# Vagueness as Adjudicator Authority:

## Theory and Evidence on Contract Vagueness and Enforcement Evaluation

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**Abstract**

I develop a simple model of optimal contract vagueness that allows for renegotiation and builds on the literatures on authority delegation and transaction costs in contracting. The main predictions of the model are that optimal contract vagueness and renegotiation rates depend on project complexity and the quality of contract enforcement. In particular, contract vagueness increases with project complexity and enforcement quality while renegotiation rates rise with project complexity and may fall with enforcement quality. I provide evidence to support the joint comparative statics of this model using new data on material contracts disclosed through the SEC. Given this support, I undertake a preliminary evaluation of public versus private contract enforcement within the context of the model. In particular, I find that contracts enforced through private enforcement (i.e., arbitration) are both vaguer and renegotiated *less* often than those enforced through public enforcement (i.e., courts). Relying on the joint comparative statics of my model for identification purposes, this evidence suggests that private enforcement institions have a quality advantage over public enforcement institutions.

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# 1 Introduction

Research in the economics of contracts focuses almost exclusively on the use of *precise contract terms*. Namely, most contracting models implicitly assume that contracts can only specify obligations and rights as explicit functions of verifiable performance measures. For instance, compensation contracts can provide managers with wage payments that depend on their firm's profits (e.g., Holmstrom (1979), Innes (1990)) while debt and venture capital contracts can specify the allocation of control as a function of repayment to creditors or the achievement of project milestones (e.g., Aghion-Bolton (1992), Hart-Moore (1998), Berglof (1994)). Correspondingly, the empirical literature in this field has focused entirely on documenting relationships between precise contractual allocations and quantifiable performance metrics (e.g., Hall-Lieberman (1998), Kaplan-Stromberg (2003, 2004)).

However, real-world contracts are not as precise as existing theory assumes. In particular, they often include vague performance obligations like the duty to undertake "commercially reasonable" or "appropriate" actions or require a controlling party to exercise discretion in "good faith". In this paper, I develop a simple agency model that explains the use of *vague contract terms*. This model predicts that optimal contract vagueness and renegotiation rates depend on the complexity of the underlying project and, more interestingly, on the quality of the institution that enforces the contract. Then, using a novel dataset of corporate contracts disclosed through the Securities and Exchange Commission, I document empirical patterns in the variation of vagueness across contracts and find that they are consistent with the predictions of the model. To further illustrate the value of studying contract vagueness, I use the joint comparative statics of the model to propose a methodology for assessing the relative quality of contract enforcement institutions. I then apply this approach in a comparison of public versus private enforcement (e.g., courts vs. arbitration). My evidence suggests that private contract enforcement has a quality advantage over public contract enforcement.

## 1.1 Overview of the Model of Contract Vagueness

The agency model I develop relies on three assumptions about the contracting environment. The first assumption takes a specific view on contract vagueness. Namely, I argue that vague contract terms allocate additional authority to adjudicators. A contract enforcer must decide whether the agent's action satisfies the "standard" implied by a vague contract term. For example, a term imposing a standard of "commercial reasonableness" on investments might require that the adjudicator determine the threshold level of investment that first meets this standard. The second assumption relates to ex-post technology restrictions in contract enforcement. Specifically, due to limited expertise and potential bias, I assume that adjudicators may be unable or unwilling to exercise their enforcement authority to enforce economic efficiency. The final assumption relates to ex-ante technology restrictions in contract writing. I assume that transaction cost considerations are important in shaping contracts since parties bear a larger up-front cost when writing a

precise contract term than when writing a vague contract term. This differential cost could stem from the need to contemplate the right course of action prior to specifying it in a contract in a precise manner.

Contracts specify rights and obligations as a function of verifiable states. For each verifiable state, the decision to write a vague contract term, rather than a precise one, involves a comparison of ex-ante efficiency gains and ex-post efficiency losses. In particular, a vague contract term economizes on ex-ante contracting costs but also yields an ex-post expected loss due to inefficient enforcement decisions. The nature of this expected loss depends on whether the vague term is action- or payoff-based. In the former case, which corresponds to specific-performance, surplus may be lost due to the imposition of ex-post inefficient actions by the adjudicator. In the latter case, which corresponds to liquidated damages, the agent appropriates a rent due to limited liability and imperfect enforcement. A fundamental observation in this setting is that the magnitude of this ex-post loss increases proportionally with the ex-ante likelihood of this state regardless of whether the vague term is action- or payoff-based. This implies a "precision threshold" where states with probabilities above this threshold are contracted on using precise contract terms while the remaining states are dealt with using vague contract terms.

The model also implies that characteristics of contract enforcement institutions (i.e., the adjudicator) matter in determining the level of contract vagueness. In particular, contract vagueness increases with adjudicator expertise and decreases with adjudicator bias. The intuition behind this result is straightforward: the statistical informativeness of the adjudicator's decision increases with his expertise and decreases with his bias. Since the expected loss due to a vague term always falls with this informativeness, a rise in expertise or a fall in bias shifts the trade-off between vague and precise contract terms in the favor of vague contract terms.

The informativeness of adjudicator decisions is an important measure of enforcement quality since the principal's expected payoff strictly increases with this measure. Given the relationship between contract vagueness and adjudicator informativeness, an empirical comparison of contract vagueness across different contract enforcement institutions may shed light on the relative quality of those institutions. If two institutions are selected to enforce contracts for a comparable set of projects, the institution that enforces systematically vaguer contracts should be of higher quality than the one that enforces systematically more precise contracts. Put differently, there is information contained in the revealed-preferences of contracting parties and this information can be useful as an enforcement evaluation tool. This ex-ante approach to enforcement evaluation is motivated by some practical difficulties in inferring institutional quality from ex-post approaches that study the outcomes of contractual disputes. These difficulties include the unobservability of optimal decisions as well as sample selection problems induced by both pre- and interim-dispute settlements (e.g., Priest-Klein (1984)). Moreover, some prominent contract enforcement institutions, including almost all private enforcement channels, do not disclose their contract dispute outcomes. In such cases, the

ex-ante approach may be the only evaluation tool available to researchers and policymakers.

However, a drawback of this ex-ante approach is that contract vagueness also depends on (potentially unobservable) project characteristics. Indeed, the model developed here highlights this concern by demonstrating that contract vagueness varies with project complexity. Following Bajari-Tadelis (2001), a project is defined as more complex when it involves a greater likelihood of "unlikely" future states. In this formulation, complexity leads to a greater reliance on vague contract terms because a larger measure of states fall below the precision threshold. This observations leads to an important identification problem in the ex-ante approach to enforcement evaluation: enforcement institutions may receive systematically different projects on the complexity dimension. If contracts to be enforced in one institution (e.g., arbitration) are systematically vaguer than those enforced in another (e.g., courts), is this due to the first institution being of higher quality than the second or due to it enforcing the contracts of systematically more complex projects? Such correlation between enforcement institution and project complexity could realistically occur because contracting parties can *choose* where to resolve their contracting disputes.

I attempt to overcome this identification problem by extending the optimal contracting model to allow for costly renegotiation. In particular, parties may want to renegotiate their contract before actions are chosen if they learn about the upcoming state of the world. The key insight from this analysis is that renegotiation rates increase with project complexity while they may decrease with the quality of enforcement. The intuition for this result is that the value of learning about the state of the world increases with project complexity while it decreases with the informativeness of adjudicator decisions. The latter point suggests that, for the purposes of adaptation, the use of vague terms in contracts may serve as a substitute for renegotiation but only if the quality of contract enforcement institutions is high enough. Put differently, high quality institutions allow vague contract terms to be self-adapting and this makes these vague terms particularly desirable for contracting parties when initially writing contracts.

From an empirical standpoint, the difference between the effects of enforcement quality and project complexity on renegotiation rates can be used to identify the presence of enforcement quality differentials from simple correlations data. In particular, within the context of the model, the only way that one enforcement institution can simultaneously be associated with systematically vaguer contracts and systematically less renegotiation than another institution is if it is of higher quality. Why? Because the model would predict that the institution would have higher renegotiation rates for its contracts if its higher level of contract vagueness was only due to systematically higher project complexity. So long as the underlying model is valid, this argument holds *regardless* of how complexity endogenously maps into forum selection.

## 1.2 Overview of the Empirical Analysis

Given these observations, I collect a large database of outsourcing, licensing, and joint venture contracts. These contracts are obtained through the Securities and Exchange Commission's Edgar Database. As a result, this contracts database consists of material contracts where at least one party in the contract is a publicly traded company in the US. Since material contracts are the most important contracts that these companies enter into, they are a particularly useful sample to use when testing contracting models.

Overall, the dataset currently consists of almost 2,200 contracts of which over 1,600 are full contracts and the remainder are partial contracts (usually amendments). From each contract, I collect information using a mixture of automated data-extraction and hand-collection. In particular, I quantify vagueness in contracts using a Perl program that identifies standard vague terms in the body of a contract at the sentence-level to compute the number and percentage of vague sentences in a contract. For each contract, I then hand-collect data on the enforcement institution used to enforce the contract, on whether the contract is an original or an amendment, on the location (i.e., country) of the non-filing party to the contract, as well as other contract-level control variables. I also manually check whether "situationally vague" terms picked up by my Perl program are indeed vague.

I then investigate correlations between various contract enforcement institution dummies and the two observables that are endogenized in my model: contract vagueness and renegotiation rates. The goal of this exercise is to shed new light on the relative quality difference between contract enforcement institutions. In most of the empirical analysis, I focus on comparing differences across public versus private enforcement by using a private enforcement dummy to explain institutional variation in contract vagueness and renegotiation rates within multivariate regressions. I emphasize this comparison in my empirical analysis because the question of public versus private enforcement quality is economically interesting and fundamental.

