The Welfare Analytics of Transaction Costs, Externalities, and Institutional Choice

Ronald C. Griffin

A natural result of the economist's participation in externality literature has been a strong emphasis upon market and price-guided policies. Available theoretical foundations are insufficient for supporting this ideology. Absent is a conceptual framework which integrates institutional options and their attendant resource costs with what we know of resource and technology constraints. This paper addresses this omission by incorporating an explicit role for transaction costs into traditional welfare diagrammatics.

Key words: externality, institutions, property rights, resource policy, transaction costs, welfare economics.

Externality and market failure literature of recent decades has been responsible for a substantial amount of discussion, debate, and insight regarding the social relations which bind and, indeed, define mankind. These developments have been spurred in no small part by the policy relevance of externality-like issues. In addition, because economists have believed that they offer valuable input for such issues, market devices for "correcting" externalities have always been emphasized in the literature, often to the exclusion of other social/legal relationships. "When the only tool you have is a hammer, everything looks like a nail." Throughout this literature, concern for the relative abilities of the market and government policy has usually been explicit.

One of the primary themes of the externality literature and its variants should be that a wide array of institutions is available for correcting externalities. While certain camps might focus on narrowly defined subsets of these internalizing institutions, common sense suggests that society examine externality situations on a case-by-case basis and choose the best structure available for accommodating the externality interdependence. The importance of transaction costs becomes apparent in the pursuit of this objective.

A major tenet of the more recent literature has been the integral involvement of transaction costs within organizational processes which seek to have externality creators account for their impacts upon recipients. These processes include both market and nonmarket forms of internalization, and all such alternatives incur transaction costs to some degree. Literature on this subject observes that markets for accommodating externality problems will naturally arise if transaction costs are sufficiently low (Demsetz 1964, 1967). Moreover, because it is rarely possible to know, a priori, whether market-incurred transaction costs are exceeded by the transaction costs of each policy (nonmarket) alternative, the desirability of policy is usually founded upon subjective biases regarding relative levels of transaction costs (Dahlman).

While transaction costs are usually viewed as affecting the economic efficiency of alternative internalizing institutions, it is not typically acknowledged that transaction costs are also relevant in defining economic efficiency. The prevalence of transaction costs implies that concepts such as Pareto optimality are not immune to a consideration of information and its costs. Even when this fact is suggested, means for operationalizing it are rarely provided. By properly applying some traditional "welfare ana-

Ronald C. Griffin is an associate professor, Department of Agricultural Economics, Texas A&M University.

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lytics," an insightful background can be obtained for institutional choice in the presence of transaction costs. The purpose of this paper is to expand neoclassical tools of welfare analysis (summarized by Bator) to accommodate a role for transaction costs.

Definitions and Background

To facilitate the exposition it is useful to establish a few fundamental definitions. It is particularly important to elucidate the concepts of externality, property rights, and transaction costs so that a common basis for the forthcoming discussion can be obtained. With regard to externality, the following definition is adopted and progressively justified in this paper. An externality is an interdependence among people. Externality, as it is defined here, does not imply Pareto relevancy. That is, there is no presumption of social ill in this definition. This definition is not mainstream, for the literature more commonly defines externality as an interdependence among economic actors for which a market or some other compensatory device does not exist (Baumol and Oates, Bromley 1986, Heller and Starrett). This second definition offers instructional utility, which hopefully explains its predominance, but it has the potential to perform great damage in application. While economists have a predilection for emphasizing market absence as a necessary condition for externality, an institutionally unbiased definition allows one to entertain nonmarket allocation processes as potential externality remedies. Casual reflection will isolate numerous social modes of externality resolution. For the most part, these institutions are so broad and permeating that they escape exhaustive classification efforts and, often, even our abilities to identify particular mechanisms.[1] One purpose of this paper is to assign a greater standing to the diverse array of nonmarket externality-addressing institutions. By directly incorporating transaction costs into the definition of Pareto optimality, the central objective of this paper is to build upon the idea that a Pareto-relevant externality is an externality that is being addressed by the wrong institution rather than not being addressed by any institution (especially markets) at all.

In the course of studying the entirety of institutions relevant to externality interdependencies, insight can be achieved by carefully emphasizing markets. The concept of property rights is crucial here, and, with Macpherson's warning in mind, "the meaning of property is not constant" (p. 1), it is useful to preface forthcoming discussion with a brief sketch of the elements composing property rights. Following Calabresi and Melamed's classic paper, property rights can take the form of property rules, liability rules, or inalienable entitlements.[2] Protection of one's interest in an interdependence by a property rule infers that one's desires in this relationship are ascendant to the desires of other involved parties unless the protected individual chooses to reassign this control. Similarly, protection via a liability rule in an interdependence provides for compensation should other individuals choose to assume control over the relationship. An inalienable entitlement declares that one's interests in a relationship cannot be legally reassigned or taken under any circumstances even when each party to the interdependence is willing.

Property rules are fundamental to the operation of markets which assign value prior to an interdependence, and liability rules necessitate some form of judicial system to settle value after an interdependence has occurred. Generally speaking, property rules are the foundation of market activity, and liability rules are the basis for litigation. However, sufficiently established

[1] A few examples of common interdependence-internalizing institutions may be in order.

Envy is a term representing a specific class of consumption interdependencies among individuals. Envy, therefore, qualifies as an externality given either the above definition or the more traditional "interdependence without a market" definition. Institutions that address this type of interdependence do, however, exist. Society seeks to teach or convince individuals that envy is undesirable, even irrational. In this case the intent of the control institution is to repress the interdependence. Social teachings (e.g., the ninth and tenth Commandments) serve to allocate the costs of envy to the envious themselves. This is conceivably an efficient solution, because the envious may be in the best position to solve the problem—by adapting their utility functions to be less responsive to the interdependence.

A child is dependent on his or her parents for the provision of a positive environment in which to live, learn, and mature. Yet, no market is available for the interdependence. Instead, parents possess a felt or declared responsibility to bear the burden of the interdependence. The source of these feelings may be partly founded on instinct, but this is assuredly reinforced by the parents' childhood participation in family relationships in addition to the important role of social teachings. It is notable that changes in tastes or relative scarcities may have recently led to dissatisfaction with the ability of family/community/church institutions to internalize the child-parent interdependence. As a result, additional institutions are being tried. Public awareness and opinion regarding child abuse has increased. Child abuse is being more broadly defined. Welfare agencies now act in an oversight capacity, monitoring the performance of parents previously suspected to be remiss in their parental duties. The "rights" of children are being refined to the point that they are better able to serve as the basis for court action brought upon parents by their children or by others.

