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When Are Law and Economics Isomorphic?

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WHEN ARE LAW AND ECONOMICS ISOMORPHIC?

by

John Cirace*

A foolish consistency is the hobgoblin of little minds, adored by little statesmen and philosophers and divines.

With consistency a great soul has simply nothing to do.

Ralph Waldo Emerson, *Essay on Self-Reliance* (1841)

When the legal community says that the law is a rational decision process, it generally refers to the way in which judges decide cases. However, the concept of judicial rationality is ambiguous because judges use two rational decision processes: legal rationality and economic rationality. Legal rationality is based on the principle of precedent, stare decisis, which requires that judges decide like cases alike. Judges determine whether cases are like or distinguishable through the construction of legal classifications and relations between cases based upon the recognition of similarities and differences.¹

Economic rationality is concerned with balancing competing interests via marginal trade-offs. Whenever judges balance competing interests via marginal trade-offs, for example, when judges engage in cost-benefit analysis, they implicitly use economic optimization theory. In the law of torts, Judge Learned Hand’s test (B < PL) for negligence is a specific example of cost-benefit analysis; the level of care (precaution) at
which the marginal cost of accident prevention, B, is equal to the marginal benefit from a reduction in accident damage, PL, is the optimal level of care.

Judge Richard Posner has said:

There is a remarkable isomorphism between legal doctrine and economic theory. . . . The isomorphic relation is illustrated by Judge Learned Hand’s formula of negligence in United States v. Carroll Towing Co.\([2]\) . . .”

There are many other important examples of isomorphism between legal doctrine and economic theory; indeed, I regard it as pervasive.\(^3\)

Law and economics are isomorphic if there is a correspondence rule or mapping of concepts from one discipline into the other that preserves properties and results of operations in both disciplines.\(^4\) The Judge Hand test is an example of an isomorphism between law and economics: in the law of torts, every negligence case in which the economic relation $B < PL$ holds corresponds to or can be mapped into the legal category of “negligence”; every negligence case in which $B \geq PL$ holds corresponds to or can be mapped into the legal category of “due care”, and vice versa.

Although Judge Posner’s assertion that examples of isomorphism between law and economics are “pervasive” is consistent with ideas expressed in his well known book, **ECONOMIC ANALYSIS OF LAW**,\(^5\) in other contexts, he has denigrated legal reasoning and placed it in a subordinate position to economic reasoning.\(^6\) Other law and economics scholars also tend to argue that law should adopt the methodology and the efficiency goal of economics.\(^7\) In short, they do not take law seriously.
The purpose of this article is twofold: First, to provide a formal statement of legal rationality that is parallel to and can be compared with the standard formal statement of economic rationality. Second, to discuss the conditions under which it is possible to map economic concepts into legal concepts so as to preserve properties and results of operations in both disciplines. In other words, this article answers the question, how are law and economics related to each other?

The formal description of economic rationality in terms of elementary mathematics of binary relations and their properties, such as reflexivity and transitivity, which is presented in this article, is part of the standard theory found in intermediate microeconomic textbooks. Although legal rationality is not usually discussed formally in terms of binary relations and their properties, such as reflexivity and transitivity, this description is implicit in the Tussman & tenBroek model of equal protection of the laws.

There are three conclusions: First, legal rationality is a separate and distinct rationality from economic rationality. Second, if judges are willing to balance competing interests through marginal trade-offs, economic rationality will be the dominant rationality, in which circumstances economic rationality and legal rationality will often be isomorphic or close to it because economic concepts can be mapped into relevant legal concepts, which judges will tend to interpret so as preserve the properties and results in both disciplines. However, if judges employ legal rationality as the dominant rationality, legal rationality and economic rationality are often neither isomorphic nor consistent because there is often no mapping from legal concepts to economic concepts that will preserve properties and results in both disciplines. For example, in cases involving fundamental rights, legal rationality and economic rationality are often totally at odds
because there is no way to map or translate one into the other; that is, they can not speak to each other.

Third, economic rationality is *completely ordered* (complete consistency) whereas legal rationality is merely *partially ordered* (partial consistency). Practically speaking, this difference means that economic rationally has a unique global maximum corresponding to economic efficiency, whereas legal rationality has multiple local maxima, which may be discrete and unrelated to each other or may be *nested* within broader local maxima such as due process, equity, and equal protection of the laws. Whether or not legal rationality’s local maxima are discrete or nested is crucial for the question of whether the principle of stare decisis is a weak or strong constraint on judicial decisions.

In Section A, the three essential elements of a rational decision process are defined. In Section B, the standard model of economic rationality is explained in terms of binary relations and their properties. Section C is concerned with “well behaved” preferences and Arrow’s Impossibility Theorem, which, in the judicial context, is concerned with whether appellate judges, who employ economic rationality and decide cases by *majority rule*, can make collectively rational decisions. In Section D, the classic Tussman & tenBroek model, in which equal protection categories and relations from constitutional law are described with Venn diagrams, is presented and translated into binary relations. In Section E, the model of legal rationality is stated and explained in terms of binary relations and their properties. Then, the principle of precedent, stare decisis, which is the law’s principal institutional constraint, is discussed. The case selection hypothesis, which economists have used to argue that the common law tends
toward economic efficiency, is also shown to apply in legal rationality to the tendency of common law adjudication to move toward optimal size legal categories and rules of law. Next, the question, whether legal rationality’s local optima are separate and discrete or are nested, is discussed. The answer to this question is crucial for whether the principle of precedent, stare decisis, is a weak or strong constraint. Section F is concerned with the relevance of the Impossibility Theorem to panels of appellate judges, who employ legal rationality and make decisions by majority rule. Section G is concerned with the conditions under which economic rationality and legal rationality are isomorphic. Five examples, which concern judicial decisions in entrapment cases, the potential conflict between efficiency and distributional equity (two examples), and the conflict between fundamental rights and security (two examples), are discussed.

A. THE THREE ELEMENTS OF A RATIONAL DECISION PROCESS

Both economic optimization and legal adjudication are rational decision processes. When asked to describe the essential elements of their disciplines, both economists and lawyers tend to emphasize the criterion of consistency. A philosopher, Robert Nozick, wrote that “rationality is a matter of reliability.” The reliability element of rationality accounts for the emphasis that both economists and lawyers place on consistency in their explanations of economic and legal decision-making.

Nozick also said and that rationality is a goal directed or instrumental process. This is a second element of a rational decision process. The textbook definition of economics, the allocation of scarce resources among competing ends, includes the goal
directed element because individuals who allocate resources are assumed to maximize satisfaction, utility, or profits. These two elements of a rational decision process, purposefulness and consistency, are related because consistency criteria govern the permissible relations among means and ends.13

The textbook definition of economics also suggests a third element of a rational decision process, which is defined in part by the constraints that hinder a rational actor from achieving her or his goals. In economic rationality, the achievement of purposes or goals is subject to various scarcities in the form of budget, cost, and other constraints.

In sum, a rational decision process 1) is purposeful or goal directed, 2) has a criterion of consistency, and 3) is subject to constraints.

Legal adjudication also exhibits the three elements that define a rational decision process. Legal adjudication is purposeful because judges and lawyers are constantly refining and clarifying the goals and issues that are to be decided in cases. It is not possible to determine which facts of a case are material unless one knows the purpose for which they are probative: For example, in a negligence case, if the goal is deterrence of careless behavior, one set of facts is material; however, if the goal is risk distribution or enterprise liability, another set of facts, having to do with who is the cheapest insurer, is material.14 First-year law students are taught to begin briefs for mock appellate court competitions with a question which frames the issue that the court is to decide so as to focus the court on facts most favorable to their side of the case.

Legal rationality has a criterion of consistency analogous to that of economic rationality: In economic rationality, it is assumed that when presented with any two bundles of goods (or outputs), an individual can determine whether he or she prefers one
to the other or is indifferent between them. When this principle or axiom is stated in terms of elementary mathematics of binary relations, one of its properties, transitivity, is the consistency criterion of economic rationality. In legal rationality, it is assumed that when presented with any two cases, a judge can determine whether the cases are like in all material respects or are distinguishable; that is, given any two cases, a judge can determine whether or not one case is a binding precedent for the other. When this principle or axiom is stated in terms of elementary binary relations, one of its properties, transitivity, is the consistency criterion of legal rationality. Finally, the principle of precedent, stare decisis, is the law’s principal institutional constraint; that is, stare decisis mandates that judges are required to (must) decide like cases alike.

B. THE MODEL OF ECONOMIC RATIONALITY

1. THE ECONOMIC AXIOMS

The following brief exposition of economic rationality is similar to that found in many intermediate microeconomics textbooks. Definitions specify fundamental abstract categories and collections of categories, state that economics is purposeful or goal directed, and is subject to constraints. Economic rationality is specified by two axioms (or accepted principles): Axiom E1 assumes that individuals maximize their goals; when Axiom E2 is stated in terms of binary relations, one of its properties, transitivity, is the consistency criterion of economic rationality.
**DEFINITIONS**: The fundamental abstract categories of economic rationality are called “goods”, which represent products and services. Collections of goods are called “bundles”, among which self-interested individuals are assumed to choose so as to maximize utility or satisfaction, subject to budget constraints; that is, individuals weigh costs and benefits. Alternatively, “inputs” (land, labor, and capital), are used to produce “outputs”, which firms are assumed to choose so as to maximize profit; that is, maximize the difference between revenue (benefits) and costs.

**AXIOM E1** (Individuals Maximize Their Goals): More of a good is preferred to less. (Alternatively, more profit is preferred to less.)

