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THE SUCCESS AND SURVIVAL  
OF CAUTIOUS OPTIMISM: LEGAL RULES  
AND ENDOGENOUS PERCEPTIONS IN  
PRE-TRIAL SETTLEMENT NEGOTIATIONS

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# The Success and Survival of Cautious Optimism

## Legal Rules and Endogenous Perceptions in Pre-Trial Settlement Negotiations

Oren Bar-Gill\*

July, 2002

### Abstract

Litigants are unrealistically optimistic with regard to the probability of prevailing at trial. This systematic bias is well documented, and has been often invoked to explain breakdowns in pre-trial settlement negotiations. Contrary to existing models that allow for optimism as an exogenous assumption, the present study derives this cognitive bias endogenously. It thus provides a theoretical foundation for optimism in litigation. Quasi-evolutionary forces - market pressure (in the market for legal services) and imitation processes – are shown to favor cautiously optimistic litigants. Moreover, the endogenous optimism model enables an examination of the factors that determine the magnitude of the optimism bias. In particular, it is shown that the legal environment influences the equilibrium level of optimism. Focusing on rules for the allocation of litigation costs, the American rule induces a higher level of optimism, as compared to the British rule. This finding qualifies the conventional wisdom regarding the advantage of the American rule in fostering settlements. Finally, the present analysis is offered as an illustration of a broader theme, that the law can play an important role in determining the types and magnitudes of prevailing cognitive biases. The identification, characterization and analysis of this perception-shaping role of legal institutions are a novelty of the present study. Behavioral law and economics is revealed as a two-way, rather than a one-way street. Not only do cognitive biases affect the operation of legal rules, but also the legal rules themselves influence the types and magnitudes of observed biases.

**Keywords:** Litigation, Pre-Trial Settlement Negotiations, Optimism.

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# The Success and Survival of Cautious Optimism

## Legal Rules and Endogenous Perceptions in Pre-Trial Settlement Negotiations

Oren Bar-Gill\*

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### 1. Introduction

Over 90% of all legal proceedings end up outside the courtroom, via settlement. Still in a large number of cases settlement negotiations fail, and considerable amounts of litigation costs are incurred at trial. These facts have led to an extensive literature regarding the prerequisites for settlement and the terms of settlements reached through pre-trial negotiations (for recent surveys, see Daughety (2000) and Hay and Spier (1998)).

The law and economics literature, having recognized that without information problems parties will always settle<sup>1</sup>, has turned to models of uncertainty and asymmetric information in attempt to explain the failure to reach settlement (see, for example, Cooter et al. (1992), Priest and Klein (1984), Bebchuk (1984), Reinganum and Wilde (1986), Nalebuff (1987), Spier (1992,1994) and Farmer and Pecorino (1996)). The main insight suggests, that when uncertainty or asymmetric information induce a sufficiently large gap

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<sup>1</sup> A settlement saves litigation costs, thereby ensuring the existence of a settlement range.

between the (net) expected gain at trial, as perceived by the plaintiff, and the (net) expected liability at trial, as perceived by the defendant, the parties will fail to reach a settlement.<sup>2</sup>

However, uncertainty and asymmetric information are not the only explanation for the common breakdown of settlement negotiations. Indeed, in many cases the relevant information, at large, is known to both parties, and still settlement is not always reached. Legal scholars and practitioners often attribute such breakdowns in settlement negotiations to an optimism bias shared by many lawyers and litigants (see Birke and Fox (1999) and the references cited therein<sup>3</sup>; see also Kaplow and Shavell (2000) (section 5.2.1) and Loewenstein et al. (1993)). The law and economics literature includes incidental discussions of the implications of optimism in litigation and settlement contexts (see, e.g., Shavell (1982) and Loewenstein et al. (1993)). The origins of the optimism bias, however, were never considered. Optimism, when recognized, was taken to be an exogenously imposed impediment to settlement, not susceptible to analytical examination.<sup>4</sup>

The present study sets out to derive optimism endogenously, rather than assume its existence exogenously. It is shown that quasi-evolutionary forces operating in the litigation environment induce “cautious optimism”. When lawyers and litigants with a

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<sup>2</sup> Of course, settlement will not be reached only if the plaintiff believes that his (net) expected gain at trial is greater than the (net) expected liability that the defendant believes she faces at trial. If the defendant believes her (net) expected liability to be greater than (net) gain as perceived by the plaintiff, a settlement will surely be reached.

<sup>3</sup> Birke and Fox (1999) provide a comprehensive survey covering the relevant psychological literature on the optimism bias, as well as specific studies, which prove the prevalence of a systematic bias towards optimism in legal settings. For an account of optimism in bargaining - see Bottom and Paese (1999). Bottom and Paese (1999) also summarize the experimental literature, which demonstrates the persistence of optimism in various settings.

<sup>4</sup> A main problem with the exogenous view of optimism is that it precludes any analysis of the determinants of the optimism bias as well as any attempt to influence the level of the bias. Birke and Fox (1999) is a recent exception to this common view. These authors focus on practical measures, which can mitigate optimism as well as several other psychological biases that impede upon settlement negotiations.

variety of bias levels, ranging from pessimism to extreme optimism, interact with each other in the pre-trial setting, only the bias levels that earn the highest average payoff will survive in the long run. The evolution of lawyers' optimism has the greatest intuitive appeal. A lawyer with a systematic bias that leads to below average profits will receive little or no business and will eventually be forced out of the market (compare: Alchian (1950), Friedman (1953), Camerer (1992) and Dutta and Radner (1999)).<sup>5</sup> Alternatively, successful lawyers will pass on their bias levels, through the training process of legal interns, judicial clerks and junior associates<sup>6</sup> and through their general influence on the legal profession (see Bowles (1998), p. 82: "The cultural transmission process translates economic well-being, exposure to roll models, and other influences into replication of traits, and thus intervenes between payoffs and replication." ).<sup>7</sup>

But, why will these quasi-evolutionary forces select "cautious optimism"? Why not select pessimism, realism or more extreme levels of optimism? The answer builds on an analysis of the two effects of optimism in the litigation and settlement context. First, as previously recognized, optimism may prevent settlement. This force pushes towards less

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<sup>5</sup> On the cases that this lawyer does get, she will lose money. Thus, even if her below-average performance is not made public and thus does not affect her caseload, she will eventually be driven out of the market.

<sup>6</sup> Optimism may also be selected through the law firm promotion process. A cautiously optimistic associate will do better on average, and will thus have greater chances of being made partner.

<sup>7</sup> The evolutionary methodology links the present study to papers, which attempt to explain seemingly irrational behavior as the result of an evolutionary selection process. See, for example, Kyle and Wang (1997), Waldman (1994) and Heifetz and Spiegel (1999) (Heifetz and Spiegel also demonstrate the evolutionary stability of cautious optimism albeit in an entirely different setting). More generally, our analysis relates to the growing literature on endogenous preferences. Prominent examples of this growing literature are: Frank (1988), Guth and Yaari (1992), Fershtman and Weiss (1997, 1998), Huck and Oechssler (1998), Bester and Guth (1998) and Dekel and Scotchmer (1999). The evolutionary methodology has also been utilized to study the emergence of various elements of bargaining behavior (see Young (1993) and Ellingsen (1997)). Closest to the present analysis are the study by Huck, Kirchsteiger and Oechssler (1997), explaining the "endowment effect" (the endowment effect describes the fact that people demand much more to give up an object than they are willing to spend to acquire it); and the study by Heifetz and Segev (2001) on the role of toughness in bargaining. This line of study has employed the evolutionary or cultural transmission approaches to examine how preferences are formed in different economic settings. Although psychological biases and preferences are distinct human characteristics, they are both subject to similar dynamic forces.

optimism. Second, if a settlement is reached, optimism provides for more favorable settlement terms. Intuitively, optimism operates as a commitment device, leading the litigant to appear tougher in the bargaining game. This force pushes towards more optimism. Balancing these countervailing forces leads to the “cautious optimism” result.<sup>8</sup>

After providing a theoretical underpinning for optimism in the pretrial bargaining, the analysis proceeds to examine which factors determine the magnitude of the optimism bias. In particular, it is shown that the legal environment plays an important role in shaping litigants’ perceptions. The present study focuses on the legal rules that determine the allocation of litigation costs between the parties. It is shown that the American rule, which lets each party bear her own litigation costs, induces a greater level of optimism, compared to the British rule, under which the loser at trial bears also the winner’s litigation costs.<sup>9</sup> Intuitively, since the implications of victory at trial are greater under the British rule<sup>10</sup>, optimism regarding the probability of victory is more powerful under this rule. This greater impact of optimism enhances both the negative effect of optimism on the probability of settlement and the positive effect of optimism on the terms of settlement. Overall, this leads to a lower level of optimism under the British rule.

The higher level of optimism induced by the American rule (as compared to the British rule) reduces the relative advantage of the American rule in fostering settlements.

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<sup>8</sup> The present analysis argues that cautious optimism provides for higher expected returns. There are alternative explanations for the success and survival of optimism. For instance, even if optimists do poorly on average, a few lucky optimists may do better than their realist or pessimist rivals (if optimism leads players to choose lower mean, but higher variance projects or cases). Compare: Majumdar and Radner (1991) on the success and survival of risk loving behavior.

<sup>9</sup> While the analysis focuses on the American and British rules, it can be readily extended to cover other rules for the allocation of litigation costs, such as the pro-plaintiff rule and the pro-defendant rule (for a characterization of these rules – see Shavell (1982)).

<sup>10</sup> Under the British rule, the allocation of litigation costs as well as the judgment amount itself depend on the outcome at trial. Under the American rule, each party bears its own litigation costs, regardless of the outcome at trial.

These findings add a new perspective to the ongoing debate over the optimal allocation of litigation costs. Generally, Law and Economics scholars have supported the American rule as the more effective promoter of settlements (see, for example, Shavell (1982)). This conventional wisdom, however, is (implicitly) based on an exogenous optimism assumption (or simply on a no-optimism, or realism, assumption). The proposed endogenous optimism model qualifies the conventional wisdom.

This paper demonstrates that the equilibrium level of optimism depends on the legal environment in a systematic way. This result is indicative of a much broader theme. The law can play an important role in determining the type and magnitude of prevailing cognitive biases. The identification, characterization and analysis of this perception-shaping role of legal institutions are a novelty of the present study. Behavioral law and economics is characterized here as a two-way street, rather than the one-way characterization implicit in the current literature. Clearly, cognitive biases affect the operation of legal rules. But also the legal rules themselves influence the type and magnitude of the prevailing cognitive biases. Both effects should be considered in the evaluation of legal policy.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 establishes the evolutionary stability of cautious optimism in a deterministic setting. Section 4 analyzes the effects of uncertainty on the evolutionary stable level of optimism. Section 5 examines welfare issues and highlights the main policy implications of the analysis. Section 6 offers concluding remarks and discusses possible extensions.