Furthermore, there is a debate regarding the relative merits of arbitration (as well as other forms of alternative dispute resolution) and courts. Proponents of private enforcement tend to emphasize its expertise advantages relative to public enforcement while opponents generally point to concerns of bias disadvantages. On the expertise front, the motivation for the potential expertise advantage of forums like arbitration is that arbitrators tend to have industry experience that is closely related to the disputes they adjudicate. On the bias dimension, the argument for a bias disadvantage with private enforcement is due to its profit-seeking motive. Will a private enforcement institution adjudicate impartially when hearing a dispute between an important client and a smaller disputant? Despite the presence of anecdotal arguments favoring both arbitration and courts, there is virtually no hard evidence on these institutions' relative merits.[1] The empirical work in this paper makes a first attempt to fill this gap with evidence-based analysis.

[1] Indeed, there is even disagreement among practitioners regarding the relative cost of arbitration versus courts the other (see, e.g., Price Waterhouse Coopers (2006)).

My findings regarding public versus private enforcement are as follows: (i) Contracts are vaguer when they are enforced through private enforcement channels and (ii) Firms that enforce a greater fraction of their contracts through private enforcement channels renegotiate a smaller share of their contracts as well. In light of the model developed in the paper, this suggests a quality interpretation to the evidence. If one takes the model seriously, this evidence is *only* consistent with a world where private enforcement has a quality advantage over public enforcement. Recall, the model allows for the possibility of unobserved complexity differences across projects and is agnostic about how this complexity varies across enforcement institutions.

This enforcement evaluation exercise assumes that my contracting model is valid. Therefore, I try to support this assumption by testing my model's main predictions. In particular, I explore the joint comparative statics of the model. Regarding the enforcement quality comparative statics, I exploit heterogeneity in public enforcement institutions within the US by comparing Delaware and New York courts to other courts in the US. Delaware and New York are widely viewed by practitioners as specialists in the area of business litigation among public forums. Assuming that Delaware and New York are of higher quality than the other US courts, I then find that, consistent with my model, both courts are associated with systematically higher levels of contract vagueness. Moreover, contracts enforced in New York courts are renegotiated less often as well. Indeed, when comparing patterns across private enforcement, New York, Delaware and other public enforcement institutions in my domestic contracts sample, I find no differences in vagueness between private enforcement, New York, and Delaware. This suggests that while private enforcement may have a quality advantage over courts in states like Illinois or Oklahoma, there is no evidence that this quality advantage exists relative the the "best" public enforcement institutions.

I also attempt to test the complexity comparative statics of my model. Validating these predictions is important since they are fundamental for identification in my methodology for enforcement evaluation. Unfortunately, testing these complexity predictions is particularly challenging because measuring all dimensions of underlying project complexity is impossible. In order to capture meaningful observable variation in project complexity, I focus on the subsample of licensing contracts in my database because these contracts have the distinction of including both projects that require further product development and projects that do not. I consider projects that involve further product development as more complex and find that contracts covering these projects are vaguer even after controlling for enforcement institution type. The evidence on renegotiation rates is somewhat mixed: the relationship between complexity and renegotiation rates is either statistically positive (in public enforcement) or statistically indistinguishable from zero (in private enforcement).

At a minimum, the empirical evidence provided in this paper establishes previously undocumented facts

regarding the use of vagueness across contract enforcement institutions and, relatedly, the likelihood of renegotiation across these institutions. While I attempt to develop an economic framework for drawing interpration from these facts, this interpretation should be understood as speculative and exploratory. The evidence provided herein is supportive of the predictions of the model but it is far from conclusive. Nonetheless, I believe the documented facts, including the enforcement evaluation results, are relevant to better understanding the determinants of contract design and add some hard much needed evidence to the debate on public versus private enforcement.

## 1.3 Related Literature in Economics

### 1.3.1 Related Theoretical Work

The model on contract vagueness is related to research that emphasizes transactions costs in contracting. The specific formulation of transaction costs used in this paper is closest to Bajari-Tadelis (2001). To keep the model as simple as possible, it abstracts from nuances like private contemplation by the principal and the agent which can lead to endogenous asymmetric information (Bolton and Faure-Grimaud (2009)) or the foundations of contract writing costs (e.g., Anderlini-Felli (1994), Battigali-Maggi (2002)). This paper contributes to this literature by theoretically exploring the relationship between transaction costs and contract vagueness.

The model emphasizes the role of contract vagueness in allocating authority to adjudicators. As a result, it is related to a few papers that study the role of adjudicator discretion in contracting. The reduced-form way that I model this discretion is similar to the approach used by Ayotte-Yun (2009). However, they focus on optimal bankruptcy procedures where the government chooses the optimal authority allocation and where parties take this allocation of authority as given when designing contracts. It should be noted that the modelling approach employed here abstracts away from the impact of contracts on an adjudicator's endogenous knowledge (e.g., Bernardo-Talley-Welch (2001), Dewatripont-Tirole (1999)) and on his willingness to act appropriately on the basis of this knowledge (e.g., Bond (2008), Tirole (1986)). This paper contributes to this literature by exploring the degree of adjudicator authority in contracts as chosen by contracting parties.

Relatedly, a body of work in organizational economics studies the allocation of authority in organizations (e.g., centralizated versus decentralized decision-making). This paper is most closely related to the strand of this literature that characterizes this choice as involving a trade-off between expertise and bias in decision-making (e.g., Dessein (2002), Harris-Raviv (2005), Alonso-Dessein-Matouschek (2008)). Relative to these papers, my model allows for richer contracting options while incorporating a more realistic formulation of transactions costs. However, as pointed out earlier, it also neglects endogenous decision-maker expertise by abstracting away form the cheap talk framework used in these models. Interestingly, by exploring dynamic considerations (i.e., renegotiation) and patterns in the data, this paper may provide evidence that is further supportive of the micro-foundations of this delegation literature. In this sense, it also complements

empirical work that is consistent with the static predictions of this literature (e.g., Acemolgu et al. (2007), Bloom-Sadun-Van Reenen (2009)).

On the topic of renegotiation, the model is related to the literature on the role of renegotiation in settings with non-verifiable information (e.g., Hart-Moore (1998)). In particular, the paper is closest in spirit to Garleanu-Zwiebel (2009) which models the renegotiation of debt contracts in states where covenants are violated and creditors have control. Their model is also driven by costly contracting considerations, however, my model differs from theirs since it focuses on delegating control to a third-party adjudicator rather than to one of the contracting parties. My model also abstracts away from the use of renegotiation design (e.g., prohibition, asymmetric penalties for renegotiation occurence or delay) to overcome efficiency problems associated with non-verifiability (e.g., Aghion-Dewatripont-Rey (1994)).

### 1.3.2 Related Empirical Work

This paper is related to prior empirical work in contract economics. Regarding the relationship between legal institutions and contracts, Lerner-Schoar (2005) document that private equity contracts in countries with higher enforcement scores are more state contingent and are associated with higher deal valuations. Qian-Strahan (2007) find that loans in countries with greater creditor protections are more concentrated, have longer maturities, and lower interest rates. My evidence complements these works in two ways: (i) it studies a new dimensions of contracts, namely, contract vagueness, and (ii) it compares public versus private enforcement rather than public enforcement across different countries. Regarding renegotiation, Roberts-Sufi (2009), Chava-Roberts (2008) as well as others document evidence that is consistent with the transactions-cost model developed by Garleanu-Zwiebel (2009). My evidence complements theirs by relating renegotiation rates across enforcement institutions and showing that it is also consistent with a related transactions cost framework. However, both my model and empirical analysis abstract away from the interactions between internal (implicit) and external (explicit) enforcement. For some evidence on internal enforcement, see Banerjee-Duflo (2000) which explores the role of reputation in shaping contracts.

More ambitiously, this paper also attempts to provide new empirical empirical support for incomplete contracting theories in the spirit of Williamson (1975, 1985). Existing empirical work in this area has generally focused on ownership design issues like vertical integration (e.g., Masten (1984), Joskow (1985), Baker-Hubbard (2003, 2004)). These papers generally lend support to transaction cost theories like Klein-Crawford-Alchian (1978), Grossman-Hart (1986), and Hart-Moore (1990). However, with the exception of Lerner-Malmendier (2010), this literature does not focus directly on contracts data. The emphasis herein on documenting empirical patterns in contract vagueness may be a relevant to this literature. In particular, one can argue that contract vagueness is a measure of contractual incompleteness since vague contract terms cover states that were not "completed" through the use of precise contract terms. In this sense, contract vagueness might be a *measurable* form of incompleteness and this may allow for tests of incomplete contract

theories that use a richer and fuller snapshot of contracts data.

# 2 Background

## 2.1 Vague Contract Terms and Adjudicator Authority

The use of vague terms in contracts is extremely common. While this will be illustrated within my sample of contracts in Table 2, this observation would not come as a surprise to legal scholars and transactional lawyers. For instance, as E. Allen Farnsworth commented in his famous treatise on contracts (Farnsworth (2004)):

> "It is a rare contract that requires no interpretation... Contract language abounds in examples of vagueness."

As Stark (2007) has pointed out, few transactional lawyers view vagueness as necessarily a problem in contracting (i.e., an indication of bad contracting practices). Indeed, it can be seen as good or bad depending on the characteristics of a transaction and the contingency in question.

In particular, a commonly cited advantage of vague contract terms is the reduction of ex-ante contracting costs. The disadvantages mentioned involve a variety of ex-post costs that can take a many different forms. For instance, Scott-Triantis (2006) argue that contract vagueness involves higher litigation costs. Relatedly, Kaplow (1992) posits a similar set of trade-offs in choosing between the establishment of rules versus standards in the context of legislation. Consistent with an analogous trade-off in contract design, it has been remarked by Burton (2009) that:

> "parties tend to communicate in detail only about the most salient parts of their contract. As possibilities seem more remote... the parties tend to express themselves, if at all, with less clarity and completeness."

Only in salient and frequent states is it worthwhile for parties to "figure out" all the details and implications of these states and to express them precisely. These observations motivate the inclusion of ex-ante contracting costs and ex-post inefficiencies in my model.