Although an individual can become sated with any one good, “the interesting region from the viewpoint of economic choice is where you have less than you want of most goods. The choices that people actually care about are choices of this sort, and these are the choices with which we will be concerned.”

The economic axioms are given mathematical interpretation in terms of binary relations, which are defined on real numbers: \( x \succ y \), which is read as “\( x \) is strictly preferred to \( y \)”; \( x \succeq y \), which is read as either “\( x \) is weakly preferred to \( y \)” or “\( x \) is as least as good as \( y \)”; and, \( x = y \), which is read as either “\( x \) is equal to \( y \)” or “an individual is indifferent between \( x \) and \( y \)”.
AXIOM E1 (stated in terms of binary relations): If \((x_1, x_2, \ldots, x_n)\) is a bundle of goods, and \((y_1, y_2, \ldots, y_n)\) is a bundle of goods with at least as much of all goods and more of one, then \((y_1, y_2, \ldots, y_n) > (x_1, x_2, \ldots, x_n)\).

Axiom E1 states that preferences are monotonic: if there are two bundles of goods, such that the second bundle has at least as much of every good as is in the first bundle and more of one good, then the second bundle is strictly preferred. In the two-dimensional space of Figure 1, Bread and Apples, which represent any two economic goods, are depicted on two axes, Bread on the horizontal axis and Apples on the vertical axis. Consider any arbitrarily chosen bundle, say Bundle x, which consists of three loaves of Bread and four Apples. Two lines are drawn through Bundle x, so that each line is perpendicular to one of the axes; these two lines divide the commodity space into four regions with Bundle x at the intersection. Because of Axiom E1, any bundle in region III is strictly preferred to Bundle x because all bundles in region III have more bread, more apples, or more of both. By similar reasoning, Bundle x is strictly preferred to any bundle in region I because all these bundles have less bread, fewer apples, or less of both.

However, with respect to the relation between Bundle x and any bundle in regions II and IV, Axiom E1 does not define any relation between Bundle x and any bundle in these regions because all these bundles have more of one good and less of the other good than Bundle x. (Axiom E1 is a partial order relation, as defined below.)

Axiom E2 eliminates that indeterminacy between Bundle x and any bundle in regions II or IV and provides the logical foundation for balancing of competing interests via marginal trade-offs.
**AXIOM E2** (Preference or Indifference Relation): For any two bundles of goods, an individual can determine whether he or she prefers one bundle to the other or is indifferent between them.

![](image)

**Figure 1**

**AXIOM E2** (stated in terms of binary relations): For any two bundles of goods, x and y, one of the three binary relations, $x \succeq y$, $y \succeq x$, or $x = y$, must be true. (Alternatively, for any two outputs, x and y, one of the three binary relations, $x \succeq y$, $y \succeq x$, or $x = y$ must be true.)

The binary relation $x \succeq y$, defined on real numbers, has four properties, which together define a “total order relation” (total or complete consistency).\(^{17}\)

**Reflexive:** The binary relation $x \succeq x$ is trivially reflexive; that is any bundle $x$ is at least as good as itself, $x \succeq x$. 
**Transitive**: The binary relation $x \succeq y$ is transitive: whenever $x \succeq y$ and $y \succeq z$, then $x \succeq z$.

The transitivity property of the binary relation $x \succeq y$ is the consistency criterion of economics.

**Antisymmetric**: The binary relation $x \succeq y$ is antisymmetric because $x \succeq y$ and $y \succeq x$ imply $x = y$.

**Complete**: The binary relation $x \succeq y$ is defined for any two bundles; that is, for any two bundles $x$ and $y$, one of the three binary relations $x \succeq y$, $y \succeq x$, or $x = y$ must be true.

**Total Order Relation (Linear Order Relation)**: Axiom E2 is a total order relation, which is defined as a relation that is reflexive, transitive, antisymmetric, and complete. A total order relation is also suggestively called a linear order relation because its properties guarantee that it is possible to rank order all bundles, outputs, or even cases at law (when economic rationality is being used by judges).

Choices involving marginal trade-offs concern the relation between Bundle $x$ and bundles in quadrants II and IV. Assume that the goods in Figure 1 are infinitely divisible. Given a Bundle $m_+$ in the upper right part of region II, which is assumed to be preferred to Bundle $x$ because it contains a great many more apples than Bundle $x$ but only slightly less bread, and a Bundle $n_-$ in lower right part of region II, which is assumed to be inferior to Bundle $x$ because it contains very little bread and only slightly more apples than Bundle $x$, there must be a bundle, Bundle $p_0$, between Bundle $m_+$ and Bundle $n_-$ for which the individual is indifferent between this bundle and Bundle $x$. A consumer could be asked to express her or his preference or indifference with respect to every bundle in regions II and IV in relation to Bundle $x$. An indifference curve can be drawn which
connects all the bundles with zero subscripts in regions II and IV with reference to Bundle x. This procedure for constructing an indifference curve, I, can be repeated in relation to any bundle within the Apple-Bread axes, so that indifference curves are said to be “everywhere dense”. All bundles on the same indifference curve occupy the same rank; bundles on higher indifference curves occupy higher ranks. Economic rationality is completely ordered in this sense. The transitivity property of Axiom E2 implies that indifference curves cannot intersect.

An individual is indifferent among all bundles on an indifference curve, even though these bundles have different amounts of bread and apples. In Figure 1, as an individual moves along indifference curve I from right to left, the marginal rate of substitution in terms of the trade-off between apples and bread, which is equal to slope of the indifference curve (\(\Delta\text{Apples}/\Delta\text{Bread}\)), increases (in going from left to right along the indifference curve, the marginal substitution ratio decreases). This makes sense because as an individual has more of one good and less of another good, the good one has less of becomes more valued relative to the more plentiful good, so that indifference can only be maintained if more and more of the relatively plentiful good is added for each unit of the relatively scarce good that is taken away. The model of economic rationality provides the logical foundation for marginal trade-offs among competing interests or goals.

2. THE THEORY OF OPTIMAL CHOICE: CONSTRAINED MAXIMIZATION

Economically rational individuals act in accordance with axioms E1 and E2, which define the properties of indifference curves, subject to budget constraints.
According to Axioms E1-E2, the consumer wishes to achieve the highest possible indifference curve that can be achieved given that he or she has a limited income to spend on bread and apples. In Figure 1, the budget constraint is depicted by the budget line A-B. Point A on the vertical intercept, depicts the maximum amount of apples that can be bought if a consumer’s entire income is spent on apples (income/price of apples); Point B, the horizontal intercept of the budget line depicts the maximum amount of bread that can be bought if a consumer’s entire income is spent on bread (income/price of bread). Interior points on the budget line indicate different combinations of bread and apples, the total cost of which would just expend equal income.

An individual’s utility is maximized subject to the budget constraint by finding the highest achievable indifference curve that is just tangent to the budget line (tangency solution) or intersects it at its end points (corner solutions). In Figure 1, given the budget constraint, prices of the two goods, and the consumer’s preferences as expressed by her or his indifference curves, the consumer’s optimal choice is where indifference curve I is just tangent to budget line A-B at Bundle w.

C. “WELL BEHAVED” PREFERENCES AND ARROW’S IMPOSSIBILITY THEOREM

Axioms E1-E2 do not restrict the shape of indifference curves beyond requiring that they have a negative slope. In addition, indifference curves are assumed to be convex to the origin. Convex indifference curves are said to be “well behaved” because they imply that for any two goods, an individual generally prefers some of each good rather
than all of one good and none of the other. When generalized to choice among many goods, this assumption means that consumers do not specialize in the consumption of one or a few goods but prefer to consume some of many goods. Specialization in consumption is ruled out because it is contradicted by casual observation of how consumers’ act. The assumption of convex indifference curves is also sufficient to ensure competitive markets will be efficient; that is, collectively rational.

However, unlike market decisions in which the assumption of well behaved preferences seems reasonable, in legislative and judicial decisions, which often involve socially divisive issue, such as abortion and gun control, the assumption that preferences are well behaved is often not justified. When individuals make political (non-market) decisions and when appellate courts decide cases via majority rule in circumstances in which preferences area not well behaved, the assumption of individual economic rationality is not sufficient to guarantee the group decision via majority rule will be collectively rational.

Given certain conditions, Kenneth Arrow proved that if individuals have preferences that are transitive but are not well behaved, groups of three persons may not be able to arrive at collectively transitive decisions by majority rule when there are three or more alternatives from which to choose and these alternatives are considered pairwise. Arrow’s Impossibility Theorem showed that it is not possible to prove that unstable, pairwise cycling among the choices will not occur. The following hypothetical example illustrates the Theorem: Huey, Dewey, and Louie wish to accompany each other to one of three entertainments: an art gallery, a baseball game, or a concert. The preferences of
three persons are transitive but have “unrestricted domains;” that is, there are no restrictions on the order in which individuals may rank alternatives.

For Huey: art $\succ$ baseball $\succ$ concert;
for Dewey: baseball $\succ$ concert $\succ$ art;
for Louie: concert $\succ$ art $\succ$ baseball.

If Huey, Dewey, and Louie attempt to choose an entertainment by a series of pairwise (binary) votes, unstable cycling will result. If the choice is between art or baseball, a majority (Huey and Louie) will prefer art; if the choice is between baseball and a concert, a majority (Huey and Dewey) will prefer baseball; and if the choice is between a concert and art, a majority (Dewey and Louie) will prefer a concert. Even though the preferences of each person are individually transitive, they are not collectively transitive (consistent) because there is an “aggregation” problem when the domain of preferences is unrestricted. However, unstable cycling can be avoided if individual preferences are well behaved, legislators engage in vote swapping, cumulative or “point” voting schemes are used, or if one party controls the agenda, that is, the order in which various proposals are considered.

