THE DYNAMICS OF THE LEGAL PROCESS

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I. Introduction

In the last few years a number of legal scholars have studied the common law from a primarily positive point of view, asking whether or not the behavior of the relevant parties will cause the legal system to move to an "efficient" outcome. Several have claimed that judges will be motivated to prefer an efficient rather than inefficient outcome,[1] while others have expanded this approach by arguing that the repeated litigation of inefficient legal rules will generate a tendency to replace these inefficient rules with more efficient precedents.[2] Goodman[3] has taken this analysis a step further by developing a model which looks more carefully at the adversary process. As a result, he is able to develop a more general set of conditions under which the common law will be efficient. Goodman, as well as Rizzo and Arnold[4] and Cooter, Kornhauser, and Lane[5] present interesting critiques of the earlier models, while focusing on the question of whether the legal process will tend over time to an efficient outcome.

In terms of the language of economics, all of the previous authors focus

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[1] Richard A. Posner, Economic Analysis of Law (2d ed. 1977).

[2] See Paul H. Rubin, Why Is the Common Law Efficient? 6 J. Legal Stud. 51 (1977); George L. Priest, The Common Law Process and the Selection of Efficient Rules, 6 J. Legal Stud. 65 (1977); but also see Robert Cooter & Lewis Kornhauser, Can Litigation Improve the Law without the Help of Judges? 9 J. Legal Stud. 139 (1980).

[3] John C. Goodman, An Economic Theory of the Evolution of Common Law, 7 J. Legal Stud. 393 (1978).

[4] Mario J. Rizzo & F. S. Arnold, The Tendency toward Efficiency in the Common Law (Discussion Paper No. 79-10, N.Y.U. Center for Pub. Econ. 1979).

[5] Robert Cooter, Lewis Kornhauser, & David Lane, Liability Rules, Limited Information and the Role of Precedent, 10 Bell J. Econ. 366 (1979).

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on the question of the existence and stability of an equilibrium (in the static sense), whether it will be attained, and whether it is efficient. Little if any attention is given, however, to the costs of transition and to the manner in which the legal process does change.[6]

In this paper we concentrate on the normative issue of dynamics rather than on static outcomes, that is, on the legal rules toward which the legal process evolves. We argue that given transitional costs and a positive rate of time discount, whether or not the legal process tends to a statically efficient outcome, there is a dynamically efficient path that should be followed. Questions of dynamics involve the often-discussed issue of the weight that should be placed on precedent in the legal process. Should the legal system follow a *stare decisis* policy with legal precedent remaining essentially undisturbed over time and avoid transition costs, or should precedent change rapidly over time to keep apace with changing social, economic, and technological conditions? While our focus is primarily normative, our paper speaks to issues of positive analysis as well. Our simple model of legal evolution suggests an obvious focus for positive models of behavior for participants in the legal process—with emphasis being placed on the dynamic behavior of the individual and the resulting incentives for rapid or slow precedential change. Our intuition suggests that there is little reason for the legal system to be dynamically efficient, but we leave that issue as a challenge for future research.

In Section II the problem is introduced in somewhat greater detail with a discussion of the dynamic characteristics of the legal process. The focus of the analysis is on the trade-off involved when *stare decisis* is compared to a system which involves rapid precedential change. Finally, the implications of this analysis for the modeling of the dynamics of legal change are considered. Section III develops the dynamic argument further through the detailed development of a simple model, one involving the use of negligence rules in tort law. The negligence rule in a framework of changing social conditions provides the basis for an analysis of the comparative dynamics of optimal adjustment paths. In the model both the injurer and the victim choose levels of care which can affect the probability of the accident. If levels of care are changed by either individual costs of transition or adjustment they are borne by the individual. In addition, future costs are discounted and therefore valued less than current costs. The socially optimum legal rule is not a single negligence standard which

[6] Cooter *et al.*, *supra* note 5. We should note that Cooter *et al.* do present an interesting dynamic model of court behavior. They argue that legal rules involving standards of care taken both by victims and by injurers will converge to an efficient outcome as the court "learns" over time. The formal model of process involves a simple dynamic model, but the normative concerns lie solely with the character of the resulting equilibrium.

minimizes static social costs. Rather, the objective is to choose a time path of legal rules, a changing set of negligence standards which minimize the expected discounted social costs of accidents. The results suggest why it is suboptimal for the legal process to be overly sensitive to environmental change, and help to clarify the dependence of the optimal rate of precedential change on some important behavioral parameters. In Section IV, an example is pursued and the results of the analysis are briefly evaluated with emphasis placed on their implications for the recurring debate about the static efficiency of the common law.