According to my reading of contract law and contract interpretation, vague contract terms convey more discretion to adjudicators than precise contract terms (see, e.g., Farnsworth (2004), Burton (2009)). In essence, a vague contract term invites an adjudicator to decide the precise meaning of an implied standard or to the "spirit of a contract". The adjudicator has some liberty in doing this, especially when a project involves relationship-specific factors (as is generally the case in my sample of contracts). As Farnsworth (2004) remarks:

> "In its search for meaning, the court is free to look at all the relevant circumstances surrounding the transaction. This includes the state of the world, including the state of law, at the time. It also includes all writings, oral statements, and other conduct by which the parties manifested their assent, together with prior negotiations between them and any applicable course of dealing, course of performance, or usage."

As Scott-Triantis (2006) point out, contracting parties can delegate the choice of evidentiary proxies, which are used to map standards into rules, to courts by using vague contract language.[2] The same observation holds true in private enforcement venues. To be clear, no one argues that precise contract terms provide no discretion to adjudicators. There is always some room for fact discretion regarding, for instance, what actions took place. However, the enforcement of a vague term conveys both this type of fact discretion and discretion on meaning. The latter is likely to leave more room for interpretation because judging on meaning technically requires an assessment of counterfactuals. For example, determining whether a given product development strategy was "profit-maximizing" requires an estimate of the profits that would have been generated by every other strategy that was not undertaken. To simplify the analysis, my model will build from these observations but will also make the distinction between vague and precise terms in a stark manner: vague terms will provide complete discretion to the adjudicator while precise ones will provide none.

Also relevant in the discussion of vagueness is contracting parties' intent when writing a vague contract term. I view a vague term as a desire by contracting parties for the adjudicator to impose or require a first-best action to be taken. In fact, contracting parties occasionally explicitly demand this in their contracts. For example, in my sample, a 2004 licensing contract between Novodaq Technologies Inc. and Akorn Inc. explicitly provides a definition for its most prominent vague term. Namely, the contract specifies that:

> "Commercially reasonable efforts shall mean *efforts and resources normally used by a party for a compound or product owned by it...* which is of similar market potential at a similar stage in its product life, taking into account the competitiveness of the marketplace, the proprietary position of the compound or product, the regulatory structure involved, the profitability of the applicable products, and other relevant factors."

I've added the emphasis using italics to draw the reader's attention to the key content of this definition. Specifically, the reference to an action that would be taken by the agent if he were the principal (i.e., owner) closely resembles the canonical definition of first-best actions.

Of course, while an adjudicator can be asked to rule on the basis of the first-best, he cannot be forced to do so. This is due to two reasons: (i) he may be incapable of meeting this lofty request or (ii) he may be unwilling to do so. His inability to impose first-best actions on parties stems from his limited knowledge.

[2] However, Scott-Triantis (2006) also document examples that suggest this allocation of authority is not perfect and is somewhat nuanced. The stark description of ruling on vague contract terms provided herein should be viewed, more accurately, as a probabilistic statement: vague contract language is more likely to lead to discretion by adjudicators in enforcing a contract.

The ability to determine what's first-best in a given situation is likely to be limited by ex-post informational asymmetries between the adjudicator and the contracting parties. Importantly, this ability is likely to vary across adjudicators. For instance, adjudicators with related industry experience are more likely to draw meaningful inference regarding the first-best through the use of internal logic (e.g., thought experiments) and external comparables (e.g., evidentiary proxies). Meanwhile, the idea that an adjudicator cannot be forced to rule on the basis of his belief stems from the observation that mental states cannot be verified.

Clearly, there are other ways for contracting parties to allocate authority to adjudicators. They could express this explicitly. However, this is not done in practice. This is probably due to the fact that writing "Party A must undertake $a$ appropriately where the meaning of appropriate is to be judged by the adjudicator" is equivalent to writing "Party A must undertake $a$ appropriately". A more problematic alternative to vagueness is the use of gaps in contracts (see, e.g., Ayres-Gertner (1989, 1992)). Rather than writing "Party A must undertake $a$ appropriately", parties could simply write nothing at all about this action. However, a problem with this approach is that it pools $a$ with all the other gaps in the contract. As a result, how would an adjudicator distinguish action $a$ from another action $b$ that contracting parties might not want to restrict at all? Certainly, there are actions that parties don't want to restrict ex-ante but might want to restrict ex-post. Gaps do not address this but contract vagueness can. Thus, contract vagueness may be a clearer way than gaps to allocate authority to adjudicators.

To summarize, I believe there is a reasonable basis for most of the fundamental assumptions that I will make in my model (see Section 3). These assumptions are: (i) costly contracting at both the initial drafting and renegotiation stages, (ii) contract vagueness is the mechanism of choice for allocating authority to adjudicators in imposing or requiring first-best actions, and (iii) adjudicators differ in their ability and willingness to exercise this authority in a desirable way.

## 2.2 Dispute Resolution Clauses in Contracts

Almost every important business contract includes an explicit set of dispute resolution clauses governing how parties are to proceed through a dispute. These clauses most notably specify whether a contract is to be enforced in public or private enforcement (i.e., court or arbitration). Moreover, these clauses can also require parties to resolve certain disputes internally (with one party having more control than another in the eventual decision) or with third-party non-legal institutions like testing laboratories. The contract can also impose mediation and other pre-litigation negotiation procedures.

An important observation about these clauses is that they are written into a contract before a dispute arises between contracting parties. As a result, I can determine the default contract enforcement institution that would be used in the event of a dispute by looking at the details of these dispute resolution clauses. This observation is fundamental to my ability to explore the relationship between contract enforcement

institution and contract vagueness and renegotiation patterns. The reason I can do this is the existence of a wide body of statutory and case law indicating that these clauses are enforceable in a court of law. Most notably, in the US Code, the Federal Arbitration Act of 1925 provides that a clause to arbitrate future disputes is "valid, irrevocable and enforceable".[3] Similar laws exist in most other countries, especially in the context of international business transactions (see, e.g., parties to the New York Convention of 1958). Put simply, if a contract states that you are to resolve a dispute in arbitration, you will resolve it there even if you would prefer going to a court ex-post (so long as the other party holds you to this commitment). It is my understanding that these enforceability clauses also apply to other forms of alternative dispute resolution though I will not explore these other alternatives in my empirical analysis.

# 3 A Model of Optimal Contract Vagueness

## 3.1 The Agency Problem and Contracting Technology

A principal must hire an agent to implement a project. Both the principal and the agent are risk-neutral. The agent has no initial wealth, an incremental outside option of zero, and enjoys limited liability protections. The principal is not wealth constrained. Project implementation involves taking one of three verifiable physical actions, i.e., $a \in \mathcal{A}^p = \{a_1, a_2, a_3\}$. As a concrete example, we can think of a licensing setting where a biotech research firm delegates the commercialization and distribution of one of its patented drugs to a pharmaceutical development and distribution firm. The latter (downstream) firm can direct its focus to one of three potential activities: improving existing applications of the drug, developing new applications of the underlying compound used in the drug, or improving the marketing of the drug.

At the time of initial contracting ($t = 0$), there is uncertainty about the optimal course of action and a known conflict of interest between principal and agent. In particular, in each verifiable *public* state $s$ (to be defined below), a *meaning* state is drawn by nature from the set $\mathcal{A}^m = (\mathcal{A}^p)!$ where $(X)!$ denotes the set of all permutations of a set $X$. A generic meaning state is denoted by the triple $(a'_s, a^*_s, a''_s)$ and this triple defines, for state $s$, which action from $\mathcal{A}^p$ is efficient and which ones are inefficient as described in equations (1) to (3) below. Thus, the meaning state defines the meaning of each physical action in efficiency terms. The probability distribution over the set $\mathcal{A}^m$ is assumed to be uniform for every $s$. Given the realized state $\omega = \{s, (a'_s, a^*_s, a''_s)\}$, the distribution of revenues for the project when the agent selects action $a$ is:

$$\tilde{V} = \begin{cases} V & \text{w.p. } q(a,\omega) \\ \\ 0 & \text{otherwise} \end{cases} \qquad \text{with} \qquad q(a,\omega) = \begin{cases} q' & \text{if } a = a'_s \\ \\ q^* & \text{if } a = a^*_s \\ \\ q'' & \text{if } a = a''_s \end{cases}, \tag{1}$$

[3] Chapter 1, Section 2 of the Federal Arbitration Act, Title 9, US Code, Section 1-14 (1925).

where $q' > q^* > q''$. The agent's private cost of implementing this action is:

$$C(a,\omega) = \begin{cases} C' & \text{if } a = a'_s \\ C^* & \text{if } a = a^*_s \\ C'' & \text{if } a = a''_s \end{cases}, \tag{2}$$

where $C' > C^* > C''$. As is standard in the literature, $\tilde{V}$ is verifiable while $C$ is not. Thus, if the contract specifies fixed payments from the principal to the agent, the principal will strictly prefer that action $a'_s$ be selected while the agent will strictly prefer actions $a''_s$. Consequently, I refer to these actions as principal-preferred and agent-preferred, respectively. In terms of efficiency, I further assume that:

$$NPV^* \equiv q^* \cdot V - C^* \geq q' \cdot V - C' = q'' \cdot V - C'' \equiv NPV^{\neg}. \tag{3}$$

Thus, action $a^*_s$ is always optimal. I choose this formulation to obtain a conflict of interest in all states and to guarantee that both parties pick inefficient actions when they have authority under a contract that has no payoff-based contingencies.

The principal designs the initial contract and makes a take-it-or-leave-it offer to the agent. If he knew the identity of $a^*_s$, he could easily overcome the conflict of interest problem in state $s$. For instance, if he knew that $a^*_s = a_3$ (e.g., improve marketing of the drug), he would include the following term in the contract: "Take action $a_3$ in state $s$ and I will pay you $C^*$ for doing so. Otherwise, I will pay you zero." I refer to such a contract term as a *precise action-based clause*. This contract term would be enforceable since both $a$ and $s$ are verifiable, the agent would accept this term since he breaks even, and the principal would capture all the surplus of the project. However, this first-best solution is ruled out by a form of contracting costs: *contemplation costs*. In order to figure out $a^*_s$ for a measure $m$ of the public states, the principal must bear a private cost $k \cdot m$ where $k > 0$. To avoid endogenous information asymmetries at the contract design stage, I assume that the principal can costlessly and credibly communicate his knowledge of $a^*_s$ to the agent. This allows for the simplest possible analysis of the determinants of contract vagueness with a focus on the role played by enforcement and project characteristics.