## 2. Model

### 2.1 Pre-Trial Bargaining

Let  $p$  represent the true probability of a judgment in favor of the plaintiff. If the plaintiff is victorious, the defendant is ordered to pay him a sum  $W$ . The plaintiff and the defendant incur litigation costs of  $c_p$  and  $c_d$ , respectively, if negotiations fail and trial commences. Let  $C = c_p + c_d$  represent the total costs of going to trial.

The optimism, realism or pessimism of the parties is with regard to the probability of the plaintiff's victory at trial. Let  $p_p = p + x_p$  represent the probability that the plaintiff succeeds at trial, as perceived by the plaintiff. Correspondingly, let  $p_d = p - x_d$  represent the probability that the plaintiff succeeds at trial, as perceived by the defendant. Therefore, the players are considered realists if  $x = 0$ , optimists if  $x > 0$  and pessimists if  $x < 0$ . It should be emphasized that optimism, realism and pessimism are viewed as intrinsic characteristics of the individual, such that the individual is unaware of the bias (if one exists).<sup>11</sup>

Under the American rule each player bears her own litigation costs regardless of the outcome at trial. Hence, in pre-trial negotiations, the plaintiff's reservation price is  $R_p = (p + x_p)W - c_p$ ,<sup>12</sup> and the defendant's reservation price is  $R_d = (p - x_d)W + c_d$ . In other words, the plaintiff will reject any settlement below  $R_p$ , and the defendant will

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<sup>11</sup> Hence, optimism cannot be used strategically. This type of unawareness is assumed in the dynamic extension as well (see section 2.2), where individuals play the pre-trial bargaining game again and again through time. This implies a limited bounded rationality assumption, since in our model players do not learn about their bias level.

<sup>12</sup> The analysis assumes positive present value suits, i.e.  $pW - c_p > 0$ . It is further assumed that  $R_p = (p + x_p)W - c_p > 0$ . These assumptions focus the analysis on the effects of optimism on pre-trial settlement negotiations, as they ensure that suit will be brought regardless of the plaintiff's perceptual bias. It should be noted, however, that optimism may also affect the plaintiff's decision whether to file suit in the first place. This and related effects are discussed further in section 6.1.



reject any settlement above  $R_d$ . Therefore, a settlement range  $[R_p, R_d]$  exists if and only if  $R_p \leq R_d$ , i.e. a settlement will be reached if and only if  $x_p + x_d \leq \frac{C}{W}$ . Under the British rule, the loser at trial is required to cover the winner's litigation costs. Hence, the plaintiff's reservation price is  $R_p = (p + x_p)(W + C) - C$ , and the defendant's reservation price is  $R_d = (p - x_d)(W + C)$ . A settlement range exists under the British rule if and only if  $x_p + x_d \leq \frac{C}{W + C}$ . The settlement range under each of the two rules is illustrated in figure 1.

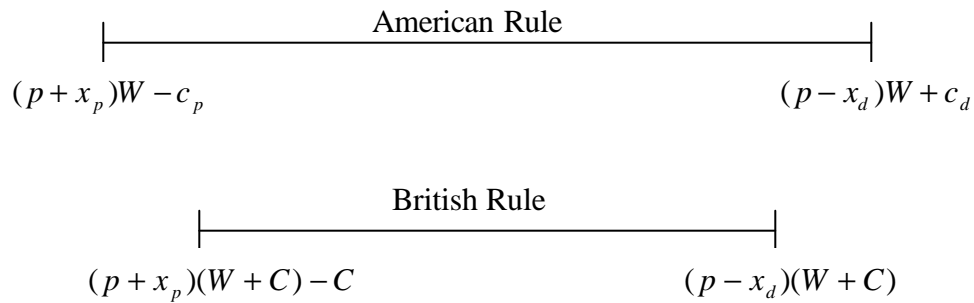


Fig. 1: The settlement ranges under both rules

Figure 1 exhibits the main advantage of the American Rule, as described in traditional models. The wider settlement range induced by this rule is capable of “absorbing” greater levels of uncertainty, and thus it guarantees more settlements.<sup>13</sup> As demonstrated below, this advantage of the American rule is significantly weakened when optimism is determined endogenously (rather than assumed exogenously).

<sup>13</sup> The American rule induces a wider settlement range under both a ‘no optimism’ (or realism) assumption as well as under an exogenous optimism assumption.

If a settlement is reached, its terms will be determined by the parties' relative bargaining power. For simplicity of exposition assume that the parties have equal bargaining power.<sup>14</sup> Specifically, under the American rule, if a settlement is reached, the defendant will pay the plaintiff:

$$S^A = 0.5 \cdot (R_p + R_d) = 0.5 \cdot [((p + x_p)W - c_p) + ((p - x_d)W + c_d)]$$

Similarly, under the British rule, the settlement amount will be:

$$S^B = 0.5 \cdot (R_p + R_d) = 0.5 \cdot [((p + x_p)(W + C) - C) + ((p - x_d)(W + C))]$$

Based on the aforementioned definitions and assumptions, the payoff functions in an American regime are:

$$\mathbf{P}_p^A = \begin{cases} S^A & , x_p + x_d \leq \frac{C}{W} \\ pW - c_p & , x_p + x_d > \frac{C}{W} \end{cases} \quad \text{and} \quad \mathbf{P}_d^A = \begin{cases} -S^A & , x_p + x_d \leq \frac{C}{W} \\ -(pW + c_d) & , x_p + x_d > \frac{C}{W} \end{cases}.$$

Similarly, in a British regime the payoff functions are:

$$\mathbf{\Pi}_p^B = \begin{cases} S^B & , x_p + x_d \leq \frac{C}{W + C} \\ p(W + C) - C & , x_p + x_d > \frac{C}{W + C} \end{cases} \quad \text{and} \quad \mathbf{\Pi}_d^B = \begin{cases} -S^B & , x_p + x_d \leq \frac{C}{W + C} \\ -p(W + C) & , x_p + x_d > \frac{C}{W + C} \end{cases}.$$

These payoff functions characterize the outcome of the pre-trial bargaining phase.

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<sup>14</sup> Alternatively, apply the Nash bargaining solution (Nash (1950)) to the pre-trial negotiations game. Nevertheless, as will be made obvious shortly, the main results of this paper do not hinge upon the assumption of equal bargaining power (nor on the alternative assumption of a Nash solution).

## 2.2 Matching, Fitness and Evolutionary Dynamics

The analysis assumes a single population of potential plaintiffs and defendants. Each period the population is randomly divided into two groups, such that half the population are plaintiffs and half the population are defendants. Each member of the plaintiff group is randomly matched with a member of the defendant group.<sup>15</sup>

Let  $x_i$  represent the level of optimism (or pessimism) of individual  $i$ . The level of optimism is independent of the role, *plaintiff* or *defendant*, which is assigned to player  $i$  at the beginning of each period.

The distribution of optimists, realists and pessimists in the population is represented by the probability density function (pdf) –  $g(x)$ , and the corresponding cumulative distribution function (cdf) –  $G(x)$ .

The  $g(x)$  function determines the probability that player  $i$  will meet a player  $j$  with an  $x_j$  level of optimism. The probability that a player  $i$  will be assigned the role of *plaintiff* and meet a *defendant*  $j$  is equal to the probability that  $i$  will be assigned the role of *defendant* and meet a *plaintiff*  $j$ . Therefore, the *a-priori* expected payoff to a player  $i$  which meets a player  $j$  in an American regime is:

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<sup>15</sup> A different model may consist of two distinct populations - a plaintiff population and a defendant population. This model better describes a reality, in which a certain group of people is more likely to sue, while a different group is more likely to be on the defending side. The model studied in this paper better describes a reality, in which the entire population has equal a-priori probabilities of becoming plaintiffs or defendants. As in the single-population model (see section 3), the two-population model also yields the basic cautious optimism result. Nevertheless, the analysis of the two-population model employs a slightly different methodology.

$$m_i^A(x_i, x_j) = \begin{cases} \frac{1}{2}[S_p^A - S_d^A] & , x_i + x_j \leq \frac{C}{W} \\ \frac{1}{2}[(pW - c_p) - (pW + c_d)] & , x_i + x_j > \frac{C}{W} \end{cases}$$

$$\text{where } S_p^A = \frac{1}{2}[(p + x_i)W - c_p] + [(p - x_j)W + c_d]$$

$$S_d^A = \frac{1}{2}[(p + x_j)W - c_p] + [(p - x_i)W + c_d]$$

or -

$$(1) \quad m_i^A(x_i, x_j) = \begin{cases} \frac{1}{2}[x_i - x_j]W & , x_i + x_j \leq \frac{C}{W} \\ \frac{1}{2}(-C) & , x_i + x_j > \frac{C}{W} \end{cases}$$

The expected payoff function in a British regime is -

$$(2) \quad m_i^B(x_i, x_j) = \begin{cases} \frac{1}{2}[x_i - x_j](W + C) & , x_i + x_j \leq \frac{C}{W + C} \\ \frac{1}{2}(-C) & , x_i + x_j > \frac{C}{W + C} \end{cases}$$

The expected fitness of player  $i$  is defined as -

$$(3) \quad f_i(x_i) = \int_x m_i(x_i, x) g(x) dx$$

A description of the evolutionary dynamics completes the formulation of the model. As specified earlier, at period  $t$  each player  $i$  is randomly assigned a role of *plaintiff* or *defendant* and is then matched with a player  $j$  of the opposite role according to the current distribution of players in the population,  $g_t(x)$ . Using equation (3) the expected fitness of every player  $i$  can be calculated, yielding the fitness function,  $f_i(x)$ . The fitness

function, together with the current distribution, determines the distribution of optimism in the following period, via a payoff/fitness-monotonic dynamic algorithm.<sup>16</sup>

Section 3 proceeds to study the evolutionary stable distributions of optimism and to prove that cautious optimism will prevail.

### 3. The Evolution of Optimism

#### 3.1 Optimism - Pros and Cons

The question whether optimism will eventually dominate the population, and if so at what level, depends upon the relative strength of the following two effects, which determine the impact of a variation in the level of optimism on a player's payoffs / fitness:<sup>17</sup>

*Effect 1: A higher level of optimism entails fewer settlements (and consequently more costly trials).*

Take the American rule, for instance. Substituting expression (1) into expression (3), results in the following:

$$(4) \quad f_i(x_i) = \frac{1}{2} \left\{ \left[ 1 - G\left(\frac{C}{W} - x_i\right) \right] (-C) + \int_{x_{\min}}^{\frac{C}{W} - x_i} [W(x_i - x)] g(x) dx \right\}$$

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<sup>16</sup> The results presented below hold for any payoff monotonic dynamic process. See Weibull (1995) for examples of commonly used payoff-monotonic dynamic algorithms. The numeric calculations (see appendix B) employ the discrete-time (continuous strategy) version of the replicator dynamics:

$$g_{t+1}(x) = \frac{\hat{f}_t(x) \cdot g_t(x)}{\int \hat{f}_t(x) \cdot g_t(x) dx}, \quad \text{where } \hat{f}_t(x) \equiv f_t(x) - \min_x \{f_t(x)\}.$$

<sup>17</sup> These two effects may be viewed as stylized facts, which are captured, in reduced form, by the present model.