II. The Dynamics of the Legal Process

There is extensive legal literature on legal process and the evolution of common law that need not be reviewed here.[7] In our simple stylized model of the legal process the objects subject to evolution or change are legal rules. Technically speaking, a legal rule is simply a function which translates a set of facts into a prescribed outcome. An example of a legal rule in tort law is the negligence rule with contributory negligence defense, which states that the injurer is liable in tort if he is negligent and the victim is not. The application of a negligence rule to a specific set of facts involves a number of related steps. In most cases negligence must be determined, proximate cause established, and the damages associated with the injury determined.[8]

The legal process describes the means by which rules change over time, and the outcome of the process is a time path of legal rules. Of course, precedent plays an important role in the legal process.[9] When faced with a set of facts, a judge can do one of three things: He may simply decide which of the legal rules in current use is relevant to the facts and apply it; he may decide the case in such a manner that one or more of the relevant rules is necessarily changed; or he may find that no rule relates to the facts and thus, of necessity, expand the domain of some existing rule. Both of the last two possible outcomes involve changes of precedent, but we will

[7] We found the following discussions of the evolution of the common law and legal process to be useful: Karl N. Llewellyn, The Bramble Bush, esp. § 4 (1960); Edward H. Levi, An Introduction to Legal Reasoning, esp. § 1 (1948); Carl A. Auerbach *et al.*, The Legal Process §§ 2 & 4 (1961); Harry Wilmer Jones, John M. Kernochan, & Arthur W. Murphy, Legal Method, esp. ch. 2 (1980).

[8] Rules can often be compounded. For example, the "Learned Hand rule" might be used to determine negligence, after which the negligence with contributory negligence rule can be applied. Thus, one rule is used to establish the facts for the application of the next rule.

[9] The role of precedents is discussed in William M. Landes & Richard A. Posner, Legal Precedent: A Theoretical and Empirical Analysis, 19 J. Law & Econ. 249 (1976); and also in Walter V. Schaefer, Precedent and Policy, 34 U. Chi. L. Rev. 3 (1966).

focus only on the second outcome—the removal or changing of existing rules in favor of other rules.[10]

That the legal process is dynamic is obvious. Over a sufficiently long period of time, changes in social conditions, technology, and so on appear to make changes in certain legal rules desirable. What is perhaps less obvious is that the characteristics of the legal process are sufficient to make a normative analysis of the dynamics of legal change worthwhile. To simplify the discussion consider (as is done in the model) the pluses and minuses associated with a world in which precedents do change.[11] The advantages of *stare decisis* have been listed by many legal scholars. Oliphant,[12] for example, suggests that "it makes the law predictable." The notion that the increase in "reliance" fostered by the *stare decisis* doctrine is a social good is best summarized by Justice Brandeis, who said: "*Stare decisis* is usually the wise policy because in most matters it is more important that the applicable rule of law be settled than that it be settled right."[13] *Stare decisis* has the advantage of making it easier—less costly—for judges to render decisions. Finally, *stare decisis* has the advantage of being equitable in the sense of guaranteeing uniformity of treatment under the law. Put somewhat differently, a system in which legal rules change rapidly increases the probability that two individuals exhibiting identical behavior in identical situations will be treated differently by the courts.

This discussion focuses on the notion of predictability of the legal process. To understand the implications of predictability it is important to distinguish two sources of uncertainty in the application of the law. One source of uncertainty is the role of judicial discretion in deciding the facts

[10] Fred W. Catlett, The Development of the Doctrine of Stare Decisis and the Extent to Which It Should Be Applied, 21 Wash. L. Rev. 158 (1946). According to Catlett, "if the rule in question is a rule of property or a rule affecting trade, business or commerce in reliance upon which the people have acted for a long period of time, the courts are slow to upset it. If the matter is one which can be easily changed by the legislature and the legislature has had an opportunity to act and has not done so, the courts will assume that the earlier rule has not been found unsatisfactory." *Id.* at 159. The role of precedent in the common law itself changed over time. According to Catlett, *id.* at 158–64, the doctrine of *stare decisis* was not fully established in England until late in the nineteenth century. The U.S. courts have placed less weight on precedent than have the British, thus allowing for more rapid legal change. We should note in passing that the role of precedent has varied within the different common-law subjects and should vary, as our results will suggest.

[11] Llewellyn, *supra* note 7, argues that there are really two views of precedent, the orthodox or strict view, which suggests that a legal rule applies only to a narrow set of facts, or the loose view, in which a decision sets a much broader precedent going substantially beyond the immediate configuration of facts in the case. It is this latter view which more closely approximates our perspective.

