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Contracting and Litigation Under Biases and Asymmetric Information

A dissertation submitted in partial satisfaction of the
requirements for the degree
Doctor of Philosophy

in

Economics

by

Elisa Wynne Kirsten Hovander

Committee in charge:

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    Professor Joel Sobel

2011

The dissertation of Elisa Wynne Kirsten Hovander is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

2011

DEDICATION

To the individuals who have blessed me with their presence along
this journey:
To my mom, who has been an endless fountain of comfort,
encouragement and moral support.
To my dad, whose example instilled the work ethic and principles
that have guided me along my academic path.
To my other family members and friends who have always stood by
me to share both my triumphs and my burdens.
And to my advisor, Joel Watson, whose patience, dedication and
generosity toward his advisees have never ceased to amaze me.
Without his insightful guidance and encouraging perspective, this
project would not have come to fruition.

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2002	B.S. in Economics, University of Washington
2002	B.A. in Business Admin., University of Washington
2006	M.A. in Economics, University of California, San Diego
2011	Ph.D. in Economics, University of California, San Diego

ABSTRACT OF THE DISSERTATION

Contracting and Litigation Under Biases and Asymmetric Information

by

Elisa Wynne Kirsten Hovander

Doctor of Philosophy in Economics

University of California, San Diego, 2011

Professor Joel Watson, Chair

Human decision-making is often influenced by various departures from perfect rationality; it is also limited by natural constraints on available information. My dissertation studies the effects of such behavioral and environmental elements in contractual settings. In my dissertation, this research theme can be divided into two main chapters.

The first chapter studies the role biases and other cognitive limitations on belief formation play in individual incentives and dispute. I address questions such as: Can biases benefit individuals? Why do misunderstandings arise?

"Optimistic Biases: Implications for Incentives and Dispute in Contractual Relationships," examines the impact mutual biases and litigation rules have on the efficiency of a productive relationship. A primary purpose of this chapter

is to provide a deeper foundation for existing litigation models in which parties exhibit biased beliefs. Additionally, this chapter goes beyond the scope of standard litigation models; implications are obtained for the relationship in its entirety, tracing from contract formation to dispute. This allows for the identification of bias driven efficiency trade-offs, as well as the impact of legal rules on the relationship as a whole.

The second chapter considers issues pertaining to language use and interpretation. Questions of interest include: How do individuals optimally structure language rules when faced with language restrictions? How does this optimal structure and use of language vary under differing environmental conditions?

"A Model of Plain Meaning and Precedent" examines how plain meaning in legal contexts might arise as an equilibrium response to characteristics of the contractual and legal environment. I provide a technical definition of plain meaning that relates to both its common usage in the legal literature and in practice. Equilibrium use of language is more "plain" if the interpretive rule used by an external enforcer (court, arbitrator, or other) leads to rulings that vary less according to the context. Some of the existing theoretical work on optimal interpretive rules implicitly assumes some form of plain meaning. One objective of this chapter is to provide a foundation for such assumptions. More broadly, it provides theoretical results on the conditions under which plain meaning might arise.

Chapter 1

Optimistic Biases: Implications for Incentives and Dispute in Contractual Relationships

1.1 Introduction

In the United States, only a small fraction of relationships ever engage in a formal dispute, and even fewer end litigiously.[1] Although such cases are the exception, they bear significant economic weight. State courts handle the majority of cases filed in the United States; they also boast correspondingly high expenditures.[2] Private costs associated with litigation are also high and include use of time,[3] money and other resources. Given the substantial personal expense,

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[1]Approximately 3% of all general civil claims are disposed of by means of either a jury or bench trial. This was estimated using data from 116 of the 156 jurisdictions that participated in the 2005 Civil Justice Survey of State Courts. Note that *general* civil cases include tort cases, contract cases and real property cases. They do not include other civil cases, such as probate, mental health or small claims. Small claims are tort, contract and real property cases that fall within state statutory limits.

[2]Over 98% of the cases processed by U.S. courts during the years 1984 to 1993 were handled by state courts. *Caseload Highlights: Examining the Work of the State Courts* (Vol. 1, No. 1). In 2006, state and local governments spent $36,823,027 directly on judicial and legal services. While this included support of criminal cases, prosecutor funcions and public defender services, a large percentage of court business was focused in the civil arena. *Bureau of Justice Statistics 2006 Justice Expenditure and Employment Data.* Specific civil expenditures not available.

[3]Although the average trial length for general civil cases is about four days for a jury trial and two days for a bench trial, the amount of time that lapses between initial filing to final verdict is

it is no surprise that most disputes never see the courtroom. However, there still exists a subset of individuals who are simply unable to reach settlement. This has prompted many scholars to ask: What distinguishes these relationships from the rest?

Most theoretical work addressing this question begins analysis at the point of dispute, abstracting from any causal factors. These papers seek to identify conditions under which rational individuals might fail to settle, despite the existence of mutual gains.[4] Two classifications characterize the majority of such litigation theories: asymmetric information and divergent expectations. Bebchuk (1984) and Reinganum and Wilde (1986) are seminal pieces under the asymmetric information classification, the former utilizing a model in which screening occurs and the latter obtaining results in the context of a signaling model.[5] Priest and Klein (1984) offer the primary theory of divergent expectations.

The current paper bears elements of each class, yet it distinguishes itself from previous work in two significant ways. First, it provides a litigation account which incorporates details of the pre-dispute interaction. Asymmetric information arises within the course of play as a result of privately chosen actions in the productive phase. Consequently, disputes arise endogenously, rather than by assumption.

Second, this paper suggests another important mechanism at play in the incidence of litigation, one based on bounded rationality in the form of *systematically* biased beliefs. This is in contrast to the random bias which leads to divergent expectations in the Priest and Klein model. Systematic biases, in particular optimistic biases, have extensive support in the psychological literature. Farmer and Pecorino (2002) also utilize a self-serving bias in the context of an asymmetric

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significantly longer. This interim period spans an average of over 26 months for jury trials and over 20 months for bench trials. These estimates are based on the data collected in the 2005 Civil Justice Survey of State Courts and reported in: *Civil Bench and Jury Trials in State Courts, 2005* (Bureau of Justice Statistics Special Report, 2008).

[4]This analysis, in line with standard economic assumptions, does not consider emotional factors which may add to overall costs or limit the disputants' ability to negotiate terms outside of the courtroom.

[5]The more general economic analysis of bargaining failure under asymmetric information predates these litigation-specific models. Key contributors include: Crawford (1982), Chatterjee and Samuelson (1983), Fudenberg and Tirole (1983), Myerson and Satterthwaite (1983), and Sobel and Takahashi (1983).

information litigation model, however they only examine biases regarding litigation outcomes. The current paper moves beyond modeling how such biases might affect litigation decisions in isolation. It shows how differing (and self-serving) beliefs among disputants can be linked to shared optimistic biases in the initial productive interaction. This approach provides a simple foundation for divergent beliefs regarding litigation, one based on biases which have empirical backing *and* which are present throughout the entire course of the relationship.

The resulting analysis provides efficiency results for the relationship as a whole, while highlighting a key trade-off: increases in productive efficiency associated with optimism come at the cost of increased incidence of litigation. These results bring new light to policy implications shared with other models, as well as uncover new ways in which wasteful litigation might be reduced.

I examine a model in which two individuals engage in a one-shot productive endeavor under the umbrella of an objective legal system. One might envision a scenario in which two individuals have developed a business plan and have chosen to enter into a contractual agreement as entrepreneurial partners. The initial contract would specify terms of participation such as: initial contributions to the project, specific roles and duties, ownership shares, allocation of profits or losses, dispute resolution clauses, and other details relevant to pursuing the business venture.[6]

The productive setting is modeled in a standard way, with observability constraints on effort levels. This creates incentive problems associated with moral hazard; since neither partner can monitor the other's contribution to the start-up, each has an incentive to shirk some of the business responsibility and free-ride on the efforts of the other. The key innovation (to an otherwise standard joint production model) is that parties may hold biased beliefs regarding the productivity of their efforts and hence, the productive potential of their joint endeavor. While the case of a pessimistic bias is briefly considered, the focus of this paper is on the more prevalent case of an optimistic bias. In both cases, it is assumed that the parties share the same bias. This is fitting for parties who would have carefully

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[6]The contracts considered in this paper take a basic, general form and contain only a few key parameters. They can be considered as abbreviated representations of the much more detailed contracts we see in practice.

discussed their goals and beliefs about the productive feasibility of the project ex ante.

The legal setting is one in which courts may serve two purposes: 1) to objectively enforce contractual terms and 2) to facilitate costly discovery of information through the litigation process. Depending on the treatment, court penalties may either be freely specified by the parties in the initial contract or they may be forced to satisfy an externally set upper bound.

The main purpose of this paper is to provide a cohesive model which links biases that exist in the litigation phases of a relationship to relevant elements present in the initial productive interaction. In doing so, it seeks to provide a theoretical basis for divergent self-serving beliefs in litigation. In particular, it explains how parties with *common priors* and an initially optimistic and cooperative outlook on a partnership could find themselves at odds and with divergent self-serving beliefs regarding prospects at trial. A complementary goal of this paper is to obtain results for such partnerships that can help inform discussion of welfare improving policies and actions.

Two variations of the model are considered. The main model illustrates a case in which parties draft a contract that is specifically designed to support cooperation; parties do not expect their partners to shirk responsibility, and they do not expect to engage in dispute. An alternate version is briefly examined in which partners utilize mixed strategies regarding effort choices in equilibrium. In this case, litigation occurs without the existence of biases. Key results are shown to persist in these cases, even when parties anticipate shirking and litigation in equilibrium.

The results can be summarized as follows: First, it is shown that unbiased partners are able to reach efficient outcomes when there are no constraints on penalties. However, this is not the case when a binding constraint is in place; efficient outcomes are no longer attainable. Given such constraints, the existence of an optimistic bias may benefit the parties, enabling them to reach better (albeit still inefficient) expected outcomes. This is not universally true, as the bias has two countervailing effects on joint expected surplus. The positive effect is due

to increased marginal incentives, which encourage higher effort provision. The corresponding negative effect is due to costly litigation, the probability of which is increasing in the level of optimism. This trade-off drives the result that under constrained penalties, a moderate amount of optimistic bias benefits the parties for certain parameter values, whereas for other parameter values, optimism is harmful for the partnership.[7] Extreme optimism is generally harmful for both parties, as it drives wasteful overinvestment of resources and increased litigation.[8] In both versions of the model, optimism leads to increased litigation through the creation of divergent, self-serving beliefs regarding litigation outcomes.

Discussion of these results sheds light on existing legal rules and provides additional implications for optimal policies. The first implication is related to the role legal bounds on penalties may play in increasing welfare, a topic which has been discussed extensively in the legal literature. In an environment with no bounds on penalties, optimistic biases have an unambiguously adverse effect, in that they induce overprovision of effort and increase the likelihood of dispute. Penalty bounds are shown to increase the efficiency of optimistically biased relationships, both by reducing the incidence of litigation *and* by decreasing the tendency to overprovide effort. The first effect is supported by the results of the three main papers cited previously; the second effect is a unique implication of this model.

Results of this model also pertain to the question of whether business consulting geared toward reducing optimistic biases would benefit parties, and if so, when consulting should optimally occur. The results imply that while there may be some benefits to decreasing the ex ante bias of extremely optimistic parties, it would generally be useful to wait until disputes arise. In such cases, consulting (perhaps in the form of mediation) may benefit disputing parties by reducing

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[7]Here, the words "harmful" and "wasteful" are used in a paternalistic manner. Throughout the paper, the parties' joint welfare is defined in terms of the true (rather than perceived) productivity of effort.

[8]This result is reminiscent of a common theme in both economic and psychological literature, whereby a moderate amount of over-optimism is shown to benefit individuals, but an extreme amount is shown to be harmful. See Puri and Robinson (2007) for an empirical study on economic choice that supports this idea. See also Phelps et. al. (2007) for a succinct summary of psychological papers supporting this idea, as well as an interesting neurobiological study of the optimism bias in humans.

biases and enabling them to avoid costly litigation.

The rest of the paper is organized as follows: Section 2 discusses related literature and additional motivation. Section 3 describes the main model and assumptions. In Section 4, initial results are obtained for the general case. Section 5 explores the implications of biased beliefs and establishes the main results of the model. Section 6 briefly examines a separate case with differing assumptions and complementary results. Section 7 concludes.

1.2   Related Literature and Motivation

In the law and economics literature, there are two prevailing classes of theories that explain why rational agents might fail to settle: asymmetric information and divergent expectations. Bebchuk's (1984) screening model and Reinganum and Wilde's (1986) signaling model are the seminal papers in the asymmetric information class; Priest and Klein's (1984) model is the seminal paper in the divergent expectations class. While other litigation theories exist, most can be classified as a variant of one of these fundamental theories.

In the Bebchuk model, the defendant has private information regarding his case and the plaintiff's probability of prevailing, p. The plaintiff knows the distribution of p; the court penalty is common knowledge. Before litigation, the plaintiff makes a take-it-or-leave-it settlement offer. His optimal offer satisfies conditions that lead some types of defendant to accept and others to reject. In this screening model, only certain types ever go to trial. In the Reinganum and Wilde model, the information asymmetry is reversed. Here, the plaintiff has private information regarding the level of damages inflicted by the defendant, which determine the court award. The defendant knows the distribution of potential damages, and the plaintiff's probability of prevailing is assumed to be common knowledge. Again, the plaintiff makes a take-it-or-leave-it settlement offer. A separating equilibrium is shown to exist in which settlement demands are increasing in the plaintiff's type; the rejection function (which gives the probability of the defendant rejecting any given demand) is increasing in the level of settlement demand. In this model, all

except for the low type have a positive chance of going to trial. In the Priest and Klein model, disputing parties develop individual beliefs regarding the probability of prevailing at trial. These beliefs are derived from private estimates of case quality, which are subject to random, mean zero error. The parties have knowledge of the possibility of error and the specific distribution of the errors; they use this to calculate the probability of prevailing at trial, given an objective decision standard. The existence of the random error leads to some circumstances in which the parties' expectations diverge significantly. With positive probability, this divergence is sufficient to prevent the parties from reaching a mutually agreeable settlement.

Note that the assumptions of the PK model essentially introduce a random ex ante bias in beliefs. These beliefs are equally likely to be overly optimistic or pessimistic. While the general existence (and prevalence) of biases is supported by empirical and observational evidence, the specific nature of the bias employed in the Priest and Klein model is not. Rather, the random nature by which estimation errors are made in their model contradicts evidence regarding ways in which people systematically err in judgment.[9] Evidence suggests that biases tend to persist on an individual-specific level, both in the form (whether optimistic or pessimistic) as well as the magnitude. More importantly, biases exhibit regularities over the population as a whole: biases are predominantly optimistic or self-serving in nature.

