Mitigating Incentive Conflicts in Inter-Firm Relationships: Evidence from Long-Term Supply Contracts

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Abstract

I examine variation in the design of long-term supply contracts in response to incentive problems between firms along the supply chain. To do so, I hand-collect a large sample of long-term supply contracts from SEC filings. I investigate the potential for adverse selection and moral hazard problems that result from transactions between a separately owned buyer and supplier and find that contracts are designed to mitigate these problems. I find that information asymmetry between buyers and suppliers leads to shorter duration contracts. However, when longer duration contracts facilitate the exchange of relationship-specific assets, the parties substitute short-term contracts with financial covenants in order to reduce the costs associated with moral hazard. The buyer and supplier are more likely to include financial covenant restrictions when monitoring is difficult and the products exchanged are highly specific. Finally, I show that buyers and suppliers are less likely to rely on financial covenants when contracting with a private party, consistent with private firms having less reliable financial statements than public firms.

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1. Introduction

The nature of inter-firm relationships is of broad interest to researchers in economics, finance and accounting. An extensive literature in economics investigates the determinants of the boundaries of the firm, including the decision to make assets internally or to buy them from an external trading partner (Coase [1937], Klein et al. [1978] and Williamson [1979]). Prior studies cite the benefits of using external suppliers, including increased productivity through specialization (Alchian and Demsetz [1972]), improved speed to market and cost savings (Bettis et al. [1992]). However, Klein et al. [1978] and Williamson [1979] point out that a relationship between a separately owned buyer and supplier will be subject to opportunistic and inefficient behavior. In this paper, I empirically investigate inter-firm contractual relationships between buyers and suppliers using a unique, hand-collected dataset of long-term supply contracts. In particular, I develop and test predictions about how supply contracts are structured to alleviate agency problems between firms and their suppliers.

Prior accounting and finance studies investigating incentive conflicts between contracting parties focus primarily on financial contracting (Roberts and Sufi [2009b], Armstrong et al. [2010]). For example, there is a growing literature on how debt contracts are designed to alleviate conflicts of interest by including accounting covenants and performance pricing provisions (Smith and Warner [1979], Leftwich [1983], Dichev and Skinner [2002], Asquith et al. [2005]). However, there is limited research on the characteristics of contracts between the firm and its suppliers. Understanding these contracts is particularly important because supply relationships are economically significant (Gilley and Rasheed [2000], Rajan and Zingales [1995]). Further, this unique setting allows me to identify how variation in the assets exchanged

and the relative bargaining power of the contracting parties impact contract design. This aids in understanding how contractual provisions are set in both non-financial and financial contracts.

I investigate information asymmetry in transactions between a separately owned buyer and supplier. Suppliers hold asymmetric information about the quality of their products and their ability to meet the demands of the buyer, and buyers hold asymmetric information about their credit quality and the demand for the downstream product. The ex ante uncertainty regarding the quality of the potential buyers and suppliers results in an adverse selection problem (Akerlof [1970]). Rational buyers and suppliers anticipate the potential for opportunistic and inefficient behavior ex ante and design the contract to mitigate these potential costs. When information asymmetry is high, I predict that the buyer and supplier mitigate adverse selection costs by offering shorter duration contracts. The less informed party can screen potential buyers or suppliers by offering a short-term contract because lower quality buyers and suppliers will find it too costly to frequently renegotiate the terms of trade. In addition, shorter duration contracts force more frequent information disclosure, allowing the less informed party to tightly monitor the buyer or supplier and to renegotiate the contractual terms when necessary.

While I predict that adverse selection leads to shorter term contracts, the prior literature in economics suggests that the exchange of relationship-specific assets is best facilitated by longer duration contracts. Because more specific assets have a lower value in an alternative use, sunk investments in these assets give one party more ex post bargaining power at renegotiation (Klein et al. [1978], Williamson [1979, 1983]). Understanding this risk, the parties will under-invest in relationship-specific assets. A partial solution to this problem is to commit to a longer duration contract in order to avoid repeated bargaining over the terms of trade and thus facilitate optimal investments in specific assets.

I predict that financial covenants will be used as a substitute for shorter term contracts when information asymmetry between the buyer and the supplier is high and the exchange of specific assets is best facilitated by longer duration contracts. Making the contract conditional on financial performance mitigates the potential for moral hazard by transferring decision rights to one party in those states of the world where incentive conflicts are likely to encourage inefficient behavior by the other party (Aghion and Bolton [1992]). Because incentives for opportunistic behavior are higher when financial performance deteriorates, financial covenants that specify minimum performance thresholds can be used to transfer decision rights to the non-defaulting party. Further, financial covenants provide an early warning sign of financial distress (Dichev and Skinner [2002]), which is particularly important when the costs of switching to an alternative buyer or supplier are high. Since relationship-specific assets increase the costs of switching, covenants can be used to mitigate those costs.

To test my predictions, I use two proxies for information asymmetry. First, the physical distance between the buyer and supplier is likely to increase information asymmetry because monitoring becomes more costly at greater distances. Second, I argue that contracting with private firms increases information asymmetry because private firms are more informationally opaque than public firms. I also develop several empirical proxies for asset specificity based on initial investments in the assets exchanged and the technical specifications of the assets in the contract.[1] Consistent with my predictions, I find that higher information asymmetry between the buyer and supplier leads to shorter duration contracts, while the exchange of relationship-specific assets leads to longer term contracts. I also show that both information asymmetry and asset specificity increase the probability that the contract will contain financial covenant restrictions. To test whether contract duration and financial covenants are substitutes, I estimate a system of

[1] The empirical proxies for information asymmetry and asset specificity are discussed in detail in Section 3.2.

equations where duration and covenants are simultaneously determined, and I show that the use of financial covenants is increasing in contract duration.