When appellate judges decide commercial disputes by majority rule, unstable cycling is unlikely because their individual preferences are likely to be relatively well behaved and homogeneous; that is, when considering commercial disputes, most judges tend to have values that are consistent with efficient markets. On the other hand, unstable cycling is more likely on controversial social issues, such as abortion and gun control,
where preferences are more likely to be concave, heterogeneous, and extreme. Due to recent changes in personnel on the U.S. Supreme Court, such cycling may be occurring.\textsuperscript{20}

\section*{D. THE TUSSMAN \& TENBROEK MODEL OF EQUAL PROTECTION\textsuperscript{21}}

The classic article, \textit{The Equal Protection of the Laws}, by Tussman \& tenBroek, in which constitutional equal protection categories and relations are described with Venn diagrams, is a well known and generally accepted example of the formal approach to legal rationality. Tussman \& tenBroek begin by distinguishing between “general” legislation, which applies without qualification to all persons, and “special” legislation”, which applies to a limited class of persons. When legislation concerns general matters of economic or social welfare, the law need only relate rationally to a legitimate governmental purpose. However, when legislation classifies persons for differing benefits or burdens, it is tested under the Fourteenth Amendment which commands that no person shall be denied equal protection of the laws.

Constitutional jurisprudence has changed a great deal since Justice Holmes said in \textit{Buck v. Bell} \textsuperscript{22} that a claim based upon equal protection of the laws “is the usual last resort of constitutional arguments”. When subsequent to \textit{Buck}, the United States Supreme Court eschewed substantive due process\textsuperscript{23} as the test by which to evaluate the constitutionality of statutes,\textsuperscript{24} it necessarily had to find some other test or means by which to evaluate legislative enactments. Equal protection analysis is a natural choice for such a test because it relies on the ability of judges to recognize similarities and differences in the classification of individuals for treatment by legislative statutes. Since the
construction of legal classifications and relations based upon the recognition of similarities and differences is the essence of legal rationality, equal protection arguments are paradigmatic examples of legal rationality. The importance of equal protection in contemporary constitutional jurisprudence is attested to by the space allotted to it in a popular constitutional law textbook, which has a chapter on equal protection that is over three hundred pages in length.\textsuperscript{25}

Equal protection is the guarantee that similarly situated people will be dealt with in a similar manner by government and that people of different circumstances will not be treated as if they were the same. In reviewing any classification, a court must determine whether or not the persons classified by government for different treatment are in fact “dissimilar”. The equal protection principle does not prohibit government from classifying persons or drawing lines in the creation or application of laws in order to advance society’s legitimate interests, but it guarantees that those classifications will not be based upon impermissible (discriminatory) criteria or used arbitrarily to burden a group of individuals.

The equal protection guarantee does not deal with the issue of whether a specific individual is properly placed within or without a classification. That issue, whether an individual properly falls within a specific classification, concerns procedural due process. Equal protection tests whether the classification itself is based upon permissible criteria and whether it is properly drawn. The concern is whether persons classified by law for similar treatment are “similarly situated” and whether persons classified by law for different treatment are “dissimilar”. This question relates to the bases upon which the
government can distinguish between individuals in society. In interpreting the crucial phrase, similarly situated, two errors must be avoided.

First, to define a class is simply to designate a quality, characteristic, trait or relation, the possession of which includes an individual in the class. Similarly situated cannot mean simply similar in the possession of the classifying trait; otherwise, any classification would be reasonable by this test, since all members of any class are similarly situated in this respect. For example, a law that imposes burdens on all those who are “red-haired makers of margarine” would be legitimate in this trivial sense in which the law applies equally to all who have the classifying traits.

The second error in the interpretation of the meaning of similarly situated concerns the notion that a classification which includes individuals who themselves belong to different “natural” classes is somehow artificial and therefore illegitimate. For example, the question of whether a classification violates the equal protection guarantee is not usually tested by whether or not individuals are different in some absolute sense like gender. Although men and women are different, most often there is no difference between men and women in terms of the promotion of legitimate governmental ends; one’s sex can not be used to determine whether an individual may be allowed to practice law or is old enough to drink alcoholic beverages. Thus, the equal protection issue is not whether, in defining a class, the legislature has carved the universe at a natural joint.

In order to determine whether a law that classifies different groups for different benefits or burdens is legitimate, that is, is based upon constitutionally permissible criteria, a court must look to the purpose of the legislation. The purpose of a law is legitimate if it either eliminates a public mischief or achieves some positive public good.
This focus on the purpose of legislation is consistent with the notion that a rational process is purposeful.

Once a court has determined that the governmental purpose is legitimate, that is, does not itself violate the Constitution, it is often required to analyze the actual way in which the government has classified persons to achieve that end. Analysis is required because the purpose at which the law aims and the trait or traits which define the actual legislative classification are not the same. Such an analysis involves a determination of the relation of the two classifications to each other. For example, in time of war, it is legitimate for Congress to pass a law, the purpose of which is to meet the dangers of sabotage. But, what if the trait by which saboteurs are identified in the actual legislation is ethnic ancestry, as in *Hirabayashi v. United States*,\(^{26}\) which is discussed below. Does such an actual classification based upon ethnicity violate equal protection of the laws?

Let L stand for a classification based on a legitimate governmental purpose, and A stand for the actual government classification that is defined in law. There are five possible relations between L and A. Tussman & tenBroek used Venn diagrams to depict the five cases, which are reproduced as Figure 2.
The reasonableness of any actual government classification, A, defined in law depends entirely upon its relation to the classification based on a legitimate governmental purpose, L. The first two relations represent the ideal limits of reasonableness and unreasonableness respectively. (1) The law is perfectly reasonable: Every member of the actual class defined in the law is included in the classification based on a legitimate governmental purpose; the converse is also true. (2) The law is perfectly unreasonable: no member of the actual class defined in the law is included in the classification based on a legitimate governmental purpose. (3) The law is under-inclusive: all those in the actual class defined in law are included in the classification based on a legitimate governmental purpose, but the actual class excludes some who are members of the classification based on a legitimate governmental purpose. However, the Supreme Court has not struck down all under-inclusive legislation because the legislature may attack a general problem in a piecemeal fashion. Although it is possible to avoid the charge of under-inclusiveness by giving a narrower formulation to the purpose of the law, such an approach runs the risk of being
unconstitutional on grounds that the law employs suspect classifications such as race or ethnicity, forbidden traits, or involves unreasonable and arbitrary discrimination.

(4) The law is over-inclusive: the actual class defined in law includes a wider range of individuals than are included in the classification based on a legitimate governmental purpose. The prima facie case against over-inclusive classifications is stronger than the case against under-inclusiveness because all those included in an under-inclusive classification at least have the characteristic at which the law aims, while over-inclusive classifications reach out to the innocent bystander, the hapless victim of circumstance or association. However, over-inclusive classifications have sometimes been sustained in emergency situations, such as in the wartime.  

(5) The law is both under-inclusive and over-inclusive. Hirabayashi is an example. The World War II classification of “American citizens of Japanese ancestry” for the purpose of meeting the dangers of sabotage can be challenged both on grounds that it is under-inclusive, since American citizens of German or Italian ancestry were equally under the strain of divided loyalties, and is over-inclusive, since it is not supposed that all American citizens of Japanese ancestry were disloyal. Sustaining this classification requires both the finding of sufficient emergency to justify imposing a burden upon a larger class than is believed within the legitimate purpose of the statute and a justification of the failure to extend the operation of the law to a wider class of potential saboteurs.

The Venn diagrams used by Tussman & tenBroek can be represented symbolically in terms of binary relations. (1) Both $L \supset A$ and $A \supset L$, where the binary relation $L \supset A$ is read “$L$ contains $A$” or “$A$ is a proper subset of $L$”. (2) $L$ and $A$ are
disjoint, so the relation $\supset$ is not defined. (3) $L \supset A$. (4) $A \supset L$. (5) $L$ and $A$ intersect, so the relation $\supset$ is not defined.

Tussman & tenBroek’s diagrams can also be used to depict the five and only five possible relations between any two abstract legal categories or any two cases that can be related to each other in terms of similarity and difference. Consider how any two cases, call them case $L$ and case $A$, may be related to each other through the principle of precedent or stare decisis in the context of the Tussman & tenBroek model. Diagrams (1), (3), and (4) depict the three possible ways that two cases can be related to each other as binding precedents. Diagram (1) the two cases are like in all material respects; they are mutual precedents; Diagram (3), case $L$ is a precedent that includes case $A$; Diagram (4), case $A$ is a precedent that includes case $L$. In Diagrams (2) and (5), the cases $L$ and $A$ are distinguishable; that is, unrelated by binding precedent.

F. THE MODEL OF LEGAL RATIONALITY

1. THE LEGAL AXIOMS

As in the discussion of economic rationality, definitions will specify fundamental abstract categories and collections of categories, state that judging is purposeful or goal directed, and is subject to constraints. In parallel with economic rationality, legal rationality is also specified by two axioms: Axiom L1 specifies that judges maximize their goals; Axiom L2 states that for any two cases, judges can determine whether they are like or distinguishable; when this axiom is stated in terms of binary relations, one of its properties, transitivity, is the consistency criterion of legal rationality.
A “case” is a short story of an incident in which the state acted or may act to settle a particular dispute. Treating a case as a short story of an incident emphasizes that every case is unique as are its particular facts. Since concrete facts are unique, particular facts in one case have no precedential value for particular facts in another case. In order to have precedential value, facts must be considered as general or abstract fact categories. N. Karl Llewellyn said: “Each concrete fact of the case arranges itself, I say, as the representative of a much wider abstract category of facts, and it is not in itself but as a member of the category that you attribute significance to it.”  