A large volume of evidence has been gathered in the psychological literature, supporting the existence of some form of self-enhancing bias. DeBondt and Thaler (1995, p. 389) argue: "Perhaps the most robust finding in the psychology of judgment is that people are overconfident." People exhibit the tendency to "view oneself, one's ability to control the environment, and one's future in somewhat more positive terms than can realistically be justified." (Taylor and Brown, 1994) This positive distortion of future prospects persists in varying degrees and in many diverse environments; it plays an even greater role when an individual perceives

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[9]Interestingly, Lederman (1999) refers to the Priest and Klein model as an optimism model, despite the lack of systematic optimism in the model's structure. She and a few others make this classification due to the implication of the model that litigation will only occur in equilibrium when parties (by chance) are sufficiently optimistic in their respective estimates of the actual case quality. Because of this, Priest and Klein focus their discussion and examples on those contingencies.

that future events are under his control. Beyond studies in psychology, biases have been shown to play a role in issues pertaining to entrepreneurship, finance, management, and other economically relevant areas. Trade papers can be found giving advice reflecting the belief that individuals behave in this manner. To better inform such advice, theoretical work should consider such circumstances and explore the implications for decisions made – both by actors who are subject to the biases and by those who must interact with biased individuals.

Economic theory has made progress in this direction, primarily in the study of entrepreneurship and management. Both optimism and overconfidence[10] are utilized to explore topics such as entry decisions, optimal debt contracts, bank regulation, bankruptcy rules and the existence of financial intermediaries, among other issues.[11] Manove (2000) models optimism in the same manner as the current paper. He finds that in long-run equilibria, agents self-select into roles according to their level of optimism: those characterized by levels above a certain threshold become entrepreneurs and those below that threshold become workers. He also finds a trade-off between positive incentive and negative efficiency effects of optimism and provides results indicating that too much bias is harmful. Camerer and Lovallo (1999) provide experimental support for the existence of optimistic biases driving excessive business entry. They find a marked increase in this effect when payoffs depend on skill, reinforcing other papers which highlight perceived control as a factor contributing to overoptimism.

General theoretical papers seeking to justify the existence of optimism can be found in the economic literature. Brunnermeier and Parker (2005) establish a framework by which agents develop optimistically biased beliefs as the result

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[10]As emphasized in Ben-David, Graham and Harvey (2007), these are distinct (albeit related and sometimes confounded) biases. They define overconfidence as a miscalibration by which "people overestimate the precision of their own beliefs, or underestimate the variance of risky processes." (p. 2) They define optimism as an overestimation of the mean value of future uncertain prospects. Coelho (2010) defines unrealistic optimism in absolute terms as "the difference between an individual's subjective estimate of the probability of a good/bad event occurring and the 'true' value of that probability." (p. 399)

[11]For some examples of such studies, see de Meza and Southey (1996), Manove and Padilla (1999), Malmendier and Tate (2005), Landier and Thesmar (2009), and Dushnitsky (2010). For an extensive discussion of various other studies pertaining to entrepreneurship and optimism, see Parker's (2006) section on "entrepreneurship, optimism and other cognitive biases."

of an optimization exercise: agents weigh the benefit of believing their future is brighter than reality ("current felicity") with the negative impact inaccurate beliefs have on decision making. They apply the theory to provide insight in portfolio choice and consumption-saving examples. Santos-Pinto and Sobel (2005) examine a mechanism by which individuals develop subjective assessments of their relative abilities that are (overly) positive. In the model, individuals invest in skill acquisition to maximize their overall ability. Overly positive self-assessments arise due to the existence of distinct beliefs regarding the relative importance of various skills, in conjunction with the resulting investments. The model captures observed regularities such as the relationships between positive biases and: task ambiguity, task difficulty and initial skill-level.

The law and economics literature has also made contributions in the study of biases. In an experimental paper, Babcock and Loewenstein (1997) find that self-serving biases regarding a judge's expected award at trial hinder bargaining and settlement; Babcock, Loewenstein and Issacharoff (1997) further show that such subjects may be successfully debiased. Loftus and Wagenaar (1988), followed by Goodman-Delahunty, Granhag, Hartwig and Loftus (2010), study whether lawyers' beliefs are well-calibrated. They find that as a whole, lawyers tend to be subject to an overconfidence bias. In Farmer and Pecorino (2002), Bebchuk's (1984) model is augmented to include a self-serving bias in interpreting the facts of the case. They find that in most cases, an increase in the bias also increases the likelihood of litigation.

The results of this paper also pertain to another branch of the law and economics literature, that involving the study of why penalties should (or should not) be bounded. Specifically, the literature studies whether the court should uphold liquidated damages clauses that are deemed to be in excess of a reasonable estimate of actual damages. The law of liquidated damages currently voids any such contractual clauses, labeling them as penalties. This law, also known as the penalty doctrine, has been given much attention as a particularly puzzling aspect of the common law of contracts for several reasons. First, it sits in stark contrast to the majority of contract law, which generally supports freedom of contract

and upholds parties' agreements. Second, basic economic analysis would suggest that placing such restrictions on parties' contractual options could only reduce efficiency of the relationship. Third, there is asymmetry in the sense that courts do not intervene when liquidated damages are lower than a reasonable estimate of actual damages.

Some economic arguments both for and against the existing law of liquidated damages have been put forth by scholars in this area. In support of a new rule, Edlin and Schwartz (2003) provide an extensive survey of the existing theories regarding damages. They make the case that liquidated damages of any size can be either efficient or inefficient, depending on the intentions of the parties. DiMatteo (2001) makes a similar point and provides an extensive discussion of the existing law of liquidated damages, as well as a less technical discussion of many of the economic and legal arguments for and against. The main points cited in support of the penalty doctrine are that excessive penalties may discourage efficient breach, may be used to exploit an unsophisticated party, or may be used to deter entry of competitors. The key points against argue that damages are often necessary to encourage efficient investment, and that they may be efficient when breaches are difficult to detect. Beyond the arguments included in these surveys, Polinsky (1983) shows that penalty clauses may play a role in efficiently allocating risk, and Aghion and Hermalin (1990) find that informational asymmetries may lead parties to use costly signaling, in which case bounds on penalties can increase efficiency. The current paper provides another way in which bounded penalties may improve welfare – by compensating for optimistic biases.

1.3 Main Model

Two risk-neutral parties are endowed with a one-shot opportunity to undertake a joint venture, in which their combined efforts determine the expected profitability of a project. Let output be governed by the following production technology:

$$Y = \alpha \left(e_1 + e_2 \right) + \epsilon, \tag{1.1}$$

where Y is the value of output, $e_i \in [0,1]$ denotes individual i's effort, and $\epsilon \sim U[0,1]$. The parties provide effort at a commonly known personal cost, $C(e_i) = e_i^2$. For simplicity, assume that the outside option for both parties is zero. α, the marginal productivity parameter, will play a central role as I explore the implications of biases governing the partners' beliefs. Let α^P represent the perceived marginal product of effort. This term will be used to capture the parties' shared beliefs (whether biased or accurate) regarding the productive technology. In all cases, I assume common "knowledge" of the perceived production technology as stated above, but with $\alpha = \alpha^P$.

The setting I examine is one in which the parties are subject to the problem of double moral hazard; effort levels are privately observed and unverifiable. The realized value of the venture, Y, is the only measure which can be readily observed and costlessly verified in court. I also allow for a costly signal regarding effort choices to be discovered through the process of litigation. This expands the contractual possibilities, enabling the parties to include transfers contingent upon this additional information. To further add realism to the model, I assume the contractually specified transfer must satisfy an externally set upper-bound, $\bar{z}$. Otherwise, it will not be enforced.[12][13]

After the realization of the venture's value, parties may initiate court proceedings. However, since litigation is costly, it is in the joint best interest of the

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[12]Existing legal rules impose such restrictions on contractual clauses, prohibiting anything that could be considered a "penalty". This effectively imposes a bound on contractually specified transfers in the event of breach. Although the level of the bound is determined by case specific factors, I consider the implications of a general bound in this context.

[13]Later in the paper, I will solve for the "optimal bound" z^* as a function of the optimistic bias and other parameters of the model. I will show that the optimal bound in this model is in fact restrictive when parties are optimistically biased.

parties to settle any differences outside of court. Settlement is modeled as a random proposer ultimatum offer game. Each player is equally likely to be in the position of making a settlement offer. If this offer is accepted by the other party, settlement is achieved under those terms; if the offer is rejected, litigation ensues and each incurs a cost of γ. At trial, the actions of both parties are evaluated.[14] The court observes e_1 and e_2 with probability p and observes nothing with probability $(1-p)$. The court then delivers a verdict based on observed evidence and enforces the contractually (or legally) specified transfers. Note that although this description of court frames information discovery as an inquisitorial process, this is simply for the sake of exposition. The assumptions of the model are not restrictive in this sense, and the model is also equivalent to a scenario where evidence is obtained through adversarial means.

The timing of the model is as follows:

At $t = 1$, two individuals are endowed with the means (e.g. inspiration, opportunity, etc.) to undertake a joint venture. They write a contract specifying effort levels, $\bar{e}_1$ and $\bar{e}_2$, entitlement shares to the final output value, s_1 and s_2, (where $s_1 + s_2 = 1$) and a transfer contingent upon the results of a possible court inquiry, $F(e_1^c, e_2^c)$. Without loss of generality, we can restrict attention to the class of contingent transfers which satisfy (0,0) in the event that either both or none of the players is found to have shirked, (-z,z) in the event that player 1 is found to have shirked and (z,-z) in the event that player 2 is found to have shirked. For the rest of the paper, I will simplify notation by referring to this transfer rule simply in terms of z. At $t = 2$, both players simultaneously and independently select their effort levels e_1 and $e_2 \in [0, 1]$. At $t = 3$, Nature moves; the final output value Y is realized and shares are automatically distributed between the parties.

With court discovery, the game proceeds to $t = 4$, where nature randomly selects a proposer to make a settlement offer. Offers take the form of a simple monetary transfer from one player to the other. If the offer is accepted in $t = 5$,

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[14]I chose a symmetric treatment of both "plaintiff" and "defendant" both for simplicity and to better capture the dynamics of this model. In this model, since fault arises endogenously by the actions taken on the part of both, there is a less clear plaintiff vs. defendant role distinction between the two players than in other models where exactly one party is assumed to be at fault.

the game ends.[15] If the offer is rejected, the game continues to the litigation phase at $t = 6$. In this phase, the cost γ is incurred by both parties, the court delivers its verdict regarding the effort levels of the parties (e_1^c, e_2^c), the contractually specified transfer z is enforced (provided it satisfies the bound $\overline{z}$), and the players part ways.

1.4 General Results

As a starting point, I derive equilibrium results in terms of the general belief parameter, α^P. (The standard case coincides with accurate beliefs, $\alpha^P = \alpha$.) The results of this section are then used as a basis for subsequent analysis in which the implications of biased beliefs are explored.

1.4.1 The First-Best

If the parties could commit ex ante to provide any desired level of effort, they would each select (what they believe to be) the efficient level. That is, they would choose e_1 and e_2 to maximize their perceived joint expected surplus:

$$\max_{e_1, e_2} E\left[Y^P | e_1, e_2\right] - e_1^2 - e_2^2,$$

which is equivalent to

$$\max_{e_1, e_2} \alpha^P (e_1 + e_2) + \frac{1}{2} - e_1^2 - e_2^2. \tag{1.2}$$

This optimization program yields the perceived first-best levels of effort, $e_1^* = e_2^* = \frac{\alpha^P}{2}$.[16]

1.4.2 The Second-Best

Let z denote the transfer imposed in the event one party is found to have shirked, let $\overline{e}_i$ denote the contractually specified level of effort for player i and

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[15]In the case where neither party believes he could gain by taking the other to court, the optimal offer technically would not be zero, due to the automatic move to litigation and corresponding costs when an offer is rejected. Instead, the proposer would offer γ (or $\gamma - \epsilon$), which would be accepted. Although this may seem somewhat unrealistic, it is equivalent in expectation to a zero transfer outcome and what would more likely happen in reality, where no offer is made because both parties are content with the productive outcome.

[16]In the case where $\alpha^P = \alpha$, this yields the true efficient levels of effort.

let $\widetilde{e}_i$ denote i's *maximum sustainable* equilibrium level of effort. I will search for equilibria in which contractually specified effort levels are provided. (Note that this implies a restriction to pure strategy equilibria.) I assume conditions hold ensuring court is a credible threat when low output is observed.

The best deviation for i solves:

$$\max_{e_i} \ s_i E\left[Y^P | e_i, \widetilde{e}_j\right] - e_i^2 - Prob\left[Y^P < \alpha^P \left(\overline{e}_i + \overline{e}_j\right) | e_i, \widetilde{e}_j\right] pz,$$

or

$$\max_{e_i} \ s_i \left[\alpha^P \left(e_i + \overline{e}_j\right) + \frac{1}{2}\right] - e_i^2 - \alpha^P \left(\overline{e}_i - e_i\right) pz, \quad i, j = 1, 2; \ i \neq j.^{17} \qquad (1.3)$$

The solution to this optimization problem gives us the maximum sustainable effort levels, $\widetilde{e}_i = \frac{\alpha^P}{2}\left[s_i + pz\right], \ i = 1, 2.^{18}$

Here, the effort level selected by each partner depends upon the share of the realized project value he can expect to obtain. The parties will use this information when determining the optimal shares to include in the contract.

Optimal s_1, s_2 solves

$$\max_{s_1, s_2} \ \alpha^P \left[\frac{\alpha^P}{2}\left[s_1 + pz\right] + \frac{\alpha^P}{2}\left[s_2 + pz\right]\right] + \frac{1}{2} - \left[\frac{\alpha^P}{2}\left[s_1 + pz\right]\right]^2 - \left[\frac{\alpha^P}{2}\left[s_2 + pz\right]\right]^2$$
$$(1.4)$$

s.t. $s_1 + s_2 = 1$.

The solution yields optimal shares $s_1 = s_2 = \frac{1}{2}$, and corresponding maximum sustainable effort levels become:

$$\widetilde{e}_i = \frac{\alpha^P}{2}\left[\frac{1}{2} + pz\right], \ i = 1, 2. \qquad (1.5)$$

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[17]For ease of exposition, $\widetilde{e}_j$ is replaced by $\overline{e}_j$ in the second line. Since I am searching for equilibria in which contractually specified effort levels are provided, these values will hold in equilibrium; the solution to this optimization problem does not depend on the specific values and these values are not functions of the other individual's effort, so this can be done without consequence.

[18]To constitute an equilibrium without shirking, it follows that the contractually specified effort levels must satisfy $\overline{e}_i \leq \frac{\alpha^P}{2}\left[s_i + pz\right], \ i = 1, 2$. Note that it is optimal to select such contractual levels, since the maximum sustainable effort levels would not be higher with any other specified level of effort, and court (along with its associated costs) is avoided in such an equilibrium.

I continue analysis in the general environment where the limit on allowable transfers does not act as a binding constraint.[19] In this setting, the only contractual limitations faced by the parties are those caused by information constraints.