I find that financial covenant restrictions are imposed on *both* the buyer and the supplier, consistent with the idea that both parties have incentives to act opportunistically. Covenants are imposed on the buyer and the supplier when direct monitoring is difficult and the costs of switching to an alternative buyer or supplier are high. In addition, bargaining power plays a role in setting contractual restrictions; the party with more bargaining power is more likely to impose a covenant restriction on their counterparty. Finally, I show that buyers and suppliers are less likely to impose financial covenants when contracting with a private party and instead rely on product warranties and collateral to mitigate the costs associated with default. This is consistent with privately held firms having less reliable financial statements, making financial covenants less effective monitoring tools.

My paper makes three main contributions. First, I contribute to the literature that investigates the nature of inter-firm relationships along the supply chain. Examining supply chain relationships is particularly important because nearly all firms outsource some portion of their production components (Gilley and Rasheed [2000]). Further, firms along the supply chain are financially linked through the extension of trade credit, which represents the largest source of short-term external finance for U.S. firms (Rajan and Zingales [1995] and Peterson and Rajan [1997]). This suggests that it is important to understand the incentives for opportunistic behavior between buyers and suppliers and how managers can design a contract to minimize these costs. Prior empirical work on supply contracting is limited to a small number of contracts within a single industry; this reduces the variation in asset specificity and leaves the external validity of the results in question. In addition, prior empirical studies have not addressed the impact of

adverse selection and moral hazard on the design of supply contracts. I hand-collect a large sample of contractual agreements between buyers and suppliers from SEC filings, allowing me to provide broad evidence on the impact of information asymmetry and asset specificity on the design of contracts for firms across different industries.

Second, I provide evidence that buyers and suppliers use accounting information to mitigate the costs of opportunistic behavior. Watts and Zimmerman [1986], Watts [1993], Ball [2001] and Holthausen and Watts [2001] suggest that financial statement information is particularly important for contracting purposes, and there is extensive research documenting the use of financial statement information for debt contracting (Leftwich [1983], Dichev and Skinner [2002], Asquith et al. [2005] and Li [2010]). To my knowledge, I am the first to document the explicit use of accounting information in supply contracts and to show that financial covenants can be used as a substitute for other contractual terms. Moreover, documenting the use of financial statement information by another set of users can aid in understanding the factors that influence financial reporting behavior.

Finally, I provide further empirical support for the important theories of adverse selection and moral hazard. While previous studies document a link between information asymmetry and financial contracting (Barclay and Smith [1995], Gompers and Lerner [1996] and Sufi [2007]), I show that information asymmetry also impacts the design of contracts to exchange goods and services. An important feature of my setting is the variation in the nature of the assets exchanged. I show that the exchange of more specific assets makes information asymmetry problems more costly because of the difficulty in switching to alternative buyers or suppliers.

The remainder of my paper proceeds as follows. Section 2 discusses my research hypotheses. Section 3 discusses the data, the main variables and the descriptive statistics.

Section 4 presents the research design. In Section 5, I discuss the main results and in Section 6, I report the results from restricting the sample to a single industry. Section 7 concludes the paper.

2. Hypothesis Development

Prior theoretical literature suggests that incentive problems between buyers and suppliers will lead to variation in the organizational structure of the firm. For example, Coase [1937] discusses how constraints on market transactions will lead to intra-firm rather than inter-firm transactions. Klein et al. [1979] hypothesize that inter-firm transactions with the greatest potential for ex post opportunistic behavior will lead to vertical integration. However, because organizational structure is influenced by a multitude of factors including diversification strategies and growth opportunities, empirical investigation of the impact of incentive problems on firm structure becomes difficult. Therefore, for empirical tractability the scope of this study is limited to inter-firm contracts. In this section, I discuss the incentive problems between buyers and suppliers and the potential contractual tools used to mitigate the costs of these problems. [2]

2.1. Adverse selection

Prior to entering the contract, firms may have limited information about the quality of their contractual counterparties. There are many potential sources of information asymmetry between the buyer and the supplier. For example, the supplier is more informed about product quality inputs and the buyer is more informed about downstream demand. In addition, there may be information asymmetry regarding the buyers' or suppliers' financial quality and their ability

[2] I recognize that a supply contract is a multi-dimensional contract, and the parties can choose between multiple contracting tools to deal with incentive problems. The mechanisms I analyze are based on prior literature and my observations upon reading each contract. I choose to analyze the contracting mechanisms which appear frequently enough and which appear to vary cross-sectionally. I address these limitations in Section 6.2.1.

to meet the contractual expectations.[3] This uncertainty regarding the quality of the potential buyers and suppliers results in an adverse selection, or lemons, problem (Akerlof [1970]).[4]

One potential solution to the adverse selection problem is for the less informed party to offer a short-duration contract to the more informed party. Lower quality firms will find it more costly to frequently renegotiate short-term contracts. This is consistent with Diamond [1991a] and Flannery [1986], who suggest that lower quality firms will choose more expensive, longer term debt to avoid costly refinancing. Thus, when the potential for adverse selection is high, the less informed party can screen potential buyers or suppliers by offering shorter contracts (Arrow [1973] and Stiglitz [1975]). In addition, a shorter term contract requires the parties to renegotiate more frequently, allowing them to periodically evaluate the quality of the more informed party.