For example, a Toyota automobile in one case has no precedential significance for a Mack truck in another case. However, if the Toyota is considered as a generalized instance of the abstract fact category, “vehicle”, the case in which it occurs is capable of being a precedent for the case involving the Mack truck because the legal category of vehicle covers or contains the concrete facts of both cases. Cases also contain concepts that are mixtures of abstract fact and law or standards, like the concepts of negligence and due process, and abstract concepts, such as order and liberty (which can be represented by Venn diagrams or sets). All three concepts, generalized facts, mixed fact and law or standards, and abstract legal concepts, are included in the concept of “abstract legal categories”.

Llewellyn also said: “The court can decide the particular dispute only according to a general rule which covers a whole class of like disputes.”  

Since each case stands for a general rule which covers or contains a whole class of cases in addition to the one before the court, and rules of law are collections of legal categories, then, cases stand for collections of legal categories. For example, the rule of law, which covers many negligence cases is: a person who breaches a duty of care to another, which breach is the
cause, both direct and proximate, of an injury to the other’s person or property, is legally liable for compensatory damages. The plaintiff’s lawyer has the burden of proving that the defendant’s action satisfies or is contained in each and every legal category in the general rule. Both economic rationality and legal rationality are defined by fundamental abstract categories and collections of those categories: “goods” are to “abstract legal categories” as “bundles” are to “cases” and “rules of law”.30

Judging is purposeful activity. By analogy with economics where self-interested individuals are assumed to maximize utility or satisfaction, judges, who are required to be impartial or disinterested rather than self-interested, are assumed to maximize social utility or social welfare. Just as individual utility or satisfaction, which is a subjective concept, can be given concrete meaning in terms of the revealed preferences or choices that individuals make among bundles of competing goods or ends, the goal of judges, to maximize social utility or social welfare, which is also a subjective concept, can be given concrete meaning in terms of the decisions of judges that reveal their preferences among the sometimes competing goals of efficiency, equity, liberty, order, majority rule, and so on.

**DEFINITIONS**: Abstract legal categories or classifications consist of generalized facts, such as defendant and vehicle, mixed abstract fact and law or standards, such as negligence and due process, and abstract legal concepts, such as order and liberty. Cases stand for general rules of law, which are collections of abstract legal categories. Cases are adjudicated by impartial or disinterested judges, who are assumed to maximize social
utility or social welfare, subject to institutional constraints, the chief of which is the principle of precedent or stare decisis, that like cases must be decided alike.

For ease of exposition, the binary relation specified by Axiom L2, which states that judges can determine whether cases are like or distinguishable, will be discussed before Axiom L1, which states that judges, who maximize their goals, that is, prefer broader precedents to narrower precedents. Llewellyn’s proposition, quoted above, that courts decide particular disputes according to a general rule which covers a whole class of like disputes, in conjunction with Tussman & tenBroek’s Venn diagrams, restated symbolically as binary relations, provide the logical foundation for legal rationality, that is, a judge’s ability to determine whether cases are like or distinguishable.

**AXIOM L2 (Like vs. Distinguishable Cases):** For any two cases, a judge can determine whether the cases are like in all relevant (material) legal categories or are distinguishable.

**AXIOM L2 (stated in terms of binary relations):** For any two cases x and y, if x ⊇ y, y ⊇ x, or both, then the cases are like; if the binary relation ⊇ is not defined over x and y, then they are distinguishable.

Axiom L2 says that the only way that the binary relation ⊇ can be satisfied is if case x is a *binding* precedent on case y, case y is a *binding* precedent on case x, or both. Any two cases for which the binary relation ⊇ is not defined are distinguishable, that is, unrelated by binding precedent.
The binary relation $x \supset y$, defined on sets, has the following four mathematical properties, which define a partial order relation (partial consistency).

**Reflexive:** The binary relation $x \supset x$ is trivially reflexive; that is, any case $x$ contains itself.

**Transitive:** The binary relation $x \supset y$ is transitive: whenever $x \supset y$ and $y \supset z$, then $x \supset z$; that is, whenever the legal category in case $x$ covers case $y$, and the legal category in case $y$ covers case $z$, then the legal category in case $x$ covers case $z$. The transitivity property is legal rationality’s criterion of consistency.

**Antisymmetric:** The binary relations $x \supset y$ and $y \supset x$ imply $x = y$. If case $x$ contains (is a precedent for) case $y$ and case $y$ contains (is a precedent for) case $x$, then case $x = case y$.

**Incomplete:** The binary relation $x \supset y$ is not defined for every two cases; that is, there are many pairs of cases for which the relation $\supset$ is undefined either because the cases have no relation to each other with respect to a particular legal category or because the legal categories form intersecting rather than inclusive sets.

**Partial Order Relation:** Axiom L2 is a partial order relation, which is defined as a binary relation that is reflexive, transitive, antisymmetric, and incomplete. All cases cannot be completely ordered according to legal rationality because the binary relation in law lacks the property of completeness. Because the binary relation that describes legal rationality is only partial ordered, it is possible to conceive of legal rationality narrowly as a collection of disparate local optima in contrast to economic rationality which is completely ordered and therefore has a global optimum, efficiency.
Edward Levi’s discussion of nineteenth century product liability cases contains a classic description of the legal rationality’s transitivity property. In those nineteenth century cases, courts were primarily concerned with the question of whether a seller ought to incur legal liability for products that cause injury to a person who was not the buyer of the product; that is, where there was no contractual relationship, no “privity” between the injured party and the seller. Nineteenth century product liability cases chronicle the gradual erosion of the legal rule that privity of contract between the seller and the injured party was a legal prerequisite for a law suit.

During the first half of the nineteenth-century, courts searched for a rule of law that would justify an expansion of product liability beyond those cases in which there was privity and yet limit liability within manageable bounds. Although the privity rule was arbitrary in the sense that standing to sue depended entirely upon the purely fortuitous circumstance of whether the injured party was the buyer or merely the ultimate user of the product that caused injury, it had the negative virtue of preventing “an infinity of actions”. An alternative rule would also have to be able to confine the scope of liability within what nineteenth century courts considered to be manageable bounds.

By mid-nineteenth century, a categorical distinction began to crystallize between products that are imminently dangerous and products that are not imminently dangerous. Persons injured by imminently dangerous products had standing to sue sellers without privity of contract, whereas persons injured by products not imminently dangerous had no standing to sue sellers without privity of contract. The second half of the nineteen century saw the gradual expansion of the imminently dangerous category. Three of those cases will be used as illustrations of the transitivity property of Axiom L2.
In *Thomas v. Winchester* (1852), a woman was seriously injured after she took poison mislabeled as medicine by a druggist. In order to prevent “an infinity of actions”, the court, which upheld the verdict for the plaintiff, could have narrowly limited the legal category of the imminently dangerous articles to those articles whose *function is to destroy*, like poison and guns. In *Devlin v. Smith* (1882), a man was killed when a scaffold on which he was working collapsed. In order to broaden the definition of imminently dangerous articles to include a scaffold but still not have open-ended liability for all articles, the court, which ruled for the plaintiff, could have defined the legal category imminently dangerous articles to include those that are *dangerous in ordinary use*. In *Statler v. Ray* (1909), a man was killed when a coffee urn in a restaurant exploded. In order to include a coffee urn in the legal category of imminently dangerous articles, the court, which ruled for the plaintiff, could have further expanded the legal definition to include articles *possibly capable of being dangerous*.

![Diagram showing the relationship between Thomas v. Winchester, Devlin v. Smith, and Statler v. Ray]

In terms of the transitivity property of legal rationality, *Statler*, is a precedent that covers *Devlin*, and *Devlin* is a precedent that covers *Thomas*, therefore *Statler* must cover *Thomas* (*Statler ⊃ Devlin ⊃ Thomas*); however, the reverse order is not transitive. In
other words, the transitivity principle in law is like those Russian dolls, each of which contains a successively smaller one. The transitivity property of legal rationality is depicted by the Venn diagram in Figure 3.

As discussed above, Llewellyn said that courts can decide particular disputes only according to a general rule of law, which consists of legal categories, that covers a whole class of like disputes. The rule of law in a case may be stated on a continuum from narrow to broad formulations depending upon the level of generality of the relevant legal categories. Because legal categories or rules of law that are so narrow as to be limited to a single case, for example, applying only to a “pale magenta Buick eight by number 732507” instead of a “vehicle”, provide no future guidance to lawyers or society, judges, other things being equal, are assumed to prefer more general legal categories or rules of law to less general legal categories or rules of law.

**AXIOM L1** (Judges Maximize Their Goals): More general (inclusive) legal categories or rules of law are preferred to less.

**AXIOM L1** (stated in terms of binary relations): If case $y \supset case \ x$, then case $y \succ case \ x$.\(^{37}\)

Just as economically rational individuals are assumed to prefer more of a good to less but cannot have an unlimited amount of goods because their choices are constrained by their budgets, so too, judges, who are assumed to prefer more general legal categories or rules of law to narrow ones, confront constraints that limit the inclusiveness of legal
categories, such as the fear expressed in the nineteenth century product liability case, *Winterbottom v. Wright*, that over-inclusive rules of law will result in “an infinity of actions. . . . [and] the most absurd and outrageous consequences . . . would ensue”\(^{38}\) The principal institutional constraint on the generality of legal categories or rules of law is provided by the principle of precedent or stare decisis.