A player  $i$  with a  $x_i$  level of optimism will reach a settlement with any player  $j$  with a level of optimism  $x_j \leq \frac{C}{W} - x_i$ . Hence, more optimistic individuals will reach a settlement with a smaller range of players. However, it should be noted, that a settlement is not necessarily preferable to trial. A pessimistic player may reach a settlement, which is worse than the expected outcome at trial, including litigation costs.

*Effect 2: A higher level of optimism guarantees more favorable settlements.*

A player's optimism shifts the settlement range in her favor (optimistic plaintiffs shift the settlement range towards higher settlements, and optimistic defendants shift the settlement range towards lower settlements).<sup>18</sup> This effect is captured by the integral term of equation (4) above.

At the evolutionary equilibrium *effect 1* and *effect 2* balance out on the margin.<sup>19</sup>

### 3.2 The Disappearance of Pessimism

Pessimistic players will not survive the evolutionary selection process. This result is summarized in the following proposition.

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<sup>18</sup> The plaintiff's reservation price is  $(p + x)W - c_p$ , therefore a more optimistic plaintiff will shift the settlement range towards higher settlements. The defendant's reservation price is  $(p - x)W + c_d$ , therefore a more optimistic defendant will shift the settlement range towards lower settlements.

<sup>19</sup> Similar effects are noted in Bottom and Paese (1999) and in Cooter, Marks and Mnookin (1982). See also Huck, Kirchsteiger and Oechssler (1997), who identify two competing effects with regard to the "endowment effect". On the one hand, a positive "endowment effect" distorts the player's substitution rate between the good she is endowed with and the good she needs to acquire. On the other hand, the "endowment effect" improves the player's bargaining position.

Proposition 1: Under both the American and British rules, pessimists, i.e. players with  $x < 0$ , will disappear, namely will not survive the evolutionary selection process –

$$\forall x < 0 \quad \lim_{t \rightarrow \infty} g_t(x) = 0$$

*Remark*: The intuition for this result, which is proved in appendix A, relies on the two effects of optimism, which were identified in section 3.1. *Effect 2* encourages pessimistic players to become more optimistic. Therefore, it remains to be shown that *effect 1* also supports more optimism. *Effect 1* states that increased optimism leads to more trials. However, a player with  $x < 0$  prefers going to trial to an out of court settlement, i.e. the settlement is less preferable than the expected judgment including litigation costs. The reason is that the extra settlements reached by pessimists are settlements with very optimistic rivals (a realist, and even a cautious optimist, will settle with a mildly optimistic rival). These extremely optimistic rivals will drive such a hard bargain that the pessimist is better off going to trial.

### 3.3 Evolution Towards Cautious Optimism

Proposition 1 has shown, that pessimism will be abolished in the evolutionary process. It remains to be seen whether realism is evolutionary stable or perhaps optimism is evolutionary stable, and if so what level of optimism. Proposition 2 begins by demonstrating that evolutionary forces eliminate excessively optimistic individuals.

Proposition 2: (i) Under the American rule, excessively optimistic players, with  $x > \frac{C}{W}$ , will disappear, namely will not survive the evolutionary selection process -

$$\forall x > \frac{C}{W} \quad \lim_{t \rightarrow \infty} g_t(x) = 0$$

(ii) Under the British rule, excessively optimistic players, with  $x > \frac{C}{W+C}$ , will disappear, namely will not survive the evolutionary selection process -

$$\forall x > \frac{C}{W+C} \quad \lim_{t \rightarrow \infty} g_t(x) = 0$$

*Remark*: The intuition for this result, which is proved in appendix A, is as follows. Using the two effects of optimism from section 3.1, note that optimists will generally enjoy the benefits of *effect 2* which promises more favorable settlements. However, after the disappearance of pessimists, as shown in *proposition 1*, players with  $x > \frac{C}{W}$  will never settle under the American rule, and players with  $x > \frac{C}{W+C}$  will never settle under the British rule. Therefore, after the disappearance of pessimism, *effect 2* becomes moot, leaving only *effect 1*, which supports a decrease in the level of optimism.

Proposition 2, combined with proposition 1, narrows down the range of possible bias levels significantly -

Proposition 3: Under both the American and British rules, in the evolutionary equilibrium, all players will be either realistic or cautiously optimistic.



Under the American rule -

$$\forall x \notin \left[0, \frac{C}{W}\right] \lim_{t \rightarrow \infty} g_t(x) = 0$$

Under the British rule -

$$\forall x \notin \left[0, \frac{C}{W+C}\right] \lim_{t \rightarrow \infty} g_t(x) = 0$$

*Remark:* Proposition 3 is derived directly from combining the results of proposition 1 and proposition 2.

Proposition 3 takes a large step towards one of the paper's main results, namely the evolutionary tendency towards "cautious optimism". All that remains to be shown is that the population will not converge to the lower boundary of realism. However, the analysis leads to a much stronger result. Not only does it prove the non-stability of realism, it also pin-points the level of optimism in equilibrium, under the two legal regimes. This result is derived using the following two lemmas.

*Lemma 1:* (i) Under the American rule, the degenerate distribution  $g(x)$ , in which the entire population shares the unique level of optimism  $\hat{x} = \frac{C}{2W}$  is evolutionary stable.

(ii) Under the British rule, the degenerate distribution  $g(x)$ , in which the entire population shares the unique level of optimism  $\hat{x} = \frac{C}{2(W+C)}$  is evolutionary stable.

*Remark:* The intuition for this result, which is proved in appendix A, is as follows. Focusing on part (i) of the lemma (part (ii) follows a similar intuition), consider a homogeneous  $\hat{x} = \frac{C}{2W}$ -population. Can any “mutant” with a different level of optimism successfully invade this population, i.e. can any such mutant earn a payoff higher than the payoff earned by members of the population? The answer is ‘no’. Members of the population, when matched-up with one another, always settle and earn a zero payoff ( $m_i(\hat{x}, \hat{x}) = 0$ ). A mutant with  $x_m < \frac{C}{2W}$ , when matched-up with a member of the population, will always settle as well; and thus by *effect 2* will be hurt by her lower level of optimism. A mutant  $x_m > \frac{C}{2W}$ , when matched-up with a member of the population, will never settle, and thus will incur substantial litigation costs.

*Lemma 2:* (i) Under the American rule, any degenerate distribution  $g(x)$ , other than the distribution in which the entire population shares the unique level of optimism  $\frac{C}{2W}$ , is evolutionary unstable.

(ii) Under the British rule, any degenerate distribution  $g(x)$ , other than the distribution in which the entire population shares the unique level of optimism  $\frac{C}{2(W+C)}$ , is evolutionary unstable.

*Remark:* The intuition for this result, which is proved in appendix A, is as follows. Focusing on part (i) of the lemma (part (ii) follows a similar intuition), consider in turn a

homogeneous  $\hat{x} > \frac{C}{2W}$ -population and a homogeneous  $\hat{x} < \frac{C}{2W}$ -population. Starting with the homogeneous  $\hat{x} > \frac{C}{2W}$ -population, a small group of mutants with  $x_m = \frac{C}{2W}$  can successfully invade this population, i.e. such mutants will earn a payoff higher than the payoff earned by members of the population. Members of the population will never settle – neither when matched-up with one another nor when matched up with the mutants. The mutants also will not settle, when matched-up with a member of the population, but they will settle, when matched-up with their own kind. Therefore, the  $\frac{C}{2W}$ -mutants save on litigation costs, and hence earn higher payoffs.

Moving on to the homogeneous  $\hat{x} < \frac{C}{2W}$ -population, a mutant with  $x_m = \frac{C}{2W}$  can successfully invade this population as well. Members of the population, when matched-up with one another, always settle and earn a zero payoff ( $m_i(\hat{x}, \hat{x}) = 0$ ). A mutant with  $x_m = \frac{C}{2W}$ , when matched-up with a member of the population, will likewise settle, but according to *effect 2* will enjoy more favorable settlements. Therefore, the  $\frac{C}{2W}$ -mutants earn higher payoffs.

A population of realists, namely a homogenous population where everyone shares the  $\hat{x} = 0$  level of optimism, is a special case within the category of homogeneous  $\hat{x} < \frac{C}{2W}$ -populations. Lemma 2 precludes the possibility of a population composed solely of realists.

Combining lemma 1 and lemma 2 results in the following proposition –

Proposition 4: (i) Under the American rule, the unique evolutionary stable homogenous population shares the  $\hat{x} = \frac{C}{2W}$  level of optimism.

(ii) Under the British rule, the unique evolutionary stable homogenous population shares the  $\hat{x} = \frac{C}{2(W + C)}$  level of optimism.

*Remark*: Proposition 4 is derived directly from combining the results of lemma 1 and lemma 2.

Proposition 4 summarizes the influence of the legal rule on the equilibrium level of optimism. The American rule is shown to induce a higher level of optimism, as compared to the British rule. Intuitively, since the implications of victory at trial are greater under the British rule<sup>20</sup>, optimism regarding the probability of victory is more powerful under this rule. This greater impact of optimism enhances both the negative effect of optimism on the probability of settlement and the positive effect of optimism on the terms of settlement. In essence, a lower level of optimism under the British rule has the same effect as a higher level of optimism under the American rule.

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<sup>20</sup> Under the British rule, the allocation of litigation costs as well as the judgment amount itself depend on the outcome at trial. Under the American rule, each party bears its own litigation costs, regardless of the outcome at trial.

The remainder of the paper focuses on homogenous populations of the kind characterized in proposition 4.<sup>21</sup> Substituting the stable levels of optimism from proposition 4 into the definition of the settlement range (see section 2.1), leads to the following corollary –

*Corollary:* Under both the American and British rules the evolutionary equilibrium induces a degenerate settlement range, i.e.  $R_p = R_d$ .

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<sup>21</sup> Heterogeneous stable populations also exist in the present model. For instance, the following 2-type

population is evolutionary stable:  $\left\{ (x_1, x_2, p) \mid x_1 \in \left[ 0, \frac{C}{2W} \right), x_2 = \frac{C}{W} - x_1, p = \frac{2W}{C} \cdot x_1 \right\}$ ,

where  $x_1$  and  $x_2$  are the optimism levels of the two types and  $p$  is the proportion of the first type (with optimism  $x_1$ ) in the population. The average bias level in these populations may also be characterized as cautious optimism. Nevertheless, we choose to focus on the unique stable homogenous population for the following reasons: First, numeric calculations demonstrate that the stable homogenous population has a particularly large basin of attraction. Specifically, if the initial distribution of optimism in the population is not “too concentrated” outside the ranges defined in proposition 3 ( $[0, C/W]$  for the American rule and  $[0, C/(W + C)]$  for the British rule), the dynamic process will converge to the stable homogenous population (see appendix B). Second, since no *a-priori* heterogeneity was assumed (except for possibly different initial levels of optimism) a resulting stable homogenous population seems intuitively appealing. Moreover, professional norms within the legal profession foster such homogeneity. Third, the  $\hat{x} = \frac{C}{2W}$  (or  $\hat{x} = \frac{C}{2(W + C)}$  under the British rule) result emerges also via a

completely different approach to the pre-trial bargaining game. Assume that litigants observe lawyers’ optimism (directly or through its correlation with their expected earnings), and thus may choose a lawyer, and consequently a level of optimism, as if it were a strategy in a bargaining game (see section 6.7 below). In such a 2-player game between a plaintiff and a defendant,  $x_p = x_d = \frac{C}{2W}$  is the unique

symmetric Nash equilibrium, and it is also supported by the Nash bargaining solution (Nash (1950)). Now, consider a 2-player game, in which each player has an equal chance of being either a plaintiff or a defendant. The Nash solution supports the  $x = \frac{C}{2W}$  “strategy” for both players in this game as well.