Empirical evidence on the relation between information asymmetry and debt contract duration supports this theory. Barclay and Smith [1995] and Ortiz-Molina and Penas [2008] find that informationally opaque firms with more growth opportunities issue shorter term debt. The evidence is similar for venture capital contracts. Gompers [1995] reports that venture capitalists use short-term, staged financing in order to tightly monitor the entrepreneur; the findings are more pronounced for early stage ventures and high-tech firms. Despite the evidence on debt and venture capital contracting, I am unaware of any empirical evidence on the relation between information asymmetry and the duration of supply contracts. This leads to my first prediction:

> **H1:** Ceteris paribus, a higher degree of information asymmetry between the buyer and the supplier will lead to shorter duration contracts.

[3] The parties can also be symmetrically uninformed. For example, I expect that general uncertainty regarding future product demand will also impact the contractual terms. I address this prediction by controlling for uncertainty in my regression analyses (discussed in Section 4).

[4] The adverse selection problem may be exacerbated if the information transferred can be misappropriated. Baiman and Rajan [2002] show that when the cost of information transfer is high, the parties may forgo disclosing proprietary information.

2.2. The hold-up problem

Theory suggests that the nature of the asset exchanged can impact ex post incentive problems between the buyer and supplier. When the exchange between buyers and suppliers involves investments in relationship-specific assets, one party can hold-up the other at renegotiation. Sunk investments in specific assets give one party more ex post bargaining power because the asset has a lower value in an alternative use. Understanding this risk, parties will be unwilling to invest ex ante (Klein et al. [1978], Williamson [1979], [1983], Grossman and Hart [1986] and Tirole [1986]). One solution to the hold-up problem is to commit to a longer duration contract, thus avoiding repeated bargaining over the terms of trade ex post; this will encourage the parties to make optimal investments in assets ex ante. Joskow [1988b] suggests that the contract will be long enough to pay off the relationship-specific component of the investment.

There is limited empirical evidence on the relation between transaction-specific investments and the duration of supply contracts. Joskow [1985, 1987 and 1988a] investigates whether the location of electric utilities with respect to coal mines impacts the duration of the coal supply contract. He finds that when electric generating plants are sited next to a specific mine (mine-mouth plants), the duration of the coal supply agreement is significantly longer than non-site-specific plants. Goldberg and Erickson [1987] find that petroleum coke contracts are longer and include more contractual restrictions when the initial investment is high.

As the authors of these studies point out, data availability limits the empirical analysis to a small number of firms within a single industry, and the external validity of these results is an open question in the literature. In order to show that variation in asset specificity impacts contract design, I test the following hypothesis across all industries in my sample:

> **H2:** Ceteris paribus, the exchange of highly specific assets will lead to longer duration contracts.

2.3. Moral hazard

Upon entering the contract there is a moral hazard problem because the parties' actions are unobservable (Holmstrom [1979]). The buyer cannot directly observe the effort exerted by the supplier in producing a high quality product.[5] Because the supplier can extract a higher profit by reducing product quality, he is likely to substitute lower quality materials and labor if the buyer cannot easily monitor his activity. Similarly, under certain conditions the manager of the buying firm will act in his own self interest to the detriment of the supplier (Jensen and Meckling [1976]). Biais and Gollier [1997] discuss the potential for a buyer to use the input good from the supplier for riskier projects than the supplier would prefer and/or continue investing in negative NPV projects which provide non-pecuniary private benefits to the buyer.

Theory suggests that the potential for moral hazard increases when financial performance deteriorates. Maksimovic and Titman [1991] present a model in which customers are reluctant to do business with a supplier in financial distress because of the incentive for the supplier to shirk on product quality. Titman [1984] argues that as the likelihood of bankruptcy increases, buyers will be wary of product quality, future serviceability and the continuity of supply. Further, the incentive to risk-shift increases when financial performance is low.

When longer duration contracts facilitate the exchange of highly specific assets, I suggest that the parties can enter into long-term contracts with contractual restrictions that mitigate the potential for opportunistic behavior. Specifically, when the potential for moral hazard is high, the parties can include financial covenants that require the firms to maintain a minimum level of accounting performance. Making the contract conditional on financial performance mitigates these potential costs by transferring decision rights to one party in those states of the world

[5] Consistent with this, Baiman et al. [2000] model a double moral hazard problem in supply contracting and show that the information available for contracting impacts the quality of the good exchanged.

where incentive conflicts are likely to encourage inefficient behavior by the other party (Aghion and Bolton [1992]). Since the incentives for opportunistic behavior are higher when financial performance deteriorates, financial covenants specifying minimum performance thresholds can be used to transfer decision rights to the non-defaulting party when a violation occurs.[6] Because negotiating and monitoring covenants are costly, I expect that the parties will only include covenants when the *potential* for moral hazard is high. Consistent with this, Gompers and Lerner [1996] find that venture partnership agreements use covenants in early-stage and high-technology funds where the agency problems are highest.

I also expect that the parties will include covenant restrictions when the *costs* associated with moral hazard are highest. This will be the case when the exchange involves highly specific assets, making switching to an alternative buyer or supplier costly. Because search and start-up costs are higher for relationship-specific assets, timely indicators of decreased performance will be particularly important to mitigate the costs of switching. Smith [1993] argues that lenders use covenants in debt contracts as an early warning sign of a borrower's deteriorating performance, and Dichev and Skinner [2002] find that syndicated lenders set financial covenants fairly tight and use them as tripwires for borrowers. Therefore, I expect that the parties will be more likely to use covenants when exchanging specific assets. I summarize these predictions as follows:

> **H3:** When information asymmetry is high and the asset exchanged is specific, parties will be more likely to include financial covenants in the supply contract.