2. STARE DECISIS: LEGAL RATIONALITY’S CONSTRAINT

Not only may a court state the generality of a rule of law in a case on a continuum from narrow to broad formulations, subsequent courts may alter the level of generality at which the rule is stated. In what is known as the *result oriented approach* to precedents, a later court can always reexamine the case and invoke the canon that no judge has power to decide what is not before her or him; this later court can, by recategorizing the facts or altering categories, broaden (or narrow) the picture of what was actually before the court and can hold that the legal categories in the prior case should be understood as thus expanded (or restricted).\(^{39}\) The categorizing of the facts by a prior judge even in a controlling case is nonbinding; it is mere *dictum*.\(^{40}\) A judge in a present case may also find irrelevant the existence or absence of facts that prior judges thought important. This view of precedents is elastic; it may be used to expand or diminish a prior case. However, the view that precedents are very malleable, does not alter the conclusion that the principle of precedents or stare decisis constrains a judge’s freedom to determine the level of generality of legal categories or rules of law.
When confronted with a new case, consider the affect of stare decisis on a judge’s decision when he or she believes existing precedents are either *under-inclusive* or *over-inclusive*, respectively. Judges often realize that a rule of law is under-inclusive, when they must decide a new case, say case x, that does not fall within the rule of law as currently formulated in case y (and so must be decided contrary to it), but which they believe should be decided consistently with case y. In order to provide a rationale for the decision based upon a general rule of law, it is often necessary to reformulate the rule of law in case y more broadly so as to include both case x and case y.

Alternatively, precedents that seem helpful can be expanded by thinking and arguing exclusively from language found in past opinions and in citing and working with that language wholly without reference to the facts of the case that called the language forth. This way of using the authority of precedents is the *literal view*. Levi’s discussion of nineteenth century imminently dangerous product liability cases, which was discussed above, is an example of inclusion over time using the literal view because the concept, imminently dangerous products, remained roughly the same, but its contents expanded.

When *Statler v Ray*, the coffee urn case, along with other cases, expanded the meaning of imminently dangerous in *Devlin v. Smith*, the scaffold case, from articles dangerous in ordinary use to articles possibly capable of being dangerous, it contributed to explosion of the concept. Only five years after *Statler*, in the famous case, *McPherson v. Buick*, Judge Cardozo overruled the half century-old distinction between products which are imminently dangerous and those which are not, making it possible for any person injured by a new product to sue the manufacture in negligence regardless of privity. Thus, judges are constrained from expanding rules of law by the fear that such
expansion will result in legal categories that are so broad as to make it impossible to
distinguish future cases, so that the “flood gates” will be open to law suits and result in an
infinity of actions.

Judges often realize that a rule of law is over-inclusive, when they must decide a
new case, say case z, which falls within the rule of law as currently formulated in case y,
but which cases they believe should be distinguished from each other and decided
differently. In order to distinguish case z from case y, that is, in order not to apply the
over-inclusive rule of law of case y as required by the principle of stare decisis, it is
necessary to reformulate the rule more narrowly to exclude case z. The technique for
whittling away unwelcome precedents is known as the strict, narrow, or minimalist view.
The attempt to cut down precedents is also constrained by stare decisis because it may
not be possible to construct a rule of law with which to distinguish case z from case y,
unless the rule of law in case y is reformulated on an entirely different basis, which may
risk employing suspect, illogical, unreasonable, or discriminatory classifications, which
in the long-run will be unsustainable.

An example of an illegitimate (defined as incorrectly deduced) attempt to
distinguish two cases is provided by the U.S. Supreme Court’s attempt to distinguish
*Bowers v. Hardwick*,\(^43\) from *Griswold v. Connecticut*.\(^44\) *Bowers* upheld a Georgia state
sodomy statute, which makes consensual homosexual activity between adults in private a
crime, on the ground that sexual activity is not a fundamental right. This case seemed to
conflict with *Griswold v. Connecticut*,\(^45\) in which the Supreme Court struck down a law
prohibiting the use of contraceptives by married persons on the ground that it infringed a
fundamental right to privacy. It is hard to conceive of a rule of law, which can distinguish
the right to privacy of married couples from the right to privacy of homosexual couples, which is not based upon suspect or unreasonable classifications. Subsequently, both the Supreme Court of Georgia\textsuperscript{46} and the U.S. Supreme Court, in \textit{Lawrence v. Texas},\textsuperscript{47} overruled \textit{Bowers}. 

In its extreme form, the strict, narrow, or minimalist view results in what is known “distinguishing a case to death” by expressly “confining a case to its particular facts.” When you find this said of a past case you know that in effect it has been overruled.\textsuperscript{48} In \textit{Bowers}, the U.S. Supreme Court was constrained from using this approach because it probably neither wanted to overrule \textit{Griswold} nor wanted to curtail or repeal the constitutional principle, the right to privacy, on which it was based.

\section*{3. CASE SELECTION HYPOTHESES AND OPTIMIZATION 
IN ECONOMICS AND LAW }

It has been argued that judge-made law tends toward economic efficiency even if judges do not consciously strive for this goal.\textsuperscript{49} The argument is that judge-made law becomes more \textit{efficient} over time through the process of selective litigation. This process has two key assumptions: First, inefficient laws are more likely to be challenged than efficient laws. Since there is a strong presumption that efficient laws generate more economic benefits than inefficient laws, if the allocation of a legal entitlement is inefficient, those who would benefit from a change to an efficient law will have more to gain than those who benefit from the inefficient law, so that the former will file more law suits and spend more on such suits than those who benefit from the inefficient status quo;
conversely, if the allocation of a legal entitlement is efficient, those who would benefit from a change to an inefficient law will have less to gain than those who benefit from an efficient law so that the former will file fewer law suits and spend less on such suits than those who benefit from defending the efficient status quo. Thus, there will be more expenditure on litigation to overturn inefficient laws than to overturn efficient laws. The second assumption is that judges are at worst indifferent as to whether a decision is efficient; that is, judges are not hostile to efficiency. Even if judges decide cases randomly, judge-made law will become more efficient as long as inefficient laws are litigated more than efficient laws. Since economic rationality is completely ordered, the efficiency to which it tends is a global optimum.

There is also a second mechanism by which judge-made law can tend toward an optimum. In the context of legal rationality, the process of selective litigation causes judge-made law to tend toward legal categories and rules of law of optimum level of generality. There are two key assumptions: first, “hard” cases are more likely to be litigated than are “easy” cases. The judicial system is constantly sifting thousands of new cases. Easy cases, those which are clearly within a legal category or rule of law about which there is little or no controversy as to whether the category or rule is over-inclusive or under-inclusive, are usually not litigated or are disposed of at trial and do not often reach the highest appellate courts. “Hard” cases, those that are “interstitial”, that is, fall in the “cracks” between legal categories or rules of law, or are within a category or rule about which there is a question as to whether it is over-inclusive or under-inclusive, usually reach the highest appellate courts for decision.
The second assumption is that judges decide cases according to the principle of stare decisis, which requires them to decide like cases alike. The process of selective litigation causes hard cases rise to the top of the judicial pyramid where the decisions of appellate courts are expected to give guidance to lower courts, the legal profession, and citizens through the principle of precedent, which requires that like cases be decided alike. Through the process of reformulation of legal categories and rules of law by inclusion and exclusion of hard cases, legal categories and rules of law approach optimum levels of generality. Since, as shown above, legal rationality is only partially ordered, these multiple optimal size categories and rules are local optima. Of course, many cases may need to be considered over a long period of time before a particular local optimum size is achieved; moreover, as Levi stressed, the level of generality may change over time. Of course, the global optimum of economic rationality also changes over time.) Legal fields, in which it is thought that the process toward local optimum-size rules of law is too slow or is not occurring due to inconsistency or confusion caused by the multiplicity of state and federal jurisdictions, are ripe for legal codification by legislative enactment; e.g., the Uniform Commercial Code.

Judges and lawyers often construct hypothetical cases in order to determine whether the level of generality of a rule of law that is the appropriate to determine whether two cases are like or distinguishable is sensitive to small (marginal) changes in abstract facts or is robust. This is law’s version of sensitivity analysis.

With respect to certain constitutional categories, like free speech and the right to bear arms, the First and Second Amendments to the United States Constitution, it is argued by some that there is no optimum size legal category or level of generality that
can provide a stopping place or separation point between cases that should be decided one way from cases that should be decided the other way. For example, some of those who object to gun control laws maintain there is no logical stopping point between any restrictions on guns and a total prohibition of guns. Since the essence of legal rationality is the ability to recognize similarity and difference and to create optimal size legal categories which separate cases that should be decided one way from those that should be decided the other way, this type of argument, which is known as the “slippery slope” argument, is usually the last refuge of extremists.

An alternative interpretation of the illegitimate distinction between *Griswold* and *Bowers* by the U.S. Supreme Court is that it tried to locate these cases in different discrete, optimal-size legal categories, *Griswold* in a legal category having to do with the right to privacy and *Bowers* in a legal category having to do fundamental rights. In this context, even if the Court was correct that the right to sexual activity is not included within the fundamental rights category, it was wrong in not including *Bowers* in the right to privacy category.