Since maximum sustainable efforts satisfy $\widetilde{e}_1 = \widetilde{e}_2 = \frac{\alpha^P}{2}\left[\frac{1}{2} + pz\right]$, it is a simple matter to solve for z sufficiently high to support the perceived first-best effort levels on the part of both individuals. Throughout this paper, I assume that the parties (when given the chance) will select penalties equal to the minimum z required to support their desired equilibrium levels of effort.[20] Setting $\widetilde{e}_i = e_i^*$ and solving the resulting equality for the minimum required value of z yields:

$$\frac{\alpha^P}{2}\left[\frac{1}{2} + pz\right] = \frac{\alpha^P}{2} \Rightarrow z = \frac{1}{2p}. \tag{1.6}$$

By specifying this penalty in the event of breach, the parties can support equilibrium effort levels $\overline{e}_i = \widetilde{e}_i = e^* = \frac{\alpha^P}{2}$, $i = 1, 2$. Allowing contracting parties to fully utilize the court's ability to play an investigative role (by specifying appropriate contingent transfers) can provide a solution to the incentive problem.

Proposition 1a: *Under the assumptions governing the case with unbounded transfers, the parties are able to achieve the perceived first-best levels of effort.*

This result relies crucially on the ability of the contracting parties to define the minimum amount of the transfer z ex ante. In general, the law does not give contracting parties free reign to dictate contingent penalties in the event of breach. Instead, courts are instrumental in determining appropriate limits on contractually specified remedies. Denote the court determined transfer $\overline{z}$ and now assume this imposes a binding constraint on the relationship: $\overline{z} < \frac{1}{2p}$. In this case, analysis ends at equation (5); the parties must take z as given, and the maximum sustainable effort levels become functions of $\overline{z}$.

Proposition 1b: *Under the assumptions governing the case with a binding*

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[19]This is equivalent to the case where there are no legal restrictions imposed on the terms of a contract.

[20]This assumption is made without loss of generality and is intended to simplify exposition and analysis of results. This enables a formulation of the optimization problem in terms of selecting z. This is useful for a more direct comparison of the cases with and without bounded penalties. In practice, it is also reasonable to conjecture that parties would naturally select the lowest penalty required to achieve their objectives (rather than willingly subject themselves to the risk of unnecessarily high punishments).

constraint on transfers, the parties cannot achieve their perceived first-best levels of effort. The maximum attainable second-best effort levels are given by: $\widetilde{e}_i = \frac{\alpha^P}{2}\left[\frac{1}{2} + p\overline{z}\right], \;\; i = 1, 2.$

It is clear from Proposition 1 that the magnitude of the incentive problem depends directly upon the restrictiveness of $\overline{z}$. As $\overline{z} \to 0$, the sustainable equilibrium effort levels approach those attainable in the case where the parties cannot dispute effort levels in court. (When $\overline{z} = 0$, the problem reduces to that case.) On the other hand, for arbitrarily high levels of $\overline{z}$ the parties can sustain arbitrarily high levels of effort.

While this might seem to indicate that the removal of such legal restrictions would benefit contracting parties (as argued by some scholars), the following section including biases provides results which may help validate the existence of such constraints.

Some comments are in order at this point. In the preceding analysis, I restricted attention to the effort selection problem without discussing the overall efficiency of the partnership. While parties who are unconstrained by $\overline{z}$ will always maximize perceived joint expected surplus, the only case in which true joint expected surplus is objectively maximized is the case in which parties' perceptions match reality.[21] Of particular import is the fact that I omitted discussion of any potential costs associated with litigation. While it is true that for any α^P the parties will always *believe* litigation costs are irrelevant, there are some beliefs for which litigation costs actually do become relevant. This will be examined in detail in the following sections.

This leads to a related comment, regarding the question of how welfare should be measured in this context. Up to this point, I have been able to avoid taking a stance on any given welfare measure. In the discussion that follows, I will be evaluating the overall efficiency effects of biases and must adopt a welfare measure to do so. I take a paternalistic stance in evaluating the results. Welfare measures for biased parties will all be defined in terms of the true (rather than perceived) productivity parameter, α. This can be justified by taking the perspec-

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[21]In the case of accurate beliefs, Proposition 1a can be extended to indicate that parties are able to achieve the efficient outcome, both in terms of effort levels and joint expected surplus.

tive of a social planner who is only interested in maximizing the total objective welfare of the economy.

1.5 Biased Partners

The previous section derived sustainable efforts in terms of a general belief regarding the marginal productivity of effort. Most economic analysis assumes that decision-makers develop such beliefs by accurately integrating and processing all available information. Regardless of their level of precision, the resulting beliefs are generally assumed to be accurate in the sense that they are based on truth, rather than erroneous assumptions or biased views of the world. So in this model, standard assumptions would dictate $\alpha^P = \alpha$.

This section studies the cases in which this standard assumption does not hold. I consider partnerships in which the parties hold biased beliefs of the form $\alpha^P \neq \alpha$. This is broken into two special cases, one representing optimism and the other representing pessimism. Using the true parameter α and accurate beliefs as a baseline, I consider the implications such biases hold for productive efficiency, incidence of dispute and total objective welfare.

1.5.1 Mutual Optimism

I first examine the case where both parties are optimistic about the productive technology governing their joint endeavor. In particular, they believe the technology delivers a higher marginal (and absolute) return to their efforts than the true process, i.e. $\alpha^P = \alpha^o > \alpha$.

Using Proposition 1b, we can easily determine the maximum sustainable efforts under bounded penalties for the cases of optimism and of accurate beliefs. Denote these effort levels $\widetilde{e}_i^o$ and $\widetilde{e}_i$, respectively. The difference in sustainable effort $(\widetilde{e}_i^o - \widetilde{e}_i)$ is simply:

$$\frac{(\alpha^o - \alpha)}{2} \left[\frac{1}{2} + p\overline{z} \right] > 0. \tag{1.7}$$

As one would expect, holding all else fixed, a higher level of optimism ($\uparrow \alpha^o$) leads to higher levels of effort and a greater difference in sustainable effort levels (relative to the no bias case). So, in the case where the parties are faced with a constrained transfer, $\overline{z}$, the optimistic bias tends toward easing the team production incentive problem.

It is important to note, however, that this boost in voluntary effort levels: 1) should not be viewed as an unambiguous benefit and 2) comes at a cost (associated with litigation).

While it is true that for sufficiently low levels of $\overline{z}$, joint expected surplus will increase as a result of higher effort provision (ignoring litigation costs for the moment), an optimistic bias has the potential to do more harm than good if $\overline{z}$ is not constrained to be sufficiently $< \frac{1}{2p}$. Just how low is sufficient depends on the magnitude of the bias.[22] "Overly eager" partners will contract upon and provide levels of effort that are *higher* than optimal; this over-provision of effort acts as a drain on the efficiency of the relationship much like under-provision.

The benefit from the bias, in terms of *actual* joint expected surplus, (for the moment, still holding litigation costs aside) is given by the difference between the joint expected surplus in the case with bias and the case without:

$$(\alpha^o - \alpha) \left(\frac{1}{2} + p\overline{z} \right) \left[\alpha - (\alpha^o + \alpha) \frac{1}{2} \left(\frac{1}{2} + p\overline{z} \right) \right]. \tag{1.8}$$

This "benefit" will be negative for certain combinations of α^o and $\overline{z}$. If $\overline{z}$ isn't sufficiently low for a given level of bias, over provision of effort will lead to lower joint expected surplus. In the case with optimistic bias, a lower level of $\overline{z}$ can actually benefit parties to the extent that it constrains the sustainable levels of effort and tempers the tendency to overprovide.[23]

Recall that unbounded penalties enable parties to sustain any desired level of effort in equilibrium. While this was beneficial for unbiased parties, this is no longer the case when optimistic biases are involved. If the parties were free to set

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[22]This relationship will be made precise shortly.

[23]The sign of the expression as a whole depends upon the sign of the square bracketed term. By inspection, one can see that the higher the bias, the lower pz must be for this term to be positive. Equivalently, higher $(\alpha^o - \alpha)$ requires a lower pz to maintain efficient (or closer to efficient) effort levels.

any level of z in their contract, they would also choose to contract upon excessively high levels of effort. To make matters worse, optimistic parties further expect to see higher output for their efforts and will therefore be surprised by low output even more often. Given the nature of the bias, this will lead to increased levels of wasteful litigation. The larger the bias to which the parties are subject, the larger this effect.

To see this formally, consider the problem of selecting the optimal effort levels and corresponding z from the perspective of an optimistically biased party. Denote the effort level that optimistically biased parties believe to be optimal e_i^{o*}. It is straightforward to verify that the believed first-best levels in this case satisfy $e_i^{o*} = \frac{\alpha^o}{2}$, $i = 1, 2$. If the parties are free to set z ex ante, they will select z to support these efforts: $z^o = \frac{1}{2p}$.

While this is the same minimum level of z that had truly been optimal in the case without bias, it is no longer optimal to set $z \geq \frac{1}{2p}$ when the parties are biased. However, since the parties are completely unaware of the bias, they have no reason to believe any other effort levels and corresponding penalty would suit their partnership better. The fact that $z = \frac{1}{2p}$ is sub-optimal for biased parties becomes clear by comparing the chosen effort levels under this contract with the objectively efficient levels. The difference between the *joint* effort levels is given by: $2e_i^{o*} - 2e_i^*$. So, the total level of effort induced is greater than the efficient level by exactly the amount of the bias $(\alpha^o - \alpha)$.

The z that will induce productively efficient effort levels among biased partners (by constraining their maximum attainable efforts to the true efficient levels) is given by:

$$z = \frac{1}{p}\left(\frac{\alpha}{\alpha^o} - \frac{1}{2}\right). \tag{1.9}$$

This is strictly lower than $\frac{1}{2p}$ for optimistically biased parties and is decreasing in α^o.

This expression provides the level at or below which z must be constrained to avoid overprovision of effort. Any z greater than this value will enable parties to support equilibrium effort levels above e^*. This brings us back to the issue of court-imposed restrictions on transfers and penalties. These results provide an

economically-based justification for such constraints in cases where the court has reason to believe individuals in a certain type of relationship (or in general) are particularly prone to exhibiting overconfidence.

While the above analysis addresses the issue of efficiency in production, the drain on the relationship in terms of litigation costs has not yet been considered explicitly. Even in cases where the effort boost is beneficial (expression (8) representing the "benefit" of the bias before litigation costs is positive), the increase in productive efficiency may come at a large cost. To see this, it is useful to look at the implications the bias has for litigation. Since the bias represents an inaccurate picture of the true productive process, the parties have an inaccurate belief as to the true support of the output for any given levels of effort. The optimists believe the support covers a range that is shifted up from the true range of possible output realizations. Hence, there are certain feasible levels of output that may arise which are lower than what is believed to be possible by either party (under contractually specified effort levels). In this case, each party will believe with certainty that the other must have shirked. (They have no other explanation for the observed output within their belief system.) Such "surprise" realizations will occur with probability:

$$Prob\left[\epsilon < \alpha^o\left(e_i^o + e_j^o\right) - \alpha\left(e_i^o + e_j^o\right)\right]$$
$$= \left(e_i^o + e_j^o\right)\left(\alpha^o - \alpha\right)$$
$$= \alpha^o\left(\frac{1}{2} + pz\right)\left(\alpha^o - \alpha\right). \qquad (1.10)$$

In the event this occurs, both will want to file suit (and both believe they will win with probability p); hence, no mutually agreeable settlement exists. This will always be the case when the parties are subject to symmetric biases. Each will pay γ in court costs and they will proceed to trial, only to find that neither party has shirked with probability p or that there is inconclusive evidence with probability $(1-p)$.

Due to the existence of litigation in equilibrium,[24] the ex ante expected cost associated with litigation (e.g. from an omniscient planner's perspective) is:

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[24]This had only been an out-of-equilibrium event in the no-bias case.

$$2\gamma \left(e_i^o + e_j^o\right)(\alpha^o - \alpha)$$
$$= 2\gamma\alpha^o \left(\frac{1}{2} + pz\right)(\alpha^o - \alpha). \tag{1.11}$$

Given this, the actual joint expected surplus of mutually optimistic parties (including litigation costs) can be written as:

$$\alpha \left[\alpha^o \left(\frac{1}{2} + pz\right)\right] + \frac{1}{2} - \frac{(\alpha^o)^2}{2}\left(\frac{1}{2} + pz\right)^2 - 2\gamma\alpha^o \left(\frac{1}{2} + pz\right)(\alpha^o - \alpha). \tag{1.12}$$

This expression will be used to obtain the next two main results. I will first examine the conditions under which "a little" bias is better than none.

Taking the derivative of the true joint expected surplus with respect to the bias yields:

$$\alpha \left(\frac{1}{2} + pz\right) - \alpha^o \left(\frac{1}{2} + pz\right)^2 - 2\gamma \left(\frac{1}{2} + pz\right)(\alpha^o - \alpha) - 2\gamma \left(\frac{1}{2} + pz\right)\alpha^o. \tag{1.13}$$

Evaluating this expression at zero bias ($\alpha^o = \alpha$) results in:

$$\alpha \left(\frac{1}{2} + pz\right)\left[\frac{1}{2} - 2\gamma - pz\right]. \tag{1.14}$$

If this expression is positive, at least a small amount of optimistic bias will make the parties better off than none at all. Note that everything outside the square bracketed term will always be positive. Therefore, to obtain conditions under which bias will improve the total welfare of the parties, one must simply solve for conditions under which the square bracketed term is positive.

Proposition 2: *Starting at the baseline case of no bias, introducing a small amount of optimistic bias will either increase or decrease joint expected surplus, according to the following conditions:*

i) For $z < \frac{1}{2p} - \frac{2\gamma}{p}$, there exists an ϵ for which any bias $F < \epsilon$ will increase joint expected surplus.

ii) For $z \geq \frac{1}{2p} - \frac{2\gamma}{p}$, the introduction of an optimistic bias of any magnitude will decrease the joint expected surplus.

Furthermore, an optimistic bias will never increase joint expected surplus if court costs γ exceed $\frac{1}{4}$.

As we can see, the existence of waste associated with litigation costs diminishes the benefit of an optimistic bias. Setting $\gamma = 0$ yields the condition that must hold in order for a slight amount of optimism to be able to provide a positive boost in productive efficiency, due to the higher effort provision. When incorporating the drain of court costs, higher levels of gamma require even lower bounds on z to ensure the overall effect of the bias is beneficial, rather than harmful. Note that for some values of gamma, it is impossible to select a bound for z which will make the bias beneficial. γ must be strictly less than $\frac{1}{4}$, otherwise the bias will *never* help the parties; the costs of litigation will always outweigh any productive benefits.

Proposition 3:

i. For positive court costs and any given level of optimistic bias, the optimal bound on z lies strictly below both the minimum z the parties would choose and also the bound on z that induces the productively efficient levels of effort. The equilibrium effort levels under the optimal bound are lower than e^*.

ii. For zero court costs, the optimal bound is strictly below the minimum z the parties would choose and is equal to the bound that induces the productively efficient efforts. The equilibrium effort levels are equal to the productively efficient levels.