2.3.1. Other contractual mechanisms to mitigate the costs of information asymmetry

The effectiveness of financial covenants in mitigating the potential for moral hazard is dependent on the quality of the financial statements. For example, Ball et al. [2008], Costello and Wittenberg-Moerman [2010] and Minnis [2010] show that when financial statement

[6] Common remedies in default include contract cancellation, immediate delivery of goods, early payment or alteration of the terms of trade credit. Legal action can be taken if the violation is not remedied.

reliability decreases, lenders are less likely to use contractual terms that are based on accounting numbers and substitute them with non-accounting-based monitoring mechanisms. Since private firms are less likely to have audited financial statements and are not monitored by equity investors, analysts or regulators, the quality of their financial statements is likely to be lower than that of public firms (Ball and Shivakumar [2005], Burgstahler et al. [2006] and Wittenberg-Moerman [2008]). Because of this, I expect the parties to use other contracting mechanisms to mitigate the costs of information asymmetry when they are contracting with a private firm.

To ensure product quality, the supplier can offer a warranty that allows the buyer to return the good if it does not meet certain quality standards. This will reduce the costs to the buyer by providing recourse in the event that the supplier shirks on quality. Further, Grossman [1981] develops a model in which the seller signals his quality by offering a product warranty to the buyer, mitigating the potential for adverse selection. I also suggest that the supplier can require the buyer to provide collateral in order to mitigate the costs of payment default.[7]

> **H4:** When contracting with a private party, product warranties and collateral will be used to mitigate the costs of information asymmetry.

3. Data selection, variables of interest and descriptive statistics

3.1. Sample selection

I collect supply contracts from SEC filings for the period January 1996 to May 2010.[8] Regulation S-K of the Securities Act of 1933 requires publicly filing companies to include all material contracts as exhibits in SEC filings.[9] Included in this requirement is "[any] contract upon which the registrant's business is substantially dependent, as in the case of continuing

[7] Note that product warranties and collateral do not provide early warning signs of performance problems, they merely provide remedies in the case of default. They are therefore likely to be less effective than financial covenants in reducing the costs of moral hazard. However, if financial statements are not reliable, parties can substitute financial covenants with these alternative mechanisms.

[8] 1996 was the first year that the SEC required firms to file electronically.

[9] Material contracts must be attached to the S-1, S-4, S-11, F-1, F-4, 10-Q, 10-K or 8-K for the corresponding period in which the contract is executed. Supply Agreements are most often exhibits in a 10-Q or 10-K filing.

contracts to sell the major part of registrant's products or services or to purchase the major part of registrant's requirements of goods, services or raw materials" (www.sec.gov). I search SEC filings for exhibits with "Supply" or "Procurement" in the title and "Buyer" and "Supplier" or "Seller" in the first paragraph. This initial search results in 4,927 contracts, and I randomly select 1,500 contracts for inclusion in my sample.

First, I read the first paragraph of each contract to confirm that the contract is between two independent companies agreeing to exchange a good or service over a stated period. I exclude joint ventures and agreements between mutually held companies because these companies are more likely to have aligned incentives and well-established lines of communication. I also exclude any duplicate filings. Second, I determine whether the filer is the buyer or the supplier of the good or service and match the filing party to Compustat using the Central Indexing Key provided in the filing.[10] Next, I determine whether the non-filing counterparty is public or private by searching Capital IQ for the company name and location. If the counterparty is public, I hand-match the name and location to Compustat (U.S. firms) or Thomson Reuters Datastream (international firms). If the counterparty is private, where possible I hand-collect the firm's annual revenue from Dun & Bradstreet. Finally, I read each contract to determine the following variables: zip codes of the buyer and supplier, product description and word count, duration of the contract, initial investment requirements, exclusivity provisions, product warranties, covenant restrictions and collateral requirements. The resulting dataset is comprised of 852 contracts between 1,471 unique firms (Table 1).

In Table 2, columns 1 and 2, I report the distribution of unique sample firms by two-digit SIC codes. Chemicals and allied products represent the largest portion of my sample firms,

[10] Only the party for which the contract is material will file the contract. I find no cases in my randomly selected sample where both the supplier and the buyer filed the same contract.

followed by electrical and electronic equipment. For comparison purposes, in columns 3 and 4, I tabulate the industry distribution of unique filing firms from the initial SEC search of 4,927 contracts. The industry distribution of the total sample of contracts is similar to that of my random sample.

3.2. Proxies for the variables of interest

Investigating the impact of asset specificity and information asymmetry on the design of the supply contract requires empirical proxies for the variables of interest.

3.2.1. Proxies for asset specificity

Williamson [1983] discusses four types of transaction-specific investments that can intensify the hold-up problem. First, assets are site-specific if they are highly immobile after the buyer and supplier decide, ex ante, to locate next to each other. Second, physical asset specificity refers to assets with highly specific design specifications, making them less valuable in alternative uses. Third, dedicated assets are general investments that would otherwise not be made except for the commitment to exchange a significant amount of product with a particular buyer or supplier. Finally, human asset specificity refers to the investment in skills, knowledge or experience specific to the transaction.