[12] Herman Oliphant, A Return to Stare Decisis, 14 A.B.A. J. 71 (1928).

[13] Burnet v. Coronado Oil and Gas Co., 285 U.S. 405 (1931).

of a case. Even though the rules relevant for a case may be known by all parties involved, the outcome may still be uncertain due to uncertainty about how the court will view the facts. For example, the consideration of whether an individual has been negligent in a given tort situation may be unclear. This uncertainty is static—it has nothing to do with uncertainty about what the applicable legal rule will be in the future.[14] However, it is a second source of uncertainty—uncertainty about future decisions—which goes to the heart of the *stare decisis* discussion. In general, more rapid changes in rules lead to greater uncertainty about the shape of case law in the future. Thus, an analysis of dynamic uncertainty must focus on the time path of legal rules.

The same issues raised about uncertainty concerning the future also arise when one considers the ease of judicial decision making. Decision-making costs may be a direct function of the rapidity with which legal rules change. For example, Ehrlich and Posner[15] have argued that an increase in the predictability of the outcome of litigation should result in an increase in the settlement rate, which should lower the costs of resolving disputes. Considerations of this sort lead to the formulation of a dynamic optimization model wherein litigation costs play a large role. Inclusion of litigation costs would cause substantial complication in the analysis, while reinforcing our conclusions. Thus, we choose to neglect them in the example which appears in Section III.

Given all of the mentioned social costs associated with a change in precedent, is it necessary to change a legal rule? The answer, of course, is that as economic, technological, and social conditions change, existing legal rules may be less socially desirable than other possible rules. Ehrlich and Posner[16] discuss this issue when they consider the dynamics of legal rules. They cite as an example the fact that technological developments in the railroad industry altered the relative costs of accident avoidance by railroads and by potential victims of accidents, thus making obsolete old rules of railroad accident law. The cost of *stare decisis* is therefore the

[14] The role of uncertainty seen from a static point of view is considered by Mario J. Rizzo, Law Amid Flux: The Economics of Negligence and Strict Liability in Tort, 9 J. Legal Stud. 291 (1980); and Rizzo & Arnold, *supra* note 4. They argue, for example, that a system of strict liability may be preferred to a system of liability with contributory negligence in an uncertain world, when the latter would be efficient in a world of perfect certainty. Despite the reference to dynamics in both papers, the issue of dynamic efficiency is not discussed. Rizzo and Arnold do, however, prepare the way for a positive analysis of precedential change by focusing on the effect of expected changes in precedent on the litigation of private parties.

[15] Isaac Ehrlich & Richard A. Posner, An Economic Analysis of Legal Rulemaking, 3 J. Legal Stud. 257 (1974).

[16] *Id.*

social cost associated with a certain and predictable system of legal rules which reward or penalize behavior in an undesirable fashion. It is the trade-off between the costs of precedential change (uncertainty) and the benefits (a more desirable legal rule) that makes the normative question of dynamic efficiency important.

To pursue this issue further, consider a legal rule which is currently in vogue. The elucidation of this rule in court shows it to be flawed, possibly due to a change in the social or economic environment, and it becomes evident that a change is in order. However, there are a variety of time paths that will ultimately reach a particular "better" rule, each differing in the speed at which rules change over time. A dynamically efficient time path is one in which the rate of change of legal rules minimizes the social costs placed upon such changes—the social cost function accounting for the uncertainty of change and the inefficiencies of a suboptimal legal rule.

It is important to distinguish our definition of dynamic efficiency from the common usage of efficiency in a static framework. Our definition of dynamic efficiency presupposes the existence of some social welfare function which measures "static welfare" or "static efficiency." The problems associated with the existence of such a measure are well known. Our definition takes as given the initial position of the process—the past history of legal rules. We then ask where the process should go from this initial point. There is no presumption that the initial position is economically efficient in any sense, and there is no presumption that the final position of the process should be efficient as well.[17] Our approach to modeling dynamics is also not inconsistent with wealth maximization.[18]

III. An Example: The Efficient Dynamic Path of a Negligence Rule

Our argument concerning the dynamics of legal rules can be illustrated if we consider a specific example of a legal rule: the negligence rule in tort

[17] For a recent discussion of this issue, see the March 1980 issue of the *Journal of Legal Studies*. We might note that Richard Epstein's argument that the static conception of the law is appropriate is consistent with our view of the legal system. Epstein argues that the principles of the legal system ought not to respond immediately to new social conditions, but he leaves clear the notion that some change in legal rules may be desirable. Richard A. Epstein, The Static Conception of the Common Law, 9 J. Legal Stud. 253, 254 (1980).