[2] This classification is essential to a great deal of literature. See, for example, Bromley (1978), Buchanan and Faith, and Frech.

liability rules also may provide a basis for market transactions, and the ongoing refinement of property rules often occurs in the courthouse. Inalienable entitlements act as constraints on market activity, presumably to advance higher-order social objectives.

In forthcoming discussion, the emergence of markets to address an externality interdependence will be equivalent to the establishment of a property rule. In the simplistic view of this process, society must decide which person or group of persons should be vested with a newly created property rule. The more complex (and more realistic) perspective is that property rules do not emerge into an institutional vacuum but must coexist in an evolved system of, among other things, detailed property rules. Therefore, new property rules are best characterized as additional circumscriptions or alterations within social institutions. The simpler of these two interpretations is not too misleading for the more immediate purposes of this paper.

Transaction costs include "the costs of obtaining information, establishing one's bargaining position, bargaining and arriving at a group decision, and enforcing the decision made" (Randall 1972, p. 176n). Dahlman separates transaction costs into (*a*) search and information costs, (*b*) bargaining and decision costs, and (*c*) policing and enforcement costs and then states that all of these costs "represent resource losses due to lack of information" (Dahlman, p. 148). Moreover, the amount and distribution of transaction costs will differ between property rules and liability rules as well as between situations in which an initial entitlement (either a property or liability rule) is held by one party or another (Bromley 1978).

The Welfare Analytics of Property Rules

It is convenient to introduce the elements of this discussion in a progressive fashion beginning with the establishment of a general externality. Let us temporally adopt, for the sake of argument, the instructional definition: Externalities are interdependencies among economic actors which, for the purpose of the immediate discussion, are not accompanied by markets. A specific act of internalization merely causes the relation to enter into the decision calculus of causal economic agents who previously ignored it in full or in part. The interdependence may involve producers, consumers, or both producers and consumers.

Beginning with a narrow but instructive framework, internalization occurs whenever property rights for the interdependence are erected and allocated by the appropriate legal system. All other rights and institutions are fixed. Of course, legal inaction regarding the property right arrangements which surround a particular interdependence does not imply that there is no presumptive or putative ownership (Samuels and Schmid, Umbeck). Parties probably have some preconceived notions regarding unvalidated ownership claims. The degree of certainty (or uncertainty) attached to these notions is the foundation of present and future social, political, and legal action by individuals. Externality instigators (i.e., those having the physical power, though possibly not the right, to modify the level of an externality) may clearly create the externality in the absence of prior government action. There is nothing to halt such action by instigators nor to force it.

At a later date a liability or property rule may be newly erected or derived from a more general concept (such as the law of nuisance). Recognition of this possibility may enter the instigator's decision calculus as part of his or her preconceptions regarding the validity of the claim. Uncertainty as to the status of claims will motivate some parties, particularly those with better access to processes of institutional change and/or with positive attitudes regarding the validity or worth of their claims, to pressure the social system for a sanctioned declaration of ownership.

As each externality relationship is born, the process begins: the relationship is tolerated, that is, ownership remains presumptive and unsanctioned, so long as the relation is relatively unimportant. Through an evolutionary process the externality grows or fades in relevance to economic actors as a result of gradual and not so gradual changes in preferences, technology, and relative scarcities. Externalities may diminish into obscurity or evolve into important socioeconomic relationships whereby social declarations of property form the basis of an entire market. Alternatively, trade in the interdependence may not be permitted, and legal constraints can be formed to guarantee the absence of trade (inalienable entitlement). And let us not forget that externalities are resolvable by a large array of social mechanisms other than markets: regulations may be enacted, less formal rules of conduct may be formed, economic incentives may be established, and specific liability rules may be promulgated.

To model these concepts first in the absence of transaction costs, consider an evolving production externality in which the production of good X affects the production of one or more other goods in a manner which is unaccounted for by an existing market. Figure 1 depicts a typical production possibility frontier (*PPF*) exhibiting social transformation opportunities between good X and the monetary equivalent of all other goods. If the evolving production externality is positive, then the *PPF* wil be shifted outward. If the externality is detrimental, then the shift will be inward. In both cases intercepts A and B will be unaltered. In this way, positive externalities increase the convexity of the *PPF*, and negative externalities decrease convexity (Baumol).

The impact of the production externality on the potential welfare of consumers is illustrated in utility space. Corresponding to each point on the *PPF* there is a contract curve depicting Pareto-optimal allocations of all goods between any two consumers. Mapping the contract curve in utility space produces a utility possibility frontier (*UPF*). The outer limit of all *UPF*'s (one for each point of the *PPF*) produces the grand utility possibility frontier (*GUPF*). Through its effect upon the *PPF*, detrimental production externalities will shift the *GUPF* inward and beneficial production externalities will shift the *GUPF* outward. Unlike the *PPF*, production externalities can alter the endpoints of the *GUPF*. For example, in figure 2 the initiation of a detrimental production externality has shifted the *GUPF* from CD to $C'D'$. On the other hand, a consumption externality will preserve points C and D as endpoints of the *GUPF*. In figure 3, a detrimental consumption externality has produced an inward shift of the *GUPF*. In this latter case, the *PPF* is unaltered.

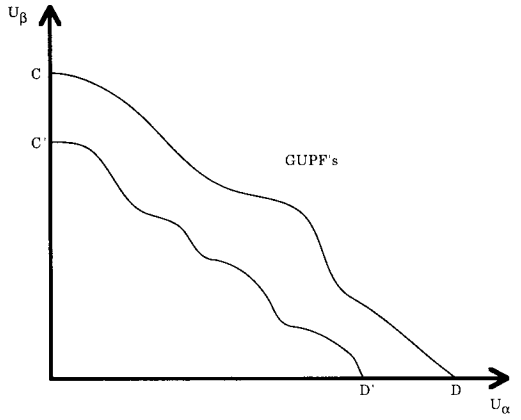

Figure 2. Grand utility possibility frontier shifts for production externalities

The formation of producer → consumer externalities may affect the *PPF* in that consumers may choose to adjust their supplies of production inputs. More important, production at any point along or interior to the *PPF* will shift the indifference maps of individuals in X-\$ space, assuming that the new externality relationshp is exogenous to these variables. Contract curves may be affected depending on how indifference maps are shifted, but *UPF*'s will certainly be shifted. Therefore, the *GUPF* will be shifted inward or outward in the manner depicted by figure 2.