I utilize three proxies for asset specificity in order to capture different aspects of transaction-specific investments; these proxies allow me to perform the analysis both across and within industries. First, I develop a proxy based on the number of words used in the "Product Specifications" section of the contract. Most contracts detail the specifications of the asset in an appendix, which includes a general description of the product and any measurable specifications. I expect the number of words used to specify the asset to be highly correlated with the asset's complexity, and thus I am capturing Williamson's physical asset specificity. I provide examples

of the "Product Specifications" section of the contract in Appendix B. A benefit of this proxy is that I can capture significant variation in the asset exchanged, and I can easily compare this measure across industries. A limitation is that, due to the proprietary nature of asset specifications, many firms remove this information from their public filings.

Second, I determine whether the parties make a significant investment in capital specifically relating to the exchange relationship. This variable captures Williamson's dedicated asset specificity. Investments vary by industry and typically include specialized plant or equipment purchases or upgrades.[11] I obtain information on capital investments directly from the supply contract and record whether or not an investment is made. An advantage of this measure is that it is relatively unambiguous and does not require researcher judgment. However, data restrictions prohibit me from capturing variation in the magnitude of the investments.[12] In addition, most relationships likely require some level of transaction-specific investment; I expect that my proxy captures only large investments that warrant mention in the supply contract.

Finally, I utilize a textual analysis tool to measure the complexity of the contract. Williamson [1975] and Mulherin [1986] suggest that as assets become more specific, supply relationships will move from simple transactions to more complex contracts. Therefore, the exchange of relationship-specific assets should be associated with more complex contracts. Further, highly specific assets will likely be described using more technical language, making the contract more complex. The Flesch Reading Ease test computes a score reflecting the readability of the contract based on sentence length and the word complexity, and a higher score indicates

[11] In addition to capital expenditures on property, plant and equipment, I include licensing expenditures (used in pharmaceutical supply agreements). For example, an upstream biotechnology firm will grant a downstream pharmaceutical company the rights to a patented active pharmaceutical ingredient (API) for use in a pharmaceutical drug. The downstream company pays the biotechnology firm a large, non-refundable upfront fee and ongoing maintenance fees for the rights to use the API for the duration of the supply agreement.

[12] In many cases, the filer deletes the specific dollar amount of the investment due to the proprietary nature of the information. In addition, many contracts merely refer to an investment already made without giving further detail.

that the document is more readable. The Flesch score allows me to investigate variation in the assets exchanged, and I can easily calculate the score for the entire sample of contracts. A drawback of the score is that I cannot rule out alternative explanations for contract complexity.[13]

3.2.2. Proxies for information asymmetry

I use two proxies for information asymmetry: the physical distance between the buyer and supplier and whether the companies have publicly traded equity. Peterson and Rajan [1994, 2002] highlight the importance of the proximity of a firm to its lender, suggesting that the communication of soft information is particularly costly as distance increases. In addition, several studies have documented a home bias in equity investing, suggesting that investors have better access to information about local firms (Kang and Stulz [1997], Coval and Moskowitz [1999]). In the same way, the distance between buyers and suppliers may be particularly important in the ability to monitor the quality of the product exchanged. Audretsch and Stephan [1996] also suggest that close proximity aids in the knowledge spillover between biotechnology firms and their scientists.

I calculate the distance between the buyer and supplier using plant locations specified in the contract.[14] Because my data includes many international firms, this variable not only captures geographic distance, but it also proxies for cultural distance. Mian [2006] suggests that differences in corporate cultures, legal environments or regulatory systems can increase informational frictions between a lender and a borrower.

Second, I expect that privately held companies will be more informationally opaque than publicly traded firms. These firms do not file with the SEC, thus they have limited publicly

[13] For example, industries that have a higher potential for litigation might have more complex contracts. I address this concern in Section 6.1 by limiting the analysis to one industry.

[14] The contracts identify the locations of the plants used for production and receiving. I collect this zip code location rather than corporate headquarters because monitoring is likely to be more important at the plant location.

available information regarding their quality. Further, private firms face less scrutiny from external monitors such as equity investors, regulators and auditors (Minnis [2010]).

3.3. Descriptive statistics

Table 3 reports the descriptive statistics for the sample. All variables are defined in Appendix A. The average contract duration is 6.85 years. Forty-seven percent of the sample has at least one financial covenant. This is in contrast to private *lending* agreements, which nearly always contain at least one financial covenant (Roberts and Sufi [2009a]). On average, product descriptions are 311 words long, and 27 percent of the contracts require an initial investment. The language of the contracts is relatively complex, with a readability score of 31; Flesch scores between zero and 30 are considered most difficult to read. The buyer and supplier are located an average of 1,767 miles apart. The distance is driven, in part, by the international firms in the sample. The firms are relatively large; the buyer generates an average of $7 billion in annual revenue and the supplier collects an average of $4 billion in annual revenue. Comparison to the median revenue reveals that these numbers are highly skewed. Therefore, I take the natural logarithm of the buyers' and suppliers' revenues for the empirical analysis.

3.4. Descriptive covenant analysis

I provide more detail on the distribution of the covenants included in the supply agreements in Table 4. I group the covenants into seven categories and report the frequency of each covenant category in columns 1 and 2. The most frequently used covenants are profitability covenants and net worth covenants, representing 43.0 percent and 26.2 percent of the total covenant sample, respectively. Buyers and suppliers also include covenants on debt and leverage, asset sales, cash flow, liquidity and dividend payments.