Proof. When effort levels are constrained at or below the parties' desired levels, one can evaluate changes in the joint expected surplus in terms of changes in the bound, z.[25] The derivative of the true joint expected surplus with respect to z is

$$(\alpha)(\alpha^o) p \left[1 + 2\gamma\right] - (\alpha^o)^2 p \left[\left(\frac{1}{2} + pz\right) + 2\gamma\right]. \tag{1.15}$$

Evaluating this expression at $z = \frac{1}{2p}$ results in $p\left[1 + 2\gamma\right]\alpha^o\left(\alpha - \alpha^o\right) < 0$ for all γ. Evaluating this expression at $z = \frac{1}{p}\left(\frac{\alpha}{\alpha^o} - \frac{1}{2}\right)$ results in $p2\gamma\alpha^o\left(\alpha - \alpha^o\right)$. This is < 0 for $\gamma > 0$ and $= 0$ for $\gamma = 0$. Together these imply the bounds on z specified in parts i. and ii. The equilibrium effort levels follow directly from these bounds and the expression for the maximum sustainable effort levels for optimistic partners. $\square$

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[25]This is because a unique pair of equilibrium effort levels is associated with each level of z, provided the constraint on maximal sustainable effort binds.

It is clear from the derivative results above that the optimal bound on z in the presence of court costs will be such that the effort levels induced are lower than the productively efficient levels. It is also instructive to examine the true optimal bound for z as obtained by setting the above derivative to zero and solving for z:

$$z^* = \frac{1}{p} \left[\frac{\alpha}{\alpha^o} (1 + 2\gamma) - 2\gamma - \frac{1}{2} \right]. \tag{1.16}$$

Here, we can see that the optimal bound is decreasing in the level of bias.

Rearranging the square bracketed term helps clarify the relationship between α^o and γ:

$$\left(\frac{\alpha}{\alpha^o} - \frac{1}{2} \right) - 2\gamma \left(1 - \frac{\alpha}{\alpha^o} \right). \tag{1.17}$$

Whether the entire expression (and hence z) is positive or negative depends upon the relative magnitudes of the bias and the cost of litigation. Lower levels of the bias can support higher court costs and vice versa. Note that a negative z is not valid here, hence it is equivalent to the case where no penalty (or court) is available. This shows that there exist sufficiently high levels of bias for which access to litigation actually hurts the relationship, given positive court costs. An outsider who is aware of the biases and is concerned about the well-being of the parties would actually desire to prohibit such parties from litigation. Practically speaking, prohibiting certain parties from utilizing the courts would be an unacceptable policy rule, (especially given the lack of precision in the result). However, this result may shed further light on the benefits of laws mandating mediation, beyond the benefit of reducing government expenditures.

1.5.2 Mutual Pessimism

Next, I examine the case where both parties are pessimistic about the productive technology, in the sense that they believe it yields lower than actual returns to effort. These pessimistic parties share the belief $\alpha^P = \alpha^N < \alpha$.

Again, the analysis for this case is a straightforward application of Proposition 1. Comparing the maximum sustainable effort levels for pessimistic partners (denoted as $\widetilde{e}_i^N$) with the case without bias, the difference in sustainable effort $\left(\widetilde{e}_i^N - \widetilde{e}_i \right)$ is simply:

$$\frac{\left(\alpha^N - \alpha\right)}{2}\left[\frac{1}{2} + p\overline{z}\right] < 0. \tag{1.18}$$

As one would expect, holding all else fixed, a greater degree of pessimism $\left(\downarrow \alpha^N\right)$ leads to lower levels of effort and a greater (negative) difference in sustainable effort levels (relative to the no bias case). So, the pessimistic bias tends toward *worsening* the team production incentive problem.

The difference between the actual joint expected surplus in the case without bias and the case with symmetric pessimistic bias is given by:

$$\left(\alpha^N - \alpha\right)\left(\frac{1}{2} + p\overline{z}\right)\left[\alpha - \left(\alpha^N + \alpha\right)\frac{1}{2}\left(\frac{1}{2} + p\overline{z}\right)\right] \tag{1.19}$$

No matter what the level of $\overline{z}$, there are *no* court costs incurred in an equilibrium with a symmetric pessimistic bias. Since the parties expect to see realizations over an even lower range of output values than the truth, they will never be surprised by unexpectedly low output. They will, however be surprised by unexpectedly high output, in which case they would believe their partner had mistakenly chosen to over provide effort. This is not a matter which would be litigated, hence neither would ever have the incentive to take the other to court.[26]

Note, however that neither a lower nor upper bound on the penalty has power in correcting incentives in the pessimistic bias case. The parties would want to contract upon an effort level and would choose a minimum z lower than what is necessary to support optimal effort levels if they were free to specify the level contractually. This is the complementary result to the case with optimistic biases. The difference in this case is that their lower desired effort levels will be sustainable with *any* z at or above their believed minimum z. So, even if an unbiased outsider attempted to enforce a higher transfer, this would have no effect on equilibrium effort levels. The higher effort levels themselves would actually need to be enforced externally. This result is interesting to note in light of the asymmetric manner in which the court restricts the contracting parties' freedom to specify contingent transfers. While the court refuses to uphold damage transfers in excess of a "reasonable" compensatory amount, it does *not* intervene when

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[26]$Prob\left[\epsilon < \alpha^N\left(\alpha^N\left(\frac{1}{2} + p\overline{z}\right)\right) - \alpha\left(\alpha^N\left(\frac{1}{2} + p\overline{z}\right)\right)\right] = 0$

specified damages are under compensatory relative to the court's standard. The results of this model may also shed light on this issue, which has been highlighted as part of the puzzle regarding the law of liquidated damages.

Between the two cases, whether a pessimistic or optimistic bias would be preferable depends upon the relative magnitudes of the efficiency loss due to court costs versus the efficiency loss due to inefficient effort choices. While it is clear from analysis that having a pessimistic bias is worse than the case of no bias, a general statement cannot be made as to whether a pair of optimists or pessimists would fare better under a constrained z, without further assumptions on the parameters.

1.6   Equilibrium Shirking

While insightful, the previous model is fairly stark in the sense that litigation only occurs when parties are caught completely by surprise. Such "surprises" occur because with positive probability, the players observe outcomes that they did not believe possible in equilibrium. One might ask whether the forces identified in the previous model also persist in a model in which there are no surprises in the productive outcome.

To address this question, draw closer parallel to the existing asymmetric information models, and to further reinforce the main results and intuition provided in the preceding sections, I examine a simple variation of the preceding model. Here, the parties may provide one of two effort levels, and output may take one of two values. This will not allow for the possibility of effort overprovision as in the main model, but it will show that under certain conditions maintained previously, an optimistic bias does still deliver the main results: initially shared optimistic biases lead to self-serving biased beliefs regarding the probability of prevailing at trial, and increases in productive efficiency are obtained at the cost of increased incidence of litigation.

1.6.1   Assumptions

Consider the following modification of the main model from previous sections. Let output be governed by the following technology:

$$Y = \begin{cases} H & \text{w\textbackslash prob} & \alpha\left(e_1 + e_2\right) \\ 0 & \text{w\textbackslash prob} & 1 - \alpha\left(e_1 + e_2\right) \end{cases} \tag{1.20}$$

Where Y is the value of output, $e_i \in \{0, \bar{e}\}$ denotes individual i's effort, $\alpha 2\bar{e} < 1$ and $H > 0$. In this case, the effort levels jointly determine the probability of high versus low output. Let c denote the cost of high effort. Further assume that $\bar{e}$ is the efficient effort level, i.e. $\left(\alpha 2\bar{e}\right)H - 2c \geq 0$. Assume all other details of the productive interaction, settlement and litigation (including timing, costs, etc.) remain unchanged.

Under these assumptions, expected output can be written as:

$$E\left[Y\right] = \alpha\left(e_1 + e_2\right)H \tag{1.21}$$

Note that under the new productive technology, there are only two possible effort levels; both biased and unbiased parties will desire to support the efficient level. Further note that under the assumptions of this example, low output will be realized with positive probability, even when both parties provide full effort, $\bar{e}$. Therefore, under no circumstances will parties be surprised to see low output as they were in the previous version of the model.

Let us further assume that the following condition is satisfied: $c > \frac{1}{2}\alpha^P \bar{e} H$. This will ensure that an incentive problem exists. (The parties cannot sustain cooperation without litigation.) Note that this also implies that the parties will be unable to sustain full cooperation, even with litigation. In a pure strategy equilibrium of this game, parties would never pursue costly litigation. Furthermore, there is no output realization off the equilibrium path upon which parties can hinge a credible threat, so litigation has no bite.

1.6.2   General Results

Although litigation plays no role in a pure strategy equilibrium of this model, the availability of court discovery can boost cooperation between partners in a mixed strategy equilibrium of the effort selection game. When partners are expected to cheat with positive probability, the threats of litigation and the associated penalties are credible under certain conditions. This is the case of particular interest, as it allows for equilibrium litigation, without the surprises of the previous model.

To obtain results in this case, I first construct a separating equilibrium of the settlement phase. Let type l denote a partner who previously selected $e = 0$ and let type h denote a partner who previously selected $e = \bar{e}$. In this equilibrium, suppose a partner of type l offers a settlement of $(-pz + \gamma)$ and a partner of type h offers a settlement of $(pz + \gamma)$. (Recall, that an offer represents the amount that the *other* party must pay to avoid litigation.) Further assume that if an out of equilibrium offer is made, the recipient assigns probability 1 to the belief that the other is of type l.

Necessary conditions for these offers to hold in equilibrium can be summarized by:

$$0 \leq pz \leq \gamma \frac{r\left(1 - \alpha^P \bar{e}\right)}{1 - r}, \quad \text{for} \ \ r \in [\,0, 1) \tag{1.22}$$

where r is the equilibrium probability of high effort in the effort selection stage.

Proposition 4: *Let x denote the settlement offer made by a proposer. Under condition (22) and the conditions ensuring a mixed strategy NE of the effort selection game, there exists a separating equilibrium of the settlement continuation in which:*

i. $s_l = $ [Offer $x = (-pz + \gamma)$, Accept if $x \leq (pz + \gamma)$ and Reject otherwise];

ii. $s_h = $ [Offer $x = (pz + \gamma)$, Accept if $x \leq (-pz + \gamma)$ and Reject otherwise].

The first thing to note about this result is the fact that litigation occurs in equilibrium, even without the bias. This is reminiscent of a fundamental result in the theory of litigation; failure to settle occurs in this model with positive proba-

bility due to the informational asymmetries between the parties. Although this is not a new result, there are a couple rather large differences from the majority of existing asymmetric information litigation models that are worth highlighting in this particular case. To start, there are important differences in the type of information asymmetry at play. While the other models relied on exogenously assumed roles and corresponding information asymmetries, the information asymmetries and the sorting of the partners into their respective types ("guilty" versus "not guilty" or "defendant" versus "plaintiff") occurs endogenously in this model. Secondly, it is interesting to note the difference in the implication for the selection of *types* of individuals for litigation. In the prevailing asymmetric information models of litigation, guilt is assumed, so there is no room for the model to sort between different types going to court. In those models, any party who winds up in court as a defendant is guilty, and the only reason the court might find for a defendant is the assumed probability of "court error". In this model however, the possibility exists ex ante for either innocent or guilty individuals to go to trial. Whether or not they actually do depends on the actions taken in equilibrium. Therefore, the court is in a position to potentially play a role in determining an agent's true innocence. In equilibrium, it turns out that the *only* individuals who fail to settle are those who are innocent. While this certainly is an extreme scenario, it provides balance to the other models in which the opposite is the case.

Another interesting implication to note is that in this equilibrium, all parties who are chosen to make an offer will reveal their type, whether l or h. On the other hand, parties who do not make an offer can only be distinguished in the event that the proposer is of type h. Both types will accept an offer made by type l, and hence cannot be distinguished. This particular property – where the effort levels of the proposer are fully revealed, however in some cases, the effort level of the other party is never disclosed – is in line with the results of Daughety and Reinganum's (1994) two-sided asymmetric information model of litigation.

Given the strategies of the settlement continuation game as detailed in Proposition 4, the corresponding equilibrium effort selection for the productive stage of the partnership can be characterized; the condition required for the sepa-

rating equilibrium specified in Proposition 4 becomes:

$$0 \leq pz \leq \gamma \left(1 - \alpha^P \bar{e}\right) \left[\frac{\alpha^P \bar{e} \left(\frac{1}{2}H - pz\right) - c + pz}{\gamma + c - pz - \alpha^P \bar{e} \left(2\gamma + \frac{1}{2}H - pz\right)} \right], \qquad (1.23)$$

$$\text{for} \quad pz < \frac{\gamma + c - \alpha^P \bar{e} \left(2\gamma + \frac{1}{2}H\right)}{\left(1 - \alpha^P \bar{e}\right)}. \qquad (1.24)$$

Proposition 5: *Assume condition (23) holds. There exists a symmetric mixed strategy equilibrium (σ_1, σ_2), for $\sigma_i = (r, s_l, s_h)$. In this equilibrium, r, the probability of high effort is given by:*

$$r = \frac{\alpha^P \bar{e} \left(\frac{1}{2}H - pz\right) - c + pz}{\left(1 - 2\alpha^P \bar{e}\right)\gamma}$$

and s_l, s_h are as specified in Proposition 4.

As one might expect, the probability of high effort is increasing in both the value of high output and the expected penalty at court. It is also decreasing in the cost of high effort. A result that may seem less intuitive is the fact that it is also decreasing in the level of court costs. This is largely due to the assumption that both parties pay the court costs (a cost allocation scheme known as the American rule). Under the specified equilibrium, the parties will go to court only in cases where low output is observed and both parties are of type h. So, the only case where both parties actually pay the court costs is one in which both have cooperated. In other cases, the proposer (regardless of whether he has cheated or cooperated in the previous period) can extract the court cost in the settlement demand. So, in a larger portion of cases, the cheaters benefit from the higher court costs.

As indicated, the parties only litigate when both have cooperated and they observe low output. Given this, the ex ante *perceived* probability that the parties will go to court is:

$$\left[1 - 2\alpha^P \bar{e}\right] \left[\frac{\alpha^P \bar{e} \left(\frac{1}{2}H - pz\right) - c + pz}{\left[1 - 2\alpha^P \bar{e}\right]\gamma} \right]^2. \qquad (1.25)$$

It is straightforward to see that this expression is increasing in the level of the expected court award and decreasing in the level of litigation costs. This is in line with the results of other asymmetric information litigation models.

1.6.3 Main Results - Biased Partners

For the purposes of this example, I only consider the case of mutual optimism. As before, optimistically biased parties will have miscalibrated beliefs regarding the true productive process. Optimists believe the true process is governed by $\alpha^P = \alpha^o > \alpha$.