[18] Economists would argue that one flaw associated with the wealth-maximization criterion is that, in general, the Pareto ordering cannot be represented by any sort of social welfare function, and thus our approach is no less flawed than the transferable-utility approach of the wealth maximizers. Strictly speaking, this is true, but it should be observed that recent advances in the field of economic dynamics have made it possible to study dynamics arising from partial orderings such as the Pareto ordering for social states. The qualitative implications of our analysis would not change, and so we feel that nothing is to be gained by approaching legal dynamics at this level of generality.

law. The model that follows is adapted from the literature on the efficiency of a negligence–contributory negligence rule. This literature builds directly on the work of Brown.[19] Brown takes individual levels of activity as given and solves to find the optimal level of care that ought to be taken by each of two parties if a Pareto-efficient outcome is the objective. He then shows that such an efficient outcome can be achieved through a negligence rule, with the levels of "due care" correctly set.

Our model is a simple dynamic version of Brown's model. We suppose that there are two potential litigants, a victim and an injurer. Both victim and injurer choose a level of care, x and y, respectively (where each is greater than zero). The cost to taking care is w^x per unit for the victim and w^y per unit for the injurer. If care levels x and y are taken, then the probability of an accident occurring is given by the function $p(x,y)$. Finally, if the accident occurs, a cost A (the damages associated with the accident) is borne initially by the victim. As stated, the model is a static one in which the expected social cost of the accident $c(x,y)$ is given by:

$$c(x,y) = w^x x + w^y y + p(x,y)A. \tag{1}$$

Brown has shown that under reasonable assumptions it is possible to define due-care standards and negligence rules so that each potential litigant has the incentive to take the socially optimal (cost-minimizing) amount of care. We will change the model to make it dynamic and then see how the optimal due-care standards are affected.

To simplify the argument, assume that there are three time periods: the past (period -1), the present (period 0), and the future (period 1). Each potential litigant is provided with information about the past, that is, the care taken in period -1, denoted x_{-1} and y_{-1} for victim and injurer, respectively. If, for whatever reason, either individual chooses to change his or her level of care, a cost of adjustment must be borne. This adjustment cost might be a real resource cost if, for example, a new piece of safety equipment must be purchased and the old equipment scrapped. However, the cost might be psychological in nature, in that the process of change itself might harm individuals. In any case, the cost of adjustment will depend on factors such as the technology of taking care and is likely to be larger the greater the contemplated change in care. As we will see, the incentive to change one's level of care comes from two sources: a change in the cost of taking care, and a change in the due-care standard.[20]

To make all of this more precise, we assume that the victim's cost

[19] John Prather Brown, Toward an Economic Theory of Liability, 2 J. Legal Stud. 323 (1973).

[20] We could have modeled this problem with random accident costs A as well, but that would make the analysis more complex.

resulting from a change in the victim's standard of care from x_{-1} to x is $\gamma(x - x_{-1})^2$ and similarly $\gamma(y - y_{-1})^2$ for the injurer with γ positive. In a static environment, adjustment costs can be neglected because once standards of care are determined there is never any reason to change them. However, in the dynamic model, period-to-period changes make adjustment costs important. To model this we assume that w^x and w^y are random variables so that the cost of care varies from period to period. Thus although past costs w^x_{-1} and w^y_{-1} and present costs w^x_0 and w^y_0 are known to the court and to the potential litigants, future costs w^x_1 and w^y_1 are unknown.

If potential litigants have no concern for the future, then the uncertainty they face over future costs of care will have no effect on present decisions. However, if they are concerned for the future, then, since tomorrow's costs of care determine tomorrow's due-care standards, future expected adjustment costs must be taken into account in making today's decision. The value placed on the future by potential litigants can be measured by a discount factor, β $(0 < \beta < 1)$, with a lower β implying less concern for the future.

If the court is to choose legal rules so as to achieve dynamic efficiency, it must minimize expected discounted social cost. Given this objective, optimal due-care standards can be computed by using a dynamic programming algorithm. The detailed analysis which follows solves the dynamic programming algorithm to determine optimal due-care standards. For those with a nontechnical background, a brief overview might be useful. We consider the general problem of finding dynamically efficient rules, solving to find the necessary conditions that such a rule must satisfy. We then show that with nonzero adjustment costs, the dynamically efficient legal rule at any point in time will *not* be identical to the statistically efficient rule. Finally, we show exactly how the dynamically efficient path will change when either the discount rate or the adjustment costs change.

