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Preliminary Draft of Working Paper

' TRANSGENERATIONAL EQUITY AND
NATURAL RESOURCES," *Draft.*

by

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Transgenerational Equity and Natural
Resources, or Too Bad There Ain't no Coal Rangers

I. Introduction: The Ascendence of the Issue of Equity

Increasing attention is being paid to matters of equity. At the level of discussion "decisions" can produce psychic benefits while ignoring the reality checks of costs. At this level it is harmless. At the level of action, however, we should be more careful.

Attention to equity is found in those intellectual areas where we expect it, i.e., in the fringe whose outer limits of sanity are demarcated by the CoEvaluation Quarterly. Of greater potential interest, however, a substantial number of mainstream academies also consider the issue. Included in the latter category are K. Boulding, F. Hirsh (Social Limits to Growth), R. Nisbet (Twilight of Authority) and D. Bell (Cultural Contradictions of Capitalism).

In his presidential address to the Association for Social Economics, Professor Joseph McGuire of the University of California, Irvine states that "structural changes have already affected our economic policies (if not our theories), and are already so significant that they will probably affect the future of our American society. These basic alterations in the social fabric stem largely from the shift in the position of the concept of equity in our contemporary culture." [Rev. Soc. Econ. April 75, 33(1): 74-80]. The authors of the new equity literature are quite disparate in their evaluation of the social implications of a push for greater equity. Irving Kristol is critical of the social costs of an "entitlement society" while those identified with the Union of Radical Political Economists

are convinced of its virtues. All parties, however., seem to have one area of agreement. Specifically, they agree that there is a strong push toward increasing equity of outcome rather than opportunity.

The arguments involving equity can be conducted at a variety of levels. Robert Nozick can engage in a learned discourse (Anarchy, State, and Utopia) with his Harvard colleague, John Rawls (A Theory of Justice), with the Harvard logician, W. V. Quine as referee. Unfortunately, perhaps Keynes' mutterings regarding the importance of ideas deny us the luxury of believing that such debates are harmless at worst. Ignore them we can, since most people would after all rather die than think when self-interest is not directly involved, but we probably ignore with at least a twinge of guilt.

Rather than ignore we ask you to consider. Consider the issue of equity, silly though it often may be, with distortions and all it neglects. Obviously, the mask of equity is critical to the operation of political entrepreneurs as they use the coercive power of the state as an efficient engine for the extraction of plunder. Further, and of more immediate concern, a misunderstanding of the equity implications of alternative arrangements of property rights has led a substantial number of well-intended, equity-minded persons to advocate policies whose outcomes violate their equity preferences. We would like to correct a few of these misunderstandings regarding equity across generations.

II. Property Rights to Resources and Intergenerational Equity

Assume that people are largely self-interested. That will be an especially easy assumption to hold if you are acquainted with the implication of Dawkins' The Selfish Gene or some of the other socio-biology

literature. However, if you find that assumption repugnant or otherwise unacceptable make the contrary assumptions, i.e., that people do not want to be better off than others. Either assumption, if held consistently, will work.

If the human enterprise is expected to continue for at least several generations, the question of equity clearly has temporal as well as current spatial and current positioned application.

If those concerned with policy analysis are to become increasingly concerned with issues of equity, there is no obvious reason to restrict this concern to a generation's timespan. Thus, we should consider transgenerational equity. In the pure form, you are asked to assume that no one would know into which generation s/he (or anyone else) would be born. Our key question is: Which assignment of property rights will produce the greater degree of intergenerational equality, an assignment of private rights or one with collective rights assigned to a democratic government?

It is taken by many as an article of faith that we are running out of resources despite the compelling evidence of static or declining prices for most resources. Certainly a perception of resource depletion is real, regardless of the facts. Perceptions not facts influence policy. Hence, if we are interested in policy we must consider the perceptions which underlie policy.

Given a belief that we are running out of resources it follows that one should expect future generations to be seriously disadvantaged. Those with an unfortunate later birthdate will suffer a diminished welfare position as a result of conscious decisions taken, by their predecessors, decisions that violate intergenerational equity.