Previous results for equilibrium strategies and the supporting conditions all carry over, simply by replacing α^P with α^o. The only expression from the previous section that does not translate directly into actual values in this manner is expression (25) for the perceived probability of litigation. The *true* probability is the measure that will be relevant for welfare considerations, and is given by (29) below.

First, let us consider the impact an optimistic bias has on individual beliefs regarding the probability of prevailing at trial. Given low output, the true probability that a type h partner will prevail in court is:

$$p \left[\frac{[1 - \alpha \bar{e}] [1 - r(\alpha^o, \cdot)]}{1 - \alpha \bar{e} [1 + r(\alpha^o, \cdot)]} \right], \tag{1.26}$$

where r is left as a general function of the parameters. Note that the perceived probability of prevailing at trial can be obtained by substituting α^o for α in the above expression. The difference between the perceived probability and the true probability of prevailing at trial will be positive if the derivative of the above expression with respect to α is greater than zero for all relevant parameter values. This derivative can be written as:

$$\bar{e} [1 - r] \frac{[1 - \alpha \bar{e}] [1 + r]}{1 - \alpha \bar{e} [1 + r]} - \bar{e} [1 - r], \tag{1.27}$$

which is > 0 for $r \in (0, 1)$. This implies that in any mixed strategy equilibrium of this game, optimistically biased individuals who cooperate and subsequently observe low output will believe their chances of prevailing at trial are greater than they truly are. So, we again find that a shared optimistic bias in the initial stages of the relationship can lead to self-serving biased beliefs regarding the probability of prevailing at trial in later stages.

Next, let us determine the impact an optimistic bias has on the efficiency of the relationship in this setting. Again, there will again be two effects to consider. Let us first examine the impact on productive efficiency. In this model, there is no possibility of effort overprovision, so any increase in the equilibrium probability of high effort, r can be viewed as an efficiency gain.

To see whether the bias has a positive or negative effect relative to the case of no bias, consider the effect of a marginal increase in the bias on the equilibrium r. The derivative of r with respect to α^o, evaluated at zero bias $(\alpha^o = \alpha)$ is:

$$\frac{1}{\gamma} \left\{ \left[\alpha \overline{e} \left(\frac{1}{2} H - pz \right) - c + pz \right] [1 - 2\alpha \overline{e}]^{-2} (2\overline{e}) + [1 - 2\alpha \overline{e}]^{-1} \left[\frac{1}{2} \overline{e} H - \overline{e} pz \right] \right\}.$$
(1.28)

A sufficient (but not necessary) condition for the above expression to be positive under all previously maintained conditions is: $pz < \frac{1}{2} H$. So, if the expected penalty at court is sufficiently low (e.g. under a binding constraint), an optimistic bias will promote greater probability of cooperation and greater (ex ante) productive efficiency than in the case with no bias. Note that for H = 1, this condition is equivalent to the minimum condition required in the main model for a bias to increase productive efficiency (as opposed to inducing overprovision).

Next, let us consider the impact an optimistic bias has on the incidence of litigation. Under mutual optimism, the true ex ante probability that the parties will go to court is given by:

$$[1 - 2\alpha\overline{e}] \left[\frac{\alpha^o\overline{e}\left(\frac{1}{2}H - pz\right) - c + pz}{[1 - 2\alpha^o\overline{e}]\gamma} \right]^2. \tag{1.29}$$

(Note that this is not simply a restatement of expression (25), applied to the case of optimistic biases.) It is straightforward to show that under *all* conditions where $\frac{\partial r}{\partial \alpha^o} > 0$, the true incidence of costly litigation also increases with optimistic bias. Hence, the general efficiency trade-off holds. There is a difference in the nature of the trade-off in this specific case, however. For the range of parameter values considered here, the negative effect does not overpower the positive effect, even for larger levels of bias. This holds up to the maximum bias (where the maximum bias is the bias above which the specified mixed strategy equilibrium would fall apart, or where $r = 1 - \epsilon$).

The expression for the joint expected surplus is given by:

$$2H\alpha\overline{e}\left[\frac{\alpha^o\overline{e}\left(\frac{1}{2}H - pz\right) - c + pz}{[1 - 2\alpha^o\overline{e}]\gamma} \right] - 2\gamma\left[1 - 2\alpha\overline{e}\right]\left[\frac{\alpha^o\overline{e}\left(\frac{1}{2}H - pz\right) - c + pz}{[1 - 2\alpha^o\overline{e}]\gamma} \right]^2 \tag{1.30}$$

To see the overall effect of increases in the bias, consider a numerical example which satisfies all relevant conditions. The graph below depicts the probability of cooperation, r in green and the joint expected surplus in blue, both graphed as functions of the bias, $(\alpha^o - \alpha)$. The parameter values are: $\overline{e} = 0.4$, $H = 1$, $\alpha = 1.03$, $pz = 0.2$, $\gamma = 0.2$, and $c = 0.3$. The domain of the bias is graphed from 0 to 0.04. These are the bias values for which condition (28) holds for these parameter values. (The maximum value ensures that $r < 1$.) This implies a maximum joint expected surplus of approximately 0.75.
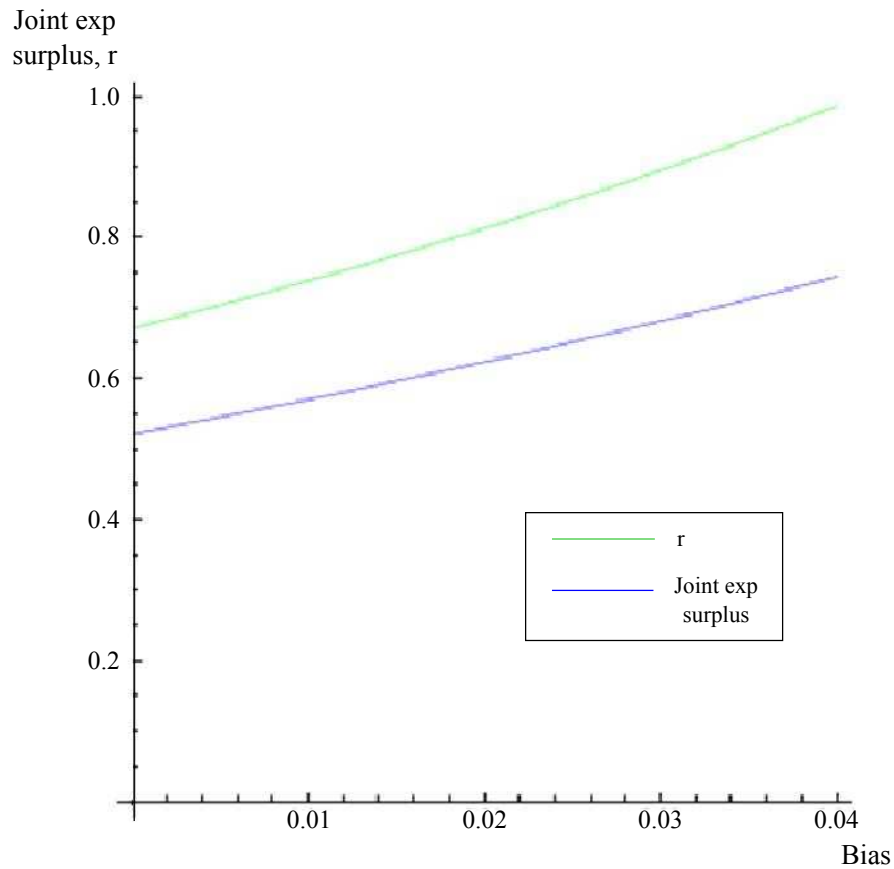
Figure 1.1: Cooperation and Expected Surplus as Functions of the Bias

As we can see, an increase in the bias increases both the probability of cooperation and the joint expected surplus over the entire domain. The specific parameter values were chosen so there would be some cooperation, even with zero bias. Under other conditions, cooperation is only possible with the existence of some level of optimism. Overall, the results of this example further support the beneficial function an optimistic bias may play in the face of moral hazard and constraints on court imposed penalties.

1.7   Conclusion

The impact of cognitive biases has long been a topic of inquiry for psychologists. More and more, researchers in other disciplines are building upon their knowledge of human decision-making by also considering the implications of various cognitive biases. One such bias is the tendency for individuals to exhibit unrealistic levels of optimism.

By introducing a simple bias of this nature to a joint production model, this paper yields implications regarding productive efficiency and factors leading to dispute. Furthermore, by explicitly including settlement and litigation, I provide a new account for why certain disputing parties might fail to reach settlement. Rather than ignoring all factors relevant to the relationship pre-dispute, this account derives its basis from the initial characteristics of the parties and the actions taken in the relationship. It shows how self-serving beliefs regarding litigation outcomes may be linked to shared optimistic biases regarding the joint venture.

Linking the productive phase and the dispute phase also reveals an interesting efficiency trade-off and adds to existing theory supporting the benefits of a moderate amount of optimistic bias. As is indicated in theoretical psychology papers, unrealistic optimism leads to higher motivation to engage in productive work, however extreme biases may be harmful. While the existence of a positive bias encourages higher effort levels in the face of moral hazard, it also leads to increases in wasteful litigation. This trade-off leads to the conclusion that while some amount of bias may be beneficial for the parties overall, too much can be detrimental. How much is too much depends upon the specifics of the environment. It is also interesting to note that support for a moderate level of bias exists in a model without litigation, although not in terms of a trade-off. Too much bias may overstimulate effort beyond efficient levels and may encourage individuals to undertake endeavors for which either they personally are not suited or which are not suitable (profitable) in general. This echoes themes present in other studies in the literature.

This analysis has the additional benefit of exposing (perhaps unrealized and unintended) consequences of placing restrictions on the form and amount of

penalties enforced in the event of contractual breach. Results from previous litigation studies can be interpreted as supporting bounds on penalties in the sense that reducing the penalty at court reduces the incidence of litigation and hence the associated waste. One difficulty in interpreting those models in that manner is the fact that it is impossible to measure the resulting impact on incentives and deterrence. In this model it is possible, and I show that under certain circumstances, the net gain is positive. Beyond affirming results from other main papers, the results of this paper provide yet another interesting argument supporting the benefits of some level of bound on penalties: they may also help dampen the tendency for optimistically biased individuals to inefficiently overinvest. This is in contrast to the common arguments against contractual restrictions that are based on results in which restrictions hinder the parties' ability to support efficient investment. While the results in this paper alone may not justify a general policy change, when other justifications for damage caps are present, these results can provide additional support.

There are many factors that cannot be accounted for in this model. One primary factor is the large amount of heterogeneity present in the population. Individuals exhibit biases to varying degrees in various contexts. While this may limit the extent to which blanket remedies may be fashioned, the results are still relevant for a large segment of the population and are only intended to capture the simultaneous interaction of two individuals. It is reasonable to conjecture that a given pair of individuals working together will have communicated sufficiently to have aligned their beliefs regarding the project at hand. It is also worth noting that the model's assumptions are particularly well-founded in the context of entrepreneurship. A significant portion of the optimism literature focuses on entrepreneurs; correspondingly, much of the entrepreneurial literature highlights the particular tendency of entrepreneurs to exhibit such biases. Parker (2006) identifies several areas where more research on entrepreneurial optimism is needed. These include determining the extent of the negative externalities caused by entrepreneurial optimism and determining the appropriate public policy set when optimism is present. This paper contributes to the literature in that dimension

by identifying a new externality, the impact of entrepreneurial biases on the court system, and by suggesting corresponding policy measures to reduce the impact.

This also calls to attention the topic of whether entrepreneurs (or society) may benefit from consulting that is geared toward reducing optimistic biases. Although many doubt the efficacy of debiasing techniques, a number of management papers present results that indicate debiasing would be a desirable policy.[27] Others take the opposite stance, even going so far as to say that "...optimism training may just be what the doctor ordered to improve the success rates of entrepreneurial ventures." (Crane and Crane, 2007, p. 13) The results of this paper imply that while there can be benefits to decreasing the ex ante bias of *extremely* optimistic parties, this is not generally the case. When parties face moral hazard issues, it may be useful to maintain optimism and only consider debiasing in the event that a dispute arises. Consulting in later stages (perhaps in the form of mediation) may benefit disputing parties by reducing the biases and enabling them to avoid costly litigation, without diminishing the positive incentive effect in the initial stages. While some studies indicate a resistance to debiasing efforts, there is hope for debiasing in the context of litigation; Babcock, Loewenstein and Issacharoff (1997) provide experimental results in which debiasing facilitates settlement. The highly successful use of mediation also provides promise, and is an area in which I believe fruitful research opportunities lie.

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[27]For example, Coelho (2010, p. 398) argues that "...entrepreneurial settings are bound to attract over-optimists and foster unrealistic optimism. ...these positive illusions create distortions which may be the most important source of efficiency loss in the economic system, and as yet their policy implications have been ignored."

Chapter 2

A Model of Plain Meaning and Precedent

2.1 Introduction

Interpretation of legal documents (such as contracts, statutes, and constitutional provisions) is a central component of the judiciary function. Not only is it an unavoidable task, it is one that has a significant and widespread impact on welfare. Interpretation shapes the outcome of economic interaction. This is because the actions of the courts have important implications for the incentives of economic agents. Furthermore, the courts' actions may have a direct impact on welfare. In fact, in many models of contracting, some or all of the payoff-relevant actions are assumed to be taken directly by the court or other external enforcer.

Much attention has been devoted to answering the question of how courts might best determine the "appropriate" meaning of a document, and hence, the "appropriate" action to take (or behavior to compel) in a given situation. A key point of debate among legal scholars revolves around whether courts should restrict themselves to the content of the document and interpret words at their face value (as in the "four corners rule" and the "plain meaning rule")[1] or whether they should look at external cues, such as intent and context, when evaluating the meaning of

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[1]These rules will be explained in more detail in the following section.

any given message. There is also another distinct dimension of this debate that is concerned with the question of whether plain meaning is even a realistic standard.

This paper explores the notion of "plain meaning" by investigating its possible foundations (a definition and conditions under which it arises) and its relation to the notion of precedence. The foundations relate to a setting in which courts seek to maximize welfare but must make decisions with limited information. Although the stakeholders who care about the courts' choices have all relevant information and can communicate with the courts, they must do so with a limited language that makes it impossible to convey all of this information.

We introduce and study the concept of plain meaning in a way that ties the meaning of a message to the equilibrium actions taken in response to that message. In doing so, we appeal to the common legal usage of the term plain meaning and how it translates into judicial decisions. The plain meaning rule dictates that if a writing or term has a plain meaning, that meaning should be used without resorting to extrinsic evidence of any kind. Context can only be used to aid interpretation when meanings are vague. In other words, terms with plain meaning should lead to fixed judicial interpretations and decisions that are independent of any available contextual information, whereas terms without plain meaning should lead to decisions that vary based on contextual evidence.