The dynamic programming solution starts with the future. If standards x_0 and y_0 were set in period 0, and if w^x_1 and w^y_1 were observed in period 1, the court would choose standards x_1 and y_1, which minimize

$$\gamma(x_1 - x_0)^2 + \gamma(y_1 - y_0)^2 + w^x_1 x_1 + w^y_1 y_1 + p(x_1,y_1)A. \tag{2}$$

This minimum cost depends on x_0, y_0, w^x_1, and w^y_1 and is denoted $C(x_0, y_0, w^x_1, w^y_1)$.

Now consider period 0. Here x_{-1} and y_{-1} are given, and w^x_0, w^y_0, w^x_{-1}, and w^y_{-1} are all known. Then

$$c(x_0,y_0) = E[c(x_0,y_0,w^x_1,w^y_1) \mid w^x_{-1},w^x_0,w^y_{-1},w^y_0] \tag{3}$$

is the expected cost in period 1, if care standards x_0 and y_0 are set in period 0, given all of the observed variables.[21] The court's problem in the present is to choose due-care standards to minimize

$$\gamma(x_0 - x_{-1})^2 + \gamma(y_0 - y_{-1})^2 + w^x_0 x_0 + w^y_0 y_0 + p(x_0,y_0)A + \beta c(x_0,y_0). \tag{4}$$

The rest of this section is devoted to exploring how the optimal due-care standards so determined depend upon γ and β.

Since we use the calculus to analyze this problem, we assume that $p(x,y)$ is differentially strictly decreasing and differentially strictly convex. Absent dynamic considerations, the optimal due-care standards are found from the solution to the pair of first-order condition equations obtained by differentiating (1) with respect to x and y, respectively:

$$\begin{aligned} w^x + p_x(x,y)A &= 0, \\ w^y + p_y(x,y)A &= 0, \end{aligned} \tag{5}$$

where $p_x(p_y)$ denotes the partial derivative of $p(x,y)$ with respect to $x(y)$.

When dynamic considerations are present, the optimal due-care standards in period 0 are obtained by differentiating (4) with respect to x_0 and y_0 and solving. (Note that the subscript 0 has been dropped to simplify the presentation):

$$\begin{aligned} 2\gamma(x - x_{-1}) + w^x_0 + p_x(x,y)A + \beta c_x(x,y) &= 0, \\ 2\gamma(y - y_{-1}) + w^y_0 + p_y(x,y)A + \beta c_y(x,y) &= 0. \end{aligned} \tag{6}$$

From (2) it is easy to see (again differentiating with respect to x_0 and y_0) that

$$\begin{aligned} c_x(x,y) &= -2\gamma(\bar{x} - x), \\ c_y(x,y) &= -2\gamma(\bar{y} - y), \end{aligned} \tag{7}$$

where $\bar{x}$ and $\bar{y}$ are the expected due-care standards in period 1. (It is important to remember, though, that $\bar{x}$ and $\bar{y}$ are functions of x and y.) Substituting (7) into (6) gives

$$\begin{aligned} 2\gamma(x - x_{-1}) + w_x + p_x(x,y)A - 2\beta\gamma(\bar{x} - y) &= 0, \\ 2\gamma(y - y_{-1}) + w_y + p_y(x,y)A - 2\beta\gamma(\bar{y} - y) &= 0. \end{aligned} \tag{8}$$

[21] The w^x_{-1} and w^y_{-1} appear in the conditional statement in (3) to remind us that the period 0 variables depend indirectly on past costs of taking care, since past costs of care influence current levels of care through the cost of transition. Since the process that we are describing is a Markov process, this link is an indirect rather than a direct one.

These equations can be differentiated to determine how the optimal period 0 due-care standards will vary as β and γ are changed. Let $p_{xx} = (\partial^2 p)/(\partial x^2)$, $p_{xy} = p_{yx} = (\partial^2 p)/(\partial x \partial y)$, and $p_{yy} = (\partial^2 p)/(\partial y^2)$. Differentiating (8) gives rise to the following matrix equation:

$$\begin{bmatrix} 2(1+\beta)\gamma + Ap_{xx} & Ap_{xy} \\ Ap_{yx} & 2(1+\beta)\gamma + Ap_{yy} \end{bmatrix} \begin{vmatrix} \frac{\partial x}{\partial \gamma} & \frac{\partial x}{\partial \beta} \\ \frac{\partial y}{\partial \gamma} & \frac{\partial y}{\partial \beta} \end{vmatrix} = 2 \begin{bmatrix} \beta(\bar{x} - x) - (x - x_{-1}) & \gamma(\bar{x} - x) \\ \beta(\bar{y} - y) - (y - y_{-1}) & \gamma(\bar{y} - y) \end{bmatrix}. \tag{9}$$