4. ARE LAW’S LOCAL OPTIMA ISOLATED OR NESTED?

Are the law’s myriad local optima discrete, disparate, and isolated or are they bound together by fundamental principles into a coherent whole in which many local optima are nested within others. The latter position is consistent with the views of Ronald Dworkin, who defines a legal system that is bound together by fundamental principles as
one that has the virtue of “integrity”. Integrity is something over and above mere consistency:

The plainest examples [of integrity] come from adjudication, and I choose one that illustrates only a partial victory for integrity so far. For some time British judges declared that although members of other professions were liable for damage caused by their carelessness, barristers were immune from liability. Consistency, narrowly understood, would have required continuing that exception, but integrity condemns the special treatment of barristers unless it can be justified in principle, which seems unlikely. The House of Lords has now curtailed the exemption: to that extent it has preferred integrity to narrow consistency. Integrity will not be satisfied, however, until the exemption is entirely erased.

When there was one rule for barristers who are negligent and another rule for other professions who are negligent, such rules were examples of disparate and isolated local optima. However, if narrow local optima are seen as being nested within broader local optima, the broadest of which have the status of fundamental principles and standards, legal rationality begins to look more like a coherent whole. The process that is described in Dworkin’s example is what Lord Mansfield may have had in mind when he spoke of “the law working itself pure”, the end result of which is that law becomes a seamless garment.
As the above example from Britain, different rules and standards for barristers than for other professions with regard to negligence, illustrates, judicial attempts to treat law as isolated, narrow local optima, rather than being nested in the broader local optima represented by fundamental principles such as due process and horizontal equity (the judicial analogue of equal protection of the laws that is applied to legislative enactments), suggest arbitrariness, pandering to special interests, politicized decisions, and raises the specter of illegitimacy. Illegitimate does not mean illegal or unconstitutional; one of the meanings the dictionary gives for illegitimate is “incorrectly deduced”.54

As discussed above, Llewellyn said that a court can decide the particular dispute only according to a general rule which covers a whole class of like disputes; and, the principle of stare decisis means that courts are required to decide these like cases alike. To isolate a case or cases in a narrow discrete local optima so as not to have to explain why this case is not like other cases, all of which are nested within the same broader local optima consisting of fundamental principles, weakens or eviscerates the principle of stare decisis, which is the law’s principle constraint on arbitrary decisions. In the example above, British law had one rule of law, local optimum, for negligence by barristers and a separate rule of law, local optimum, for negligence by other professions. In effect, Dworkin conceives of these two local optima as being nested in a broader local optimum which he calls integrity, but which could be called horizontal equity or due process.

At the limit, if each case is considered to be sui generis and is isolated within its own local optimum, the principle of stare decisis would be completely eviscerated and judicial decisions would be arbitrary exercises of power and therefore illegitimate. The principle of stare decisis in strong form mandates that courts must consider whether a
case under consideration is like or distinguishable from every other case within every local optima within which the case is nested (completely included), even if these broader local optima within which it is completely included are themselves intersecting (See, *Bush v. Gore*, discussed below) rather than nested. Before promulgating a rule of law in a case, the job of an appellate court is to look for conflicts between the proposed rule of law and the rules of law all cases in all local optima within which it is located (analogous to that of an Internet search engine); if it finds inconsistencies, then either the proposed rule of law is over or under-inclusive or one of the conflicting cases is decided incorrectly.

In *Bowles v. Russell*, the District Court erred in granting petitioner 17 days to file notice of appeal although the Federal Rules allowed only 14 days. Petitioner filed notice within the time allowed by the District Court but after the time allowed by the Rules. A divided U.S. Supreme Court (5-4) disagreed over whether the time limit was “jurisdictional,” so that courts had no power to hear the appeal, or was a “claim processing rule,” which is more like a statute of limitations and is therefore subject to waiver.

The conservative Justices in the majority held that the rule was jurisdictional, so that even though petitioner had relied on the District Court’s error, principles of estoppel and equity were inapplicable. In dissent, Justice Souter said that the core meaning of the term jurisdiction refers to the subject matter of cases which a court has the power to adjudicate; that the Supreme Court had sometimes used the term more broadly and carelessly, but that in recent cases the Court had restricted the term to its core meaning. The majority stretched the term jurisdiction beyond its core meaning in order to isolate
Bowles in a legal category, jurisdiction, which is not nested within broader legal categories like estoppel, equity, and due process, categories which give the law unity and coherence. In such circumstances, stare decisis is a weak or negligible constraint because inequitable decisions like Bowles can always be given a sham\textsuperscript{56} justification; that is, should a court so choose, a case can almost always be isolated in a discrete legal category or rule of law that is outside of the broad, inclusive legal categories, like due process and equity, which are the law’s unifying standards.

Bush v. Gore\textsuperscript{57} (5-4), which decided the 2000 presidential election, is not only controversial; its legitimacy has been seriously questioned.\textsuperscript{58} The conservative Justices in the majority, who generally criticize judicial activism, prize state autonomy, and take a dim view of new constitutional rights, aggressively intervened not once but twice in a state electoral process and held that Florida’s plan to conduct a manual recount violated a novel one-time-only equal protection right, despite the fact that manual recounts had occurred repeatedly in the past without any suggestion that they violated equal protection.\textsuperscript{59} In reaching this decision, the majority announced that it would not be bound in future cases by any principles therein, thus overtly rejecting the principle of stare decisis.\textsuperscript{60}

The conservative majority’s views on state sovereignty versus national power have been called the “New Federalism”;\textsuperscript{61} within the ambit of this concept state sovereignty usually trumps attempted national intervention either by federal statutes or federal courts exercising equal protection jurisdiction. If the Court had not intervened in Bush, it would have been decided consistently with its New Federalism precedents: the Venn diagram of Figure 4a depicts the relations among Bush, the New Federalism, and
Equal Protection had the Court followed its precedents and not intervened. Figure 4b depicts how the actual decision in *Bush* would affect the balance between New Federalism and Equal Protection on the assumption that cases in which federalism is an issue were decided consistently with this precedent; that is, if *Bush* were a legitimate decision, it would require a sharp curtailment of New Federalism jurisprudence because the legal category (New Federalism ∩ Equal Protection) would be greatly expanded.\(^\text{62}\)

The conservative Justices on the U.S. Supreme Court, who are the current majority, are entitled to their own values and goals; but, they are not entitled to disregard the logic of the law.

F. IMPOSSIBILITY THEOREM'S RELEVANCE TO LEGAL RATIONALITY

Since appellate courts decide cases according to majority rule, the question arises whether disagreements among judges employing legal rationality will lead to unstable cycling. Although the Arrow impossibility theorem clearly applies to appellate panels that decide disputes concerning three or more legal categories that are not nested, does it apply to disagreements concerning the optimum level of generality of nested legal categories? Assume that, as in the imminently dangerous cases discussed above, a panel
of three appellate judges must attempt to determine the optimum level of generality for a legal category or rule of law, and that the panel can choose from a wide spectrum of nested categories from narrow to broad. Consider three such formulations, which will be called Small (S), Medium (M), and Large (L). It is assumed that all cases that are included within a particular level of generality should be decided one way; cases not included within this level of generality are decided the opposite way. Further assume that the decision concerning the optimum level of generality is to be made by majority rule. Is it possible that there is no level of generality upon which a majority of judges can agree? Under these circumstances, can individual preference orderings that are individually transitive be collectively intransitive?

If no restrictions were placed on the range of the 3! = 6 possible orderings of the three alternatives, which are depicted in Figure 5, Arrow’s impossible theorem would apply. For example, if the three judges had the preference orderings (1), (3), and (5), pairwise cycling would result because a majority of 2-to-1 would prefer S over M, a majority of 2-to-1 would prefer M over L, and a majority of 2-to-1 would prefer L over S.

\[ (1) \text{ S} \succ \text{ M} \succ \text{ L} \]
\[ (2) \text{ L} \succ \text{ M} \succ \text{ S} \]
\[ (3) \text{ M} \succ \text{ L} \succ \text{ S} \]
\[ (4) \text{ M} \succ \text{ S} \succ \text{ L} \]
\[ (5) \text{ L} \succ \text{ S} \succ \text{ M} \]
\[ (6) \text{ S} \succ \text{ L} \succ \text{ M} \]
However, due to the transitivity property of legal rationality, the range of logical individual preferences is restricted. It is easy to see that some preferences are ruled out as being logically inconsistent with legal transitivity. The preferences orderings (1) (2), (3), and (4) are logically consistent with legal rationality: Clearly, (1) in which $S \succ M \succ L$ and (2) in which $L \succ M \succ S$ are logically consistent preference orderings. (3), as depicted by the Venn diagram in Figure 5, is a logically consistent ordering if $M$ is closer to $L$ than $M$ is to $S$; and, (4) is a logically consistent ordering if $M$ is closer to $S$ than $M$ is to $L$. However, (5) is a logically inconsistent ordering: if $L \succ S$, then $S$ cannot be preferred to $M$ because $M$ is larger than $S$ and so should be preferred to $S$; (6) is also logically inconsistent: if $S \succ L$, then $L$ cannot be preferred to $M$ because $M$ is smaller than $L$ and so should be preferred to $L$.