To incorporate this in our model, we first consider the set of possible message rules, or the various ways in which stakeholders can structure their communication to convey information about the state. We then consider the equilibrium actions of a court that has access to contextual information and evaluate plain meaning in a relative sense, where the degree of plainness lies on a continuum.[2] Equilibrium language use and interpretation is considered to contain more plain meaning if the equilibrium actions taken by the court for a given message vary less in response to contextual information than they would under another court interpretive rule.

Using this definition, we then ask whether certain conditions lead to more

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[2]It is widely acknowledged in the legal literature that the application of rules such as the plain meaning rule and the parol evidence rule are not black vs. white; rather, their application lies on a continuum. See e.g. Linzer (2002) p. 807.

or less plain meaning. We seek to answer questions such as: Why might the courts be inclined to adhere to a plain meaning rule, even if they are unable to do so perfectly? Under what circumstances might a general principle like this be more or less useful?

These questions are not only motivated by the desire to gain a better understanding of current judicial practices, but they are also motivated by some of the assumptions employed in existing theoretical work on the subject of interpretation. Several papers in the literature either implicitly or explicitly assume some form of plain meaning. The assumption of an exogenously determined fixed meaning directly affects the main results of these papers, yet they do not address the question of why plain meaning would exist or evolve in the first place and why enforcers would refrain from considering terms more broadly. So, a useful interpretation of their results hinges upon gaining an understanding of the conditions under which those assumptions may or may not be valid.

This paper seeks to identify such conditions, while lending theoretical justification for the assumptions employed in those papers. Existing theoretical papers have yet to provide such justification; in fact, some theoretical results point in the opposite direction.

We employ a model in which the judicial system is divided into two tiers. Courts in each tier preside over cases brought to them by stakeholders in a society. We examine two versions of the model: one in which courts differ in terms of the amount of information they observe and one in which they differ in terms of their preferences. This enables us to examine how such differences between courts may cause a society to develop legal rules or principles akin to the four corners or plain meaning rules. These differences among courts are crucial, because in existing models where the courts are homogeneous, results do not support the use of such judicial rules.

In the basic model with differences in judicial information, we find that more plain meaning results when there are more courts who are limited in the amount of information available. Due to the difference in the message scheme used by stakeholders, even the courts with more information utilize a more limited

range of actions (or, more plain meaning) for any given message. In the model with differing preferences, we incorporate a judicial bias. In this case, plain meaning arises in an effort to limit the lower courts from taking extreme actions.

A secondary topic studied in this paper is that of legal precedent. While seemingly distinct on its face, we argue that precedent is closely related to interpretation. This is particularly true when considering interpretation in terms of the action enforced in a given situation or for a given message. When courts are bound by precedent, their behavior is constrained. They lose the flexibility to attach vastly differing interpretations to certain types of cases. As the results of the judicial bias version of the model will show, the relationship between the two is even more intricate than that. There is a mechanism through which the existence of precedent not only directly constrains the lower courts who must follow the precedent, but that indirectly affects interpretation, since it also causes the courts who create the precedent to restrict their own actions and behave in a manner that is more in line with plain meaning. This is a novel contribution of this paper.

The rest of the paper is organized as follows: Section 2 gives an overview of the related literature and provides further motivation for the current paper. Section 3 considers the most basic version of the model, in which the distinguishing characteristic between courts is the quantity of information observed. In Section 4, an alternate case is considered in which courts differ in terms of their preferences. The connection between precedent and plain meaning is also explored. Section 5 concludes.

2.2   Related Literature and Motivation

As mentioned in the introduction, the topic of judicial interpretation has been the subject of much scholarly attention.[3] In particular, a large number of papers have been devoted to examining issues surrounding the type of information that should be allowed to factor into court decisions. Vastly differing opinions have been put forth in this controversial matter.

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[3]See Rubin (1999) for an extensive review of work specific to the law and economics literature. See also the bibliography contained herein for a large list of papers in the legal arena.

In one camp are those who argue that, whenever possible, only the specific verbiage included in a document should be used in judicial interpretation. Along this line of thought, information other than that obtained from the document itself should only be used in cases where language in the document is ambiguous on its face. In other words, if there is a common language interpretation available for a term or clause, no extrinsic or contextual evidence should be allowed to influence its interpretation. When determining what the "plain meaning" of the language in a document is, the standard prescribed is that it should reflect the meaning that would be assigned by the average English-speaking individual. This set of general principles is outlined and practiced in contractual, statutory and constitutional interpretation. Depending on the area of law, these rules may carry slightly different nuances and go by different names, but the same basic characteristics outlined above hold for each. The primary guidelines of judicial interpretation that share these properties are: the "plain meaning rule", the "four corners rule" and the "parol evidence rule". The notion of "textualism" also falls within this family of principles.[4]

A primary argument that is used to support the need for such rules is that such constraints on judicial freedom limit courts from promoting their personal ideals and taking sides in legislative or political issues. According to Justice Antonin Scalia, a strong proponent of textualism, "...legislative history is extensive, and there is something for everybody... The variety and specificity of result that legislative history can achieve is unparalleled." "The practical threat is that, under the guise or even the self-delusion of pursuing unexpressed legislative intents, common-law judges will in fact pursue their own objectives and desires, extending their lawmaking proclivities from the common law to the statutory field." (Scalia 1997, pp. 110, 93)

Another argument put forth by supporters of such rules highlights the importance for predictability and transparency in the court system. Those behind this argument believe that parties are best served if they can write contracts using terms that are consistently enforced. Allowing any and all extrinsic evidence clouds

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[4]Orsinger (2007) provides a comprehensive and objective description of these and many other rules used in the judiciary system.

the meaning behind any words included in a document and makes it difficult for parties to anticipate how any given term or clause will be interpreted by a court in the event of trial. Adding uncertainty to the enforcement of contracts, statutes, etc. only acts to reduce efficiency.[5]

On the opposite side of the spectrum are those who believe that the principle of textualism is misguided and that the plain meaning rule or any similar precept should be discarded. They believe that such restrictions only only act to hinder the performance of the judicial system. Among those who hold such beliefs are those who support "intentionalism" in interpretation. Intentionalism specifically supports the use of contextual information, such as past conversations or writings between contracting parties, legislative discussions surrounding the drafting of a statute, etc. The idea is that the meanings of a text should be determined mainly by the intentions of the author and that context is often required to fully determine those intentions.

Related arguments in support of the use of context point to the problem of "latent ambiguity." This problem arises when terms do not appear ambiguous on their face, but when considered in light of the context, the interpretation that initially seemed obvious becomes obviously incorrect.[6] In such cases, rules such as the plain meaning rule would bar extrinsic evidence.

Some in this camp believe that any and all available information should be used when making decisions. Unlike the arguments supporting the exclusion of extrinsic information, the arguments supporting the inclusion of all available information have a strong theoretical basis, both in the general economics of information and in literature more specifically oriented toward judicial interpretation.

A fundamental principle stemming from information economics is that more information is weakly better; when decisions are made based on more complete information, better outcomes generally result. Specific to the literature on judicial interpretation, Shavell (2006) finds that even when contracts contain unambiguous contractual terms, it may be optimal for courts to depart from the clear instructions when enforcing outcomes. Despite this finding, Shavell also finds that sometimes

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[5]See Linzer (2002) and Katz (2004) for recent discussions of these ideas.
[6]e.g. see Farnsworth (1967).

parties may want to have a "no-interpretation option" to keep the court from overriding certain terms in a contract. One aspect of Shavell's model that facilitates this result, however, is that it takes as a primitive the idea that there are terms that carry an exogenously determined plain or fixed meaning. In a related theoretical paper, Schwartz and Watson (2007) obtain results that lead to the conclusion that external information should *always* be utilized in determining the meaning of contractual terms. They utilize a model much like the one used by Shavell, but rather than including terms with fixed meaning, they allow for a completely general use of the contractual terms. They find that in a model with no ex ante structure or meaning imposed on the language, it would never be optimal to impose such structure on terms ex post.

Overall, the bulk of the theoretical weight on this issue points against the use of meaning that is "plain" and supports use of contextual evidence in determining optimal outcomes.[7] So, based on existing theoretical results, one might tend to side with those arguing against the existence of rules such as the plain meaning doctrine, etc.

Despite this, these rules and principles are actively used in the judicial system today and are supported by many legal scholars. Given existing theoretical results, either our courts are behaving suboptimally, or there are characteristics of the legal environment that are not accounted for in the existing theoretical models.

A standard point to consider is that of incomplete information. While incomplete information has been incorporated in some judicial interpretation models, it has not involved asymmetry between different levels of the court hierarchy. Another salient point is brought up in many of the arguments made by Judge Scalia. He supports the idea that judicial biases or policy preferences will influence decision-making if there is any flexibility in the system for a self-serving interpretation and application of laws. The current paper explores both of these issues as possible justifications for existing rules employed in the judicial system *and* as possible foundations for the assumptions of plain meaning employed in existing theoretical models.

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[7]Another recent example of such theoretical work is Anderlini, Felli and Postlewaite (2009).

2.3   Basic Model

Throughout this paper, we will utilize a model of the judiciary system in which the court hierarchy consists of two levels. This enables us to examine how differences between courts may cause a society to develop certain legal rules or principles. In this section, we begin by considering the most basic version of the model, in which the distinguishing characteristic between the court levels is the quantity of information observed.

The basic story can be told as follows. There exists a large population of stakeholders. Each stakeholder is distinguished by what we will call "context variables" $x \in X$ and $y \in Y$. These variables represent specific payoff relevant aspects of the stakeholder's environment. For example, a stakeholder could represent a partnership and their context variables might describe the specific industry, industry conditions, initial investments, etc. We assume that x and y are independently distributed random variables, the probability distributions of which are common knowledge. The distributions of x and y are also assumed to be independent across stakeholders. Stakeholders are able to observe their own context variables.

Each stakeholder ends up with a case to bring to court. The job of the court is to review each case and enforce an action $a \in A$. This action affects stakeholder welfare in a way that depends on the context variables. This is represented by the stakeholders' utility function $U : A \times X \times Y \to \Re$, where $U(a, x, y)$ is the utility of action a in the context (x, y). Courts share the preferences of the stakeholders and seek to select the actions that maximize aggregate welfare.

The courts are divided into two tiers. Let C^h represent the higher court and let C^l represent the lower court. C^h presides over a fraction α of the total cases and C^l presides over the remaining $(1 - \alpha)$. In this model, courts do not specialize, so the higher and lower courts get the same distribution of cases, just different fractions of the total case load. As a result, stakeholders do not know ex ante which court will preside over their case; they only know the probability their case will be seen by each of the respective courts.

This is an important point, because there are informational differences between the levels of the courts. C^h is able to observe one of the context variables,

y, whereas C^l is unable to observe either of the variables. Note that although C^h obtains more information than does C^l, it still does not have full information. Under these assumptions, neither court will be able to perfectly determine the welfare-maximizing action, solely based on their own information.

Knowing this, the stakeholders would like to convey information to the courts regarding the context. Since the courts share the preferences of the stakeholders, efficient actions would be taken in the equilibria of a model where stakeholders could simply announce the true state of the world. However, in this model, stakeholders are limited in their ability to convey information to the courts.

After observing x and y (and before engaging with the court), each stakeholder selects a message $m \in M$ that will be received by the presiding court. In the partnership example, these messages could represent the terms included in the partnership contract. The message space is limited so that stakeholders are unable to use the message to finely partition the state space. They are also unable to simply dictate their desired action to the court. That is, $|M| < |X \times Y|$ and $|M| < |A|$.[8]

The timing of the model is as follows: At $t = 1$, the context variables x and y are realized and observed by each stakeholder, S. Each S then selects the message m that will be heard by the court presiding over their case. At $t = 2$, a fraction α of the stakeholders present a case to C^h. At this time, C^h observes the message m and the context variable y. The court selects and enforces action a. At $t = 3$, the remaining fraction of the stakeholders present a case to C^l. C^l observes m and enforces a. After this point, the game ends.

Behavior is described by the strategies of S, C^h and C^l. S's strategy takes the form of a message rule, $MR : X \times Y \to M$. Each court's strategy takes the form of a decision rule: $f^h : M \times Y \to A$ in the case of C^h and $f^l : M \to A$ in the case of C^l. The solution concept used here is perfect Bayesian equilibrium.

Now focus on a simple case of the model outlined above. In this case,

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[8]Plain meaning is a primary topic of this paper. While these assumptions preclude the existence of *pure* plain meaning, (in both the descriptive and prescriptive sense) this paper does not take a stance as to whether pure plain meaning exists. Instead, it studies a model in which plain meaning can be viewed and evaluated in relative terms.

x and y are discrete random variables, where $X = Y = \{0,1\}$ and $Pr\,(x = 0) = Pr\,(y = 0) = \frac{1}{2}$. The message space contains two elements, $M = \{H, L\}$, and court actions can take any value in the set $A \in [0, 2]$. Payoffs are given by $U(a, x, y) = -(a - x - y)^2$.

Under these assumptions, the state space $X \times Y$ comprises four elements: $\{(1, 1)\,(0, 0)\,(1, 0)\,(0, 1)\}$. Since the message space is limited to two elements, all informative message rules partition the state space into two subsets. An example of one such rule is as follows:

$$\{m = H \text{ if } x, y = 1; \quad m = L \text{ otherwise}\}$$

This message rule partitions the state space into the subsets $\{(1, 0)(0, 1)(0, 0)\}$ and $\{(1, 1)\}$. There are eight unique partitions that may be obtained by such message schemes.[9] The possible partitions and message rules that induce these partitions are listed below. For future reference throughout this paper, these rules and corresponding partitions will be referred to by number as MR_1, MR_2, etc.

$$
\begin{array}{lll}
MR_1: & \{(1, 1)\}; \;\; \{(1, 0)\,(0, 1)\,(0, 0)\} & H \text{ if } x, y = 1; \;\; L \text{ otherwise} \\
MR_2: & \{(0, 0)\}; \;\; \{(1, 0)\,(0, 1)\,(1, 1)\} & H \text{ if } x, y = 0; \;\; L \text{ otherwise} \\
MR_3: & \{(1, 1)\,(1, 0)\}; \;\; \{(0, 1)\,(0, 0)\} & H \text{ if } x = 1; \;\; L \text{ otherwise} \\
MR_4: & \{(1, 1)\,(0, 1)\}; \;\; \{(1, 0)\,(0, 0)\} & H \text{ if } y = 1; \;\; L \text{ otherwise} \\
MR_5: & \{(0, 0)\,(1, 1)\}; \;\; \{(1, 0)\,(0, 1)\} & H \text{ if } x = y; \;\; L \text{ otherwise} \\
MR_6: & \{(1, 0)\}; \;\; \{(0, 1)\,(0, 0)\,(1, 1)\} & H \text{ if } (1, 0); \;\; L \text{ otherwise} \\
MR_7: & \{(0, 1)\}; \;\; \{(1, 0)\,(0, 0)\,(1, 1)\} & H \text{ if } (0, 1); \;\; L \text{ otherwise} \\
MR_8: & \{(1, 1)\,(0, 0)\,(1, 0)\,(0, 1)\} & H \text{ always}
\end{array}
$$

where transposing H and L yields an equivalent set of rules.