Finally, consider a  $N$ -player game, in which each player has an equal chance of being “assigned” to either the plaintiff group or the defendant group (as described in the text). Here too a natural extension of the Nash solution supports the common  $x = \frac{C}{2W}$  “strategy”.

*Remark:* This result follows immediately from the definitions of  $R_p$  and  $R_d$  (see section 2.1).

Recall from section 2.1 that under the realism assumption or under the alternative assumption of exogenous optimism (or pessimism), the settlement range under the American rule is wider than the settlement range under the British rule. For this reason the American rule is commonly considered to be a better promoter of settlements. The preceding corollary qualifies this advantage of the American rule when optimism is allowed to evolve endogenously according to the prevailing legal regime.

It should be noted, however, that in the present deterministic setting all pre-trial negotiations, under both rules, result in settlement, even when the (endogenous) optimism bias is accounted for. In other words, endogenous optimism by itself does not prevent settlements. But, optimism rarely operates in the sterile deterministic setting postulated in the above model. Therefore, a quantitative evaluation of the effect of endogenous optimism on the probability of settlement requires a synthesis between the endogenous optimism model and the standard models of uncertainty and asymmetric information, which have been commonly used to explain negotiation failures.

A comprehensive synthesis between endogenous optimism and traditional impediments to bargaining, like uncertainty and asymmetric information, is beyond the scope of the present study. Nevertheless, the following section offers an illustrative example that demonstrates how endogenous optimism affects standard results in a combined model of uncertainty and optimism.

## 4. Optimism and Uncertainty – An Example

### 4.1 Adding Uncertainty

Section 4 adds a simple form of uncertainty to the preceding deterministic model, and studies the endogenous evolution of optimism in the resulting stochastic framework. The stochastic model will then be used to quantify the effects of endogenous optimism on the probability of settlement (see section 5). Naturally, uncertainty may enter into the model in a variety of ways. Litigants may be uncertain about the probability of the plaintiff's victory ( $p$ ), about the magnitude of the judgment ( $W$ ), about their own litigation costs, about their opponent's litigation costs, and so on. Abstracting from all but one type of uncertainty, it is assumed that the defendant observes the probability,  $p$ , with a noise. Namely,  $p_d = p + \mathbf{e}$ , where  $\mathbf{e}$  is a symmetrically distributed noise element. Note that the plaintiff observes  $p$  correctly, but cannot convey this information to the defendant.<sup>22</sup>

The noise element affects the choice between settlement and trial through its influence on the defendant's reservation price,  $R_d$ . When these effects are accounted for, the *a-priori* expected payoff to a player  $i$ , who meets a player  $j$  in an American regime (expression (1)), becomes:

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<sup>22</sup> Certainly, in many bargaining situations this assumption is unrealistic, at least at its extreme. Section 4, however, adopts this assumption for the sake of expositional clarity and analytical convenience. The main results carry over to more complex (and more realistic) assumptions regarding the nature of the uncertainty and the structure of the information. Specifically, results similar to the ones presented below have been derived numerically in a model where both plaintiff and defendant observe a "noisy"  $p$  (in such a model our assumption regarding transfer of information between the parties becomes more plausible). The numeric simulations apply a *Monte Carlo* algorithm: The algorithm randomly selects a noise level for each player (from a given noise distribution), and then lets each plaintiff-defendant pair play out the litigation-settlement game with their respective noisy perceptions of  $p$ . See appendix B for further details.

$$\begin{aligned}
(5) \quad m_i^A(x_i, x_j) &= \int \left[ \begin{array}{l} \frac{1}{2}[x_i - x_j]W \quad , \mathbf{e} \geq (x_i + x_j) - \frac{C}{W} \\ \frac{1}{2}(-C) \quad , \mathbf{e} < (x_i + x_j) - \frac{C}{W} \end{array} \right] h(\mathbf{e}) d\mathbf{e} \\
&= \frac{1}{2}(x_i - x_j)W - \frac{1}{2}[(x_i - x_j)W + C] \cdot H\left(x_i + x_j - \frac{C}{W}\right)
\end{aligned}$$

where  $h(\cdot)$  is the symmetric *pdf* of the noise element, and  $H(\cdot)$  is the corresponding *cdf*.<sup>23</sup>

In a British regime the “noisy” parallel of expression (2) is:

$$\begin{aligned}
(6) \quad m_i^B(x_i, x_j) &= \int \left[ \begin{array}{l} \frac{1}{2}[x_i - x_j](W + C) \quad , \mathbf{e} \geq (x_i + x_j) - \frac{C}{W + C} \\ \frac{1}{2}(-C) \quad , \mathbf{e} < (x_i + x_j) - \frac{C}{W + C} \end{array} \right] h(\mathbf{e}) d\mathbf{e} \\
&= \frac{1}{2}(x_i - x_j)(W + C) - \frac{1}{2}[(x_i - x_j)(W + C) + C] \cdot H\left(x_i + x_j - \frac{C}{W + C}\right)
\end{aligned}$$

## 4.2 Evolution of Optimism under Uncertainty

The analysis proceeds to examine how uncertainty affects the evolutionary stable level of optimism. Taking the  $\hat{x} = \frac{C}{2W}$  result of section 3 as a benchmark, it is first shown that this result no longer holds when uncertainty is added to the model. The evolutionary stable level of optimism depends on the level of uncertainty. The relationship between the level of uncertainty and the equilibrium level of optimism is then derived. The subsequent analysis concentrates on the American rule.<sup>24</sup> The analysis of the British regime is virtually identical.

Differentiating the payoff function (expression (5)) with respect to  $x_i$  yields –

<sup>23</sup> The formulation of the payoff function in expression (5) is based on another simplifying assumption regarding the noise element. It is assumed that the uncertainty is relationship specific in the sense that a single realization of  $\mathbf{e}$  occurs for each  $i$ - $j$  pair, regardless of the role assignment (of *plaintiff* and *defendant*) between  $i$  and  $j$ .

<sup>24</sup> Hence, the superscript A is omitted from the payoff functions for notational convenience.



$$(7) \quad \frac{dm_i(x_i, x_j)}{dx_i} = \frac{1}{2} \cdot W - \frac{1}{2} \cdot W \cdot H\left(x_i + x_j - \frac{C}{W}\right) - \frac{1}{2} \cdot [(x_i - x_j)W + C] \cdot h\left(x_i + x_j - \frac{C}{W}\right)$$

Focusing on homogenous populations, let  $x_j = \hat{x}$  represent the level of optimism in the population, and let  $x_i = x_m$  represent the level of optimism of a possible mutant. If the homogenous  $\hat{x}$ -population is evolutionary stable, then  $x_m = \hat{x}$  maximizes the payoff function, and the derivative  $\frac{dm_m(x_m = \hat{x}, \hat{x})}{dx_m}$  equals zero.

Starting from the homogenous  $\hat{x} = \frac{C}{2W}$ -population, and substitute  $x_m = \hat{x} = \frac{C}{2W}$

the derivative function becomes:

$$(8) \quad \frac{dm_m(x_m = \frac{C}{2W}, \hat{x} = \frac{C}{2W})}{dx_m} = \frac{1}{2} [W - W \cdot H(0) - C \cdot h(0)] = \frac{1}{4} W \left[ 1 - 2 \cdot \frac{C}{W} \cdot h(0) \right]$$

Hence, generally, a mutant would be able to successfully invade a homogenous  $\hat{x} = \frac{C}{2W}$ -population. Note, that the key element of expression (8) is  $h(0)$ , which is determined by the variance of the *noise* element (recall that we assume a symmetrically distributed noise). Specifically,  $h(0)$  is a decreasing function of the variance of the noise distribution. Therefore, when the level of uncertainty is low, mutants with  $x_m < \frac{C}{2W}$  will successfully invade the population, and when the level of uncertainty is high, mutants with  $x_m > \frac{C}{2W}$  will successfully invade the population. Note, however, that if  $h(0)$  is continuous in the variance of the noise distribution, there exists an intermediate level of uncertainty for which the homogenous  $\hat{x} = \frac{C}{2W}$ -population is evolutionary stable.

Departing from the  $\hat{x} = \frac{C}{2W}$  benchmark, the next step is to derive the stable level of optimism as a function of the noise level, as captured by the standard deviation of the noise distribution  $\mathbf{s}_e$ . Naturally, the specific optimism levels depend on the noise distribution. The analytical solution presented below assumes a triangular noise distribution. However, the general characteristics of the  $\hat{x}(\mathbf{s}_e)$  function are common to all symmetric noise distributions. Substituting the triangular *pdf* and *cdf* into expression (7), and solving for the stable level of optimism, we obtain -

$$\hat{x}^A(\mathbf{s}_e) = \begin{cases} -\sqrt{1.5}\mathbf{s}_e + \left[ 3\mathbf{s}_e^2 + \left( \frac{C}{2W} \right)^2 \right]^{\frac{1}{2}} & , \mathbf{s}_e \leq \frac{C}{\sqrt{1.5} \cdot W} \\ -\frac{C}{2W} + \sqrt{1.5}\mathbf{s}_e & , \mathbf{s}_e > \frac{C}{\sqrt{1.5} \cdot W} \end{cases}$$

Using parallel reasoning, the  $\hat{x}^B(\mathbf{s}_e)$  function can be derived for the British rule (with a triangular noise distribution):

$$\hat{x}^B(\mathbf{s}_e) = \begin{cases} -\sqrt{1.5}\mathbf{s}_e + \left[ 3\mathbf{s}_e^2 + \left( \frac{C}{2(W+C)} \right)^2 \right]^{\frac{1}{2}} & , \mathbf{s}_e \leq \frac{C}{\sqrt{1.5} \cdot (W+C)} \\ -\frac{C}{2(W+C)} + \sqrt{1.5}\mathbf{s}_e & , \mathbf{s}_e > \frac{C}{\sqrt{1.5} \cdot (W+C)} \end{cases}$$

Figure 2 compares the stable levels of optimism under the two legal rules for different noise levels.