If transgenerational equity is to be a goal, then it becomes necessary to distribute the value of resources across generations. Obviously, it

would be inequitable to distribute the volume or mass equally for utilization efficiency will surely change. As a simple example an equal volume of timber produces, due to higher productivity efficiency, a higher value and volume of products now than it did 40 or even 10 years ago. Thus, were we to be allocated the same biomass of timber as was allocated to the previous generation we would, in terms of some simplistic notion of equity, be unfairly advantaged.

Due to increased capital accumulation, including information and human capital, we expect improvements in utilization of all resources. Under incentives that reward efficiency this outcome is expected--especially as resources become increasingly scarce. In this as in other areas, however, we expect to encounter diminishing marginal returns. The gain from moving utilization of standing biomass from 30% to 60% is likely to be easier to attain than a move from 60% to 90% utilization.

Most of the great wealth of capital stock available today was generated by the savings and accumulation of past generations, This is but one of many examples of self-interested behavior in one generation working to the advantage of later generations. It seems reasonable to consider a possible shift in the relative opportunities offered by capital accumulation and raw materials. It is at least possible that future generations would prefer present generations to bequeath them less additional capital and more natural resources. As the authors of the Federalist Papers understood so well, no one can be assumed to be the best judge of another's preferences. Hence, those in a future might want the option of developing the capital that they find most useful. Clearly, however, each generation's use of resources influences the welfare of those which follow.

The transgenerational equity question may be stated quite simply.

If one were risk adverse and did not know into which generation he would be born, how would he structure property rights to resources?

III Institutional Design for Transgenerational Equality

It is a blunt fact that the present generation operating in a historical context, establishes the rules regarding property rights with respect to resources. While there may be no logical way to apply a discount rate for the comparison of satisfactions among different generations, each generation implicitly does so. And again remember that no man can be considered a fair judge of his own interest.

The Coase theorem tells us that with clear property rights the market mechanism will arrive at a Pareto optimal; even with externalities, provided that all parties can enter the market and that negotiations have negligible costs. But because future generations cannot bargain with the present, the Coasian approach offers no help.

Hopefully, both the issues and the conditions are now clear. Many consider equity to be increasingly important. Transgenerational equity (discounted by the probability of their being future generations) is one important form of equity. Property rights to resources are a component in an equity formulation. And finally, future generations cannot speak for themselves.

Relatively few political scientists or economists have addressed the property rights issue. Alchian notes that: "Either we can infer that the profession is so obviously aware of the pervasiveness of the effects of various forms of property rights that property-rights cannot sensibly be regarded as merely a subfield; or else we can infer that economists have forgotten about the possibility of subjective rigorous systematic

coherent analysis of the various forms of property rights. My conviction is that the latter inference is the more valid one." [Alchian, Economic Forces at Work, Liberty Press, 1977. pp. 128-9]. In the following sections we will undertake a preliminary analysis that turns out to yield counter-intuitive results.

IV Property Rights and Transgenerational Equity: The Case of Stock Resources

Briefly, flow resources such as trees, fish and elk reproduce over relevant time horizons while stock resources such as oil, helium and coal do not. If a self-interested person were to know that he were to be born in some future period, and if he were to disregard the issue of capital accumulation, then he would want prior generations to have a negative discount rate with respect to stock resources. More simply, he would want prior generations to value future availability more highly than present availability.

Clearly, such an evaluation is unlikely for any stock resource of positive value. Thus, the real question becomes what system of property rights will weigh future interests more highly.

We would all expect that a market system involving privately held rights would yield very different results than would a system whose rights were held by society and decisions regarding use rates were made collectively.

It is generally believed that a market setting causes future generations to be robbed of natural resources. Krutilla and Page, for example, recently put it this way:

"... Generally, markets are considered fair only if all those affected by the outcomes are present in the market (with-

out externalities) and the distribution of market power is considered fair. In the case of deciding which new (energy) supplies to develop, the distribution of market power is indeed uneven: the present generation controls the total stock of resources, leaving future generations with no voice in today's decision." "Paying Tomorrow for Energy Today," *Resources*, #49 (June 1975).