2.3.1 Baseline Results

As a baseline, let us first consider the extreme cases in which all stakeholders either go to C^h or C^l.

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[9]One of which (number 8) is uninformative.

High Court

For $\alpha = 1$, all of the cases are seen by C^h. Since C^h observes y, it is unnecessary for stakeholders to convey information about y. Since there are two available messages and two possible values of x, parties are able to select optimal messages that fully convey the value of x. There are two message schemes that lead to full information transmission: MR_3 and MR_5. Since C^h's best response is to select the action a that maximizes welfare, equilibria with efficient outcomes result.

Proposition 1: *In the basic model with $\alpha = 1$, an optimal message rule will induce one of two state space partitions. The optimal partitions are those induced by MR_3 and MR_5. Full information transmission and efficient equilibria result.*

Proof. In general, the expected loss for the higher court, given m and y can be written as:

$$Pr\left(x = 1|m, y\right)\left(a - 1 - y\right)^2 + Pr\left(x = 0|m, y\right)\left(a - y\right)^2$$

Message rule 5: Conditional on MR_1, m and y, the expected loss as a function of a is:

$$m = H,\ y = 1:\quad \left(a - 2\right)^2$$
$$m = H,\ y = 0:\quad\quad a^2$$
$$m = L,\ y = 1:\quad \left(a - 1\right)^2$$
$$m = L,\ y = 0:\quad \left(a - 1\right)^2.$$

Since each possible m, y pair fully reveals the state to the court, the court is able to identify the action a that will set the loss function equal to 0. The expected loss associated with message rule 3 and its induced partition is therefore zero.

Message rule 3: Again, the court can determine the state for each possible m, y pair and optimally selects the action a to set the loss function equal to 0. The expected loss associated with message rule 3 and its induced partition is therefore zero.

It is easy to check that for any other message rule (partition), there will be at least one m, y pair for which the court will be unable to perfectly determine the state. In those cases, the expected loss associated with any a will be strictly positive. So for $\alpha = 1$, message rules 3 and 5 each induce one of the two optimal partitions. □

Low Court

For $\alpha = 0$, all of the cases are seen by C^l. Recall that C^l does not observe either context variable. Therefore, C^l's strategy is a function of the message only. When this is true, the stakeholders optimally utilize messages to partition the state space in a way that provides information about both x and y.

Proposition 2: *In the basic model with $\alpha = 0$, an optimal message rule will induce one of two state space partitions. The optimal partitions are those induced by MR_1 and MR_2.*

Proof. In general, the expected loss for the lower court, given m, can be written as:

$$Pr\left(x, y = 1|m\right)\left(a - 2\right)^2 \ + \ Pr\left(x = 1, y = 0|m\right)\left(a - 1\right)^2$$

$$+ \ Pr\left(x = 0, y = 1|m\right)\left(a - 1\right)^2 \ + \ Pr\left(x, y = 0|m\right)a^2.$$

Message Rule 1: Conditional on MR_1 and m, the expected loss as a function of a is:

$$m = H : \quad \left(a - 2\right)^2$$

$$m = L : \quad \frac{1}{3}a^2 + \frac{2}{3}\left(a - 1\right)^2.$$

The court will minimize these expected loss functions when determining its best response, or the optimal decision rule. Since C^l can perfectly identify the state when $m = H$, he is able to select the action a that will set the loss function equal to 0. This occurs at $a^H = 2$. When $m = L$, this is no longer the case. Instead, he selects the action a that minimizes the expected loss. The first order condition for the minimization problem is:

$$\frac{2}{3}a + \frac{4}{3}\left(a - 1\right) = 0.$$

This yields $a^L = \frac{2}{3}$. The corresponding expected loss is $\frac{2}{9}$. The ex ante expected loss associated with message rule 1 and its induced partition is therefore $\frac{1}{4}*0+\frac{3}{4}*\frac{2}{9} = \frac{1}{6}$.

Message Rule 2: The symmetry of the model, along with the symmetry of MR_1 and MR_2, leads to an ex ante expected loss for $MR_2 = MR_1 = \frac{1}{6}$.

At first glance, it may not be apparent that these rules are optimal. However, it is easy to check that for any other message rule (partition), the ex ante expected loss associated with any other decision rule is strictly greater than the expected loss for message rules 1 and 2, evaluated at the court decision rule that is the best response. This can be seen by checking the ex ante expected losses associated with the other message rules, evaluated at the court's best response. (These are all calculated as for MR_1 above.) The expected losses for rules 3 - 8 are: $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{3}$ and $\frac{1}{2}$, respectively. So in this case, rules 1 and 2 represent the two optimal message rules and corresponding partitions. $\square$

2.3.2 Heterogeneous Courts

Now, let us consider the primary conditions of interest. When $\alpha \in (0, 1)$, each court is responsible for deciding on a portion of the cases. Under these conditions, the optimal partition and corresponding message rule will account for the decision rules of both C^h and C^l, *and* it will depend upon the fraction of all cases seen by each respective court.

I will show that the optimal message rule(s) for any given α will incorporate one of the optimal rules from section 4.1. The level of α will determine whether the optimal rule is one from Proposition 1 (the high court case) or from Proposition 2 (the low court case). For levels of α above a certain threshold $\overline{\alpha}$, the impact of the higher courts will outweigh that of the lower courts. For levels of α below that threshold, the opposite holds.

Furthermore, since the two partitions in Proposition 1 are not symmetric, one of these will outperform the other for $\alpha < 1$. Which of the two rules from Proposition 1 is optimal for $\alpha \in (\overline{\alpha}, 1)$ depends upon which partition induces a smaller loss for C^l.[10] These results are summarized in the following proposition.

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[10]Since the two partitions in Proposition 2 are symmetric in terms of C^h's expected loss, both

Proposition 3: *In the basic model with heterogeneous courts, the optimal partition and corresponding message rule depends on α and will fall into one of three categories. For $\alpha \in \left(0, \frac{2}{5}\right)$, the optimal partitions are those induced by MR_1 and MR_2. For $\alpha \in \left(\frac{2}{5}, 1\right)$, the uniquely optimal partition is that induced by MR_3. For $\alpha = \frac{2}{5}$, message rules 1, 2 and 3 all perform optimally.*

Proof. To show that these rules are optimal over their respective ranges of α, it is sufficient to show that each alternative MR yields a higher expected loss for all α than at least one of the message rules from Proposition 3.

First note that MR_8 (the uninformative rule) could never be optimal.

Next, recall that the expected loss associated with C^l's best response is equal to $\frac{1}{6}$ under message rules 1 and 2. To show these rules are also equivalent for $\alpha > 0$, compute the expected losses associated with C^h's optimal responses under each message rule.

When responding optimally, C^h's expected loss under $MR_1 = MR_2 = \frac{1}{8}$.

Next, recall that the expected loss associated with C^h's best response is equal to 0 under message rules 3 and 5. To determine which rule is superior for $\alpha < 1$, we compare the expected losses associated with C^l's best response under each message rule.[11]

When responding optimally, C^l's expected loss under $MR_3 = \frac{1}{4}$, whereas C^l's expected loss under $MR_5 = \frac{1}{2}$. So, rule 3 outperforms rule 5 for all $\alpha < 1$.

Next, consider message rules 6 and 7. (These rules are symmetric for both courts.) The expected loss associated with C^h's best response is equal to $\frac{1}{8}$ under these message rules. Note that this is the same as C^h's expected loss under rules 1 and 2.

So, to show that rules 6 and 7 are never optimal, it suffices to show that the expected losses associated with C^l's best response are larger for MR_6 and MR_7 than they are for MR_1 and MR_2.

When responding optimally, C^l's expected loss under $MR_6 = MR_7 = \frac{1}{3}$, whereas C^l's expected loss under $MR_1 = MR_2 = \frac{1}{6}$. So, rules 1 and 2 outperform

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corresponding message rules remain as optimal rules for $\alpha < \overline{\alpha}$.

[11]This is true because the ex ante expected loss of each message rule for $\alpha \in (0, 1)$ is simply a weighted average of the losses associated with C^h and C^l.

rules 6 and 7 for all $\alpha < 1$.

Finally, consider message rule 7. Under this rule, each court obtains full information about one of the context variables and no information about the other. So the expected losses for $C^h = C^l = \frac{1}{4}$. This is higher than the expected loss associated with each court under rules 1 and 2, so MR_7 is never optimal.

Now we can write the ex ante overall expected losses associated with the best performing rules as functions of α:

$$EL_3\left(\alpha\right) = \frac{1}{4}\left(1 - \alpha\right)$$

$$EL_1\left(\alpha\right) = EL_2\left(\alpha\right) = \frac{1}{6}\left(1 - \frac{\alpha}{4}\right).$$

For higher values of α, message rule 3 outperforms rules 1 and 2, whereas for lower values of α, rules 1 and 2 are optimal. Since these functions are linear in α, message rule 3 will be optimal for all α above some cut-off, $\overline{\alpha}$ and rules 1 and 2 will be optimal for all $\alpha < \overline{\alpha}$. Setting the expected losses equal to each other and solving for α yields: $\overline{\alpha} = \frac{2}{5}$. $\qquad\qquad\square$

The next section expands upon these results to examine the legal concept of plain meaning.

2.3.3 Plain Meaning

In legal contexts, the term plain meaning is used in two interrelated ways. The primary use is in reference to the "plain meaning rule." According to Merriam-Webster's Dictionary of Law (1996), the plain meaning rule dictates that "when the language is unambiguous and clear on its face the meaning of the statute or contract must be determined from the language of the statute or contract and not from extrinsic evidence." The secondary use of the term is in reference to the language itself. Language that is unambiguous and clear on its face is said to have plain meaning.

These two uses highlight how the concept of plain meaning is related to both the messages sent by parties and the interpretations made by the court. The

analysis in this paper links these by considering the system of how the messages are both optimally constructed and interpreted (or decided upon) in equilibrium.

Since there are no exogenously defined meanings assigned to messages in this model, there is no scope for distinguishing whether use of context in interpretation is due to less plain language use or less adherence to a plain meaning rule in either of the standard senses. Despite this, the concept of plain meaning and its use can be broadly studied in terms of how the court's actions vary based on available contextual information.

Definition 1: A decision rule f_i^h is said to utilize more plain meaning than another rule f_j^h if the range of actions specified by f_i^h over all y is smaller than that specified by f_j^h, conditional on and for each message, m.

This definition may appear to isolate the study of plain meaning in terms of the high court's choice of decision rule, however C^h's optimal decision rule depends on the message rule chosen by the stakeholders. So, equilibrium use of plain meaning will also be a product of the stakeholders' strategies. Furthermore, since the optimal message rule depends on the fraction of C^h and C^l, the existence of C^l will also have an impact on equilibrium use of plain meaning.[12]

Proposition 4: *As the fraction α of cases seen by C^h increases, optimal equilibrium message and decision rules utilize weakly less plain meaning.*

Proof. Since the optimal message rule in this model does not change gradually as a function of α, but rather switches at a cut-off $\overline{\alpha}$, there are two cases to check. The case where $\alpha < \overline{\alpha}$ and the case where $\alpha > \overline{\alpha}$.

For $\alpha < \overline{\alpha}$, either MR_1 or MR_2 is optimal. Since they are symmetric, let us focus on MR_1. Under this rule, C^h's best response is the strategy given by:

$$f^h(H,1) = f^h(H,0) = 2$$

$$f^h(L,1) = 1$$
$$f^h(L,0) = \frac{1}{2}.$$

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[12]The definition of plain meaning is written specifically in terms of the high court's decision rule because the low court cannot vary its actions based on the context.

One can change $f^h(H,0)$ to any other value, since message H is sent only if $y=1$. For $\alpha > \overline{\alpha}$, MR_3 is optimal. Under this rule, C^h's best response is the strategy given by:

$$f^h(H,1) = 2$$

$$f^h(H,0) = 1$$

$$f^h(L,1) = 1$$

$$f^h(L,0) = 0.$$

For $(\alpha < \overline{\alpha})$, the optimal message rule leads to best response actions conditional on H and L with values spanning the intervals $[2,2]$ and $\left[\frac{1}{2}, 1\right]$, respectively. For $(\alpha > \overline{\alpha})$, the optimal message rule leads to best response actions conditional on H and L with values spanning the intervals $[1,2]$ and $[0,1]$, respectively. The range of actions resulting from messages H and L are each smaller under MR_1 than those resulting from the messages under MR_3. Therefore, higher levels of α lead to (weakly) less plain meaning in the best equilibria. $\qquad\Box$

Proposition 4 suggests one motivation behind the use or existence of plain meaning in contract formation and interpretation. Under circumstances where some courts are unable to observe all payoff relevant information, language may adapt to compensate. This can occur even when some courts have better information and could more beneficially utilize their information under a different language scheme.

The next section explores another possible explanation for the existence of plain meaning and links it to another legal principle, that of precedent.

2.4   Judicial Bias Model

Consider a variant of the basic model in which the lower court has biased preferences. We will maintain all previous modeling assumptions, with the exception of C^l's utility specification. In this model, we will continue to explore the means by which plain meaning might arise. We will also consider ways in which

society might benefit through regulating court actions, specifically through the practice of establishing and upholding binding precedent.

Assume that C^l is equally likely to be one of two types, C_1^l or C_2^l. These types are distinguished by their preferences as follows: $U_{C_0^l}(a) = -a^2$ and $U_{C_2^l}(a) = -(a-2)^2$. Given these preferences, C_0^l will always prefer to implement action $a = 0$ and C_2^l will always prefer to implement action $a = 2$.

In the basic model, all players held the same preferences, so the welfare implications were clear. In this case, we make the standard assumption that social welfare calculations place zero weight on the courts' preferences. So, welfare maximizing actions and policies are still those that minimize the loss of the stakeholders (and also the higher court).

Under these assumptions, the baseline results for $\alpha = 1$ remain unchanged. As discussed in the previous section, when all cases are seen by C^h, the two optimal message rules are MR_3 and MR_5.

In the case where $\alpha = 0$, the results differ. Under the assumptions of biased preferences, all message rules are equivalent with regard to C^l's response. Without further assumptions or restrictions on the lower court's actions, C^l will ignore all messages and simply implement his preferred action.[13]

Now, let us turn to the cases of interest in which stakeholders are seen by both courts. Under the assumptions of this section, the optimal message rule for $\alpha \in (0,1)$ differs drastically from that of the previous section. The optimal rule in this case is independent of α and it no longer accounts for the decision rules of both courts. Instead, the optimal rule is directed solely at C^h. This is due to the fact that C^l's best "response" is independent of the message. So, changing the message rule only affects the expected loss through its impact on C^h's best responses. Once again, the two optimal message rules are MR_3 and MR_5.