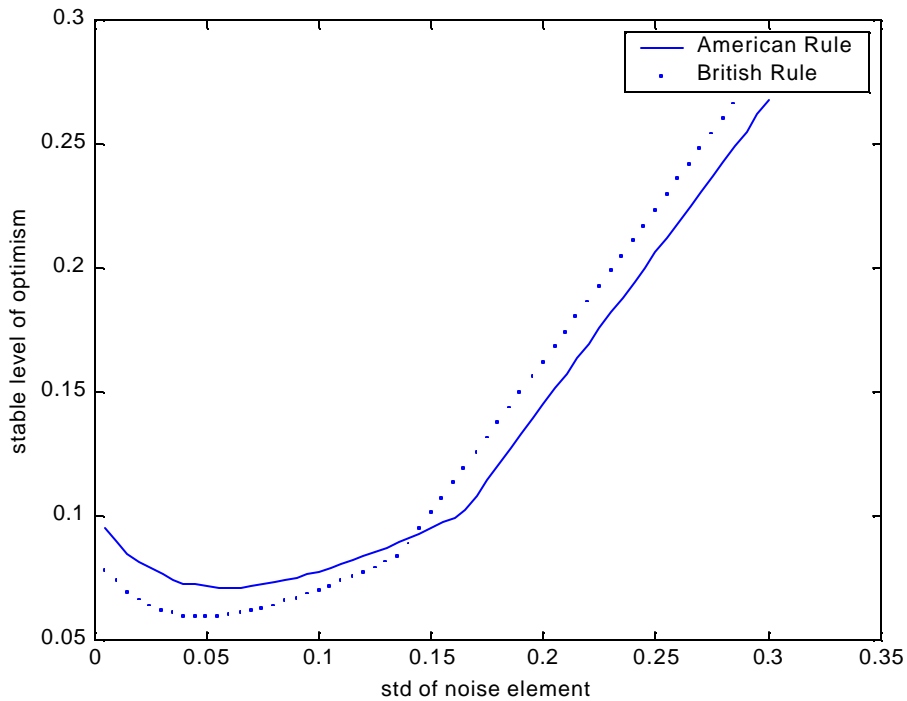


Fig. 2: Stable levels of optimism under the American and British rules  
 (parameter values:  $W = 500$ ,  $C = 100$ )

The intuition for the results depicted in figure 2 is as follows. When uncertainty is added into the model lower optimism opens the degenerate settlement range (which was derived in section 3 in a deterministic setting) and allows it to “absorb” the uncertainty. This raises the number of settlements and increases the monetary payoffs. But lowering the level of optimism also entails a cost – the cost of less favorable settlements. For low levels of uncertainty the former effect dominates and the stable level of optimism decreases. However, for higher levels of uncertainty the cost of ensuring a settlement becomes too high. Moreover, as the level of uncertainty increases players with higher and

higher levels of optimism, who could never settle in the deterministic setting, occasionally reach settlements. This explains the rising graphs in the high-noise range.

After analyzing the evolution of optimism in both a deterministic and a stochastic setting, it remains to examine the welfare and policy implications of the endogenous optimism phenomenon.

## **5. Welfare and Policy Implications**

Sections 3 and 4 have demonstrated that evolutionary forces drive the parties towards cautious optimism with regard to the probability of prevailing at trial. The optimism phenomenon, which has been empirically observed, and has now also received a theoretical explanation, has important welfare and policy implications.

First and foremost, optimism is detrimental to settlement. The dynamic model analyzed in section 3 has shown that evolution favors a moderate level of optimism. Section 4 demonstrated, how the evolutionary stable level of optimism varies with respect to the degree of uncertainty. Given the derived stable level of optimism and the noise distribution, the probability of settlement can be calculated. In the present context, the sole welfare consideration is the maximization of the settlement probability, leading to a minimization of litigation costs. Hence, the models employed in sections 3 and 4 can be readily extended to include welfare analysis.

Using the results of the previous sections, the relationship between the level of uncertainty and the probability of settlement can be derived. Uncertainty and optimism are both detrimental to settlement. For low levels of uncertainty, an increase in the degree of uncertainty lowers the stable level of optimism (as shown in figure 2). Hence, the two

effects work in opposite directions. The direct effect of uncertainty, however, is dominant, and thus welfare drops when uncertainty rises, even for low levels of uncertainty. For high levels of uncertainty, an increase in the degree of uncertainty raises the stable level of optimism. Hence, welfare clearly drops.

That uncertainty decreases welfare is not surprising. The interesting comparison is between the probability of settlement under the standard assumption of realism, as opposed to the probability of settlement in our endogenous optimism model. Figure 3 depicts the probability of settlement, under the American rule, as a function of the level of uncertainty – first, when realism is exogenously imposed, and second when endogenous optimism is considered (the quantitative results were derived using the framework developed in section 4).

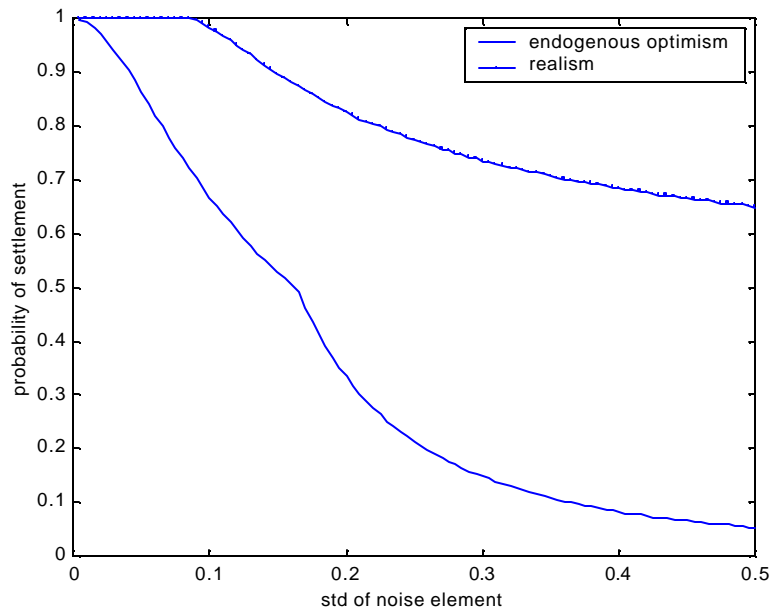


Fig. 3: The probability of settlement as a function of the noise level  
(parameter values:  $W = 500$  ,  $C = 100$ )

Low levels of uncertainty hardly affect the standard models, as they are completely “absorbed” by a wide settlement range. For this reason realism models resort to asymmetric information in order to explain negotiation failure. Given parties’ optimism, on the other hand, the shrinkage of the settlement range renders the settlement opportunities volatile, in a way that even the slightest symmetric noise may prevent settlement. For higher levels of uncertainty, negotiations may fail even under the assumption of realism. Still, the probability that a settlement will not be reached is significantly higher, when optimism is accounted for. This result supports an increased concern regarding the vagueness and uncertainty that surround the legal process. More precise procedural rules, narrower judicial discretion and more efficient discovery rules - are all policy instruments supported by the present analysis.

A second policy implication, albeit a more tentative one, concerns cost-shifting rules. Classical analysis suggests that the American rule is preferable to the British rule, since it induces a larger settlement range (see, for example, Shavell (1982) and Posner (1998)). The evolutionary analysis refines this traditional understanding. The endogenous optimism model proves, that in a deterministic setting the settlement range will disappear under both rules, and the different rules only affect the level of optimism at equilibrium. When a symmetric noise is introduced into the model, the size of the settlement range depends on the degree of uncertainty, under both regimes. However, the functional relationship between the degree of uncertainty and the evolutionary stable level of optimism, which determines the size of the settlement range, varies from one legal regime to the other (see section 4). Therefore, a comparison, in terms of welfare, between the American rule and the British rule, is not one-dimensional. Such a comparison

depends on the specific values of the model's parameters and especially on the degree of uncertainty.

Consider the relationship between the probability of settlement and the level of uncertainty under the two regimes, as derived using the model developed in section 4 (with a triangular noise distribution). The results are presented in figure 4.

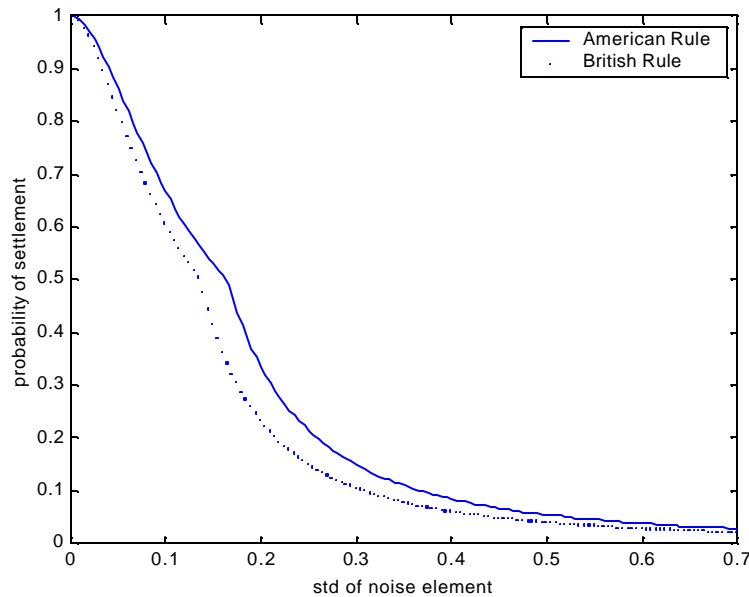


Fig. 4: The probability of settlement under the two legal rules  
(parameter values:  $W = 500$ ,  $C = 100$ )

As figure 4 demonstrates, the probability of settlement is higher under the American rule. This result is consistent with traditional models that impose exogenous realism or an exogenous level of optimism. It is interesting, however, to compare the advantage of the American rule under an exogenous optimism assumption and under endogenous optimism. The following example is illustrative. Assume that the stakes at trial are  $W =$

500 and that the parties' total litigation costs are  $C = 100$ . Also, assume that the standard deviation of the noise element is 0.05 (assuming a triangular noise distribution). First, consider endogenous optimism. Under the American rule the level of optimism will be  $x = 0.071$  and the probability of settlement will be 86%. Under the British rule the level of optimism will be  $x = 0.059$  and the probability of settlement will be 82%. However, if the level of optimism is determined exogenously to be, for instance,  $x = 0.071$ , the probability of settlement under the American rule is still 86%, but the probability of settlement under the British rule is only 68%. This simple numeric example demonstrates that endogenous optimism may be a significant phenomenon. It also suggests that assuming an exogenous level of optimism, as is common in the literature, may turn out to be quite misleading.