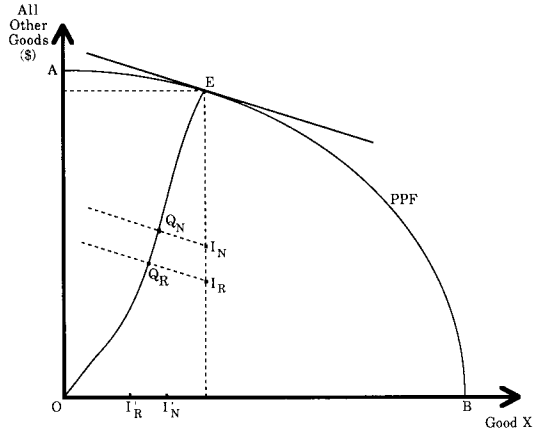

Figure 1. Equilibria for alternative endowments without transaction costs

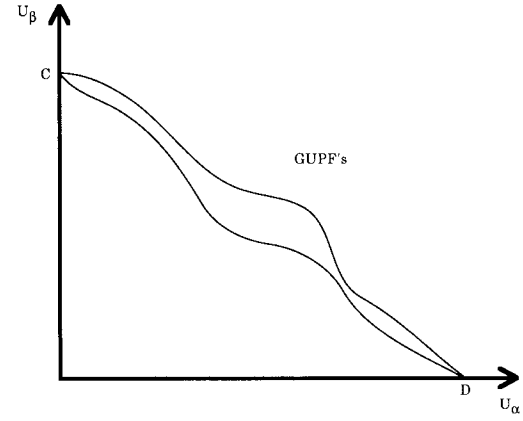

Figure 3. Grand utility possibility frontier shifts for consumption externalities

Suppose that the *PPF* illustrated in figure 1 represents present conditions including the externality. Let us assume that the externality is beneficial and that its instigators (i.e., the producers of X) have the power to produce the externality and that the receptors have no enforceable right to either prevent or force the externality. This initial situation is one of "privilege" favoring instigators and corresponding "no rights" for receptors if legal sanction has not been acquired (Bromley 1989). If legal sanction is obtained, then the situation becomes one of a property "right" for instigators and a corresponding "duty" for receptors (Bromley 1989). Denote this property right as the N (instigator) rule.

The implications of preserving the N rule or adopting its opposite, the R (receptor) rule, has received much attention in the literature.[3] This attention has focused almost exclusively on the effect of this choice on the resulting competitive equilibrium and the resulting welfare positions of the economic participants. The following Coasian conclusion is well known and warrants illustration within the above framework: In the absence of private resource constraints, wealth effects, and transaction costs, the Pareto optimality of competitive equilibrium is independent of ownership.

Assume that supply and demand conditions resulting from the initial N rule support a Pareto optimal production equilibrium at point E on the *PPF*. In figure 1 curve OE represents the corresponding contract curve where the economy is assumed to be divisible into two totally homogenous groups. Group α is composed of the producers of X, all of which have equivalent utility functions. Group β incorporates all others, who are assumed to have equivalent preferences and share equally in their group's net product.

Constructing the Edgeworth box defined by point E, we shall let point O be the origin for the indifference map of group α (the X producers) and point E shall be the origin for group β. After production has been completed, initial endowments will be given by points such as I'_N or I_N. Endowment I'_N will be relevant if X producers have to exchange part of their product to purchase inputs. Endowment I_N will be relevant if X producers own productive factors required by other producers and if the amount of these resources is more than sufficient to acquire the inputs needed for X production.

[3] At one time N and R rules have been termed L and $\bar{L}$ laws (Mishan), and L^z and L^f are similarly defined "liability rules."

Within this model, the effect of adopting an R rule to replace the N rule is only to change initial resource endowments. The R rule weakens the welfare position of group α relative to group β regardless of whether the externality interdependence is positive or negative. Thus, the R rule causes new post-production endowments of either I_R or I'_R. Considering the two alternative endowments I_N and I_R, the price vector is given, in both cases, by the tangent to the *PPF* at E. In figure 1 the post-trade distribution of goods is shown for both N and R rules. Q_N and Q_R represent the Pareto optimal allocation of total product for N and R rules, respectively.

Under the above conditions the Pareto optimality of competitive equilibria is independent of ownership. When differential wealth effects are entered into the analysis, the difference in resource endowments will induce income effects which alter the aggregate demands for the two commodities. In this case the production equilibrium for the R rule may be different from point E, the production equilibrium for the N rule. Relative prices will be altered and new welfare positions will be attained. The equilibrium will, nonetheless, be Pareto optimal. Both N and R rules permit trade in the interdependence level, thereby correcting the externality within this highly simplified model.

To summarize, the extant externality represents an irrevocable interdependence among economic agents. If we begin with a situation resembling the N rule, then instituting an R rule constitutes a "reversal" of the active property right. N and R rules, both being acts of internalization through market creation, are beset by the same technical interdependencies among economic actors. Therefore, ownership reversal cannot bring about Pareto improvements in production or utility possibilities. Reversal may easily cause movements along *PPF*'s or *GUPF*'s, but outward shifts in these frontiers will not be possible. The effects of transaction costs represent a major caveat to this rule, a fact to be discussed shortly. For now, we state with confidence the following Coasian postulate.

POSTULATE 1. *Ownership reversal can never improve upon production or utility possibility frontiers in a world without transaction costs.*

Transaction Costs and Social Optimality

It is a trivial extension of presently accepted doctrine to expand the above model into the world

of nonzero transaction costs as follows. *N* and *R* rules differ, in general, with respect to both the total amount of transaction costs that these rules impose and the distribution of these costs. Differences in the distribution of these costs will interact with wealth effects and budget limitations to produce further differences in the resulting competitive equilibria. Distributional issues aside (momentarily), any positive amount of transaction costs will prevent otherwise advantageous transactions from occurring. At this point it becomes appealing to argue that transaction costs prevent competitive equilibria from achieving Pareto optimality. We do not, however, succumb to this temptation.

Transaction costs are real and unavoidable aspects of any economic system. It is not even possible to eliminate transaction costs by prohibiting all trade because such a decree would have to be deliberated and enforced and other institutions would emerge to replace banned markets. The inevitability of transaction costs means that any notion of Pareto optimality is incomplete until transaction costs are incorporated. In what follows we shall set about this task by inquiring how welfare frontiers such as the *PPF* and the *GUPF* are affected by the adoption of either *N* or *R* rules together with their implicit transaction costs.