Solving equation (9) yields

$$\begin{bmatrix} \frac{\partial x}{\partial \gamma} \\ \frac{\partial y}{\partial \gamma} \end{bmatrix} = \frac{2}{\Delta} \begin{bmatrix} [2(1+\beta)\gamma + Ap_{yy}]\,[\beta(\bar{x} - x) - (x - x_{-1})] \\ \quad -Ap_{xy}[\beta(\bar{y} - y) - (y - y_{-1})] \\ [2(1+\beta)\gamma + Ap_{xx}]\,[\beta(\bar{y} - y) - (y - y_{-1})] \\ \quad - Ap_{yx}[\beta(\bar{x} - x) - (x - x_{-1})] \end{bmatrix}, \tag{10}$$

and

$$\begin{bmatrix} \frac{\partial x}{\partial \beta} \\ \frac{\partial y}{\partial \beta} \end{bmatrix} = \frac{2}{\Delta} \begin{bmatrix} [2(1+\beta)\gamma + Ap_{yy}]\gamma(\bar{y} - y) - Ap_{xy}\gamma(\bar{x} - x) \\ [2(1+\beta)\gamma + Ap_{xx}]\gamma(\bar{x} - x) - Ap_{yx}\gamma(\bar{y} - y) \end{bmatrix}, \tag{11}$$

where

$$\Delta = \text{Det} \begin{bmatrix} 2(1+\beta)\gamma + Ap_{yy} & Ap_{xy} \\ Ap_{yx} & 2(1+\beta)\gamma + Ap_{yy} \end{bmatrix}.$$

We will assume that x and y are substitutes for each other, that is, increasing x decreases the marginal contribution of y, and vice versa. Formally, $p_{xy} = p_{yx} < 0$, as is assumed by Brown to prove the existence of a static equilibrium. When this is true, a good deal can be said about the comparative statics of the model.

First, note that

$$\Delta = 4(1+\beta)^2\gamma^2 + 2(1+\beta)\gamma A(p_{xx} + p_{yy}) + A^2 \text{Det} \begin{bmatrix} p_{xx} & p_{xy} \\ p_{yx} & p_{yy} \end{bmatrix}.$$

Since $\beta, \gamma \geq 0$, and $A > 0$, the convexity of $p(x,y)$ implies that $\Delta > 0$. We now are in a position to consider effects of changes in the discount rate on optimal due-care standards.

Suppose first that $\gamma = 0$. Then there are no future adjustment costs to worry about, so that $(\partial x/\partial \beta) = (\partial y/\partial \beta) = 0$. Thus the discount rate has no effect on the optimal due-care standards. If $\gamma = 0$, the first-order condition of (8) reduces to (5). In each period the court should set the due-care standards at the static optimum given the observed costs of care, and dynamic considerations have no effect.

Now suppose that $\gamma > 0$. The convexity assumption implies that $2(1+\beta)\gamma + Ap_{xx} > 0$ and $2(1+\beta)\gamma + Ap_{yy} > 0$, and so the effect of an increase in the discount rate depends upon whether potential litigants think due-care standards in the future will be higher or lower than the current standards. If litigants believe that both x and y will be higher in the future, then an increase in β increases both litigants' (victim and injurer) concerns about future expected adjustment costs, and thus leads them to want to increase current care to compensate. Similarly, the expectation of lower future due-care standards leads to decreases in x and y as β is increased. Thus

$$\frac{\partial x}{\partial \beta}, \frac{\partial y}{\partial \beta} > 0 \text{ if } \bar{x} - x > 0, \bar{y} - y > 0,$$
$$\frac{\partial x}{\partial p}, \frac{\partial y}{\partial p} < 0 \text{ if } \bar{x} - x < 0, \bar{y} - y < 0.$$

Finally, we note that the effect of a change in β is ambiguous when $\bar{x} - x$ and $\bar{y} - y$ have different signs.