## **6. Concluding Remarks and Proposed Extensions**

### **6.1 Optimism in the Decision to Bring Suit**

Focusing on settlement negotiations, rather than on the decision to file suit, the preceding analysis has assumed that all claims are perceived to have (and indeed have) a positive net present value, regardless of the plaintiff's level of optimism. However, optimism may also affect the decision to bring suit. In particular, an optimistic plaintiff may decide to file a negative present value (NPV) suit. This NPV suit may settle, thus providing another advantage of optimism. On the other hand, the NPV suit might lead to a trial that by definition will impose a net loss on the plaintiff; another disadvantage of optimism.



A complete analysis of the “decision to bring suit” extension is beyond the scope of the present study. Still, the preceding observations suggest that the general “cautious optimism” result is robust to such an extension. Moreover, the general theme that legal institutions affect the magnitude of prevailing cognitive biases clearly carries over to the “decision to bring suit” extension.

## **6.2 Other Self-Serving Biases and Toughness in Bargaining**

The preceding analysis focused on the optimism bias. Optimism, however, is not the only cognitive bias that may influence the pretrial bargaining process. In particular, the psychology literature has identified a class of self-serving biases, which have been shown to exist in the pretrial environment (see Lowenstein et al. (1993)). The model studied in this paper can be readily adjusted to analyze these self-serving biases.

Related to the self-serving biases is the notion of toughness in bargaining, namely that “individuals enter a tough state of mind when they have to make a stand *vis-à-vis* somebody else”.<sup>25</sup> The proposed model can also be adjusted to study the evolutionary stable degree of toughness.

## **6.3 Information Acquisition**

The endogenous optimism model, as well as the extensions considered above, deviate from the neo-classical view of the rational decision-maker. However, the analysis also suggests a meaningful interpretation within the neo-classical framework. Assume that litigants do not “suffer” from genuine optimism or pessimism. Instead, litigants or

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<sup>25</sup> See Heifetz and Segev (2001). These authors study an evolutionary model of toughness in general bargaining contexts. (The working paper by Heifetz and Segev was issued a year after the working paper that preceded the current paper, Bar-Gill (2000).)

lawyers form rational (unbiased) estimates of their chances at trial based on the information available to them. The question then becomes what information sources are available to these litigants and lawyers and what methods of gathering information they employ. If the lawyer has control over her sources of information and can choose among various methods of information acquisition, then the analysis of the present paper becomes relevant once again. The lawyer's choice of sources and methods for acquiring information parallels the quasi-evolutionary selection of a particular bias level. In analogy, the present model would predict a tendency of lawyers to opt for information sources and for information gathering methods that produce biased self-serving estimates of their chances at trial.

#### **6.4 The “Zealous Advocacy” Norm**

The results presented in this paper, together with the extensions considered above, suggest a certain level of optimism, toughness and the production of intentionally skewed information in pretrial negotiations. Moreover, the analysis predicts greater levels of optimism, toughness and skewed information under the American rule, as compared to the British rule. This prediction is in line with the prominence of the “zealous advocacy” norm in the United States.<sup>26</sup> In contrast, the ethical rules of conduct in England substantially qualify the reach of the zealous advocacy norm (see Osiel (1990) and Kagan (1994)).

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<sup>26</sup> See Canon 7 of the 1969 *Model Code of Professional Responsibility*: “A Lawyer Should Represent A Client Zealously Within the Bounds of Law.”

## 6.5 Lawyers and Other Repeat Players

The proposed model assumes that a single group of players repeatedly interact with each other in litigation and settlement games. This simplifying assumption seems especially appealing for lawyers and other repeat players (e.g. insurance companies).<sup>27</sup> The multiple interactions within this group guarantee a relatively quick convergence to the evolutionary equilibrium. Hence, if indeed most civil cases are managed by attorneys, the endogenous optimism effect may be quite significant. In addition, the model suggests a new explanation to the commonly observed advantage of repeat players in litigation. Presumably, these repeat players will be quicker to adopt an efficient bias level and consequently will perform better than one-time litigants. Still, these conjectures need to be verified and possibly refined within an explicit model of both repeat and one-shot players.

## 6.6 Optimism vs. Reputation

The evolutionary approach adopted in the present study requires a dynamic setting with repeated interactions. The repeated interactions assumption, in turn, suggests the possibility that the litigants and lawyers develop a reputation for toughness in bargaining. In the present context, optimism and reputation may be viewed as substitutes. They both serve as commitment devices in the negotiation game. This paper's analysis sheds light on the type of reputation that a lawyer would like to develop. On the one hand, a reputation for "soft" bargaining is undesirable. On the other hand, a reputation for

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<sup>27</sup> Note that the move from litigants' optimism to lawyers' optimism is not a trivial one. In particular, the lawyer's fee structure and the market for legal services must be considered in the formulation of the lawyer's payoff function. However, adopting the simplifying assumption of a competitive market for lawyers, in which only lawyers who maximize their clients' profits survive, the present analysis may be applied directly to lawyers' optimism. See also section 6.7 below.

stubbornness or excessive aggression at the bargaining table should also prove to be counterproductive. Thus, in analogy to the endogenous optimism model, a reputation for some limited degree of toughness in bargaining would seem to be a popular trait.

The relative importance of the optimism effect and the reputation effect is context dependent. For reputation to develop information regarding the bargaining behavior of one lawyer in a specific case must be transmitted to other lawyers. While clearly plausible in certain close-knit communities, the informational requirements for the development of substantial reputation effects are often not satisfied. Consider a more-or-less competitive market for litigation services, where interactions between lawyers are practically anonymous. In such a market, it will be more difficult for an individual lawyer to develop the desired reputation. Anonymity, however, need not hinder the operation of market selection forces of the type invoked in the endogenous optimism model. A pessimist, or excessively optimistic lawyer will lose money until she is driven out of the anonymous market. In addition, the transmission of optimism *via* imitation often imposes less stringent informational requirements, relative to the informational prerequisites for the development of accurate reputation. Finally, however, optimism and reputation may work in concert. Market selection forces will work best when the success (failure) of a lawyer with the “correct” (or “incorrect”) level of optimism or toughness is made widely known through reputation mechanisms.

## **6.7 Evolution versus Strategic Delegation**

The basic model did not distinguish between the litigants themselves and their lawyers. The lawyer–client agency problem is, of course, well recognized, and has been

the subject of extensive research. This agency relationship suggests several extensions to the preceding analysis. First, consider the following alternative selection process. Lawyers can develop a reputation for specific levels of optimism or toughness. Clients can then simply choose a level of optimism by choosing a lawyer with that level of optimism.<sup>28</sup> It can be shown that in the game between two litigants, who choose lawyers and optimism levels as if they were mere strategies, “cautious optimism” will prevail at equilibrium.<sup>29,30</sup>

A second extension abstracts from reputational considerations and focuses on contractually designed incentive schemes. The question here is how to design the lawyer – client contract, so as to give the lawyer optimal incentives in the strategic interaction with rival lawyers. In particular, can the lawyer’s fee structure be designed to induce the lawyer to negotiate as if she were cautiously optimistic? The strategic delegation problem is well known in the industrial organization literature (see Fershtman and Judd (1987); see also Kyle and Wang (1997)).<sup>31</sup> In the litigation and settlement context, Bebchuk and

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<sup>28</sup> In the present interpretation, reputation operates to convey information from lawyers to clients, and not between potential bargaining rivals (compare section 6.6 above). This interpretation relates to an argument developed by Gilson and Mnookin (1994) that clients choose lawyers with a reputation for cooperation.

<sup>29</sup> In a simultaneous-move game, where the plaintiff chooses a lawyer with a level of optimism  $x_p$  and the defendant chooses a lawyer with a level of optimism  $x_d$ , the set of Nash equilibria

$$\{(x_p, x_d) \mid x_p, x_d \in [0, C/W], x_p + x_d = C/W\}$$

restricts attention to “cautious optimism”, as defined in proposition 3 (and  $x_p = x_d = \frac{C}{2W}$  is the

only symmetric Nash equilibrium). See also note 20 above.

<sup>30</sup> If the client’s perceptions, rather than the lawyer’s perceptions, are determinative in settlement negotiations, then the analysis suggests a new role for lawyers - to misrepresent (to the client) the true chances of prevailing at trial. Optimistic misrepresentations may increase the client’s expected returns. Of course, such misrepresentation violates lawyers’ ethical norms. Indeed, from a social perspective that values a higher probability of settlement, but is indifferent to the distribution of value between litigants, there is good reason to enforce these ethical norms.

<sup>31</sup> This paper is not the first to examine the relationship between evolution and strategic delegation. See Guth and Dufwenberg (1999).

Guzman (1996) compare the incentive effects of a contingent fee contract and an hourly fee contract. Still, a comprehensive analysis of the optimal lawyer – client contract is still missing, and must be left for future research.

## **6.8 The Perception-Shaping Role of Law and Two-Way Behavioral Law and Economics**

A main purpose of the present analysis was to lay a theoretical foundation for the commonly observed optimism in legal settings. Such a theoretical foundation was missing in the large body of literature, which studies the effects of optimism without any thorough account of its origin. Moreover, the present analysis demonstrated how the legal regime determines the evolutionary stable level of optimism. The effects of legal rules on the type and magnitude of prevailing cognitive biases is a novelty of the present study (see also Bar-Gill (2002)). Behavioral law and economics is characterized here as a two-way street, rather than the one-way characterization implicit in the current literature. Clearly, cognitive biases affect the operation of legal rules. But also legal rules and legal institutions influence the type and magnitude of the prevailing cognitive biases. Both effects should be considered in the evaluation of legal policy.

## **6.9 From Endogenous Optimism to Endogenous Preferences**

The present study has demonstrated the potential effects of legal institutions on the type and magnitude of prevailing cognitive biases. The evolutionary influence of the law may carry an even greater weight when the focus of the analysis is shifted from cognitive biases to preferences. The evolutionary methodology employed in this paper may be readily extended to analyze the evolution of preferences under different legal regimes.

The analysis suggests that different legal rules may lead to different stable profiles of preferences. Consider, for example, the evolution of a preference for fairness that affects the terms of settlement deemed acceptable by a litigant.<sup>32</sup> The intensity of such preferences may depend on the legal environment.

This uncharted effect of the legal system imposes a serious philosophical caveat on any proposed legal policy. Even if the proposed policy is optimal given the current preference profile, will it still be optimal after the new policy induces a new preference profile (see Bar-Gill and Fershtman (2000)). These perplexing questions are of the utmost importance. Nevertheless, they must be left open for future research.

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<sup>32</sup> Farmer and Pecorino (2000) study the effects of a preference for fairness in the context of pretrial settlement negotiations. These authors, however, consider only the possibility of an exogenous pre-determined preference for fairness.

## Appendix A: Proofs

Appendix A collects the proofs of propositions 1, proposition 2, lemma 1 and lemma 2.

Proof of Proposition 1: The proof presented below is for the American rule. The proof for the British rule follows a similar logic.<sup>33</sup> The proof consists of two stages. Stage 1 shows that pessimism is weakly dominated by realism.<sup>34</sup> Stage 2 utilizes the result of stage 1 to establish the disappearance of pessimism through the evolutionary selection process.