At the beginning it is crucial to observe a few fundamental points regarding the interdependence which constitutes the general externality to which the *N* and *R* rules are directed. First, the interdependence is produced; it is not an inherent part of the environment but is the result of particular production and/or consumption activities undertaken by man. Second, the production of this interdependence is functionally related to one, several, or many different variables controllable by man. Third, the precise nature of this functional relation may be uncertain; indeed, some of the determining variables may be unknown. Fourth, it is costly to monitor both the interdependence level and its known determinants.

Incorporating Transaction Costs

Let us begin to introduce the effects of transaction costs through example. In the pursuit of killing weeds on my farm, I ameliorate a detrimental externality that I have been perpetrating upon neighboring farmers through the propagation of weed seed. My neighbors derive external benefit from my weed control activities as I do from similar actions taken by them. The reciprocity of this relationship does not mitigate the externality. I tolerate or take action against my weeds as I see fit, regardless of the actions taken by my neighbors. Each person's neighbors have the duty to receive weed seeds.

Let us contemplate an alternative ownership pattern, an *R* rule, in which my neighbors have an enforceable right to be free of the nuisance induced by my weeds. A pure *R* rule would assign me the duty to manage my farm in such a way as to prohibit the germination of "my" weed seed on any farm but my own. Otherwise, it will be necessary for me to purchase an appropriate amount of weed-seed-propagation rights for my farm—rights which are initially held by the neighbors under the *R* rule.

The terms of the *N* and *R* rules suggested in this example represent technically perfect statements of opposing property rights. On the one hand, I am free to allow my weed seed to germinate on others' land. Under the opposite rule, I must prohibit any weed seed from leaving my property and then germinating. The "perfection" of these rules lies in the fact that the alternative property rights are stated in terms of the actual interdependence, i.e., the amount of weed seed leaving my farm and sprouting on neighbors' farms.

Statement of property rules in any other terms would be technically imperfect. An obvious example would be if an *R* rule prevented me from having weeds on my farm without trading for the rights held by my neighbors. In this case, if I do not purchase rights to have weeds on my farm, then I must eliminate all weeds. No other method of controlling the spread and germination of weed seed is admitted. Clearly, the propagation of weed seed is related to the amount of weeds, but the relationship is not complete. For example, if I trim my weeds frequently, the propagation of seed will be minimal. I could chemically retard the formation of seed without killing the weeds. Or, at the extreme, my weeds may be of a hybrid, infertile variety. A property rule which is stated in terms of a surrogate measure instead of the actual interdependence will not recognize these and other possibilities. This situation applies to all externalities but to differing degrees.

Establishing a workable *R* rule favoring one's neighbors in the weed seed scenario requires that an index/measure be formulated. At least four alternatives exist for an *R* rule favoring one's neighbors. We could state that each landowner (*a*) may not allow his/her weed seed to ger-

minate on others' land, (*b*) may not allow his/her weed seed to move to others' land, (*c*) may not possess reproducing weeds, or (*d*) may not grow any weeds. Trade can occur following the adoption of any of these *R* rules, but only option (*a*) embraces the actual interdependence. Options (*b*)–(*d*) employ surrogates for the interdependence and therefore embody misconceptions regarding the interdependence. This is a problem of transaction costs because surrogates are otherwise unnecessary.

The essential point is that technically imperfect property rules do not recognize, by definition, certain externality control processes. If the property rule ignores a control mechanism which would have been employed under costless information, then the rule results in a *PPF* and/or a *GUPF* which is interior to the idealistic frontiers which ignored transaction costs. In a world devoid of transaction costs, imperfect formulations of property rules will be unimportant to efficiency. Without transaction costs, information shall be perfectly and universally available to all. Actual interdependence levels will be perfectly and costlessly monitorable, and precise relationships between externality generation and externality determinants will be known. In the absence of such idealistic conditions we have:

POSTULATE 2. *If a particular property rule is technically imperfect, then the PPF and GUPF will be shifted inwards even though transaction costs are otherwise zero.*

According to postulate 2, the effects of an imperfect property rule for externality "correction" cannot be fully overridden, and this restrains production and/or utility possibilities. While market activity with an imperfect rule presumably will bring about some mutually beneficial transactions, some beneficial transactions will be avoided and some bad transactions will occur because of incorrect judgments regarding the nature of interdependencies.

On the other hand, use of surrogate measures in property rules is a justifiable response to transaction costs. A technically perfect property rule can be informationally demanding in practice and thereby incur high transaction costs. Of the four identified options for defining a weed seed *R* rule, only option (*a*) is technically perfect. It is also economically onerous, for it is difficult to imagine the costliness of a monitoring network capable of tracking the origin, transport, and growth of weed seeds. Clearly, an economically rational response to transaction costs may be to select interdependence surrogates for property rule formulation. Why else would we buy and sell oranges by the pound when we truly desire juice and pulp of good quality (Barzel)? Why do western water rights specify acre-feet diverted rather than consumed? How closely does tons per acre per year really represent complex soil erosion interdependencies? Surrogate measures of externality interdependencies are important, and postulate 2 is therefore relevant.

The arguments presented thus far have not addressed the nature of the respective welfare frontiers for *N* and *R* rules that utilize equivalent indices. While transaction costs can exhibit some similarities for opposing *N* and *R* rules employing the same index, the effect is likely to be unique. The following postulate offers one reason.

POSTULATE 3. *Transaction costs increase with the distance between initial endowments and final (post-trade) allocations.*

The most important implication of this postulate is that transaction costs convey inertia to initially erected property rights. Because market participants are reluctant to incur transaction costs, the restraint to trade caused by the existence of transaction costs implies that post-trade allocations of rights will bear some resemblance to initial endowments.[4] The extent of the resemblance depends on both the magnitude and distribution of transaction costs: greater transacton costs giving rise to a greater resemblance between pre-trade and post-trade allocations. The distribution of these costs is also pertinent. For example, to the degree that transaction costs are borne by individuals (or entities) who are not directly involved in the interdependence (e.g., a government authority), the inertia of initial endowments will be lessened.