A similar analysis holds for the effect of changes in γ on due-care standards, but the situation is more complicated. Suppose first that $\beta = 0$. Litigants have no concern for the future and so only current-period adjustment costs matter. Then we seen that if $x > x_{-1}$ and $y > y_{-1}$, an increase in γ reduces x and y. Adjustment costs increase when γ increases, and this is compensated for by diminishing the size of the adjustment. In this case the size is reduced by lowering x and y, but $x < x_{-1}$ and $y < y_{-1}$, the size will be reduced by increasing x and y. Thus, if $\beta = 0$,

$$\frac{\partial x}{\partial \gamma}, \frac{\partial y}{\partial \gamma} > 0 \text{ if } x - x_{-1} < 0, y - y_{-1} < 0,$$
$$\frac{\partial x}{\partial \gamma}, \frac{\partial y}{\partial \gamma} < 0 \text{ if } x - x_{-1} > 0, y - y_{-1} > 0.$$

Finally, the effect of a change in γ is ambiguous when $x - x_{-1}$ and $y - y_{-1}$ are of opposite signs.

Now suppose that $\beta > 0$. Then, expected future adjustment costs matter as well as present costs. The importance of future considerations depends upon the size of β. Large values of β put more weight on the

future than do small values. The factors which determine the effects of γ on x and y are $\beta(\bar{x} - x) - (x - x_{-1})$ and $\beta(\bar{y} - y) - (y - y_{-1})$. Thus,

$$\frac{\partial x}{\partial \gamma}, \frac{\partial y}{\partial \gamma} > 0 \text{ if } \beta(\bar{x} - x) - (x - x_{-1}) > 0,\ \beta(\bar{y} - y) - (y - y_{-1}) > 0,$$
$$\frac{\partial x}{\partial \gamma}, \frac{\partial y}{\partial \gamma} < 0 \text{ if } \beta(\bar{x} - x) - (x - x_{-1}) < 0,\ \beta(\bar{y} - y) - (y - y_{-1}) < 0.$$

If x_{-1} and $\bar{x}$ are lower than x, and y_{-1} and $\bar{y}$ are lower than y, then lowering x and y lowers both present and expected future adjustment costs, and so $(\partial x/\partial \gamma)$, $(\partial y/\partial \gamma) < 0$. If $x_{-1} < x < \bar{x}$ and $y_{-1} < y < \bar{y}$, then a move to lower current adjustment costs increases expected future adjustment costs, and vice versa. This tension is resolved by β, with higher β's favoring the future $[(\partial x/\partial \gamma) > 0,\ (\partial y/\partial \gamma) > 0]$ and lower β's favoring the present $[(\partial x/\partial \gamma) < 0, (\partial y/\partial \gamma) < 0]$. However, nothing general can be said when $\beta(\bar{x} - x) - (x - x_{-1})$ and $\beta(\bar{y} - y) - (y - y_{-1})$ have opposite signs.

We have illustrated in this negligence rule case why the statically efficient rule is not dynamically efficient when adjustment costs are present. We have not derived an explicit solution for the optimal due-care standards at each time period, however. To do so would necessitate the treatment of specific functional forms and add substantial detail to our analysis.[22]

IV. Evaluating the Results

The discussion to this point has been rather abstract, but it can be made more concrete by considering a specific example of how a legal rule has evolved. We choose to examine the breakdown of the "inherently dangerous" rule in tort law.[23] At issue is the potential liability of a seller of a commodity that causes injury not to the buyer but to a third party. The traditional view (held through the first half of the nineteenth century) was that sellers are never liable for negligence to a third party. However, the foundation for change was laid in *Dixon* v. *Bell*[24] in which the owner of a gun was held liable for damage done by a servant girl who was sent in to

[22] Our model can be extended from a three-period model to one with an infinite horizon. In the infinite-horizon case, the dynamic programming problem becomes somewhat more complex, but the results remain essentially the same. In addition, the model can be used to evaluate the dynamically efficient response to a one-time change in the unit costs of taking care. In an infinite-horizon model of this type, it can be shown that the dynamically efficient time path of legal rules converges to, but never equals, the statically optimal solution.

[23] This discussion is a summary of an excellent discussion of the "inherently dangerous" rule by Levi, *supra* note 7, at § 2.

[24] 5 Maule & Salwyn 198, 105 Eng. Rep. 1023 (1816).

get it. According to the court, the gun, being loaded, was ". . . left in a state capable of doing mischief."[25] The application of the inherently dangerous concept to the problem of vendor liability for injuries to third parties was urged upon the court, and finally accepted in *Longmeid v. Holliday*.[26] The court distinguished an object ". . . in its nature dangerous . . ." from an object ". . . which might become so by latent defect entirely unknown . . . ."[27] A series of subsequent cases identified various objects by nature dangerous and objects latently dangerous, beginning with *Thomas* v. *Winchester*,[28] where it was found that the defendent's negligence in the mislabeling of a poison "put human life in imminent danger."