Stage 1: Stage 1 proves that  $x_i = 0$  weakly dominates  $x_i < 0$ . Substituting  $x_i$  and  $x_i'$

into expression (1), we obtain:  $m_i(x_i, x_j) = \begin{cases} -\frac{1}{2}Wx_j & , x_j \leq \frac{C}{W} \\ -\frac{1}{2}C & , x_j > \frac{C}{W} \end{cases}$  and

$m_i(x_i', x_j) = \begin{cases} -\frac{1}{2}W[x_j - x_i'] & , x_j \leq \frac{C}{W} - x_i' \\ -\frac{1}{2}C & , x_j > \frac{C}{W} - x_i' \end{cases}$ . Comparing the two payoff functions, it is

clear that:  $\forall x_j \leq \frac{C}{W} \quad m_i(x_i, x_j) = -\frac{1}{2}Wx_j > -\frac{1}{2}Wx_j + \frac{1}{2}Wx_i' = m_i(x_i', x_j)$ ;

$\forall x_j \in \left( \frac{C}{W}, \frac{C}{W} - x_i' \right]$   $m_i(x_i, x_j) = -\frac{1}{2}C > -\frac{1}{2}Wx_j + \frac{1}{2}Wx_i' = m_i(x_i', x_j)$  (since

$x_j > \frac{C}{W} \Rightarrow Wx_j > C$ ); and  $\forall x_j > \frac{C}{W} - x_i' \quad m_i(x_i, x_j) = m_i(x_i', x_j) = -\frac{1}{2}C$ . This

completes stage 1 of the proof.

<sup>33</sup> The rest of the proofs also focus on the American rule. Therefore, we omit the superscript A in the payoff functions for notational convenience.

<sup>34</sup> For the present purpose the level of optimism may be viewed as a strategy, and standard evolutionary game theory may be used.



Stage 2: Unlike strictly dominated strategies or biases, weakly dominated strategies or biases do not necessarily vanish in a payoff monotonic dynamic selection process. However, if a strategy  $x_{i'}$  is weakly dominated by a strategy  $x_i$ , and the subpopulation programmed to strategy  $x_{i'}$  does *not* vanish, then the entire set of strategies against which  $x_i$  is better than  $x_{i'}$  vanish from the population (Weibull (1995), proposition 3.2). The implication of this result in the present context is that either all pessimists vanish from the population or that *only* pessimists and excessively optimistic players, with  $x > \frac{C}{W}$ , survive. The latter possibility is clearly unstable, since the excessively optimistic players will earn a strictly higher payoff than the pessimistic players, and thus the pessimists will be driven to extinction. Therefore, at the evolutionary equilibrium -  $\forall x < 0 \quad g(x) = 0$ .

QED

Proof of Proposition 2: Part (i) of the proposition is proved below. The proof of part (ii) follows a similar logic. The proof consists of two stages, similar to the two stages employed in the proof of proposition 1. Stage 1 shows that excessive optimism is weakly dominated by realism. Stage 2 utilizes the result of stage 1 to establish the disappearance of excessive optimism through the evolutionary selection process.

Stage 1: Stage 1 proves that  $x_i = 0$  weakly dominates  $x_{i'} > \frac{C}{W}$ . Substituting  $x_i$  and  $x_{i'}$

into expression (1), we obtain: 
$$m_i(x_i, x_j) = \begin{cases} -\frac{1}{2}Wx_j & , x_j \leq \frac{C}{W} \\ -\frac{1}{2}C & , x_j > \frac{C}{W} \end{cases} \quad \text{and}$$

$$m_i(x_i, x_j) = \begin{cases} \frac{1}{2}W[x_i - x_j] & , x_j \leq \frac{C}{W} - x_i (< 0) \\ -\frac{1}{2}C & , x_j > \frac{C}{W} - x_i \end{cases} .$$

. Since by proposition 1, all players with

$x_j < 0$  will eventually vanish, we only need to compare the two payoff functions with respect to  $x_j \geq 0$ . Through this comparison we obtain:

$$\forall x_j < \frac{C}{W} \quad m_i(x_i, x_j) = -\frac{1}{2}Wx_j > -\frac{1}{2}C = m_i(x_i, x_j) \quad (\text{since } x_j < \frac{C}{W} \Rightarrow Wx_j < C); \text{ and}$$

$$\forall x_j \geq \frac{C}{W} \quad m_i(x_i, x_j) = m_i(x_i, x_j) = -\frac{1}{2}C .$$

This completes stage 1 of the proof.

Stage 2: Using the same reasoning employed in the proof of proposition 1, the weak dominance of excessive optimism means that either *only* cautiously optimistic players,

with  $x < \frac{C}{W}$ , survive, or only excessively optimistic players, with  $x > \frac{C}{W}$ , survive. The

latter possibility is clearly unstable, since any mutant with  $x \leq \frac{C}{2W}$  can successfully

invade such a population. Therefore, at the evolutionary equilibrium -  $\forall x > \frac{C}{W} \quad g(x) = 0$ .

QED

*Proof of Lemma 1:* Part (i) of the lemma is proved below. The proof of part (ii) follows a

similar logic. To prove the evolutionary stability of  $\hat{x} = \frac{C}{2W}$  we have to show that no

mutant  $x_m \neq \hat{x}$  can successfully invade the homogenous  $\hat{x} = \frac{C}{2W}$ -population.<sup>35</sup> This is

---

<sup>35</sup> This condition is equivalent to the definition of an Evolutionary Stable Strategy (ESS) – See Maynard Smith (1982) and Weibull (1995).

demonstrated through a comparison between the payoff obtained by a member of the population and the payoff obtained by any possible mutant. Substituting the relevant levels of optimism into expression (1) yields:  $m_i(\hat{x}, \hat{x}) = 0$ ;

$$\forall x_m < \hat{x} \quad m_m(x_m, \hat{x}) = \frac{1}{2}W[x_m - \hat{x}] < 0; \text{ and } \forall x_m > \hat{x} \quad m_m(x_m, \hat{x}) = -\frac{1}{2}C < 0.$$

Since any mutant earns a strictly lower payoff compared to the homogenous population,  $\hat{x} = \frac{C}{2W}$  is evolutionary stable. QED

*Proof of Lemma 2:* Part (i) of the lemma is proved below. The proof of part (ii) follows a similar logic. Assume a homogenous population, in which the unique level of optimism is  $\hat{x} > \frac{C}{2W}$ . We now show that a mutant  $x_m = \frac{C}{2W}$  can successfully invade the population.

This is demonstrated through a comparison between the payoff obtained by a member of the population and the payoff obtained by the mutant. Substituting the relevant levels of optimism into expression (1) yields:  $m_i(\hat{x}, \hat{x}) = -\frac{1}{2}C = m_m(x_m, \hat{x})$  and

$$m_i(\hat{x}, x_m) = -\frac{1}{2}C < 0 = m_m(x_m, x_m), \text{ i.e. when matched against } \hat{x}, \text{ both the population,}$$

$\hat{x}$ , and the mutant,  $x_m$ , receive the same payoff, but when matched against  $x_m$ , the mutant receives a strictly higher payoff.

Next, examine the complementary case in which the unique level of optimism is  $\hat{x} < \frac{C}{2W}$ . Again, a mutant  $x_m = \frac{C}{2W}$  can successfully invade the population. We

substitute the relevant levels of optimism into expression (1), and compare payoffs

$$m_i(\hat{x}, \hat{x}) = 0 \text{ and } m_m(x_m, \hat{x}) = \frac{1}{2}W[x_m - \hat{x}] = \frac{1}{2}W\left[\frac{C}{2W} - \hat{x}\right] > 0 \text{ (since } \hat{x} < \frac{C}{2W}\text{)}. \quad \text{QED}$$

## Appendix B: The Numeric Algorithm

The analytical results presented in sections 3 and 4 have been supported and extended using a computer based numeric algorithm. This algorithm has also been applied to generate the results presented in section 5. Appendix B describes the numeric algorithm and presents its implementation in the MATLAB 6 programming language. The appendix also presents illustrative results of the numeric simulations.

### Flow Chart

Figure 1a presents a flow chart of the evolutionary process studied in the present paper. The legal setting is represented by the payoff function  $m_i(x_i, x_j)$ . The dynamics are defined by the *Dyn*:  $g_t(x) \rightarrow g_{t+1}(x)$  function, and the initial conditions of the dynamic process are summarized in the initial distribution function,  $g_0(x)$ .

The algorithm consists of two main blocks. The first block calculates the fitness for each optimism level. The second block embodies the dynamic structure vis-a-vis the *Dyn*:  $g_t(x) \rightarrow g_{t+1}(x)$  function. The algorithm applies a payoff monotonic dynamic process. Hence, the output of the first block directly influences the dynamics of the second block. The two procedures are carried out  $T$  times, where  $T$  represents the number of periods specified for the dynamic process.