If the range is restricted so that only logical preference orderings (1) through (4) are allowed, that is, the unrestricted range condition of Arrow’s impossibility theorem is not fulfilled, pairwise cycling will not occur in any of the four possible combinations of preference orderings taken three at a time, which are depicted in Figure 6. As is clearly evident in these four combinations, $M$ is first in each collective preference function.
As depicted in Figure 7, the four sets of preferences, (1) through (4), which are logically consistent, are single-peaked preferences, whereas the logically inconsistent preferences, (5) and (6) are multi-peaked. The preferences that are logically permissible in legal rationality, (1) through (4), result in a stable equilibrium, which is an example of the median voter theorem: if a) the preferences are defined along a single dimension and b) each voter's preferences are single-peaked, then majority rule will result in a stable equilibrium rather than cycling.\textsuperscript{63}

This is not to say that there can never be inconsistent decisions concerning the optimum level of generality with respect to a legal category or rule of law. Judges may disagree about whether a decision involves a choice among legal categories that are nested in Russian doll fashion, as for example, the imminently dangerous categories, as opposed to a choice among legal categories that are either entirely separate from each other or are intersecting. If legal categories are either entirely separate or intersecting
rather than nested, the Arrow’s Impossibility Theorem applies and inconsistent decisions are possible.

![Diagram](image)

Figure 7

**G. WHEN ARE ECONOMIC RATIONALITY AND LEGAL RATIONALITY ISOMORPHIC?**

The final question is whether legal rationality and economic rationality are isomorphic? Is there a correspondence rule that maps each rationality into the other so as to preserve properties and relations in both? In cases in which judges are willing to balance interests via marginal trade-offs, economic rationality is the dominant rationality, so economic rationality and legal rationality will often be isomorphic because judges will tend to interpret legal concepts so as to be consistent with economic concepts. For example, in the law of torts, when judges use the Judge Hand test in negligence cases, all cases that satisfy the binary relation \( B < PL \) \( \supset \) (“negligence”); the converse is also true. All cases that satisfy the binary relation \( B \geq PL \) \( \supset \) (“due care”); the converse is also true.
However, when legal rationality is the dominant rationality, there will often be no mapping from legal rationality to economic rationality which will preserve the properties and results in both; that is, they will usually neither be isomorphic nor consistent.

Five examples are discussed, one in which economic and legal rationality are consistent and nearly isomorphic (entrapment cases), two examples involving the possible conflict between efficiency vs. distributional equity (one in which they conflict and one in which they do not), and two examples involving the conflict between fundamental rights and security, in which law and economics are usually neither isomorphic nor translatable.

In Chapter 4, six U.S. Supreme Court cases and a number of appellate cases involving entrapment. In these cases, the courts purported to use either the “objective (or subjective) predisposition test” to determine whether a defendant had been entrapped; this is a legal categories test. However, all six of the Supreme Court cases and nearly all of the appellate cases were decided consistently with a balancing of two competing interests: the government’s need for entrapment (little need in less serious crimes, like receiving pornography through the mail, to great need in very serious crimes, like bribing of government officials, activity which if unchecked could totally undermine public morals) is balanced against the nature and extent of government involvement in the entrapment (from simple solicitation to repeated and prolonged involvement). In extreme cases, little government need for entrapment along with repeated and prolonged government involvement led to acquittal as a matter of law; great government need for entrapment along with simple solicitation result in conviction as a matter of law. In less extreme cases, where reasonable persons could differ as to the balancing of interests, the
cases were given over to the jury for decision. Courts may have been using the interest balancing test sub rosa.\textsuperscript{65} Even though nearly all of the entrapment cases would have been decided the same way under either a predisposition test or a balancing of competing interests test, one appellate case was a clear exception, so that entrapment law and economic rationality can be said to be consistent with each other, but not quite isomorphic.

Two examples (perfect competition and the Coase Theorem) consider the relationship between efficiency vs. distributional equity. Since economic rationality has one overarching goal, efficiency, whereas legal rationality has at least several broad goals in addition to efficiency, such as due process and equity (both horizontal and distributional), economic rationality and legal rationality can conflict with each other, especially when efficiency and distributional equity are at issue.

As is well known, in perfectly competitive markets, questions of efficiency and distributional equity are separable; efficiency conditions are fulfilled by markets and distributional equity can be achieved by government through lump sum transfers. Any attempt by courts or government to interfere with perfectly competitive markets for reasons of distributional equity will result in inefficiency. If courts create such interferences, legal rationality and economic rationality will be neither consistent nor isomorphic.

(Readers who are not familiar with bilateral monopoly and the Coase Theorem should postpone reading this summary of the Coase Theorem until they have read Chapter 10.) However, in the context of bilateral monopoly (the ubiquity of bilateral monopoly is emphasized in Judge Posner’s \textsc{Economic Analysis of Law}), efficiency and
distributional equity are interrelated and not easily separable. The bargaining version of
the Coase Theorem, which is the foundation theorem of law and economics, is a good
example of bilateral monopoly. The bargaining version of the Coase Theorem is usually
stated as: if property rights are clearly specified and transactions costs are zero, then
bargaining between those who have property rights specified in their favor and those who
do not will result in an efficient allocation of resources.

But, in Coase’s famous article, *The Problem of Social Cost*, the numerical
(crops-cattle and crops-sparks) examples he used did not compare two property right
regimes, but rather a *property right* regime was compared to a *liability rule* regime, as
defined by Judge Calabresi and Melemand’s well known distinction between property
rights and liability rules. Coase compared a regime with a liability rule for crop damage,
that is, a regime of judicial determined monetary damages, vs. a regime of no liability for
crop damage, in which regime the parties are allowed bargain freely without court
intervention; only the latter regime, no liability, is actually a property right. The amount
of compensation that the party, whose entitlement is protected by a mere liability rule,
can demand is restrained by the courts; on the other hand, if a party’s entitlement is
protected by a property right, its right to bargain is not so restrained. Although there are
bilateral monopoly problems inherent in Coase’s examples as stated, if two property right
regimes are contrasted, bilateral monopoly and *extortion* problems inherent in the
bargaining version of the Coase Theorem become much more severe.

If the farmer in Coase’s crops-cattle example had an entitlement to be free from
damage by trespassing cattle, which entitlement was protected by a property right,
enforceable by *injunction* (rather than a liability rule enforceable by monetary damages
for crop destruction), the “invariance” conclusion (that the result will be the same regardless of the property rule), is not sustainable. For example, assume it is profitable for the cattleman to have, say 1 steer, that the steer brings in a profit of $1.50 to him, and that the trespassing steer causes $1 worth of crop damage to the farmer, which results in a net social gain of $0.50. (Under a liability rule, the cattleman pays the farmer $1 in damages and retains $0.50 in profit.) However, if the farmer can get an injunction prohibiting the steer from trespassing on her land, the cattleman must choose among building a fence, bargaining to remove the injunction, or doing without the profitable steer. If the cost of the fence is $4, the farmer could demand payment from the cattleman of more than the steer was worth, up to $4, as the price of not enforcing the injunction. Under these circumstances, the cattleman would do without the steer, which is inefficient, since by assumption, the steer resulted in a net gain to society.

As Robert Cooter has shown, the flaw in the bargaining version of the Coase Theorem is that it assumes cooperative bargaining, an assumption which is contrary to the fundamental assumption of economic rationality that individuals are self-interested; bargaining may break down over the inability of the parties to agree on the division of the cooperative surplus (as in the example above). In the context of bilateral monopoly, if a self-interested party has a property right specified in its favor, it has a monopoly advantage, so that bargaining is likely to result in solutions that are both inefficient and distributionally inequitable. Judicial intervention or the threat of it in such cases (possible alteration of property rights, shift to a liability rule, or equitable relief) is likely to enhance both efficiency and distributional equity. Thus, in the context of bilateral
monopoly, economic rationality and legal rationality are likely to be consistent and isomorphic.

Consider two examples involving the conflict between personal liberty and security: One conflict concerns the interpretation of the exclusionary rule for evidence seized illegally in violation of the Fourth Amendment. This conflict can be characterized as one between judges who engage in balancing via marginal trade-offs, that is, use economic rationality, and judges who use legal rationality, in which the logic of interest balancing has no meaning because it is undefined.

In *Weeks v. United States* (1914), the U.S. Supreme Court held that illegally seized evidence, that is, evidence seized in violation of the Fourth Amendment, which prohibits “unreasonable searches and seizures”, must be excluded in a federal trial; it said that to admit such evidence would put a judicial stamp of approval on unconstitutional conduct. The exclusionary rule was extended to state trials in *Mapp v. Ohio* (1961). However, in *United States v. Leon* (1984), the Court, 6-3, held that the exclusionary rule should be modified so as not to bar the use of evidence obtained by officers acting in reasonable reliance on a search warrant, which a magistrate had issued but which was ultimately found to be unsupported by probable cause. The majority reasoned that the exclusionary rule is “a judicially created remedy designed to safeguard Fourth Amendment rights generally through its deterrent effect”, the applicability of which “must be resolved by weighing the costs and benefits of preventing the use” of illegally seized evidence. The dissenters questioned whether the exclusionary rule is merely a “judicially created remedy” for Fourth Amendment violations, subject to being narrowed “through guesswork about deterrence” rather than as indicated in *Weeks* “a right
grounded in that Amendment to prevent the government from subsequently making use of any evidence so obtained.”

The majority in *Leon* were willing to balance Fourth Amendment rights and the probability of convicting a guilty defendant via marginal trade-offs; for them economic rationality is relevant. For the majority, the trade-off in moving from *Weeks-Mapp* to *Leon* is such that the majority must believe that what is gained by society in terms of the increased probability of convicting a guilty defendant is as least as great as what is lost in terms of protection against unreasonable search and seizure, otherwise the majority would not have modified the rule. For the majority, *Leon* \( \succeq \) *Weeks-Mapp*.