The breakdown of the inherently dangerous rule was marked by the decision of Judge Cardozo in *MacPherson v. Buick*.[29] He argued that whereas the rule in *Thomas v. Winchester* had originally been applied to weapons, whose normal function is to injure or destroy, the scope of the rule should no longer be restricted. In his interpretation, the rule was: "If the nature of a thing is such that it is reasonably certain to place life and limb in peril, when negligently used, it is then a thing of danger."[30]

Case law in this instance evolved through three steps. In the initial stage the doctrine of no vendor liability was maintained. In the second stage, an exception to this rule was allowed: "[O]ne who manufactures articles inherently dangerous, e.g., poisons, dynamite, gunpowder, torpedoes, bottles of water under gas pressure, is liable in tort to third parties which they injure, unless . . . he has exercised reasonable care with reference to the article manufactured . . . ."[31] Finally, Cardozo's decision extended the class of "inherently dangerous" articles to include anything "imminently" dangerous, meaning that they would be dangerous if negligently used. What was once the exception had now become the rule. Or, as the Massachusetts court put it, "The MacPherson case caused the exception to swallow the asserted rule of nonliability, leaving nothing upon which that rule could operate."[32]

Judge Cardozo's reluctance to admit explicitly to a change in the legal

[25] *Id.* at 199, 105 Eng. Rep. 1024.

[26] 155 Eng. Rep. 752 (1851).

[27] *Id.* at 755.

[28] 6 N.Y. 397 (1852).

[29] 217 N.Y. 382, 111 N.E. 1050 (1916).

[30] MacPherson v. Buick Motor Co., 217 N.Y. 382, 289, 111 N.E. 1050, 1053 (1916). In England, the scope of the "inherently dangerous" rule was also enlarged upon. In Donoghue v. Stevenson [1932] A.C. 562 emphasis was placed upon the control of a vendor of an article until it reached the third party, in this case, the consumer of a bottle of ginger beer.

[31] Cadillac v. Johnson, 221 Fed. 801, 802 (C.C.A. 1915).

[32] Carter v. Yardley & Co., 319 Mass. 92, 103, 64 N.E. 2d 693, 700 (1946).

rule suggests the great weight that the court does place on legal precedent. Our analysis suggests that it may make sense to change precedent slowly if the transition costs of change are high. A sudden switch from a rule of no vendor liability to an "imminently" dangerous rule could present serious incentive problems for individuals who have little idea of the situations in which they are likely to be liable or for firms that have to make long-run production plans, with the possibility of additional and sudden changes in the tort liability rules that they face.

Our argument is that static notions of optimality tell only part of the story. Given that the social and technological milieu of common law changes over time, it is meaningful to ask what the optimal rate of change of legal rules—the optimal weight given to precedent—ought to be. In our model the optimal time path of legal rules depends upon the importance society places upon the future (the discount rate) and on adjustment costs (how individuals respond to changes in legal rules and changes in technology). It is evident that individuals' (or society's) attitudes toward risk will also play a role in the determination of the optimal time path, although we have not explicitly examined that here. However, it seems plausible that an increase in risk aversion would increase the optimal reliance upon precedent.

Of course, the development of a normative analysis along the lines suggested here is only valuable if the norm can be used to evaluate the current status of the legal process. In particular, it is important to ask whether or not the legal process has evolved and will evolve in a dynamically efficient manner. The answer depends, of course, upon the construction of a suitable positive model of judicial and litigant behavior—an effort beyond the scope of this paper. However, as a precursor to that effort it is worthwhile to reflect briefly on the differences that might exist between the optimal time path of legal rules and the time path that results from the self-interest-maximizing behavior of litigants and judges.

Our intuition is that there is little reason for the observed time path of legal rules to approximate the optimal time path. Put somewhat differently, we see reasons for expecting judges and other relevant parties to behave in a socially suboptimal manner. Landes and Posner[33] have observed, for example, that a judge's ability to set a lasting precedent has implications for his status within the legal profession and ultimate ability to attain various career goals. If judges are likely to place great emphasis on changing precedent, then judges would have less regard for the costs of adjustment than would the rest of society. Alternatively, extremely risk-

[33] Landes & Posner, *supra* note 9.

averse judges might place little emphasis on changing precedent due to their fear of being overturned by higher courts. In this case the evolution of common law would be too slow. These stories must be coupled with models of the behavior of potential litigants, for it has been demonstrated that the rate at which efficient and inefficient rules are litigated is an important determinant of the legal process.[34]

[34] See Rizzo & Arnold, *supra* note 4, for a review of the literature on this subject.