Since these contracting costs are borne per unit of state $s$ that is contemplated, the probability distribution of $s$ matters in the principal's contract design problem. For tractability, I assume that $s$ is drawn from $\Omega = \mathcal{R}$, and that its probability distribution is exponential with parameter $\mathcal{C} > 0$. This parameter is interpreted as a measure of project complexity since higher values of $\mathcal{C}$ are associated with greater likelihoods of low probability states. Namely, using $f$ to denote the density of $s$, we have:

$$\Pr\left(f(\tilde{s}|\mathcal{C}) \leq p\right) = \mathcal{C} \cdot p, \tag{4}$$

which increases with complexity regardless of the density threshold $p$. This parametrization conforms with the commonly found modelling assumption that complex projects involve more frequent realizations of rare

and nonstandard contingencies (see, e.g., Bajari-Tadelis (2001)).

In addition to the possibility of writing precise action-based clauses in a given state, the principal has other contracting options at his disposal in this state as well. As is normally the case in contracting models, he can design *precise payoff-based clauses* that give authority to the agent or to himself in picking $a$ but attempts to incentivize the controlling party to pick $a^*$. Most interestingly, the principal also has vague contracting options. He can offer a *vague action-based clause* that, for simplicity, is assumed to involve the adjudicator picking an action for the contracting parties. This can be interpreted as a vague contract term that describes a standard on actions and is accompanied by a requirement of specific performance. He can also offer *vague payoff-based clauses* that formally give control to either himself or the agent but differ from precise payoff-based clauses in that they condition payments to the agent on both project payoffs and the adjudicator's decision regarding whether the action taken by the agent is efficient or not.

I model the adjudicator's decision-making in a state covered by a vague term in a reduced-form fashion. In particular, the adjudicator's discretion is represented as a statistical machine who's distribution is parametrized by two fundamental characteristics of the adjudicator: his expertise ($e$) and his bias ($b$). In particular, when an adjudicator is given authority over choosing an appropriate action, his decision is determined as follows:

- **Adjudicator's Preference:** With probability $b$, he is biased and always favors the agent (or, equivalently, the status quo).[4] In this case, he will state that the first-best action is $a''_s$. The remainder of the time, he is neutral and will impose state the the first-best action is $\hat{a}_s$ where $\hat{a}_s$ is the adjudicator's belief about what the optimal action is (see next bullet). The variable $b$ serves as a proxy for adjudicator bias.

- **Adjudicator's Belief:** Through an unmodeled litigation process, the adjudicator forms a posterior belief about what action is optimal in the realized state. With probability $e$, the adjudicator's posterior belief is correct (i.e., $\hat{a}_s = a^*_s$). The remainder of the time, the adjudicator is equally likely to believe that $a'_s$ and $a''_s$ are the optimal actions. In other words, the adjudicator can make errors but these errors don't systematically favor one party or the other. The variable $e$ serves as a proxy of adjudicator expertise.

[4] Alternatively, he could favor the agent with probability $\lambda$. For bias to matter in determining contract vagueness (which is not essential in the points I make), it is important that the adjudicator occasionally have a bias towards the agent. Why? If adjudicator bias favors the principal always, parties can contract around the adjudicator's bias by conditioning payoffs on successful outcomes and the adjudicator's assessment of the appropriateness of the agent's action. This allows parties to take advantage of the adjudicator's expertise without suffering from his bias. The intuition behind this fact is that, in the optimal contract, payoffs to the agent will only occur in states where it is *guaranteed* that the adjudicator thinks the agent did the right stuff. Of course, this is an unrealistic modelling feature and there are different ways to work around this: (i) Make $b$ uncertain and have it revealed after contract signing but before actions, (ii) Add agent risk-aversion, and (iii) Impose limited principal wealth.

The realizations of randomness on the adjudicator's preferences and beliefs are assumed to be independent. As a result, in the case of a vague action-based term, the adjudicator exercises authority by imposing action $\hat{d}_s$ according to the following distribution in state $s$:

$$\hat{d}_s = \begin{cases} a'_s & \text{w.p. } \frac{(1-b)\cdot(1-e)}{2} \\ a^*_s & \text{w.p. } (1-b)\cdot e \\ a''_s & \text{w.p. } b + \frac{(1-b)\cdot(1-e)}{2} \end{cases} . \tag{5}$$

From an ex-ante perspective, the perfect adjudicator has $e = 1$ and $b = 0$. A value of $e = \frac{1}{3}$ implies no expertise.

In this setting, both the expertise and bias parameters are taken as exogenous and, in particular, do not depend on the details of the contract. This assumption is not necessarily realistic. As pointed out by Bond (2007) and Tirole (1986) in a related supervisor model, the presence of high-powered incentives can encourage more aggressive influence activities by the contracting parties towards the adjudicator (e.g., via more frequent or larger bribes) and, consequently, can increase bias. Secondly, litigation influences both bias and expertise and I make no attempt to model a litigation game in this setting. Bernardo-Talley-Welch (2000) consider a reduced-form litigation game in contracts-based dispute resolution while Dewatripont-Tirole (1999) present a model suggesting that the design of a litigation game likely matters in determining information production (i.e., the adjudicator's expertise). Finally, the reduced-form model abstracts away from the source of adjudicator bias and, as a result, cannot address the question of whether adjudicator incentives or reputation can be exploited to induce more neutral decision-making (e.g., using mechanisms like adjudicator compensation or appeals processes). Put simply, while my stylized setting captures several elements that seem important in most contracting environments (especially as they related to contract vagueness, see Section 2), it nevertheless ignores potentially important and realistic features of a contract enforcement technology. Further analysis along these lines is beyond the scope of this paper.

## 3.2 Optimal Contract Vagueness Without Renegotiation

When actions take place ($t = 1$), both the principal and the agent have become aware of the realized state $\{\omega, (a'_s, a^*_s, a''_s)\}$. As mentioned earlier, if state $s$ was contemplated at $t = 0$, the contract will cover this state with a precise action-based term that implements the efficient action $a^*_s$. Thus, the only states that need to be analyzed formally are those that are not contemplated at the time of initial contract writing. For now, we will assume that parties cannot renegotiate after the contract is first written and will delay the analysis of the renegotiation case to Section 3.4.

As a first step in the analysis, I will determine the principal's payoff loss for each type of contract used in a generic non-contemplated state. To avoid degenerate contracts, I will assume that it is never

optimal to impose a precise action-based contract in an uncontemplated state (i.e., to "cluelessly" provide detailed contingencies for all states). A sufficient condition for guaranteeing this is the parameter restriction $(1-b)\cdot e > 1/3$. Thus, I assume that adjudicators are (in some combination) sufficiently smart and sufficiently neutral.

If state $s$ is covered by a vague action-based term, the principal's payoff loss is easy to calculate. With probability $(1-b)\cdot e$, the adjudicator imposes the efficient action and there is no ex-post inefficiency. Otherwise, the adjudicator imposes one of the inefficient actions and the payoff is $NPV^{\neg}$ rather than $NPV^{*}$ (see equation (3) for notation). The principal binds the agent to his participation constraint by offering him a wage equal to:

$$\left(\frac{1-e}{2}\right)\cdot C' + [(1-b)\cdot e]\cdot C^{*} + \left(b + \frac{1-e}{2}\right)\cdot C''. \tag{6}$$

Therefore, the possibility of loss due to inefficient actions being imposed by the adjudicator is the only source of payoff loss for the principal. This implies that:

$$L^{VA}(e,b) = [1-(1-b)\cdot e]\cdot(NPV^{*} - NPV^{\neg}) \tag{7}$$

where $L^{VA}(e,b)$ denotes the principal's expected payoff loss in state $s$ when that state is not contemplated ex-ante. Reference to the state $s$ is suppressed in this loss function since all parameters are assumed to be constant across states. Clearly, $L^{VA}$ is decreasing with $e$ and increasing with $b$. This should not surprising since increasing $e$ makes it more likely that the adjudicator will impose the efficient action while increasing $b$ makes this event less likely.

In order to simplify the analysis of the principal's payoff loss in the case of payoff-based terms, I assume that the agent cannot be forced by the principal to stay on the job (as is the case in Holmstrom-Harris (1982)).[5] This allows me to ignore the unrealistic possibility of using wages in contemplated states to subsidize the provision of incentives in the states that are not contemplated. This assumption is not critical to the qualitative results of the model but, quantitatively, dropping it would lead to increased precision in contracts since, at the margin, contemplating an additional state $s$ would now directly eliminate rents in that state while indirectly reducing rents in non-contemplated states covered by payoff-based terms. This subsidization would be accomplished by setting the agent's wage equal to zero in the contemplated state.

If state $s$ is covered by a precise payoff-based term, the principal's payoff loss will be entirely due to the rent the agent enjoys in an incentive-compatible (IC) contract. We can focus on IC contracts because a payoff-based term that is accepted by the agent but is not IC must be strictly worse for the principal than a precise action-based term that is not contemplated. Moreover, given the no slavery condition described above, the principal cannot use the rents provided in this state to lower wage payments in others. Hence,

[5] To keep the analysis consistent with the case of action-based terms, I assume that the adjudicator can force the agent to stay on the job to implement action $\hat{d}_s$.

the principal's payoff loss equals the full rent enjoyed by the agent. The rent in the precise payoff-based case is standard in the literature on moral hazard with limited liability:

$$L^{PP} = \frac{C^* - C''}{1 - \left(\frac{q''}{q^*}\right)}. \tag{8}$$

Unsurprisingly, this quantity is unaffected by the adjudicator's characteristics because it doesn't rely on adjudicator authority at all.