Once a particular property rule and the mechanism for enforcing this rule are adopted, the amount and distribution of transaction costs are more clearly assigned (though still unknown). That is to say, the burden of information generation is more apparent. As a consequence of adopting a specific rule, traditional production and utility possibility frontiers must be shifted inward to reflect the amount of resources which are consumed for the production of information

[4]Randall (1983) has observed this consequence of transaction costs and has also stated that the income effects of alternate property rules cause similar differences in post-trade allocations.

and lost because of imperfect decisions made under imperfect information. That is, the traditional concepts of *PPF* and *GUPF* do not incorporate the very real costs imposed by transaction costs. Once property institutions are known, adjustments to welfare frontiers within our theoretical constructs can and should be performed to account for these costs.

POSTULATE 4. *Once transaction costs are admitted, different property rules give rise to different welfare frontiers.*

In figure 4 the *PPF* relating to a hypothetical *R* rule is drawn as the locus PPF_R which lies strictly interior to the original, idealistic frontier. For generality PPF_R lies strictly interior to the old frontier to indicate that information generation will occur even in the absence of transactions. Transaction costs incurred by the public sector would also be incorporated in determining PPF_R. Property right inertia due to the inherent transaction costs of the *R* rule implies a proportionately greater inward shift along the lower end of the *PPF* (assuming that the *R* rule was imposed for a detrimental externality).

Similarly, PPF_N represents production possibilities for the *N* rule. Presumably, inertia under the *N* rule will favor greater production possibilities for *X* in comparison to the *R* rule. Under the *R* rule, larger amounts of bargaining and monitoring activities must be pursued in order to have a larger production of *X*, that is, a greater number of rights must be exchanged.

Each of these production frontiers relates to a specific *GUPF* which also incorporates transaction costs. It is not, however, true that intersecting production possibility frontiers produce intersecting grand utility possibility frontiers. It is therefore feasible for either $GUPF_R$ or $GUPF_N$ to be everywhere superior.

Regardless of the relative positions of the two pairs of welfare frontiers, we might impose social indifference curves of the form

$$W = W(U_\alpha, U_\beta)$$

on the alternative *GUPF*'s, as in figure 5, in order to determine whether the *N* or *R* rule is socially preferred. Equivalently, as in figure 6, welfare indifference curves of the Bergson variety,

$$B = B(\$, X),$$

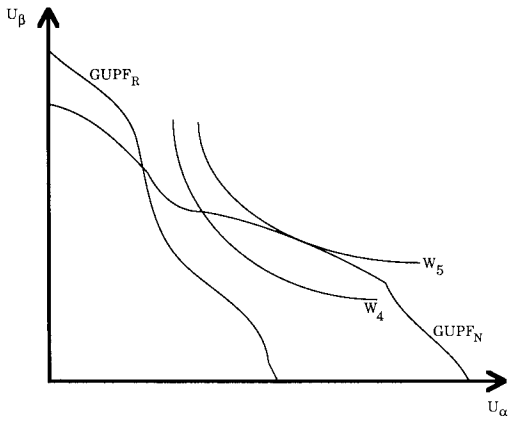

Figure 5. Social optimization in utility space

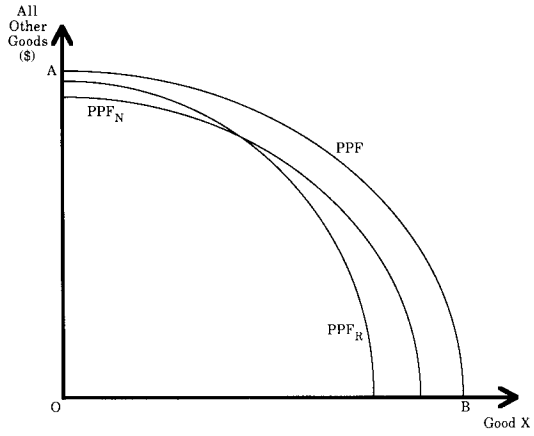

Figure 4. Production possibilities for alternative endowments with transaction costs

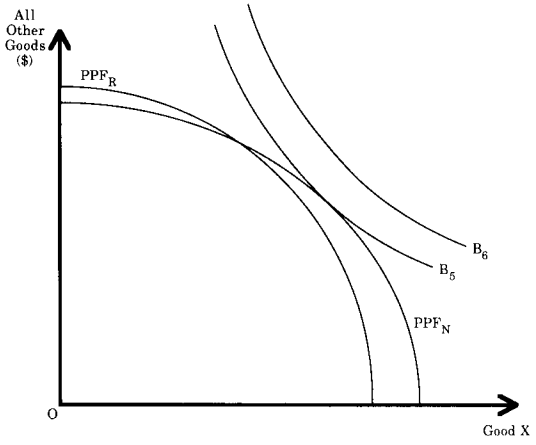

Figure 6. Social optimization in goods space

could be drawn together with the two alternative *PPF*'s to illustrate the socially optimal property rule. Either approach is flawed.

Choice between Opposing Property Rules

While the imposition of social indifference curves is a nice theoretical device for illustrating the "optimal" choice of property rule with transaction costs, it is neither realistic nor helpful. Beyond the obvious acknowledgement that we do not possess a social welfare function, these devices treat every point on the welfare frontiers as being attainable even though each frontier corresponds to a particular distribution of the property rule in question.

The welfare frontiers in effect for the two distinct property rules can become determinant only by incorporating the burden of information costs. This, in turn, requires distribution of the property right under examination. However, this same fixity tends to define the resulting competitive equilibrium by declaring an initial endowment. Each such endowment will presumably support a unique competitive equilibrium which is represented by a single point on the appropriate welfare frontier.[5] Because true welfare frontiers must incorporate transaction costs and because the inclusion of transaction costs requires property right specification which then fixes the competitive equilibrium, the concepts of Pareto optimality and competitive equilibrium appear to come perilously close to being definitionally identical. Randall (1983) has employed this closeness to argue that "externality" and "Pareto relevance" are vacuous terms. This argument is feasible only when nonmarket institutions are assumed inferior and no Pareto-inefficient definitions of property rights are envisioned.

Focusing now on the correct interpretation of the choice between polar *N* and *R* rules, it is clear that the two alternatives present distinct welfare frontiers. Furthermore, only one point on each of these frontiers, the competitive equilibrium, is relevant to the decision. In figures 7 and 8 the diagrammatic illustration of a newly emerged production externality is continued.[6] Regardless of whether the new interdependence is positive or negative, the *N* rule favors the producers of the externality, in this case the producers of *X*. As depicted in figure 7, the *N* rule results in an initial endowment given by I_N, an output vector given by *F*, and an output distribution of Q_N. The determination of these three points is simultaneous; even I_N is dependent on *F* since I_N represents post-production claims on net output.[7] Because property right inertia brought on by transaction costs will favor greater *X* production under an *N* rule than an *R* rule, point *F* lies to the left of point *G*. Post-production endowments and output distribution are similarly depicted for the *R* rule.

