ability to determine areas under curves, through integral equations, is also fundamental to analyses like Crotty's. Difference equations, a parallel method to calculus for analyzing dynamics, i.e., phenomena of variation in time (change), I have not mentioned but such equations, as in economics, could be usefully employed for problems as herd dynamics as they are employed to determine mortgage rates. Probability theory, regression analysis and game theory have all been mentioned.

A final question I want to consider is somewhat parenthetical to the theme of the symposium. Have formal studies in pastoralism helped the development of the formal approach in anthropology? This is a complex question best answered by first taking up the matter of the place of formal methods in anthropology in general. I mentioned at the beginning that the formal approach is a paradigm, not just a technical device. To put it in other terms, it is a culture. Every discipline, we understand today, has its own culture. In sociology, for instance, they still ponder the words of Weber, Toennies and Durkheim even though one must wonder what real analytical value remains in the concepts of gemeinschaft and gesellschaft. In anthropology we still debate questions raised long ago by our paradigmatic forefathers, Boas, Malinowski and Radcliffe-Brown. The culture of these people bequeathed to us, whatever it may be described as, is not very hospitable to the formal approach. Seen in that perspective, it was unlikely from the start that formal studies in pastoralism would help the position of formal methods in anthropology in general. As a matter of fact, since the culture of anthropologists seems especially oriented to agriculture and hunting and gathering, combining pastoral studies with formal studies may be a recipe for professional suicide. But thanks to recent work there seems to be a surge in interest in pastoralism. Whether the other problem can be solved remains to be seen.

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