Similarly, if state $s$ is covered by a vague payoff-based term, the principal's payoff loss will again be due to the rent enjoyed by the agent in a new IC contract. As is standard in the contracting literature (e.g., Holmstrom (1979)), the decision of how to provide incentives reduces to a search for informative events in the verifiable state space. In this case, the verifiable states are: (i) High payoff and adjudicator says action was efficient, (ii) High payoff and adjudicator says action was inefficient, (iii) Low payoff and adjudicator says action was efficient, and (iv) Low payoff and adjudicator says action was inefficient. In nonlinear payoff contracts with agent limited liability like this one, it can be shown that the optimal contract provides all payoffs to the agent in the event who's probability is most sensitive to taking the good versus the bad action. In other words, if $q(a, E)$ is the probability of event $E$ given action $a$, the second-best contract will pick the event $\hat{E}$ so as to maximize the likelihood ratio $q(a^*, \hat{E})/q(a'', \hat{E})$. The contract will then provide all payoffs necessary to satisfy the agent's IC constraint in this event. In the case of vague payoff-based terms, the event that maximizes the likelihood ratio is the verifiable state (i). Thus, the contract will set:

$$W_V^{\neg} = W_0^* = W_0^{\neg} = 0 \tag{9}$$

where $W_{\hat{V}}^{\hat{d}}$ denotes the payoff to the agent conditional on the realization of project payoffs and adjudicator statements about efficiency. Consequently, the contract will set the agent's IC constraint to bind as follows:

$$\begin{aligned} [b \cdot q^* + (1-b) \cdot e \cdot q^*] \cdot W_V^* - C^* &= \left[b \cdot q'' + (1-b) \cdot \left(\frac{1-e}{2}\right) \cdot q''\right] \cdot W_V^* - C'' \qquad (10) \\ &\Downarrow \\ L^{VP}(e,b) &= \frac{C^* - C''}{1 - \left(\frac{q''}{q^*}\right) \cdot \left(\frac{b+(1-b)\cdot\left(\frac{1-e}{2}\right)}{b+(1-b)\cdot e}\right)} \qquad (11) \end{aligned}$$

where $L^{VP}$ denotes the principal's payoff loss due to the vague payoff-based term.

From the analysis above, it follows that a vague payoff-based clause dominates a precise payoff-based one since:

$$\frac{b + (1-b) \cdot \left(\frac{1-e}{2}\right)}{b + (1-b) \cdot e} < 1. \tag{12}$$

The intuition for this result is that the adjudicator's stated belief regarding efficiency is informative due to his expertise and should be used regardless of his bias.[6] As $e$ increases, the informativeness of the adjudicator's decision in the state where a payoff is given to the agent (as measured by the likelihood ratio)

[6] Note that when $b = 1$, the vague payoff-based contract becomes equivalent to a precise payoff-based contract.

increases while it decreases as $b$ becomes larger. Thus, similar to $L^{VA}$, the expected loss $L^{VP}$ decreases with $e$ and increases with $b$.

When choosing not to contemplate a state $s$ at $t = 0$, the principal will choose the contracting option that minizes his loss conditional on that state. As a result, he will either choose to write a vague action-based clause or a vague payoff-based clause where the precise form of vagueness depends on whether $L^{VA}$ or $L^{VP}$ is smaller. As a result, the actual loss conditional on this state $s$ can be written as:

$$L(e, b) = \min\{L^{VA}(e, b), L^{VP}(e, b)\}. \tag{13}$$

For the purposes of characterizing the optimal contract, the only thing that will be relevant about $L(e, b)$ is that it is decreasing with $e$ and increasing with $b$.

Once we've computed the loss associated with not contemplating a particular state conditional on this state being realized, we can turn to the optimization problem at $t = 0$ and determine the optimal amount of vagueness in the contract. Namely, when choosing whether or not to contemplate for a state $s$, the principal compares the gain from contemplating (i.e., the loss saved conditional on $s$ occuring multiplied by the probability of state $s$ occuring) to the cost of contemplating. Only when the former is larger does he contemplate about $s$. Thus, the principal will contemplate for all states where:

$$\begin{aligned} k &\leq f(s|\mathcal{C}) \cdot L(e, b) && (14) \\ &\Downarrow \\ s &\leq \underbrace{-\mathcal{C} \cdot \ln(\mathcal{C} \cdot k \cdot Q(e, b))}_{\text{Precision Threshold } (s^*)}, && (15) \end{aligned}$$

where $Q(e, b)$ is defined as 1 divided by $L(e, b)$ and measures the quality of the contract enforcement institution. The motivation for measuring quality using $Q$ comes from the fact that the net payoff to the principal can be shown to strictly increase in its value. Since I'll be focusing on contract enforcement quality rather than on $e$ and $b$ individually in my empirical analysis (since they cannot be separated in my model), I will now suppress the values of the individual adjudicator characteristics in most of the description of the optimal contract.

Given the expression for the precision threshold in equation (15), we can compute the probability measure of the states that are not contemplated. If $k \cdot Q \leq 1/\mathcal{C}$, we get:

$$\begin{aligned} \mathcal{V} &= \int_{s^*}^{\infty} f(s|\mathcal{C})ds \\ &= k \cdot \mathcal{C} \cdot Q. && (16) \end{aligned}$$

where $\mathcal{V}$ denotes the likelihood of the states where the contract leaves terms as vague. If $k \cdot Q > 1/\mathcal{C}$, the contract is entirely vague. In the first case, optimal contract vagueness is increasing with both project

complexity ($\mathcal{V}_{\mathcal{C}} > 0$) and the quality of the adjudicator ($\mathcal{V}_Q > 0$). We are now ready to summarize the economically meaningful features of the optimal contract:

**Proposition 1 (Optimal Contract Vagueness w/o Renegotiation)** *If $k \cdot Q < 1/\mathcal{C}$, the optimal contract satisfies the following properties:*

1. *The most likely states, namely those with $s \leq s^*$ (as defined by equation (15)), are the ones that are contemplated. Every contract is at least partially vague.*
2. *For each contemplated state $s$, the contract specifies a precise action-based term requiring the agent to take the action $a_s^*$ and paying the agent $C^*$ for doing so.*
3. *For each state $s$ that is not contemplated, the contract uses a vague contract term. If $L^{VA} < L^{VP}$, all vague terms in the contract are action-based. Otherwise, the vague terms are payoff-based.*
4. *The optimal vagueness of the contract, defined as the probability measure of vague contract terms, is given by $\mathcal{V} = k \cdot \mathcal{C} \cdot Q$.*
5. *Optimal contract vagueness increases with project complexity ($\mathcal{V}_{\mathcal{C}} > 0$) and with adjudicator quality ($\mathcal{V}_Q > 0$).*

*Meanwhile, if $k \cdot Q > 1/\mathcal{C}$, the contract contains no precise terms and optimal contract vagueness equals 1. Thus, the level of optimal contract vagueness is unaffected by marginal changes in project complexity or adjudicator quality .*

As discussed in the introduction, I will try to evaluate the quality of contract enforcement institutions using empirical patterns in the use of contract vagueness across these institutions. Proposition 1 highlights the fundamental problem with interpreting patterns in this way using only data on contract vagueness: there is an identification problem when some aspects of project complexity are unobservable. If contracts to be enforced in one institution (e.g., arbitration) are systematically vaguer than those enforced in another (e.g., courts), is this due to the first institution being of higher quality than the other or is this due to the fact that it enforces the contracts of systematically more complex projects? One approach to answering this question is to come up with predictions regarding other observables that distinguish between complexity and quality effects. This motivates my extension of the modelling framework to allow for contract renegotiation.

## 3.3 Optimal Contract Vagueness and Renegotiation Probabilities

I now assume that parties can renegotiate contracts just before actions are taken ($t = 1^-$). At this time, both parties know the realized state $s$. However, the principal must bear a cost $\tilde{K} \sim U[0, K^{\max}]$ to renegotiate where $K^{\max} > L^{VA}$. The quantity $\tilde{K}$ may be interpreted as a stochastic contemplation cost or as another renegotiation-based transaction cost.

If the principal chooses to renegotiate, I assume that any efficiency gains (net of the cost $\tilde{K}$) are shared between the principal and the agent. Namely, the principal enjoys a share $\alpha$ of these gains. With the exception of the stochastic cost $\tilde{K}$, the qualitative nature of the renegotiation results do not depend on the details of this renegotiation process. In particular, the result is robust to all values of $\alpha$ and also to allowing the agent to hold-up the principal's interim renegotiation cost. The choice of assumptions is only made for analytical convenience.

In this section, I will also assume that the principal can only contract using vague action-based clauses. It will turn out that this assumption is without loss of generality if:

$$L^{VA} \cdot \left[1 - \frac{\alpha}{2} \cdot \left(\frac{L^{VA}}{K^{\max}}\right)\right] < L^{VP}. \tag{17}$$

However, this condition is not always met. In cases where equation (17) does not hold, the restriction to vague action-based clauses is needed because vague payoff-based clauses would be preferred by the principal ex-ante and would lead to different renegotiation patterns. Namely, within the specific context of the model, vague payoff-based terms are never renegotiated! This is due to the fact that the agent is already going to select $a_s^*$ in this state and, thus, there are no ex-post gains to be enjoyed from renegotiation. Put differently, the principal's payoff loss $L^{VP}$ consists entirely of a rent appropriated by the agent and no form of renegotiation will help the principal get this rent back. It is essentially a sunk cost at $t = 0$.[7]

Given these assumptions, renegotiation occurs in a "vague state" when $\tilde{K} \leq L^{VA}$. As a result, the probability of renegotiation conditional on a vague state is given by:

$$\mathcal{R} = \int_0^{L^{VA}} \left(\frac{1}{K^{\max}}\right) \cdot dK = \frac{L^{VA}}{K^{\max}} = \frac{1}{K^{\max} \cdot Q}. \tag{18}$$

Thus, the conditional renegotiation probability decreases with adjudicator quality and does not change with project complexity. The logic behind this result is straightforward: the better the contract enforcer, the better he adapts to meaning in all states and the smaller the benefit to renegotiation. As a result, when renegotiation is costly, it will occur less often. Interpreted more broadly, this suggests that vague contract terms become progressively more *self-adapting* as the quality of the adjudicator increases. Indeed, in the extreme case where $e = 1$ and $b = 0$ (i.e., where the adjudicator is perfect and effectively makes meaning verifiable at zero cost), the optimal contract is vague in every state, is perfectly self-adapting, and never gets renegotiated.