Further, Lippit and Hamada have argued that: "In the extreme case, future generations cannot compensate the present for foregoing the mildest satisfactions, even when the very survival of mankind is at stake." [Victor D. Lippit and Koichi Hamad, "Efficiency and Equity in Intergenerational Distribution," pp 285-299 in Dennis Cr. Pirages, *The Sustainable Society*, Praeger, 1977 (at. 288)] [For a related point see J. M. Buchanan, "Easy Budgets and Tight Money," Lloyd's Bank Review, April, 1962].

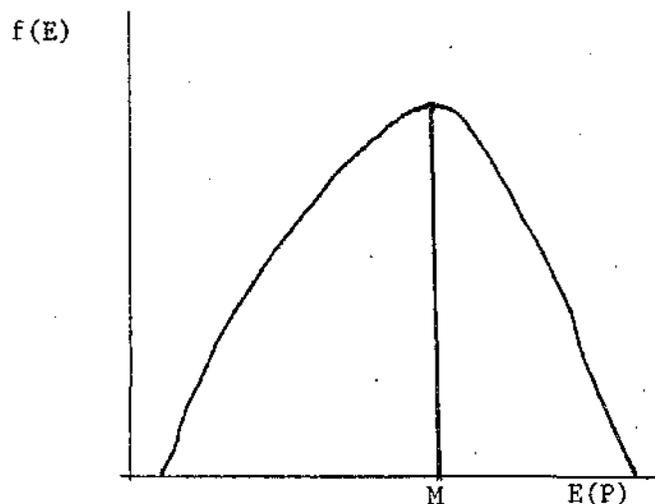
The major implication of this and similar material is that a market mechanism, as compared with collective control, results in future generations being deprived of resources. But this claim does not withstand examination. The explanation results from both the different incentives faced by decision-makers in the two situations, and from the different ways decision-makers are chosen in the two settings.

In what follows, simple models of market and collective democratic actions are employed. For concreteness, the sources stock in question will be referred to as a copper mine. This example is chosen to capture the elements of inter-temporal resource allocation and intergenerational transfer of resources, while presumably minimizing the intrusion of side issues: environmental externalities and violation of the exclusion principle. The binary decision must be made periodically on whether to

exploit the one ore body in the current period or not. Following the initial analysis, the models will be made less naive by relaxation of certain assumptions, and the resulting impacts will be noted.

To decide whether or not an existing resource should be exploited in the current time period the decision-maker simply compares its value (net of development costs) in current exploitation with its expected value in highest future use (net of development costs, and discounted to the present). If current exploitation yields more net benefits, as judged by the decision-maker, than does any future use, then the decision maker chooses current exploitation rather than preservation of the stock resource. The major difficulty, of course, lies in the estimation of value in future use. The value of a body of copper ore to be mined in any given future period depends on several factors, all of which are subject to uncertainty. Availability of other copper ore, the price of copper substitutes, the state of tastes and technology determining copper's usefulness and costs of development, attitude toward risk, and rate of discount all are important in determining a decision-maker's estimate of the mine's present value in future exploitation. For a given mine, different people are likely to have differing opinion on when the mine should be developed, or more specifically for present purposes, whether or not current exploitation is best.

The views of the populace on the present discounted value of future use might be summarized in a diagram such as the one below. The abscissa indicates $E(P)$, the estimated present value of preservation, which is a single value in dollar terms, expressing the summation of the influences listed above. The ordinate indicates the frequency of each



estimate. No particular shape is required of the distribution, for simple models. If we then locate on the abscissa a value, M , equal to the value of the ore body if mined now,* all $E(P)$ greater than the value can be characterized as indicating that preservation is preferred. Similarly, those whose $E(P)$ falls short of M , the current development value, presumably must conclude that current development is the better choice.