Columns 1 and 2 report the covenant distribution at the contract level, but do not indicate whether the covenant is imposed on the buyer or on the supplier. Therefore, I report the frequency of each category of covenants imposed on the buyer and the supplier separately in columns 3 through 6. It is interesting to note that covenants often used to protect creditors are much more frequently used as restrictions on the buyer (debt and leverage covenants and dividend restrictions). This is likely explained by the fact that suppliers extend trade credit to buyers and want to protect against the possibility that the buyer will default. In addition, the most frequently used restrictions on suppliers are profitability covenants. Christensen and Nikolaev [2010] refer to these covenants as "performance covenants" and suggest that they are more timely in detecting deteriorations in performance than other covenants, making them suited to serve as tripwires that provide an early option to renegotiate. This is consistent with buyers' concerns about product quality when the supplier's financial performance deteriorates.

4. Research Design

4.1. The impact of asset specificity and information asymmetry on contract duration

I test the determinants of contract duration using the following model:

$$\begin{aligned} Duration = {} & \alpha + \beta_1 AssetSpecificity + \beta_2 InformationAsymmetry + \\ & \beta_3 FinancialCovenant + \beta_4 FirmSize + \beta_5 Volatility + \beta_6 Profitability + \beta_7 AltmanZ, \end{aligned} \quad (1)$$

where *Asset Specificity* is either *Product Word Count, Initial Investment* or *Reading Ease* and *Information Asymmetry* is either *Distance, Buyer Private* or *Supplier Private*. I predict that asset specificity will be positively related to contract duration if buyers and suppliers use longer term contracts to mitigate potential hold-up problems associated with specific assets. I also predict that information asymmetry will be negatively associated with contract duration if less informed parties screen more informed parties by offering shorter duration contracts.

I control for the use of financial covenants because they can be used to monitor the parties when information asymmetry is high. The violation of financial covenants allows the non-defaulting party to seek performance remedies and/or cancel the supply agreement, thus shortening the effective duration of the contract. If duration and covenants are substitute mechanisms for overcoming information problems, I expect the coefficient on *Financial Covenant* to be positive (Billet et al. [2007], Bradley and Roberts [2004]).[15]

I control for both the buyer and supplier size because smaller firms are likely to be more informationally opaque. While I am interested in the impact of information asymmetry on contract duration and the use of covenants, information uncertainty can also impact the terms of the contract. For example, both the buyer and the supplier may have uncertainty about the future product demand or supply. Consistent with this prediction, Crocker and Masten [1988] find that parties protect against supply and demand uncertainty by entering into shorter term contracts. I control for product uncertainty using the buyer's and supplier's cash flow volatility over the five-year period prior to entering into the contract.[16] I also expect more profitable firms to be less risky, leading to longer duration contracts. Finally, I control for the credit quality of the buyer and supplier using the Atman Z score. Firms with a higher credit risk will be associated with higher future uncertainty, thus I expect the coefficient on *Altman Z* to be positive.

4.2. The impact of asset specificity and information asymmetry on the use of financial covenants

I test the determinants of the use of financial covenants using the following Probit model:

[15] I address the simultaneous determination of maturity and covenants in Section 6.2.

[16] As a further attempt to control for demand uncertainty, I collect product-specific revenue for each public supplier. SFAS 131 requires disclosure of revenues from external customers for each product that comprises 10 percent or more of consolidated revenue. Where possible, I collect product revenue information from Compustat and hand-match the product description in the disclosure to the product description in the supply contract. I then calculate the standard deviation of the product-specific revenue over the periods prior to the contract commencement date. This procedure limits my sample to 77 contracts with product-specific revenue information (9% of my sample); because of the small sample size, I do not include product-specific revenues in the analysis.

$$P(FinancialCovenant) = \alpha + \beta_1 InformationAsymmetry + \beta_2 AssetSpecificity + \beta_3 InformationAsymmetry * AssetSpecificity + \beta_4 Exclusivity + \beta_5 Duration + \beta_6 FirmSize + \beta_7 Profitability + \beta_8 AltmanZ, \quad (2)$$

where the dependent variable is equal to one if there is at least one financial covenant included in the contract.[17] I proxy for information asymmetry with *Distance*, and I proxy for asset specificity using either the *Product Word Count, Initial Investment* or *Reading Ease* variables. I expect that when direct monitoring of the buyer/supplier is difficult, there is a greater potential for moral hazard. Thus, I predict that the distance between the parties will be positively associated with the use of financial covenants. I also expect that the parties will be more likely to use financial covenants when the assets are more specific because the costs of switching to an alternative buyer/supplier are higher. The coefficient on the interaction term measures the incremental effect of exchanging more specific assets when the potential for opportunistic behavior is high. If the costs of moral hazard increase with the exchange of more specific assets, I expect β_3 to be positive. I include indicators for whether the supplier is the exclusive supplier or the buyer is the exclusive buyer in order to further control for the costs of switching to alternative buyers/suppliers. I expect that these variables will be positively associated with the use of covenants. As in the contract duration analysis, I expect duration and the use of covenants to be positively related, since covenants act as early warning devices and can shorten the effective duration of the contract. I include controls for buyer and supplier size, profitability and Altman Z because the likelihood of opportunism may be particularly acute for smaller, less profitable firms with a higher credit risk. Finally, I also include a control for cash flow volatility because Crocker and Masten [1988] and Bradley and Roberts [2004] suggest that the parties will include provisions that allow for flexibility in response to future uncertainty.

[17] I choose to use a binary variable because most contracts have either zero or one covenant.