However, the renegotiation probability conditional on a vague state occuring (which is not observable to the econometrician) is not the same as the renegotiation probability from the perspective of $t = 0$ (which

[7] One way to eliminate this undesirable (and unrealistic) feature of vague payoff-based clauses involves assuming that agent costs are stochastic at $t = 0$ and learned by all contracting parties (but not verifiable) at $t = 1^-$. In this case, the principal may find it optimal to only induce good incentives in the low cost state. If this happens, there will be value to renegotiating payoff-based contracts at $t = 1^-$ when the high cost state obtains. In this case, all qualitative results from this section continue to hold (albeit with messier expressions for the optimal contract).

can be estimated in my contracts data). In order to determine this ex-ante renegotiation rate, we must know the probability of a vague state occuring. As shown in the previous section, this probability is determined by the level of vagueness of the initial contract. Moreover, when renegotiation is allowed, optimal contract vagueness changes relative to the no renegotiation case. In particular, the contract becomes vaguer because the expected loss conditional on a vague state occuring is smaller than $L^{VA}$. This is due to the expected gains from renegotiation. These expected gains are equal to:

$$\int_0^{L^{VA}} \alpha \cdot \left(L^{VA} - K\right) \cdot dK = \frac{\alpha}{2} \cdot L^{VA} \cdot \left(\frac{L^{VA}}{K^{\max}}\right). \tag{19}$$

Thus, the principal's actual expected payoff loss conditional on a vague state becomes:

$$L_0^{VA} = L^{VA} - \frac{\alpha}{2} \cdot L^{VA} \cdot \left(\frac{L^{VA}}{K^{\max}}\right) \tag{20}$$

and, consequently, it follows from Proposition 1 that the optimal contract vagueness in the initial contract becomes:

$$\mathcal{V}^0 = k \cdot \mathcal{C} \cdot \left[\frac{1}{L^{VA} - \frac{\alpha}{2} \cdot L^{VA} \cdot \left(\frac{L^{VA}}{K^{\max}}\right)}\right]. \tag{21}$$

As was the case in the previous section, vagueness still increases with project complexity and adjudicator quality. The latter claim holds since $K^{\max} > L^{VA}$ and can be seen visually by observing that $\mathcal{V}^0$ decreases with $L^{VA}$. Therefore, the comparative statics for contract vagueness from Proposition 1 are robust to allowing for endogenous but costly renegotiation.

Given this optimal level o contract vagueness, we can now compute the renegotiation rate from the perspective of $t = 0$. Namely, it equals $\mathcal{V}^0$ multiplied by $\mathcal{R}$ since $s$ and $\tilde{K}$ are assumed to be independent. Therefore the renegotiation rate can be written as:

$$\begin{aligned} \mathcal{R}^0 &= \underbrace{k \cdot \mathcal{C} \cdot \left[\frac{1}{L^{VA} - \frac{\alpha}{2} \cdot L^{VA} \cdot \left(\frac{L^{VA}}{K^{\max}}\right)}\right]}_{\text{Extensive Margin, Ex-Ante Vagueness}} \times \underbrace{\frac{L^{VA}}{K^{\max}}}_{\text{Intensive Margin, Self-Adapting Vagueness}} \\ &= \frac{k \cdot \mathcal{C}}{K^{\max} - \frac{\alpha}{2} \cdot L^{VA}}. \end{aligned} \tag{22}$$

From equation (22), it is clear that this renegotiation probability at $t = 0$ decreases with adjudicator quality (i.e., $Q = 1/L^{VA}$). This is the same directional comparative static as was derived in equation (18) but this time the result is more nuanced. In particular, the ex-ante renegotiation rate is the product of two effects: (i) the intensive margin effect described by equation (18), and (ii) an extensive margin effect that is due to the impact of adjudicator quality on ex-ante contract vagueness. Effect (ii) works in the opposite direction as effect (i) since increasing adjudicator quality makes contracting parties more willing to include vague terms in the contract and increases the likelihood of a vague state occuring. Equation (22) shows that effect (i) dominates.

Importantly, this comparative static on adjudicator quality differs from the comparative static on project complexity. Namely, the renegotiation probability at $t = 0$ increases when project complexity rises because only effect (i) exists in this case. We can now summarize the economically meaningful features of the optimal contract and the resulting renegotiation probability:

**Proposition 2 (Optimal Contract Vagueness and Renegotiation Probabilities)** *If parameters are such that an interior solution obtains for optimal contract vagueness (i.e., $\mathcal{V}^0 < 1$), the optimal contract satisfies the following properties:*

- *Optimal contract vagueness, as defined by equation (21), is increasing in both project complexity and adjudicator quality.*
- *Renegotiation probability, as defined by equation (22), is increasing in project complexity but decreasing with adjudicator ability.*
- *All other features of the contract are analogous to those derived in Proposition 1 (with the exception that vague payoff-based contracts have been ruled out).*

*In the case where optimal contract vagueness equals 1, renegotiation rates are unaffected by project complexity but they continue to fall with adjudicator ability.*

In my empirical analysis, I will exploit the distinction between the effects of project complexity and adjudicator ability on renegotiation probabilities. While interpreting patterns in the use of vagueness across contract enforcement institutions is subject to an identification problem (as described at the end of Section 3.2), this is no longer always the case when we also consider patterns of renegotiation rates across the same enforcement institutions. Namely, if the model is valid, the only way that the rank order of contract vagueness across two enforcement institutions can differ from the rank order of renegotiation probabilities across these same institutions is if the institution with higher vagueness is of higher quality than the other. Any profile of heterogeneity in project complexity would not generate this result. Within the model, this is true regardless of the underlying selection model that maps projects into contract enforcement institutions on the basis of unobservable project complexity. Notice that the identification implication of the differential rank-order result is robust to the use of other plausible project complexity measures within the model (i.e., $k$ or $K^{\max}$). I exploit this result in my empirical analysis below by exploring correlations between both contract vagueness and renegotiation rates with contract enforcement institution dummies.

# 4 Empirical Analysis

## 4.1 Data and Summary Statistics

In order to estimate the correlation between contract enforcement institutions and both contract vagueness and contract renegotiation rates, I must obtain data on actual contracts. In particular, I need data on both

contract originals and their subsequent amendments. I accomplish this by making use of publicly available data from the U.S. Securities and Exchange Commission (SEC). In particular, through a variety of federal regulations (see section 229.600 in Chapter 17 of the Code of Federal Regulations (CFR)), the SEC requires that firms disclose their material contracts in the Exhibit 10 area of their annual and quarterly reports (e.g., 10-K, 10-Q, etc.). The SEC defines a material contract as follows:

> "Every contract not made in the ordinary course of business which is material to the registrant and is to be performed in whole or in part at or after the filing of the registration or report."

Ironically, this definition is somewhat vague. For some contract types, the definition of material is clarified with additional (and more precise) conditions. For instance, the SEC further requires that:

> "Any contract calling for the acquisition or sale of any property, plant or equipment for a consideration exceeding 15 percent of such fixed assets of the registrant on a consolidated basis"

be considered material. A key feature of material contract filings is the requirement that their amendments be publicly disclosed as well. Namely, section 229.601(a)(4) of the CFR states that:

> "Any amendment or modification to a previously filed exhibit to a Form 10 and Form 10-SB, 10-K, or 10-Q document shall be filed as an exhibit to a Form 10-Q and Form 10-QSB or Form 10-K and Form 10-KSB."

Given this availability, I collect a new dataset of original and amended material contract filings that can be found in the Exhibit 10 area of public companies' annual and quarterly reports.

Regardless of how material is defined or implemented in practice, it is clear that this sample of contracts should not be considered representative of the entire population of contracts, even that of business contracts. I am not particularly concerned about this sample selection issue here. The contracts I obtain are the most important contracts companies enter into and, as a result, should be the ones that are the most carefully designed. As my model predicts, if contracts are vague here, they should be vague elsewhere. Furthermore, it is in these contracts that firms should most carefully consider the possibility of disputes and decide how this possibility should shape the remainder of their contract terms. Thus, this sample seems particularly well-suited for drawing inference on the basis of my model from Section 3. Nonetheless, we should keep in mind that my analysis only describes patterns of contracting in important business contracts.

#### 4.1.1 Details of the Data Collection Process

Since the number of filings through the SEC is enormous, I must automate the collection of the Exhibit 10 filings available on Edgar. To do this, I use a Perl program to create a batch file that uses wget to obtain all the SEC's daily index files from the beginning of 2001 to the end of 2008. These index files contain lists and HTML links to all the Edgar filings for a given day. I then convert these files to text files using an AutoIt program and use another Perl program to pick out the links to all these annual and quarterly reports. I

then convert these links (which point to full documents of these filings) to related links that point to the Edgar webpages for these filings. These webpages are available for almost every annual and quarterly filing starting the year 2001. The essential advantage of using these webpages is that they separate all the filing exhibits individually from the body of the document filings in HTML table format. Given this observation, I use wget again to download all these webpages and use another Perl program to pick out all the Exhibit 10 links from these pages. Finally, I automate the download of all these exhibits and doing so yields a sample of almost 225,000 Exhibit 10 documents.