Consider now the most straightforward kind of democratic, decision-making regarding the copper mine. Each person expresses his opinion of whether the mine should or should not be developed currently., and the majority rules. Assume that each individual is altruistic, rather than self-interested, so that he votes for what he believes will benefit society most. To predict the outcome of such a vote, we simply ask whether the majority of the estimates fall to the right, or to the left,

* In reality, the value of the mine in "current" development is subject to some uncertainty, particularly since development is not really confined to one short time period. But the degree of uncertainty is all relative to development farther into the future. One could work with a similar, though much-compressed, distribution of estimates of value in current use, but that would seem to add complexity with no change in the basic outcomes in comparing private and collective management systems.

of the value of the mine in current use. If the majority is to the left, current exploitation will be mandated; if to the right, preservation is supported. Put another way, if the median voter** has $E(P)$ greater than M , the current development value, preservation will result, while current development wins if he feels the other way. In a very real sense, the median voter's judgement prevails.

Alternatively, consider a simple market situation where the copper mine is controlled by the highest bidder. One type of bid is M , for current development, made on behalf of ore processors. The highest such bid represents the mine's worth in current exploitation. The other type of bid is from those who want to preserve the mine for the future. We can assume either altruistic or selfish motives for these bidders. In either case, each bid reflects the bidder's belief as to the mine's value. Obviously, if anyone (with sufficient funds, or credit, or the ability to convince co-venturers) believes the mine will be sufficiently more valuable in future use than now, so as to justify postponing its use, the resource will be preserved. The median opinion does not control. The tendency instead is for those with the strongest preservation bias to control. They are usually called speculators.

We have long been puzzled regarding the general condemnation of speculators by environmentalists, preservationists, steady staters, and mill-run do-gooders concerned with such issues as resource preservation and land-use planning and control. Speculator is a derisive term.

** Median voter here is taken as the individual(s) whose $E(P)$ splits the distribution, in the sense that half the other people lie above him, and half below.

With the singular exception of the monopoly case, such criticism seems to be at variance with the announced preferences of the critics. The critics who we address claim to favor deferred consumption which is merely saving for the future. This, of course, is exactly the function of the speculator. Only by paying a higher price than those who prefer to consume now can he conserve the resource for the future. While current consumers have good reason to object to speculators for driving up the price and hence reducing current consumption, those in the future should shower them with praise and rewards--if the speculator guessed correctly. The central point, of course, is that successful speculators advantage those in the future at the expense of those in the present.

Whether the speculators have a long view or a more short-sighted view is unimportant. As time passes and the higher-valued time of use approaches, the present discounted value rises. Presumably, more people come to realize what the future really holds. Thus, the bidding should become more intense as the future becomes less uncertain over time and more people come to recognize that the speculator was correct.

Of course if the purchasing-speculator is wrong, and potential bidders begin to learn so, he suffers the loss as the mine's value rises less rapidly (or falls) compared to other assets he could have held. He and the deprived earlier generation bear society's loss if his decision to preserve the mine is incorrect. But the resource is preserved. Since this type of speculative activity can be expected whenever resource property rights are private and transferable, resource prices in such markets will reflect bidding for future use, and current exploitation will occur only when all speculative bids are overcome. The equilibrium market

price clearly includes pressure from future potential bidders, including those bidders yet unborn, since speculative bids are based on what future users, as bidders, are expected to be willing to pay. Hence, in a market system with transferable property rights over stock resources, those who are most optimistic regarding the future value of any storable are the ones who control the resource. Given that they believe that the future value will be high, they expect to capture rewards by keeping resources out of consumption. Thus, it seems that those concerned with short-changing future generations should advocate a negative income tax on speculative profits.

It is difficult to imagine how a mechanism could be devised to give current voters an analogous incentive to consider future citizens. Future voters must depend on the good will of present voters to sacrifice current consumption of governmentally controlled resources.

Our tendency in this paper has been to make unrealistically simple assumptions and draw out the implications. Next we make more realistic assumptions and see if the implications still hold. We initially assumed voters in the collectivity to be altruistic and found that they practice less conservation of stock resources than do those in a market context. In reality, we find that political actors tend to use the coercive power of government as a mechanism to direct subsidies in their direction. In general, government is a harvester of plunder.

Thus, in the collective model, we will assume voters not to be completely altruistic, but rather to be somewhat self-interested. With the introduction of this assumption the likelihood of preservation diminishes further. If voters are less interested in future generations' welfare than in their own, current exploitation becomes more valuable while the benefits of preservation decline in the eyes of current voters. The value

M remains constant, while their $E(PV)$ falls because future usefulness, enjoyed by others, is more heavily discounted than if current voters themselves could enjoy the benefits.