Contract curves *OF* and *OG* in figure 7 define utility possibility frontiers in utility space where α and β are the groups of completely homoge-

[5]Lump-sum transfers of other resources could be mistakenly viewed as making viable equilibria out of other points along $GUPF_N$ or $GUPF_R$. This is an oversimplification that underestimates the difficulty with which redistributive policy is performed. It is one thing to design an externality-addressing property rule of the sort under discussion here and quite another to pair such a rule with an unspecified redistributive policy. Such a policy would be accompanied by its own unique burden of transaction costs. In the face of these costs neither $GUPF_N$ nor $GUPF_R$ is relevant. Another frontier recognizing the particulars of the chosen transfer policy is needed. Each property rule *or* each pairing of a property rule and a lump-sum transfer policy will be associated with a unique *UPF*. Subsequent action by individuals will lead to a point on this frontier.

[6]Production-consumption and pure consumption externalities can also be illustrated in this framework. Where production activities have externality impacts on utility functions, indifference mappings (and contract curves and utility possibility frontiers) will depend on equilibrium production. Where production opportunities are affected by consumption activities, production possibility frontiers will be jointly interrelated to actual consumption. Nonmarket interrelationships between consumers will likewise shift indifference maps and utility possibility frontiers. In all of these situations *N* and *R* rules will necessarily induce disparate utility possibility frontiers. Moreover, since wealth effects may generally occur and transaction costs may vary, different production possibility frontiers may result from *N* and *R* rules.

[7]As demonstrated with figure 1, the placement of I_N is rather arbitrary. Its exact location is not important for the purposes of the present discussion.

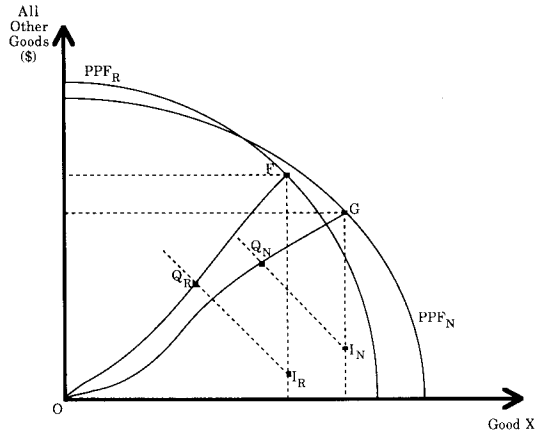

Figure 7. Equilibria for alternative endowments with transaction costs

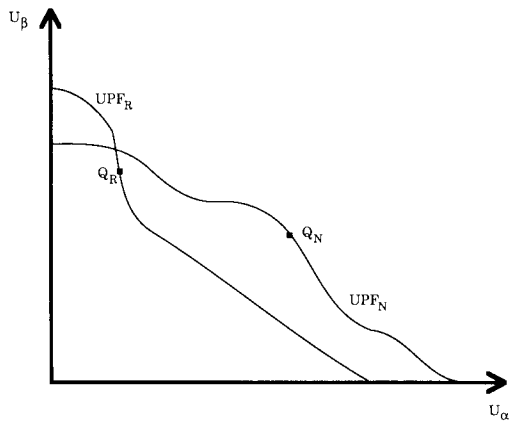

Figure 8. Equilibria with transaction costs in utility space

nous X-producers and all others, respectively.[8] These welfare frontiers are illustrated in figure 8 as are the equilibrium utility levels resulting from human action within the whole system of preferences, technology, and institutions. Points Q_R and Q_N completely summarize the welfare implications of property right choice. There are no conditions to prevent one of these equilibria from lying within the frontier defined by the other property right (as depicted in fig. 8). Nor is this relevant. The choice between property rules is a choice between the equilibrium outcomes rather than between the frontiers on which the outcomes lie. Each welfare frontier is not completely feasible. Economic activity cannot lead to an arbitrary point of the frontier.

POSTULATE 5. *The incorporation of transaction costs required for realistic welfare frontiers has the side effect of rendering irrelevant all but one point on the welfare frontier. The choice between opposing N and R rules is a choice between two and only two economic states.*

Therefore, the choice between N and R rules is reduced to a choice between Q_N and Q_R. The welfare frontiers are inconsequential, and the only choice involves whether group α or β is to be favored. Moreover, the choice itself is likely dominated by pre-existing social institutions constituting the fabric of mutual coercion. In specific instances these institutions may rigidly dictate which property rule (and which group) is to be ascendant. Of course, to the extent that flexibility in property right choice remains, we can expect each group to exploit its noneconomic opportunities for property right capture.[9]

Because of these facts, it is rarely possible for economists to interpret property rule reversals as economically inefficient. Regardless of the relative positions of welfare frontiers, the alternative economic outcomes will be Pareto noncomparable as in figure 8. Only in rare cases where Q_N is preferred to Q_R (or vice versa) by both α and β can a clear position be taken.

Institutional Choice

By utilizing two different applications of the same institution, the preceding discussion has demonstrated the dependence of economic efficiency on institutional choice. Were it not for transaction costs, postulate 1 would apply, and Pareto optimality would be divorced from the selection of institution. It should be noted that the Pareto optimality of competitive equilibria has not been investigated here (as in the Coase theorem) but has been taken for granted. Previous sections have considered the ramifications of incorporating transaction costs into the determination of Pareto optimality. By making transaction costs endogenous, the choice between N and R rules becomes a choice between two different economic states, both being Pareto optimal. Production and utility possibility frontiers are irrelevant because they are infeasible. Each of these property rules is capable of supporting a single Pareto optimum.

It is now appropriate to enrich this analysis with a consideration of internalizing institutions other than N and R property rules. Many such institutions are important, but an exhaustive listing of these would be tedious. Even so, considerable insight can be achieved by inspecting some of the more noteworthy alternatives. First among these is the multitude of property rules lying along the spectrum whose endpoints are defined by N and R rules.

Other Property Rules

Between the two extremes represented by N and R rules, there is a large, indeed infinite, number

[8]The presumed uniqueness of the competitive equilibrium implies that only one point on the production possibility frontier (and, therefore, only one contract curve) is relevant. Thus, a single utility possibility frontier, not the grand utility possibility frontier, is the appropriate concept relating to a specific property rule.