On the other hand, the dissenters were not willing to engage in marginal trade-offs. In terms of legal rationality, the dissenters’ view can be interpreted to mean that marginal trade-offs have no meaning within legal rationality because they are undefined. For the dissenters, *Weeks-Mapp* \( \supset \) *Leon*, therefore *Weeks-Mapp* is a binding precedent. By analogy, it is as if the majority decision is written computer that has an operating system that is different from and untranslatable into the operating system used by the dissenters on their computer.

An alternative interpretation of the dissenters’ view in *Leon*, which was discussed in Chapter 4 and is recapitulated here, is that the dissenters would place a Rawlsian lexical constraint on trade-offs; that is, the dissenters may believe that the Fourth Amendment requires a level of protection against unreasonable search and seizure not less than the level of *Weeks-Mapp*. Since *Leon* reduces Fourth Amendment protection below that level, it is impermissible. Rawls likened lexical constraints to constrained maximization in economics.
It is also possible to view the conflict between efficiency and distributional equity in perfectly competitive markets in terms of lexical constraints. Courts may maximize efficiency subject to minimum requirements or standards of distributional equity. However, although a partial mapping or translation between law and economics may be possible in such cases, they will be neither consistent nor isomorphic.

The constitutional change at issue in the unreasonable search and seizure cases is miniscule in comparison to the constitutional changes involved in the measures for protection of national security that the U.S. government has taken in response to the terrorist attacks of September 11, 2001. In a recent book, Judge Posner supports “marginal adjustments”, which critics have called sweeping changes (e.g., length of indefinite detention of terror suspects determined by cost-benefit analysis, coercive interrogation, “the discretion of public officers to disregard in extreme cases the prohibition against torture,” “defining torture extremely narrowly,” warrantless surveillance, absence of Official Secrets Act reflects distrust of government bordering on paranoia but also reduces likelihood of government abuse, and an end to the ‘prior restraints’ taboo’ with respect to publications) that must be made by “practical-minded judges” to constitutional rights that “impinge” on the measures taken for protection of public safety in a national emergency, which is “sui generis”, neither war nor crime. He asserts that these adjustments are justified by balancing the anticipated consequences of alternative outcomes and picking the one that creates the greatest preponderance of good over bad effects…. Unfortunately, the “weighing” is usually metaphorical. The
consequences judges consider are imponderable, and the weighs assigned to them are therefore inescapably subjective…. To weigh the unweighble is at once a contradiction and an inescapable duty. [Judges who resist this weighing] are in the thrall to precedents that were either unsound when created or have become obsolete due to changed political, social, economic, or technological circumstances.81

He may be right; he may be wrong. However, the raison d’être for the Bill of Rights is to ensure that civil liberties will not be compromised in national emergencies, which at the time only appear to be sui generis. That the weighing is “metaphorical” gives one little confidence that such “subjective” and speculative weighing can distinguish a sui generis emergency from one that is like prior emergencies. Is it not possible that the logic of legal rationality, which relies on the recognition of similarities and differences between past and present cases, may be more accurate than the logic of economic rationality based on a metaphorical weighing? The points I wish to make are that the methods and goals of legal rationality and economic rationality are not only different, they are two different logical systems, which, in cases involving fundamental rights, are usually untranslatable rather than consistent and isomorphic; and, when law and economics conflict over fundamental rights, there is no a priori reason to think that speculative economics should trump the law.
CONCLUSION

There are three major conclusions concerning the relationship between legal rationality and economic rationality: First, legal rationality is a separate and distinct rationality from economic rationality. Second, if judges are willing to balance competing interests through marginal trade-offs, economic rationality will be the dominant rationality, in which circumstances economic rationality and legal rationality will often be isomorphic or close to it because economic concepts can be mapped into relevant legal concepts which judges will tend to interpret so as preserve the properties and relations in both disciplines. However, if judges employ legal rationality as the dominant rationality, legal rationality and economic rationality are often neither isomorphic nor consistent because there is often no mapping from legal concepts to economic concepts that will preserve properties and relations in both disciplines.

Third, economic rationality is completely ordered (complete consistency) whereas legal rationality is merely partially ordered (partial consistency). Economic rationally has a unique global maximum corresponding to economic efficiency, whereas legal rationality has multiple local maxima, which may be discrete and unrelated to each other or may be nested within broader local maxima.
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2 159 F.2d 169, 173 (2d Cir.1947).


6 Richard Posner, LAW, PRAGMATISM, AND DEMOCRACY, 73 (2003)(“there is no intrinsic or fundamental difference between how a judge approaches a legal problem and how a business man approaches a problem of production or marketing.” In general, Posner prefers pragmatism to precedent.); Richard Posner, NOT A SUICIDE PACT: THE CONSTITUTION IN A TIME OF NATIONAL EMERGENCY (2006) (discussed in Section G).

7 Steven Shavell, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW, Ch. 28 (2004).

8 Hal Varian, INTERMEDIATE MICROECONOMICS: A MODERN APPROACH, 34-36 (7th ed. 2006)(general reference work for this article).


12 Id. at 64.

13 ‘The strong claim that legal reasoning is not different from reasoning in other fields is misleading in a significant respect. The characteristics of a field's data and language, as well as the laws of logic, determine the transformations, or "moves," that can or cannot be made with a field.’ Steven Burton, AN INTRODUCTION TO LEGAL REASONING xv (1985).

15 Hal Varian, note 8.

16 id. at 44.

17 R. Hirschfelder and J. Hirschfelder, note 4, Ch. 3 (general reference work for this article).

18 1) “Unanimity” according to the Pareto improvement criterion; 2) “Nondictatorship”, whereby no single individual may dictate society’s choices; 3) “Range”, whereby individuals may rank alternatives in any order they choose (unrestricted domain); 4) “Independence of Irrelevant Alternatives”, whereby the social choice between any two alternatives must depend only on the orderings of individuals over these two alternatives, and not on their orderings over other alternatives; 5) “Transitivity” of individual preferences. Kenneth Arrow, SOCIAL CHOICE AND INDIVIDUAL VALUES, (1951); David Barnes and Lynn Stout, CASES AND MATERIALS ON LAW AND ECONOMICS 451-452 (1992).

19 Id. at 451.

20 Gonzales v. Carhart, 550 U.S. 494, 530-531 (2007)(Justice Ginsberg, dissenting)(‘Though today’s opinion does not go so far as to discard Roe or Casey, the Court, differently composed than it was when we last considered a restrictive abortion regulation, is hardly faithful to our earlier invocations of “the rule of law” and the principle of stare decisis.” ‘)


22 274 U.S. 200, 208 (1927).

23 Substantive due process is contrasted with the more familiar procedural due process, which refers to whether persons have been given fair notice and the opportunity to be heard before of an impending action by government that effects their interests is taken. With the rise of natural rights philosophy, some jurists suggested that the concept of due process should also have substantive content by which they meant that if a legislature passed any law that restricted vested rights or violated natural law, it restricted the freedom of some individuals in violation of the U.S. Constitution. Ultimately, the concept of substantive due process fell into disrepute because it was believed that appointed judges should not substitute their views for the will of the people as expressed by their democratically elected representatives.

24 West Coast Hotel Co. v. Parrish, 300 U.S. 379 (1937). Nowak & Rotunda, note 26 at § ll.3-11.4.

25 Nowak & Rotunda, note 21 at 568-907.
In mathematics, fundamental categories are called “elements” and collections of categories are called “sets”.

Although symbols for Axiom L1 and Axiom L2 do not appear to go together because they use different symbols, all that Axiom L1 says is that maximizing judges can rank order legal categories that are inclusive; since Axiom L1 is a only a partial order relation, judges cannot rank order legal categories that are not inclusive.

Abbreviated form of *obiter dictum*, “a remark by the way”; that is, an observation or remark made by a judge in an opinion which is not essential to its determination and is not legally binding.
48 Llewellyn, note 1 at 72-73, 75.


50 Levi, note 1 at 8-27.


52 Ronald Dworkin, LAW’S EMPIRE, 219-220 (1986).


56 “It is intolerable for the judicial system to treat people this way, and there is not even a technical justification for condoning this bait and switch.” (Justice Souter, dissenting). 551 U.S. ___.


59 See, 531 U.S. 103 (“the use of standardless manual recounts violates the Equal Protection Clause.”).

60 See, Id. at 109 (“consideration is limited to the present circumstances, for the problem of equal protection generally presents many complexities.”) Cole, note 58 at 1429.


62 Recall the discussion in Section 4 of A ∩ L in Venn Diagram (5) of the Tussman & tenBroek model.


64 John Cirace, An Interest Balancing Test for Entrapment, 18 PACE LAW REV. 51 (1997).

65 Jacobson v. U.S., 503 U.S. 540, 560 (1992)(Justice O’Connor, dissenting)(‘The crux of the Court’s concern in this case is that the Government went too far and “abused” the “process of detection and enforcement” by luring an innocent person to violate the law.’).

66 3 J. Law & Econ. 1 (1960).


69 232 U.S. 383, 394 (1914).


72 468 U.S. 906-907 (emphasis added).


74 John Cirace, LAW AND ECONOMICS: AN INTERDISCIPLINARY APPROACH, Ch. 4 (unpublished materials used in my Law and Economics course at Brooklyn Law School).


76 id. at 43.

77 Posner, NOT A SUICIDE PACT, note 6 at 1.


79 Id., pp. 64, 80, 86, 87, 95-103, 108-110, 110.

80 Id., pp. 1, 11.

81 Id. at 24, 66, 28 (last quotation is out of order).