4.2.1. Directional covenant analysis: The use of financial covenant restrictions on the buyer (supplier)

In order to learn more about the factors explaining the use of covenants, I re-estimate equation (2), restricting the dependent variable to financial covenants that the supplier (buyer) imposes on the buyer (supplier). As an additional proxy for information asymmetry, I include an indicator variable that equals one if the buyer (supplier) is private. Because private firms are more informationally opaque, the parties may be more likely to impose financial covenants for tighter monitoring. However, if privately held companies have less reliable financial statements, financial covenants may be less effective at monitoring performance; I therefore would expect the coefficient on *Buyer Pvt.* (*Supplier Pvt.*) to be negative. In addition, I test whether bargaining power plays a role in the ability to impose contractual restrictions. Hubbard and Weiner [1991] present a model in which market power plays a role in setting contractual provisions. Gompers and Lerner [1996] find empirical support in venture capital contracts; when venture capitalists are in relative short supply, they face fewer contractual restrictions from limited partners. As a proxy for market power, I determine whether the buyer or the supplier filed the contract with the SEC. *Buyer Files* (*Supplier Files*) is an indicator variable equal to one if the buyer (supplier) filed the supply agreement. Since the contract is material for the filer, I suggest that the non-filer has more bargaining power and will be more likely to impose a covenant restriction on the filer. I therefore expect that *Buyer Files* (*Supplier Files*) will be positively related to the use of covenant restrictions on the buyer (supplier).[18]

[18]As a further test for bargaining power, I collect customer-specific revenue data from Compustat. SFAS 131 requires firms to disclose the amount of revenue from each external customer that amounts to 10 percent or more of total revenue. For each public supplier, I collect the customer segment disclosures and hand-match the disclosed material customer name to the customer name in the contract. I then calculate the amount of revenue contributed by the customer as a percentage of total revenue collected by the supplier for the contract year. This procedure yields 68 contracts with customer-specific revenue information. Due to the small sample size, I do not include this variable in my analyses.

4.3. The impact of asset specificity and information asymmetry on alternative monitoring mechanisms

I test whether the buyer is more likely to provide collateral when they are private using the following Probit regression:

$$P(Collateral) = \alpha + \beta_1 AssetSpecificity + \beta_2 InformationAsymmetry + \beta_3 ExclusiveBuyer + \beta_4 Duration + \beta_5 BuyerFiles + \beta_6 FirmSize, \quad (3)$$

where the dependent variable equals one if the buyer is required to provide collateral, zero otherwise. I proxy for asset specificity with either the *Product Word Count, Initial Investment* or *Reading Ease* variables, and I proxy for information asymmetry with *Buyer Pvt*. If private buyers substitute collateral for financial covenants because their financial statements are less reliable, I expect the coefficient on *Buyer Pvt.* to be positive.

I test whether the supplier is more likely to provide a product warranty when they are private using the following Probit regression:

$$P(Warranty) = \alpha + \beta_1 AssetSpecificity + \beta_2 InformationAsymmetry + \beta_3 ExclusiveSupplier + \beta_4 Duration + \beta_5 SupplierFiles + \beta_6 FirmSize, \quad (4)$$

where the dependent variable is equal to one if the supplier offers a product warranty, zero otherwise. Similar to the collateral regression, my proxy for information asymmetry is *Supplier Pvt.* If private suppliers substitute product warranties for financial covenants in order to reduce the costs of information asymmetry, I expect the coefficient on *Supplier Pvt.* to be positive.

5. Empirical Results

5.1 The impact of asset specificity and information asymmetry on the duration of the contract

I present the results of the contract duration analysis in Table 5. In Panel A, I restrict the analysis to contracts with public suppliers and public buyers in order to include a full set of control variables. Consistent with my predictions, I find that buyers and sellers commit to longer

duration contracts when exchanging more specific assets. I find that both a higher product word count and an initial investment in assets lead to longer duration contracts, however the coefficient on *Reading Ease* is not statistically significant. I suggest that *Product Word Count* and *Initial Investment* proxy for two different aspects of asset specificity (physical asset specificity and dedicated asset specificity), while *Reading Ease* is likely a redundant measure of physical asset specificity. The results in columns 2 through 4 show that, when included separately, all three measures of asset specificity load in the expected manner. The coefficient on *Product Word Count* is positive and statistically significant. Increasing the product description by 100 words is associated with a 0.45 year increase in contract duration. Additionally, investments in assets are associated with contracts that are 5.6 years longer; the magnitude of this effect reveals that *Initial Investment* captures significantly large investments. Finally, consistent with my prediction, contracts that are less complex are also shorter in duration. Increasing the reading ease from a score of 30 (understood by college graduates) to a score of 60 (understood by 13-15 year olds) shortens the duration of the contract by 2.4 years.

Panel A of Table 5 also shows that parties that are located further apart agree to shorter duration contracts. For example, increasing the distance between the two parties by one standard deviation decreases contract duration by about 0.7 years. This is consistent with higher information asymmetry leading to shorter duration contracts. The remaining control variables load in the predicted manner. Firms that are larger, more profitable and have a lower credit risk enter into longer duration contracts, and firms that are more volatile enter into shorter term contracts. An important result is that financial covenants are strongly positively associated with contract duration; I address the joint determination of these terms in Section 6.2.

A strength of the research design is that I can compare contracts across different industries in order to capture significant variation in the specificity of assets exchanged. However, this design makes it difficult to eliminate alternative explanations for cross-industry differences in contract design. I therefore add industry fixed effects to the regressions in columns 5 through 7 of Panel A. The results show that within-industry variation in asset specificity impacts contract duration, though at slightly smaller significance levels.