[9]As Bromley has observed, it is the incidence of gains rather than the opportunity to obtain net social gains that motivates institutional change (1989, p. 240).

of alternative property rule specifications. These choices differ with respect to the endowed level of interdependence that instigators can/must generate and, simultaneously, the endowed level of interdependence that receptors must tolerate/enjoy. Expanding upon Bromley (1989), it could be said that we are now exploring alternate linear combinations of rights and duties. For example, property rules could vest farmers with (*a*) the right to grow 100 weeds per acre and the duty not to exceed this amount, (*b*) the right to generate two tons of soil loss per acre per year and the duty not to lose more soil than this, (*c*) the duty to produce 200 pounds of oranges each year and the right to output in excess of this amount, etc. Transfer of these endowments is allowed and is the basis of market activity. In the case of the typical marketed commodity, manufacturers are empowered to produce and withhold the commodity. Potential consumers must tolerate this authority unless they purchase a portion of these rights.

In the case of a positive externality a property rule can be adopted which forces each instigator to produce y units of the interdependence. At the same time such a rule will specify the initial allocation of these y units (assuming rivalness) among the interdependence benefactors. The quantity y can be any positive number, thereby illustrating the infinite possibilities for alternative property rules. Clearly, if y is identically zero, then we have an *N* rule. As y gets large, the property right trends towards becoming an *R* rule. This indicates an area where the earlier discussion was not definitive. In the case of a beneficial interdependence the magnitude of y needed to erect an *R* rule is ambiguous.[10]

Consideration of property rights which are intermediate to *N* and *R* rules or which employ alternative surrogate indices for the true interdependence simply generalizes earlier discussion. Some of the more important conclusions bear restatement under these more general conditions.

- Each alternative property rule will exact its own unique magnitude and distribution of transaction costs. In each case ensuing transactions will be vectored by the current information base regarding known and economically measurable determinants of the externality interdependence.
- Property rule inertia induced by transaction costs will favor the initial distribution. In this way different property rules imply different distributions of attainable economic welfare.
- Each distinct property rule will be associated with a single attainable point in utility space (postulate 4). In general, many of these points will be Pareto noncomparable.

Using the same techniques employed to obtain figures 7 and 8, the attainable levels of welfare associated with alternative property rules can be shown in utility space. The outer limit of these points depicts the choices inherent to the choice among alternative property rules (fig. 9). This locus (possibly discontinuous) might be termed the Property Rule *UPF*. When property rules represent the only institutional variant for addressing an externality relationship, this frontier fully depicts the scope and implications of institutional choice. Every point on this frontier is attainable in the sense that actual transaction costs are endogenous.

The welfare frontier depicted in figure 9 must not be confused with the traditional concepts of *UPF*'s or *GUPF*'s. *UPF*'s are utility space mappings of contract curves, and a *GUPF* is the outer limit of an infinite number of *UPF*'s (one for each point on the *PPF*). The property rule *UPF* in figure 9 is composed of single points from a particular class of *UPF*'s incorporating transaction costs. The Property Rule *UPF* is not an outer limit of these *UPF*'s, but it is the outer limit of competitive equilibria lying on the *UPF*'s. The property rule for a single externality interdependence is variant along the welfare frontier depicted in figure 9; all other institutions are fixed. Social constraints which might narrow the feasible set of property rules for this

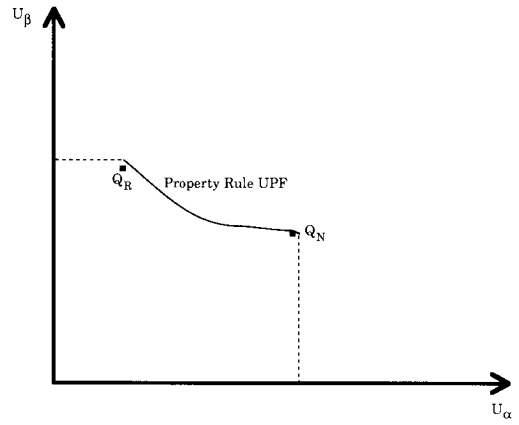

Figure 9. Property rule utility possibility frontier

[10]Similarly, in the case of a detrimental externality y would denote the amount of the interdependence that instigators are allowed to produce. Under these conditions $y = 0$ implies an *R* rule, and the size of y necessary to achieve a pure *N* rule is indeterminate.

interdependence have been disregarded in the construction of this frontier.

Liability Rules

The welfare frontier originating from the preceding discussion lays the basis for similar analysis involving broader dimensions of institutional choice. Certainly, the analysis should be extended to include liability rules. It has been demonstrated that liability rules differ dynamically from property rules (Buchanan and Faith, Frech). The static nature of the economic tools being employed here prevents immediate attention to these dynamic elements. There appears to be little opportunity to usefully depict the effects of today's institutions on tomorrow's welfare frontiers except by adding a time dimension to the welfare frontiers, and this extension is not pursued here.

Liability rules also differ from property rules in terms of transaction costs and the degree of afforded protection. Liability rules offer less protection to endowed individuals than do property rules. Therefore, the liability rule possesses less market value. Transaction costs are distributed quite differently when comparing liability rules to property rules (Bromley 1978), and, since the *ex post* determination of value in the case of liability rules requires an expensive judicial system, a large portion of transaction costs are borne by third parties. Like property rules, alternative surrogates are available and liability rules are continuously assignable, and, therefore, a Liability Rule *UPF* similar to that in figure 9 is presumably applicable.

Government Externality Policy

The final major category of externality-addressing institutions to be separately considered here pertains to various forms of government policy. Types of government policy traditionally discussed by economists include quantity-guided controls such as prohibition, standards, and regulation in general, as well as price-guided controls such as taxes, charges, subsidies, cost-sharing, and various other economic incentives. Perhaps the only characteristic serving to unify this class of institutions is that they are all modes of nonmarket activity. However, economic incentives are usually characterized as decentralized while regulation is quite centralized (Schultze), and a great deal of literature is devoted to contrasting these two subgroups.

Like the variety of property institutions which address externality interrelationships, the purpose of these alternative forms of nonmarket activity is to assist in establishing social and economic structure. The use of surrogate measures is also relevant. Market and nonmarket institutions are quite similar in that neither avoids transaction costs and in that reversal is a relevant approach for contrasting polar images of the same institution. For example, in the case of beneficial externality, a regulation can conceivably state that a producer of the externality need not produce the interdependence at any level or, alternatively, that a producer must produce y units of the interdependence. Because these are regulations, trade in these units between instigators and receptors is not possible in either case. If the externality takes on aspects of a rival good in that its use is consumptive, then the regulation might also state a distribution of these y units among recipients.