This database of exhibits includes contracts that range from licensing agreements, to private credit agreements, to leasing contracts. They also include, among many other types of documents, letters written between executives that comment on business transactions as well as termination agreements that formally end contractual relationships. In this analysis, I choose to focus on licensing, outsourcing, and joint venture agreements. My motivation for these selections is due to two observations: (i) These contracts are roughly equally likely to be enforced in private and public enforcement institutions (see Table 2), and (ii) They represent contracting environments that seem economically comparable. Specifically, they all involve bilateral agency concerns. While my model was formally set up as a single agent framework, it can easily be extended to the bilateral agency case by layering several of my setups on top of each other and switching the identities of the principal and agent across actions (e.g., Party A is the agent for action $a$ but the principal for action $b$ and vice-versa for Party B). In such a setting, all the predictions of my model would continue to hold in contractual relationships with bilateral agency.

In order to filter as many licensing, outsourcing, and joint venture agreements as possible from the large Exhibit 10 database, I write another Perl program that looks for keywords in the first few hundred characters of the body of a contract that are indicative of these types of contracts. For instance, for outsourcing contracts, the program looks to match terms like "outsourcing agreement", "sourcing contract", "manufacturing agreement", "manufacturing and supply contract", "oem agreement", etc. This screening procedure produces 3,209 matches for licensing contracts, 1,958 matches for outsourcing relationships, and 1,846 matches for joint venture agreements. While the number of matches from this screening algorithm is large, it should be noted that the program will make two types of errors: (i) it surely misses relevant contracts in the full sample of exhibits, and (ii) it contains inaccurate or duplicate matches. A concern with the first observation is the technical possibility that these misses could generate a bias that explains my results. As will become clear when I discuss these results in Section 4.2, one way this bias could arise is if contracts enforced through public enforcement (private enforcement) that are vaguer (more precise) than average were somehow the ones that were systematically missed by my filtering algorithm. However, the occurence of this type of selection bias seems highly unlikely.[8]

[8] This belief could be tested using a random sample of the Exhibit 10s. I have not done this though.

To deal with the second type of error, I validate all the matches manually. Furthermore, I hand-collect additional contract-level data for each correct, non-duplicate match. This additional data includes: (i) a dummy variable, $Private_i$, that equals 1 if contract $i$ is to be enforced in a private enforcement institution, (ii) a dummary variable, $Amend_i$, that equals 1 if contract $i$ is an amendment, (iii) the date the contract was entered into (as opposed to the date that the contract was filed), (iv) the unique Central Index Key (CIK) number for the filing company, (v) the 4-digit SIC code for the filing company, and (vi) the country location of the non-filing contracting party. The last variable is, among other things, used to create an international dummy, $International_i$. For the sample of contracts where the non-filing contracting party is from the US (referred to as domestic contracts) and the contract is enforced through public enforcement, information on choice of jurisdiction clauses is also collected. In particular, the following two variables are created: (i) a dummy variable, $DE_i$ , that equals 1 if contract $i$ imposes Delaware as the location of dispute resolution, and (ii) a dummy variable, $NY_i$, that equals 1 if contract $i$ imposes New York as the location of dispute resolution. Finally, for the sample of licensing contracts, I create a dummy variable, $Dev_i$, that equals 1 if a licensing relationship involves further development to be undertaken by the licensee. At times, this data collection procedure requires looking beyond the "four corners" of the contract due to references to side contracts contained therein. Whenever this occurs, the side contract is manually identified from the company's filings to get the required information (e.g., dispute resolution clauses might reference a Master Agreement that is separate from the contract).

**This data collection process is still ongoing.** Currently, 3,302 of the 7,013 screened contracts from above have been validated and collected by hand with a new batch of roughly 2,500 contracts to be added shortly. Of these 3,302 contracts, 2,190 have been classified as legitimate and unique matches. Some of these contracts are full contracts while others are partial contracts. Partial contracts are almost always amendments, but not all amendments are partial since some are restated in full. Information on whether a contract is partial or full is also in the data. My analysis of contract vagueness will only use full contracts while the data employed for the analysis of renegotiation rates will include data on all the available contracts.

In this sample of contracts, I use a final Perl program along with manual checking to construct measures of contract vagueness for each contract. This program does this by matching keywords from a standard list of vague contract terms like "commercially reasonable", "best efforts", "merchantable", "appropriate", "material" (but not "materials"), etc. This matching routine is implemented at the sentence level and is used to create two contract-level measures of vagueness: $VaguePct_i$ and $VagueTerms_i$. $VaguePct_i$ is equal to the fraction of sentences in the body of a contract that contain at least one vague keyword while $VagueTerms_i$ is the total number of sentences in the body of the contract that contain at least one vague keyword. Some matching keywords have been described by transactional lawyers as "situationally" vague. For instance, a term like "acceptable" is precise if the term includes a specific reference to one of the contracting parties (e.g., "acceptable to party A") because it represents a control right but is vague if it does

not references a particular party. To adequately filter situationally vague terms, I flag situationally vague keywords like "satisfactory" and manually check the paragraph that includes this term for wording that links this term to a specific contracting party. The aforementioned Perl program also computes $TotalTerms_i$ and $Length_i$. $TotalTerms_i$ denotes the total number of sentences in the body of the contract while $Length_i$ denotes the total number of words in the body of the contract.

#### 4.1.2 Summary Statistics

The final sample of contracts covers a variety of different firms and industries. The typical filing firm differs in important ways from the average Compustat firm. Most notably, as illustrated in Panel A of Table 1, the average filing firm is far smaller. Specifically, it has about one-fifth (one-third) of the assets (sales) of the average Compustat firm. This is not surprising since contracts are more likely to be material when a firm is small than when it is large. Indeed, it may be nearly impossible for a large company like Microsoft or Exxon to enter into a joint venture agreement or other contract which involves stakes so large that it would qualify as material for them.

As indicated in Panel B of Table 1, by far the most represented industry in the contracts sample at the 2-digit SIC code level is the "Chemicals and Allied Products" group (SIC2 equal to 28). Over a third of my contracts are filed from a firm in this industry group (790 out of 2,190). Moreover, almost 60 percent of these contracts (458 contracts) are filed by firms in the "Pharmaceutical Preparations" group (SIC4 equal to 2834) while 187 contracts are filed by firms from the "Biological Products (No Diagnostic Substances)" group (SIC4 equal to 2836). The other most common 2-digit SIC code groups are "Electronic & Other Electronic Equipment" firms (SIC2 equal to 36) and "Instruments and Related Products" (SIC2 equal to 38). These groups file 190 and 126 contracts, respectively. Overall, much of the sample of contracts can be classified as relating to technology-related business relationships and are usually in the fields of medicine (especially pharmaceuticals) or electronics. Regarding the non-filer contracting party, the following can be quantified: almost 30 percent of these counterparties are domiciled in a foreign country.

Every full contract includes vague contract terms. As shown in Panel A of Table 2, among the full contracts that exceed 1,500 words in length, the average contract contains a vague keyword in 75 sentences ($VagueTerms_i$) which represents 13.1 percent of its sentences overall ($VaguePct_i$). Furthermore, there is quite a bit of variation across contracts in both vagueness measures. Namely, the standard deviations of these measures is 63.3 and 0.06, respectively. The average contract contains almost 800 sentences and over 11,000 words. At 400 words a page, the latter number suggests that the average contract is almost 30 pages long.

Panel C in Table 2 shows that, of the 1,616 full contracts that exceed 1,500 words in length, 603 are licensing agreements, 822 are outsourcing contracts, and 191 are joint venture contracts. Licensing and

outsourcing contracts have similar levels of vagueness according to both measures while joint venture agreements seem less vague in terms of the $VaguePct_i$ measure and more vague in terms of the $VagueTerms_i$ measure. While I have not rigorously explored this hypothesis, I believe that the lower values of $VaguePct_i$ in joint venture contracts is due to a unique feature of these contracts relative to licensing and outsourcing agreements. Namely, joint venture agreements devote substantial space in the contract to internal governance clauses like the formation and operation of joint steering commitees and project management boards. These clauses, which rarely appear in the other contracts, tend to be quite precise. Thus, I would argue that, despite the mixed evidence above, the typical joint venture contract is probably vaguer (net of internal governance provisions) than the typical licensing and outsourcing agreement.

Panel A in Table 2 indicates that a shade over 50 percent of the contracts in my sample are subject to binding dispute resolution offered by private contract enforcement institutions. Over 98 percent of these contracts specifically involve a pre-dispute arbitration clause. The most common private enforcement institution is the American Arbitration Association though data on the choice of forum within private enforcement has not been formally collected. As shown in Panel C, the prevalence of private enforcement is highest in joint venture agreements (54.5 percent) and lowest in licensing contracts (47.6 percent). On average, contracts that are enforced through private enforcement are vaguer than those enforced in public enforcement. The average value of $VaguePct_i$ is 14.2 percent versus 12 percent (about 20 percent vaguer) when enforced in private versus public. This difference is significant well below the 1-percent level. Likewise, the average value of $VagueTerms_i$ is over 40 percent higher in private versus public enforcement. Given that a substantially larger share of full contracts are amendments in the sample of publicly enforced contracts (27 versus 13 percent), these summary statistics provide preliminary evidence that private enforcement has a quality advantage over public enforcement.

Preliminary evidence that is consistent with my model of optimal contract vagueness can seen from the fraction of amendments across contract types. Namely, under the assumption that joint venture relationships are more complex than licensing and outsourcing relationships, the presence of more vague contract terms and a higher fraction of renegotiations in joint venture contracts is consistent with the complexity comparative statics from Proposition 2.

## 4.2 Regression Analysis

### 4.2.1 Remark

Since the data used in the analysis is still being collected (as highlighted in Section 4.1.1), I will present the remainder of the empirical results in list form rather than essay form. This is due to the fact that some results will change (at least quantitatively) as the dataset is completed. However, given the strengths of many of the results, I suspect that most qualitative findings will continue to hold.