Still another, and perhaps more realistic possibility to consider is that in the collective setting, an imperfect democracy prevails. Voters have some influences but most know little about the specific issue, and only a few view the issue as important enough to weigh it heavily in how they vote for their representatives.

Put another way, any given voter is rationally ignorant about most specific issues, since the public decision is a public good. If he votes "incorrectly," he loses very little, usually, while if he expends time and effort to vote in an informed manner, he personally gains little. There is also a bundle purchase effect in voting for a representative: one candidate can be given his vote, and must represent the voter (even if the voter gets his choice) on typically hundreds of issues. Again, the likelihood of informed voting paying off in controlling the social choice is small for the voter.

Lobbying also may be important as the elected representatives also are necessarily acting with little information on all but a few of the hundreds (or thousands) of issues to be decided. The result here is that concentrated interests tend to prevail. Since current exploiters (processors) tend to concentrate--politically--people's interests as consumers wanting lower priced goods, while future generations have no such self-interested spokesmen, we might expect preservation again to suffer. The results here are rather speculative, however.

When private rights are used, our model used few assumptions. A perfectly competitive market, for example, is not required. However, as a market moves toward more monopoly or cartelization, the tendency toward preservation is increased. As Hotelling demonstrated in 1931, a monopoly will restrict the exploitation rate due to its output-restricting behavior. ["The Economics of Exhaustible Resources," J.P.E., Vol. 39, #2 (April, 1939)].

To summarize the situation with stock resources, privately held, exchangeable property rights in a stock resource tend to encourage preservation, relative to a simple democratically controlled collective management system. This is because the gains from preservation are appropriate in a market system, but not with collective ownership, and because those with expectations of high future value for the resource tend systematically to control through out bidding others. The differential is increased if people are viewed as self-interested, or if the private producing industry is a monopoly or a cartel, privately owned.

V Transgenerational Equity and Flow Resources, or Too Bad There Ain't No Coal Rangers

We above argued that market decisions are expected to utilize stock resources more slowly than democratic collective decisions. In a market those who expect resources to be especially valuable in the future tend to capture control over the resources and withhold them from present consumption. Here self-interest is harnessed in the service of future generations.

When dealing with flow resources (such as timber) the incentives,, and hence the outcome, are greatly different. With stock resources self-interested market behavior is expected to produce more conservation than the median voter would prefer. In contrast, collectively owned and collectively managed flow resources are expected to be both (1) more conserved and (2) more intensively produced than they would under private ownership. This is not, however, to suggest that collective ownership and management will result in socially optimal rates of use and investment. We merely state that collective ownership and management will tend to push benefits into the future. The pathologies inherent in this system may be so severe that all generations lose from collective ownership but the resolution of that question is outside the scope of this paper.

Unlike coal or copper, trees grow during a relevant planning horizon. This is the key to understanding the different outcomes under market and collective ownership. Growth is a process that can be influenced by intervention. Silvicultural treatments influence both composition and speed of biomass increments. Hence, there is a basis for investments in forestry. To this point, the situation is very simple and there are no grounds to predict whether market or collective management will produce and conserve more for the future.

Two considerations complicate this issue. First is the equilmarginal principle which states that resources will be most efficiently deployed when the marginal units of investment in each opportunity are equal. Related to this is the principle of diminishing marginal returns. This means that for every investment opportunity curve there is a point at which the return from an additional unit of input is less than from the previous unit. The discipline of the market is such that the successful decision-

makers are those who act as though they pay attention to these two principles.* Hence, in the private sector both standing inventory and silvicultural investments are filtered through reality checks. Firms that consistently ignore the implications of these principles are called bankrupt. Thus, the market system operates to separate systematically unlucky, incompetent, or lazy people from the control of resources. Depending upon one's ideology, this may be either good or bad but the verity of this claim seems evident.