In this way, transaction costs pertaining to the direct relationships between instigators and receptors are greatly lessened. Instead, transaction costs are incurred via the relationships between instigators and government, on the one hand, and between government and receptors on the other. As with market exchange processes, transaction costs can be quite substantial, and polar regulations or polar incentives will differ greatly in the magnitude and distribution of transaction costs. Because of the existence of transaction costs, perfect enforcement of regulations is not attractive, and, depending on the magnitude of administrative transaction costs, resulting economic activity will stray from promulgated regulations. Still, as is the case with property rules, resulting economic activity will bear some resemblance to established regulations and will be sensitive to regulatory choice.

It must therefore be clear that alternative forms of government policy or alternative specifications of the same policy will relate to different levels of attainable welfare. Technology is unaffected by available policies in this static setting; but, once a policy is chosen, transaction costs influence the outcomes which result in attained welfare. Again, if the concept of economic efficiency truly relates to attainable levels of welfare, then the concept cannot be independent of policy alternatives. Different policy actions induce different levels and distributions of transaction costs, and it is not accurate to say that one particular policy is economically efficient without accounting for these differences.

It comes as no surprise at this point that each nonmarket (policy) alternative is to be associ-

ated with a single economic outcome in terms of production, consumption, and utility levels. This outcome is selected by the whole of individual and collective action from transaction-cost-endogeneous welfare frontiers. Moreover, the results of many of these policies will not be Pareto comparable, and the locus of outermost production or utility levels can be used as an efficiency frontier for nonmarket action.

Institutional Welfare Frontiers

Because Pareto optimality cannot be divorced from institutional alternatives for a given externality, any welfare frontier depicting the range of efficient economic states must consider a variety of institutions. Institutional alternatives are endogenous to the construction of true welfare frontiers. It is evident at this point that the revised construction of welfare frontiers, elucidated earlier in the context of variable property rules, can be readily expanded to incroporate a much broader range of institutions.

Implementation of different property rules, liability rules, regulation, incentives, customs and behavioral standards, and other nonmarket devices are construed as separate institutions with distinct economic consequences. The inherent transaction costs of each specification of each institution will produce an institutionally specific production possibility frontier and utility possibility frontier, but individual action within the system of constraints and incentives will succeed in isolating a single point on each of these frontiers. Other points on these frontiers are not feasible (in the sense that they will not be chosen) and, therefore, are not entertainable as efficient. Various economic states then correspond to various institutions. Where these states are Pareto comparable, specific choices can be identified as inefficient. Minimally, there are property rule, liability rule, and nonmarket UPFs applicable for each externality. Superimposing these welfare frontiers and forming the outer limit to eliminate all inefficient alternatives will reduce the institutional choice set to a Pareto noncomparable group. This group is representable by a curve or surface in utility space which shall be called the Institutional *UPF* (*IUPF*) (not illustrated). The modifier "grand" is unnecessary here, but the frontier is, indeed, grand in the sense that it embodies the full spectrum of internalizing actions available for a given interdependence. All forms of ownership, protection, nonmarket policy, and, in general, all aspects of mutual coercion are endogenous to the *IUPF*. Grand utility possibility frontiers of earlier literature only incorporated resource and technological constraints. The *IUPF* also accounts for the range of humanly imposed constraints available to order human interaction.

An institutional *PPF* can also be illustrated in output space; each point on this efficiency locus corresponds directly with a point on the *IUPF* and a particular institutional specification. However, the *IUPF* is generally a more fundamental and interesting concept because it highlights resultant utility levels. While variable institution welfare frontiers definitely connote abstract concepts, they are no more abstract than traditional welfare diagrammatics and are far more useful as a paradigm for institutional choice.

Implications for Portraying Institutional Choice

Within the framework provided by variable institution welfare frontiers, shifts in property assignments and nonmarket policies are best depicted as movements within the region bounded by the *IUPF*. This pertains to the choice of new or different institutions as well as incremental changes in a certain type of institution. Pareto-relevant externalities are properly characterized as interdependencies currently being addressed by market/nonmarket structures associated with economic states that are strictly interior to the *IUPF*. Pareto-irrelevant externalities are those relationships being accommodated by institutions which place the economy on the *IUPF*.

One approach to "remedying" an externality is judged to be better than another on the basis of the Pareto criterion, and, in this way, the *IUPF* leads to an institutionally unbiased comparison of alternative choices. The potential usefulness of variable institution welfare frontiers as a theoretical concept stems from this unbiasedness. In practice, it is unacceptable to define externality as an "interdependence without a market." An externality is merely an interdependence. If an externality is Pareto-relevant (we are not on the *IUPF*), then some sort of policy is needed, but that policy is not necessarily a market.

Most important, these frontiers are not idealistic in that an unachievable norm for efficiency is maintained. Variable transaction costs and the effects of these transaction costs are endogenous. Social action for externality amelioration is therefore justified if current institutions do not place the economy on the *IUPF* or if current institutions do place the economy on this fron-

tier but with undesirable distributional consequences.

One purpose of this theory is to give explicit recognition to the fact that externalities do not emerge into institutional voids but are always being addressed by some, perhaps very subtle, coercive structure. In this sense externality correction, resolution, and internalization are all vague terms unless they refer to institutions which, if adopted, would move society to the *IUPF*. Because a proper analysis incorporating transaction costs has never been performed to investigate the global efficiency of a prospective institution, the applicability of such terms is highly questionable in all but conceptual work. Moreover, the empirical difficulties to be encountered in such a rich analysis imply that the chances of ever satisfying this requirement are quite remote.

Finally, it is impossible to appeal to economic efficiency (in the Paretian sense) as a norm to guide institutional choice. Taking the *IUPF* and dimensioning it into hyperspace to accommodate a utility axis for every individual has the effect of grossly multiplying the number of Pareto noncomparable (and therefore efficient) institutions. The economic analysis of social options intended to accommodate a given externality interdependence will rarely be able to consider a wide range of alternatives. Agenda formation within decision-making and research processes almost certainly excludes many institutional alternatives because of the limited scope of these processes and our limited abilities to understand and characterize many alternatives. Institutional bias may always be present because selection is from a subset of the actually available institutions.

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