#### 4.2.2 Empirical Analysis of Contract Vagueness

↪ **Key Analysis in This Section:**

- **Table 3:**
  - **Main Question:** Are contracts enforced in private enforcement institutions systematically vaguer than those enforced in public enforcement institutions after controlling for other observables?
  - **Answer:** Yes. Strong evidence.
  - **Estimation Method:** OLS regressions using the sample of full contracts above a certain length (1,500 words).
  - **Unreported Robustness:** Robust to nonlinear specifications (e.g., Tobit for $VaguePct_i$ and Poisson for $VagueTerms_i$ as well as several cutoffs for contract lengths.
  - **Implication for Enforcement Evaluation:** Interpretating this result is not possible without simultaneously exploring differences in renegotiation rates across public and private enforcement institutions. Differences in renegotiation rates are explored in Table 5.
    - **Why?** Since we cannot claim that the coefficient on $Private_i$ is an unbiased causal estimate. Its value may be driven by unobservable differences in project complexity across public and private enforcement institutions.
- **Table 4:**
  - **Main Question:** Within the sample of domestic contracts, are contracts enforced in public enforcement institutions located in Delaware or New York systematically vaguer than those enforced in public enforcement institutions elsewhere in the US?
  - **Answer:** Yes. Strong evidence.
  - **Estimation Method:** Analogous to Table 3.
  - **Unreported Robustness:** Analogous to Table 3.
  - **Implication for Contracting Model:** This evidence provides suggestive support for the relationship between contract vagueness and enforcement quality in my contracting model (i.e., that $\mathcal{V}_Q^0 > 0$).
    - **Why?** New York and Delaware courts are widely viewed as more expert than those which are located in other states. A compelling arguments for this assumption is the greater experience and body of case law that both states have in the arena of business disputes.
    - **Clarification:** This evidence is only suggestive because the coefficients on $DE_i$ and $NY_i$ cannot be interpreted as causal estimates. Indeed, there are likely to be several unobservable differences between projects enforced across different enforcement institutions.

- **Secondary Question:** Within the sample of domestic contracts, are contracts enforced in private enforcement institutions systematically vaguer than those enforced public enforcement institutions located in Delaware or New York?
    - ∗ **Answer:** No evidence supporting this claim. The increases in vagueness associated with each of these enforcement institutions (relative to non-DE or NY courts) are not statistically different from each other.
    - ∗ **Implication for Enforcement Evaluation:** Subject to important identification concerns, this evidence suggests that private enforcement may have a quality advantage over most public enforcement institutions, but not New York and Delaware public courts.

#### 4.2.3 Empirical Analysis of Renegotiation Probabilities

↪ **Key Analysis in This Section:**

- **<u>Table 5</u>: Preliminary**
    - **Main Question:** Are contracts enforced in private enforcement institutions renegotiated systematically less often than those enforced in public enforcement institutions after controlling for other observables?
    - **Answer:** Yes. Strong evidence.
    - **Estimation Method:** OLS on firm-level and firm×contract type-level data constructed from the sample of all contracts.
    - **Unreported Robustness:** Robust to Tobit-based specifications that can be estimated (requires coarser industry controls than the OLS specifications used).
    - **Implication for Enforcement Evaluation:** Assuming that my model is valid, the results in Table 5, along with those in Table 3, identify a quality advantage for private contract enforcement institutions over public ones.
        - ∗ **Why?** According to my model, the only way that arbitration can both be associated with more contract vagueness and less frequent contract renegotiations than courts (as shown in Table 3 and Table 5) is if it has a quality advantage. This is due to the fact that all project complexity explanations for the positive coefficient on $Private_i$ in Table 3 would imply a positive coefficient on $Private_j$ in Table 5.
        - ∗ **Clarification:** For this identification strategy to be legitimate, my model must be valid.
    - **Secondary Question:** Do the New York and Delaware dummies correlate with renegotiation rates in a similar way to the private contract enforcement dummy?
        - ∗ **Answer:** Yes for New York but no for Delaware.
        - ∗ **Implication for Contracting Model:** This is mixed evidence in support of my contracting model. The New York evidence is perfectly consistent with my model. However, the

model predicts less renegotiation of Delware-enforced contracts if Delaware courts receive comparable projects to other forums. Is this necessarily evidence against my model? No. In particular, the Delaware result could be explained by its specialized role in enforcing complex business disputes. It may be the case that Delaware enforces contracts for substantially more complex projects than other forums and that this difference dominates its quality advantage over other public enforcement institutions. In this case, Delaware-enforced contracts could be renegotiated more often. This observation highlights the one-sided nature of our identification strategy: the only way to identify a quality differential across enforcement institutions is to find an opposite rank-order for contract vagueness and contract renegotiation rates across these institutions. My model does not guarantee that such an ordering will obtain in the data.

- **Improvement-in-Progress:** I am currently manually matching individual amendments to original contracts to allow for estimation of renegotiation rates using contract level data (rather than firm-level and firm×contract type-level data). This data would allow for more appropriate specifications than the ones currently used. A notable problem with the current data format is that some amendments included in the analysis above cannot be linked to originals in my dataset. Thus, my current analysis overstates renegotiation rates (though it is unclear how this would lead to severe biases in measuring differences across institutions).

- **Table 6:**
  - **Main Question:** Since interpretation in the above analysis assumes that my contracting model is valid, it would be useful to provide further support for this assumption. In particular, is there evidence that supports the complexity comparative statics from Proposition 2 of the paper?
  - **Answer:** Yes, but it is not always significant.
  - **Estimation Method:** Analogous to Tables 3 and 5 but only using licensing contracts.
  - **Implication for Contracting Model:** Licensing contracts that involve a follow-on development component are arguably the most complex licensing relationships. Consistent with my model, more complex licensing relationships are associated with both greater contract vagueness and are renegotiated more often in the data. Moreover, controlling for this complexity, contracts enforced in arbitration exhibit systematically higher contract vagueness and are renegotiated less often in the data.
  - **Clarification:** This evidence is only suggestive because the coefficient on $Dev_i$ clearly cannot be interpreted as causal. There are likely to be several unobservable differences between projects that contain follow-on development components and those that do not (beyond a complexity differential).
  - **Remark:** Consistent with our initial identification concern, these complex licensing contracts are also more likely to go to private enforcement.

- **However:** In stark contrast to the findings in Table 2, the rank-order of renegotiation rates is inconsistent with my vagueness model when comparing renegotiation rates in joint venture agreements to those in licensing and outsourcing contracts (see Table 3).
- **Reconciling the Latter Result w/ My Model?** The existence of internal governance mechanisms, as is standard in joint venture agreements, might lead to a relatively smaller need to renegotiate ex-post.

#### 4.2.4 Other Views on the Use of Vagueness in Contracts

**Key Analysis in This Section:**

- **Table 7:**
  - **Observation:** My model of optimal contract vagueness abstracts away from other plausible determinants of contract vagueness. Table 7 briefly explore one alternative based on the privacy of private enforcement institutions.
  - **Clarification:** Disputes are not made public in private enforcement but often are disclosed in public enforcement. Thus, private enforcement may be selected by companies who have a desire to maintain privacy. If this source of disclosure concern is due to product market competition, the firm might also want to minimize information spillovers to its competitors in the following two ways: (i) minimize the ability of competitors to learn from your material contracts by making these contracts vaguer and (ii) minimize the ability of competitors to learn from updates to your material contracts by not renegotiating them. These potential choices would lead to the results documented in Tables 3 and 5 even with no quality differential between public and private enforcement.
  - **Main Question:** Is this a plausible alternative explanation to the vagueness and renegotiation patterns?
  - **Answer:** No evidence supporting this view.
  - **Logic and Evidence:** If product market competition concerns were driving these patterns, they should be concentrated in industries that are highly competitive. Using Compustat-based HHI measures of industry competitiveness, I find no evidence that the correlation between the private enforcement dummy and my contract vagueness measures is concentrated, or generally even higher at all, in the most competitive industries.

## 5 Conclusion

In this paper, I develop a simple model of optimal contract vagueness that allows for costly renegotiation and builds on the literatures on authority delegation and transaction costs in contracting. In the model, vague contract terms allocate authority to adjudicators and allow contracting parties to save on contemplation

costs associated with pinning down precise contract terms. However, the use of authority by adjudicators is imperfect and may differ across contract enforcement institutions. Consequently, the main predictions of the model are that optimal contract vagueness and renegotiation rates depend on the complexity of underlying business relationships and the characteristics of the adjudicators who enforce the contract. In particular, contracts will be vaguer when relationships are more complex and when enforcement institutions are of higher quality. Meanwhile, firms that enforce contracts in higher quality institutions renegotiate their contracts less often while those with more complex projects renegotiate them more often.

These joint comparative statics are used as the basis for performing an evaluation of public versus private contract enforcement. In particular, an empirical analysis of newly collected data on material contracts available through SEC finds that contracts enforced through private enforcement are both vaguer and renegotiated less often than those enforced through public enforcement. This evidence suggests that private enforcement may have a quality advantage over public enforcement. However, it is important to recognize that this interpretation of the data requires that my underlying model be valid. Evidence from variation within domestic public enforcement and within licensing contracts is generally (but not universally) supportive of the predictions of this model. As a result, more work needs to be undertaken to further investigate the joint comparative statics in the model. The main barrier to successfully doing this is coming up with observable measures of project complexity that aren't associated with changes along other variables (e.g., the use of internal governance mechanisms).

Despite these caveats in interpretation, this paper established new facts regarding the use of vagueness in contracts. In related work, I am using a similar but more detailed dataset on contracts that involves hand-collecting information on contract terms (rather automating this collection). This dataset classifies precise and vague terms into finer and better defined economic categories (i.e., representations and warranties, information sharing, investment and actions, payoffs, and termination) and preliminary analysis of the data suggests that the increase in contract vagueness associated with private enforcement institutions is most concentrated in the investments and actions category. Moreover, using the data collected in this paper, I am also tracking patterns in contracting practices over time within firms. Here, I find that firms that enforce their contracts using public enforcement institutions exhibit a relative increase in precision over time while firms that use private enforcement institutions do not. The latter claim is especially true for the firms that have historically written particularly vague contracts. Further establishing and explaining these stylized facts seems like a worthwhile avenue for future research in empirical contract economics.

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