Proposition 5: *In the judicial bias model, an optimal message rule will induce one of two state space partitions. The optimal partitions are those induced by MR_3 and MR_5. This is true for all values of α.*

Note that in this case (as well as the case in the basic model for $\alpha = 1$), the

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[13]Note that this result does not depend on C^l's information, so it also holds under the assumption that C^l observes y.

best equilibria utilize very little plain meaning. In fact, based on our definition, no other equilibrium can be said to contain less plain meaning. This does not mean that incorporating plain meaning has no use in such cases, however.

Given the nature of C^l's preferences, it seems clear that some form of restriction on permissible actions could improve welfare. One possible restriction would be to force the lower courts to adopt a plain meaning interpretation of messages. So, rather than serving an informative purpose, messages could be used by stakeholders to dictate specific actions. The problem with this solution is that unless messages were allowed to dictate specific actions to one court but not the other (so the messages would essentially mean different things, depending on the presiding court), this method of restricting the lower courts would prevent C^h's from using any of their information.

As we will see in the following section, there is another form of restriction that is used in the legal system that can improve welfare, preserve some flexibility on the part of the higher courts, and that can also lead naturally to increased plain meaning in messages.

2.4.1 Binding Precedent

As a potential way to mitigate the problem introduced by C^l's bias, let us consider a policy in which courts in the lower tier of the system are bound by actions taken by courts in the upper tier. This is the basic idea behind a fundamental principle followed in the court system today, that of binding precedent.

To explore the principle of precedent, we need to make additional assumptions regarding the information that can be observed from one period to the next. Assume that besides observing the message m, C^l also observes the set of all message and action pairs (m, a^m) from the cases seen by C^h. Recall that C^h sees a representative sample of the possible case types, so C^h tries at least one case from each state.

Definition 2: Under the policy of binding precedent, C^l is constrained by the actions of C^h as follows: for each message m received, C^l must select one of the corresponding actions a^m taken by C^h in the previous period.

This definition captures the binding effect that precedent has in the judicial system. One might conceive of other similar definitions. For example, one might consider a form of precedent in which C^l is forced to select the action that is the average of all actions taken by C^h for a specific message. In some circumstances, this simply wouldn't be feasible. For example, it would be very unclear what the average action would be when considering disputes over property rights. Furthermore, such an average rule doesn't realistically reflect the mechanism by which precedent operates in practice.

Note that precedent in this model not only acts to constrain the lower courts, but it also effectively alters language use and interpretation by forcing C^l to interpret messages in a way that is consistent with the interpretation of C^h. As we will see, the use of precedent has more than just this direct impact on language use; it also leads to an indirect effect, through the equilibrium strategy rules of C^h and S.

Another issue to consider when examining precedent is the question of whether C^h only cares about the loss associated with its own cases or if it also cares about the loss associated with cases seen by other courts. In the analysis up to this point, we simply considered the individual case because it had no impact on the results. With precedent, this does affect the results. Recall that we initially assumed that the courts cared about aggregate welfare. In this model, we maintain this assumption for C^h and relax this assumption for C^l. As we will see, this will lead C^h to restrict itself when selecting its highest and lowest actions for any given message (denoted $\overline{a}^m$ and $\underline{a}^m$, respectively).

Each type of the lower court, C_1^l and C_2^l only cares about its own losses and will therefore select an action a to minimize its loss function, subject to the precedent constraint. Under the loss functions specified above, the optimal action for C_1^l is the lowest permissible action for any given message: $\underline{a}^H$ when $m = H$ and $\underline{a}^L$ when $m = L$. The optimal action for C_2^l is likewise the highest permissible action for any given message: $\overline{a}^H$ when $m = H$ and $\overline{a}^L$ when $m = L$.

The expected loss associated with the biased lower court (C_1^l and C_2^l) can

be written as:

$$\frac{1}{8}\left[\left(\underline{a}^{m(0,0)}\right)^2 + \left(\underline{a}^{m(1,0)} - 1\right)^2 + \left(\underline{a}^{m(0,1)} - 1\right)^2 + \left(\underline{a}^{m(1,1)} - 2\right)^2\right] +$$

$$\frac{1}{8}\left[\left(\overline{a}^{m(0,0)}\right)^2 + \left(\overline{a}^{m(1,0)} - 1\right)^2 + \left(\overline{a}^{m(0,1)} - 1\right)^2 + \left(\overline{a}^{m(1,1)} - 2\right)^2\right],$$

where the superscripts $m(a,b)$ represent the message sent in state (a,b), given the prevailing message rule.[14]

So, for example, under MR_1, the expression would become:

$$\frac{1}{8}\left[\left(\underline{a}^L\right)^2 + 2\left(\underline{a}^L - 1\right)^2 + \left(\underline{a}^H - 2\right)^2\right] +$$

$$\frac{1}{8}\left[\left(\overline{a}^L\right)^2 + 2\left(\overline{a}^L - 1\right)^2 + \left(\overline{a}^H - 2\right)^2\right].$$

Both C^h and S will consider this in determining their optimal choices. Note that since C^h will always prefer a weakly higher action conditional on $y = 1$ compared to $y = 0$, for a given message, it will be the case that $\underline{a}^L = f^h(L,0)$, $\underline{a}^H = f^h(H,0)$, $\overline{a}^L = f^h(L,1)$, and $\overline{a}^H = f^h(H,1)$.

The next result shows that a binding precedent enhances welfare. The bias of the lower court causes the upper court to moderate the range of its actions. Furthermore, as in Proposition 3, S and C^h optimally coordinate on a message rule that for high values of α is informative about only x, and for low values of α is informative about x and y jointly. In the proposition, f^{h*} denotes a strategy of the higher court that best responds to the message rule used by stakeholders, when one ignores the selections of the lower court. In other words, strategy f^{h*} specifies the actions that are optimal in the basic model of section 3.

Proposition 6: *Consider the judicial bias model with $\alpha \in (0,1)$. Binding precedent increases welfare under the optimal message rules. There is a number $\overline{\alpha} \in (0,1)$ such that for $\alpha < \overline{\alpha}$, the optimal partitions are those induced by MR_1 and MR_2. For $\alpha > \overline{\alpha}$, the uniquely optimal partition is that induced by MR_3. Further, letting f^h denote the optimal strategy for the higher court, for any message m such that $f^{h*}(m,0) \neq f^{h*}(m,1)$, it is the case that $f^{h*}(m,0) < f^h(m,0) < f^h(m,1) < f^{h*}(m,1)$.*

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[14]This does not imply that the lower courts observe the state that occurred when that message was sent.

Proof. That only MR_1, MR_2, and MR_3 can be optimal message schemes follows from a similar argument to that used to prove Proposition 3. Consider first rule MR_1, in which the stakeholder sends message H if and only if $x = y = 1$. Recall that C_0^l will select action $f^h(m,0)$ and C_2^l will select action $f^h(m,1)$. Also, C^h always selects action $a = 2$ conditional on message H since message H is sent only if $y = 1$. Thus, in the event of $x = y = 1$, the high court optimally takes action $a = f^h(H,1) = f^h(H,0) = 1$ and the lower court must take exactly the same action, leading to a loss of zero.

The following lines give, in order, the losses (from the higher and lower court) in the events (i) $x = 0$ and $y = 0$, (ii) $x = 0$ and $y = 1$, and (iii) $x = 1$ and $y = 0$.

$$\alpha(f^h(L,0) - 0)^2 + (1 - \alpha)\left[\frac{1}{2}(f^h(m,0) - 0)^2 + \frac{1}{2}(f^h(m,1) - 0)^2\right]$$

$$\alpha(f^h(L,1) - 1)^2 + (1 - \alpha)\left[\frac{1}{2}(f^h(m,0) - 1)^2 + \frac{1}{2}(f^h(m,1) - 1)^2\right]$$

$$\alpha(f^h(L,0) - 1)^2 + (1 - \alpha)\left[\frac{1}{2}(f^h(m,0) - 1)^2 + \frac{1}{2}(f^h(m,1) - 1)^2\right]$$

Each of these occurs with probability $1/4$. Summing these and simplifying the expression yields the total loss of using message rule MR_1:

$$\frac{1}{8}[(3 + \alpha)(f^h(L,0)^2 + (3 - \alpha)(f^h(L,1)^2 - 4f^h(L,0) - 4f^h(L,1) + 4].$$

Taking the partial derivatives with respect to $f^h(L,0)$ and $f^h(L,1)$ and setting these to zero gives the first-order conditions for C^h's optimal strategy. This yields:

$$f^h(L,0) = \frac{2}{3 + \alpha} \text{ and } f^h(L,1) = \frac{2}{3 - \alpha}.$$

Letting L_1 denote the minimized loss, we can use the envelope theorem to calculate its derivative with respect to *alpha*:

$$dL_1/d\alpha = (3 + \alpha)^{-2}/2 - (3 - \alpha)^{-2}/2.$$

We also see that L_1 is concave.

Consider next the rule MR_3. With this rule, because of the quadratic loss function, it is clear that the higher court optimally uses a strategy f^h that satisfies

$f^h(L,0) = \beta$, $f^h(L,1) = 1 - \beta$, $f^h(H,0) = 1 + \beta$, and $f^h(H,1) = 2 - \beta$, for some $beta \in (0,1)$. The total loss (including the higher and lower courts) can then be written:

$$\alpha\beta^2 + (1 - \alpha)\left[\frac{1}{2}\beta^2 + \frac{1}{2}(1 - \beta)^2\right].$$

The first-order condition for minimization yields:

$$\beta = \frac{1 - \alpha}{2}.$$

Letting L_3 denote the minimized loss, the envelope theorem gives us:

$$dL_3/d\alpha = -\alpha/2.$$

Simple calculations show that $L_1(0) = 1/6$, $L_1(1) = 1/8$, $L_3(0) = 1/4$, and $L_3(1) = 0$. Thus, there is a point $\overline{\alpha}$ such that $L_1(\alpha) < L_3(\alpha)$ for $\alpha < \overline{\alpha}$ and $L_1(\alpha) > L_3(\alpha)$ for $\alpha > \overline{\alpha}$, proving the first claim. The conclusions regarding f^h are clear from the calculations shown above. $\square$

Proposition 6 highlights how the potential existence of judges with extremist views or biases may be a factor in the heavy reliance of precedent in our legal system. In this model, the policy of binding precedent yields strictly higher aggregate welfare than the case with unconstrained C^l's.

Precedent and Plain Meaning

Not only does this model illustrate how biases or extremist views may lead to the existence of precedent, it also yields a connection between precedent and plain meaning.

Proposition 7: *As the fraction α of cases seen by C^h increases, optimal equilibrium message and decision rules utilize less plain meaning. In particular, for changes of α that do not cross the threshold $\overline{\alpha}$, $f^h(m,1)$ is increasing in α, and $f^h(m,0)$ is decreasing in α.*

Proof. These conclusions follow immediately from the derivations shown in the proof of Proposition 6. $\square$

As α decreases and more cases are seen by C^l, C^h will select actions $\overline{a}^m$ and $\underline{a}^m$ that are progressively more moderate. This increases the loss associated with C^h's actions, but it constrains C^l, thereby reducing the loss associated with the lower court's actions. So, the desire to limit potential extremists leads the social welfare maximizing C^h to take more moderate actions than would otherwise be optimal. Language use and interpretation in such cases will utilize more plain meaning.

2.5 Conclusion

This paper contributes to the literature studying judicial interpretation in several novel ways: it suggests a theoretical definition of plain meaning based on its common usage in the legal literature. It then uses that definition as a basis for exploring the question of whether plain meaning might arise in a model without ex ante restrictions on the meaning of language. In doing so, it identifies two primary conditions under which plain meaning might arise naturally in equilibrium. Both of these rely upon the existence of a multi-level judicial system in which there are differences between the levels of the courts.

The first condition is based on a fairly standard notion of asymmetric information. When there are differences in the amount of contextual information received by the different courts, optimal message construction and interpretation will tend to utilize more plain meaning.

The second condition is based on a (somewhat less standard) difference between the preference specifications of the courts. In line with arguments given by the prominent Judge Scalia supporting the use of textualism in judicial interpretation, this paper assumes that certain courts have a personal bias toward certain actions.[15] Such biases could stem from personal ideological preferences, external political pressures, etc. When biased preferences are present in the judiciary, precedent becomes useful as a tool for restricting actions. Precedent, along with the motivation to constrain the actions of biased courts, leads to equilibria that utilize

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[15] This bias is relative to the preferences of the stakeholders in the situation or of society at large.

more plain meaning than they would otherwise.

Overall, these findings add a new theoretical component to the literature studying (and debating) the merits of rules such as plain meaning. The results help justify the use of the plain meaning rule and other similar precepts in the current judiciary system. They also help motivate and lend support to the assumptions in existing theoretical models where certain messages are assigned a fixed meaning ex ante.

Beyond these main findings, this paper also makes a novel contribution by establishing a theoretical relationship between two guiding principles in the judicial system: plain meaning and binding precedent. In cases where some judges have biased preferences, binding precedent can be used to improve welfare by restricting the actions of biased judges. In such equilibria, the use of precedent also leads to language use and interpretation that utilizes more plain meaning.

While insightful, the results of this paper are not exhaustive. There are other conditions left unexplored under which plain meaning could plausibly arise. One interesting avenue would be to study error in judicial judgment. Such cognitive errors could also lead to greater reliance on principles such as the plain meaning rule.

Models carrying a richer set of assumptions might also be employed to yield a richer set of complementary results. For example, one might relax the assumption made in this paper that the parties are restricted to selecting messages from a "small" message space. Instead, allowing for an unlimited message space and incorporating a writing cost could provide similar results, while making it possible to examine important trade-offs related to such costs.

Yet another issue to consider is whether the same basic results would hold in a model that incorporates an existing natural language. While a primary purpose of this paper was to show that plain meaning could arise in the absence of terms with an ex ante fixed meaning, one might argue that natural language does in fact exist. It would therefore be useful to consider the implications of the conditions studied in this paper, when applied to a model in which parties can select terms that carry an exogenously defined meaning. Based on other theoretical work, one

would expect that the high courts (when considered in isolation) would optimally depart from a fixed meaning interpretation of messages. In light of the results of the current model, one might expect this to change in the presence of biased lower courts and binding precedent; in some cases, high courts might refrain from altering the plain interpretation of the language in order to keep biased judges from following suit.

One might also consider modifying the assumptions that govern the judicial bias model. There, the lower courts simply pursue their own agendas without regard to overall welfare. This assumption was made for simplicity and clarity of the results, however it implies that lower courts are only harmful and that society would be better off eliminating the lower tier. A plausible alternative to this assumption would be to include a third type of lower court that shares the preferences of society. In such a model, the existence of *some* biased lower courts should yield results similar to those in this paper.

Finally, an empirical investigation of the conditions surrounding more or less plain meaning would be informative. Courts in differing jurisdictions adhere to the plain meaning rule to varying degrees. Given the appropriate data, one might find evidence of differing environmental conditions between jurisdictions that supports the theoretical results of this model.

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