When working with a market system the decision-makers face very strong incentives to heed the preferences of people facing a very wide array of opportunities. Part of this heeding involves paying attention to the equilmarginal principle and to diminishing marginal returns. This unveiling of the mystery of the market, that system of which Charles L. Schultz says ". . . we don't really understand how it's possible, but it's done so often we are no longer surprised." [The Public Use of Private Interest Brookings Institute 1977. p. 77] was not a digression. We focus on the mechanisms faced by the decision-maker in the market sector to explain the different outcome. We must then compare this situation with that faced by the manager of a collectively owned resource.

Both the private and the public manager respond to incentives. Both are largely self-interested. McKenzie and Tullock have perhaps the classic statement:

* If confused by this, review Friedman's Essays in Positive Economics, Chap. 1 and Alchian, "Uncertainty, Evolution and Economic Theory."

"Bureaucrats are not markedly different from other people. Most citizens of the U. S. are to some extent interested in helping their fellowman and in doing things in the public interest. Most citizens of the U. S., on the other hand, tend to devote much more time and attention to their own personal interests. The same is true of bureaucrats. [Richard B. McKenzie and Gordon Tullock. The New World of Economics, Richard D. Irwin. 1975. p. 197.]

One explanation for more stocking and more production investments in collectively owned and bureaucratically managed forests is based on the incentive structure faced by the bureaucratic managers.

For people in general, but for highly motivated individuals in particular self-interest leads to the desire for an increase in discretionary control over resources. For the "selfish" individual, this provides the power and deference which accompany discretionary control. For the professionally oriented or "socially concerned" individual, this provides in addition the ability to make "good¹¹ things happen. When resources are owned collectively as in a bureaucracy such as the U. S. Forest Service, a prime strategy for increased discretion is to promote growth of one's bureau.

There are reasons to believe that in most cases waste is generated from the bureau being above optimum size. Most will agree that substantial forces lead in this direction. For the bureau head, civil service rank, prestige, and pay all are strongly related to the size of his bureau. Further, symbols of success in terms of office amenities are also related to the number of persons under his charge (For example, in one university, for years only deans and above could have IBM typewriters.)

In addition, expansion generates more possibilities for promotion. This enhances the ability to control those under his charge, since under Civil Service rules firings are nearly impossible to execute successfully. Thus to gain control over inferiors, the promise of promotions may be offered as inducements. And promotions are more common in a situation of growth.

Of perhaps equal importance for the ambitious bureaucrat is the fact that a large proportion of his budget is "locked in" from previous years. This, of course, reduces the range of discretionary expenditures. In contrast, new funds offer far more opportunities for flexibility and for innovation.

Among other results, this tendency toward growth can be expected to encourage decisions leading to more intensive management of this resource,, and the reluctance to surrender territorial authority (unless the cut in manpower is small, or exercise of the authority leaves no discretionary resource claims), and the reluctance to merge with any larger entity or to transfer resources to activities outside the agency's scope.

This strong desire for growth does not depend on the presence of evil administrators or megalomaniacs. We must remember that the bureaucrat, because he lacks market information on the relative value of his product and those of other public agencies, suffers from the absence of an obvious and immediate reality check on what he wants to believe. Thus, it is easy for him to harbor the illusion that his agency mission is above average merit and thus argue that his office deserves above average budget increases. He of course has the help of clientele groups at budget time. Collective ownership and the lack of a pricing mechanism result in both anti-efficient incentives and distorted information -- or

lack of the latter - which deal to even a well-meaning, intelligent bureaucrat blows from which recovery is difficult and rare. In sum, the overwhelming bias is toward expanded activity. When dealing with flow resources this means high flows and high inventories since there is no interest charged to the inventories.

Conclusions

If there is increasing concern with equity, this concern can reasonably include transgenerational equity. If one were ignorant as to the generation into which he would be born, he would advocate a mix of property rights over resources. If stock resources are to be saved for the future, transferable property rights should be established over them with the recognition that too much would be preserved. When considering flow resources, one concerned about having a large inventory and ignorant regarding the time of his birth would advocate taking advantage of bureaucratic pathologies and putting these resources into collective ownership and bureaucratic management. If, as some have advocated, stock resources are to be put into public ownership, then those in the future would suggest that we build schools for the training of coal rangers. This would appear to be far less wasteful of resources than many governmental activities undertaken in the energy field.