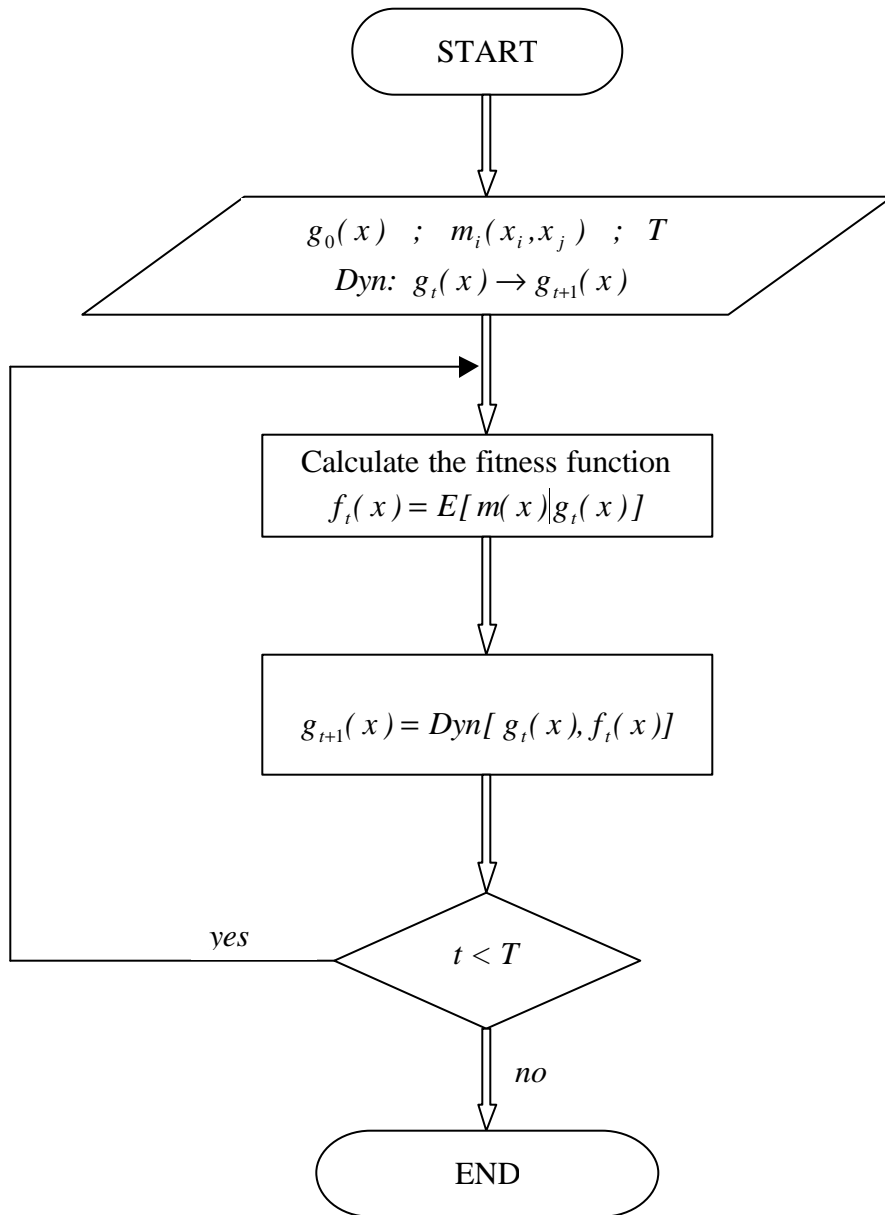


Fig. 1a: A flow chart representation of the dynamic process

## Implementation of the Algorithm in the MATLAB 6 Environment

The computer code, written in the MATLAB 6 programming language, is presented below. The code is composed of three segments: the main program, the fitness function (first block in the flow chart) and the *Dyn* function (second block in the flow chart). The presented code implements the algorithm for a deterministic model of the American regime. Implementation for the British rule requires minor adjustments. The simple type of uncertainty analyzed in section 4 can be easily added through an appropriate modification of the fitness function. Incorporating more complex forms of uncertainty requires the application of a *Monte Carlo* procedure. The *Monte Carlo* technique generates random errors (according to a given error distribution) that are then inserted into the computer simulation, according to the specified information structure.

```
% *****  
% The Main Program  
% *****  
  
% Define System Parameters  
% *****  
  
global p C W;  
  
T = 50;           % number of periods in the dynamic / evolutionary process  
  
% "Legal" Parameters  
% *****  
  
p = 0.5;         % probability of plaintiff victory at trial  
  
W = 500;         % magnitude of judgment  
  
C = 100;         % total litigation costs: C = Cp + Cd
```

```

% The Initial Distribution of Optimism in the Population
% *****

x_max = (p >= 0.5)*(1-p) + (p < 0.5)*p;           % maximal level of optimism
x_min = -x_max;                                   % minimal level of optimism
precision = 100;                                  % number of optimism levels
dx = (x_max - x_min)/precision;                   % size of optimism interval
x = [x_min:dx:x_max];

[x_rows x_columns] = size(x);

% A Uniform Distribution
g0 = 1/(x_max - x_min)*ones(size(x));             % pdf

% A Normal Distribution
g0 = normpdf(x,0,x_max/5);                         % pdf
% *****

% The Dynamic Evolution of the Population
% *****

g = zeros(T,x_columns);                           % initialize matrix of distributions
fitness = zeros(T,x_columns);                      % initialize matrix of fitness values

g(1,1:1:x_columns) = g0;                          % row 1 = Initial distribution

for i=1:T

    fitness(i,1:1:x_columns) = f(g(i,1:1:x_columns),x);

    g(i+1,1:1:x_columns) = dyn(g(i,1:1:x_columns),fitness(i,1:1:x_columns),dx);

end

```



```

% *****
% ** The Fitness Function - f(g) **
% *****
%
% Description: The f(g) function calculates the fitness of every optimism level given
%               the distribution of optimism in the population
% *****

function [f_res] = f(g,x)

global p C W;

x_min = min(x);
x_max = max(x);
dx = (x_max - x_min)/(length(x)-1);

for i=1:length(x),
    for j=1:length(x),
        xpx(i,j) = x(i) + x(j);           % calculate the (xi + xj) matrix
        xmx(i,j) = x(i) - x(j);           % calculate the (xi - xj) matrix
    end
end

cond = ( xpx <= C/W );
m = 0.5*xmx*W.*cond - 0.5*C*(1-cond);
f_res = (m*g)';

% *****
% ** Function dyn(g,f) **
% *****
%
% Description: The Dyn(g,f) function defines the evolutionary dynamics. It calculates
%               the fitness at period t+1 given the distribution of optimism and the
%               fitness at period t
% *****

function [new_g] = dyn(g,f,dx)

f_positive = f - min(f);

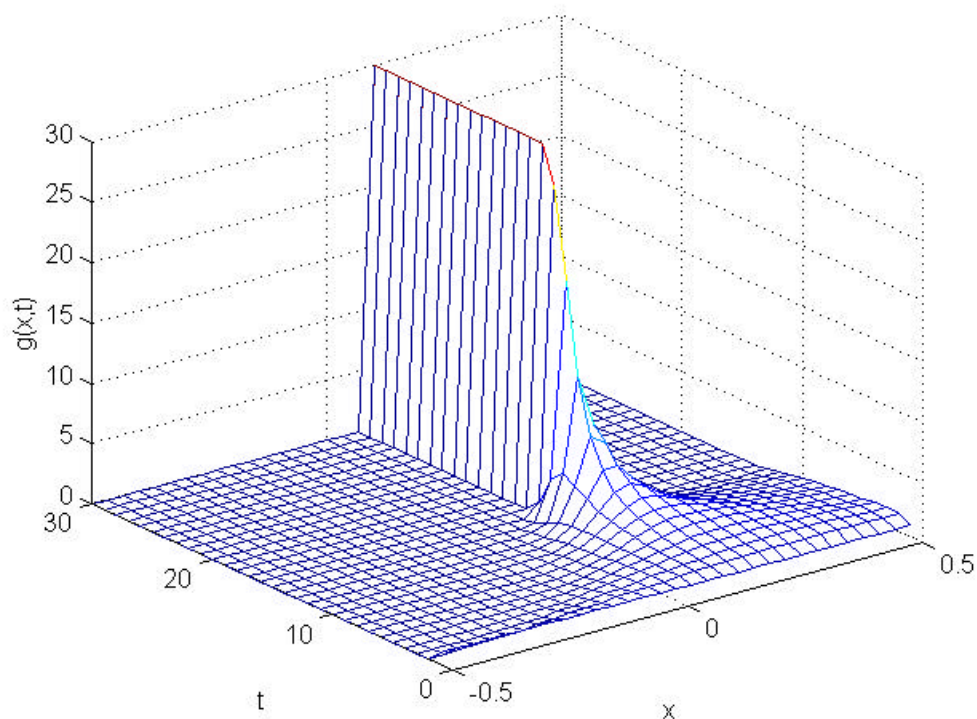
new_g = g.*f_positive;

new_g = new_g / sum(new_g)*dx;

```

### The Numeric Calculations – Illustrative Results

Figure 2a demonstrates the convergence of a heterogeneous population (with  $x \sim U[-0.5,0.5]$ ) to the unique level of optimism,  $\frac{C}{2W}$ , in the deterministic model of an American regime. As explained in section 3, the pessimists disappear first (see proposition 1). While pessimists exist, the excessive optimists prosper by exploiting the pessimists. However, the pessimists soon disappear, and then the excessive optimists are also driven out of the market (see proposition 2). Finally, the population converges to the unique level of optimism,  $\frac{C}{2W}$ .



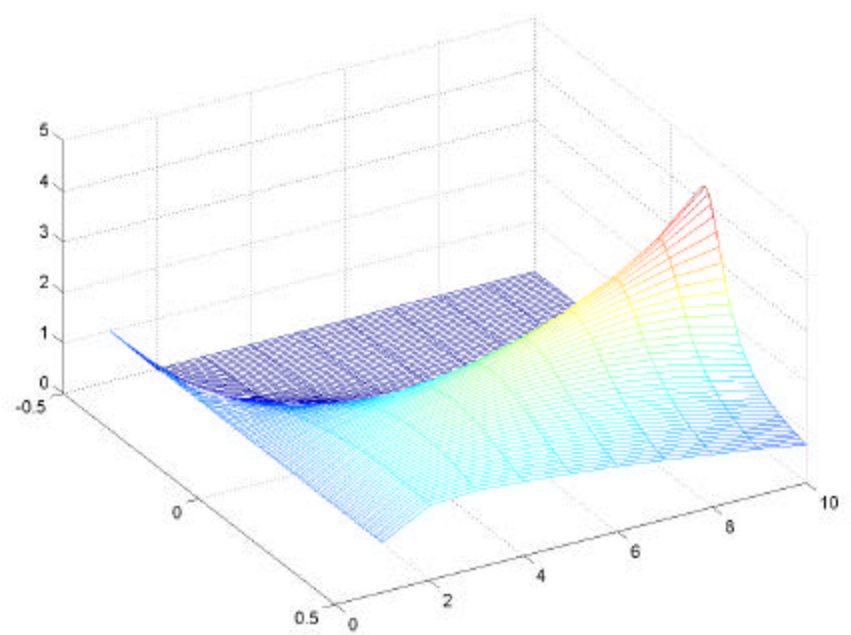
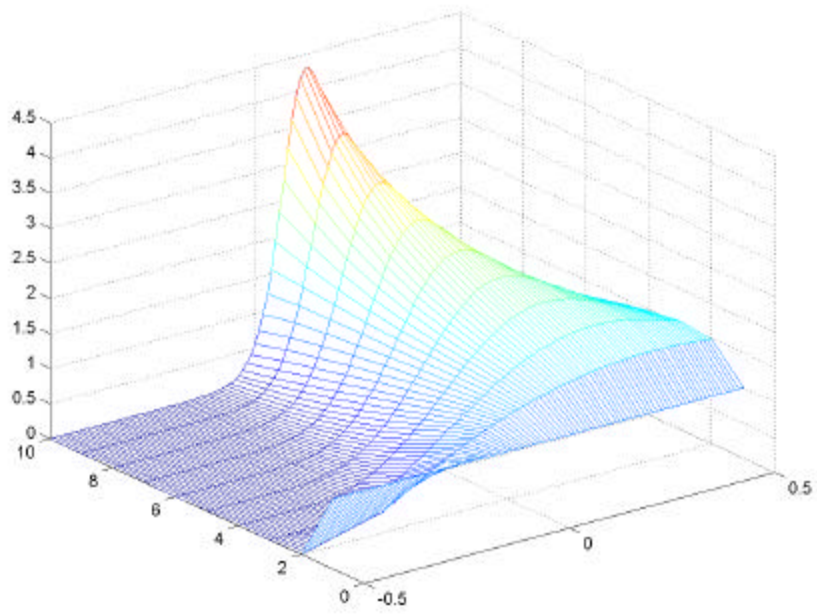


Fig. 2a: Convergence to the evolutionary stable level of optimism

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