In Panel B of Table 5, I include both public and private companies and test whether contracting with more informationally opaque, private companies leads to shorter duration contracts. In columns 1 and 2, I find that contracting with private buyers and private suppliers leads to shorter duration supply contracts. Contracting with a private firm reduces contract duration by 1 to 1.5 years; this number is economically significant when compared to the average contract length of 6.85 years. To ensure that these results are not entirely due to the size of private firms, I hand-collect annual revenue figures for private firms from Dun & Bradstreet.[19] In columns 3 and 4, I show that the private firm indicator is still economically and statistically significant after controlling for private firm size.

While private firms are typically more opaque than publicly traded firms, it is possible that firm reputation will mitigate the information problems associated with private firms. In columns 5 and 6 of Panel B, I augment my model with a reputation variable based on the age of the firm. I expect that older firms will have a more established reputation because they are more likely to have previous supply relationships and to be better known by other firms. The results in column 5 indicate that reputation almost completely mitigates the impact of being a private buyer on contract duration. However, I find no evidence that reputation matters for private suppliers.

[19] Dun and Bradstreet updates annual revenue figures for private companies after speaking with management or auditors of the firm. The database covers only a subset of private firms and is not a full time-series.

5.2 The impact of asset specificity and information asymmetry on the use of covenants and other contractual mechanisms

In Table 6, I report the results of the impact of asset specificity and information asymmetry on the use of covenants. I restrict my analysis to the contracts between public buyers and public suppliers and estimate the likelihood that at least one covenant will be included in the contract. As predicted, I find that as the distance between the buyer and the supplier increases, the probability of including covenants in the contract increases. A one standard deviation increase in *Distance* corresponds to a 34 percent increase in the likelihood that the contract will contain a covenant restriction. This is consistent with the idea that when direct monitoring is difficult, the parties use covenants to reduce the potential for moral hazard. Further, I find that the exchange of more specific assets increases the probability of imposing covenants, supporting the prediction that covenants are used as early warning signs of poor performance when the cost of switching buyers or suppliers is high. A one standard deviation increase in *Product Word Count* is associated with a 26 percent increase in the likelihood of a covenant restriction. The positive coefficient on the interaction term reveals that there is a higher probability of using covenants when it is both difficult to monitor *and* the costs of switching to an alternative buyer or supplier are high. The control variables are generally consistent with predictions. For example, when the contract states that the relationship is exclusive, the costs of switching are high and the contracting parties are more likely to include covenants. Finally, the coefficient on duration is strongly positive and significant.

I test whether the use of covenants differs for regulated industries because government regulation of product quality may substitute for market-based contractual provisions. For example, the FDA and the Department of Transportation set specific standards for the products sold to, or used by, consumers. I add the *Regulated* variable to column 2 and find that regulated

industries are more likely to include covenants. This suggests that when product quality is particularly important, regulation and contractual monitoring are complements.

Table 7 reports the results for the analysis of restrictions on the buyer. The dependent variable in column 1 is equal to one if there is at least one covenant restriction on the buyer, zero otherwise. Similar to the general analysis in Table 6, I find that asset specificity is associated with a higher probability of including covenants; a one standard deviation increase in *Product Word Count* is associated with a 19 percent increase in the likelihood that there is a covenant restriction on the buyer. I do not find evidence that distance between the buyer and the supplier impacts the use of covenants on the buyer. However, the interaction term suggests that when the product exchanged is specific *and* the buyer and supplier are located further apart, there is more likely to be a covenant restriction on the buyer. This supports the theory that when monitoring is difficult and it is costly to switch to a different buyer, covenants are used to monitor performance. Finally, the coefficient on *Buyer Files* translates into an 8.2 percent increase in the likelihood that a covenant will be imposed on the buyer. This suggests that the supplier's bargaining power influences his ability to impose restrictions on the buyer.

In column 2, I include both public and private buyers in the sample and test whether the information opacity of private buyers leads to more covenant restrictions. Interestingly, I find that suppliers are 18 percent *less* likely to impose covenants on private buyers. This can be explained by the decreased financial statement reliability for private firms; since covenants rely on financial statement numbers, suppliers may use other contracting mechanisms when reporting quality is low. Therefore, in column 3, I test whether collateral requirements substitute for financial covenants. Consistent with my prediction, the coefficient on *Buyer Private* reveals that private buyers are more likely to provide collateral than public buyers.

Table 8 reports the results for the analysis of restrictions on the supplier. Column 1 reveals that higher asset specificity increases the likelihood of including covenants on the supplier. In contrast to my findings in Table 7, I find that buyers are more likely to impose covenants on suppliers located further away; this suggests that directly monitoring the quality of the product received is particularly important.[20] A one standard deviation increase in *Distance* translates into a 41 percent increase in the likelihood that there is a covenant restriction on the supplier. The interaction term is also significant, indicating that the buyer is more likely to impose covenant restrictions on the supplier when it is *both* difficult to monitor and the costs of switching to an alternative supplier are high. The coefficient on *Supplier Files* is positive, consistent with the prediction that the party with more bargaining power imposes more contractual restrictions. Similar to the results in Table 7, column 2 of Table 8 reports that buyers are 13 percent less likely to impose covenant restrictions on suppliers when the supplier is private. Column 3 shows that private suppliers are more likely to provide product warranties to mitigate the costs of moral hazard.[21]

6. Within-industry analysis and the simultaneous estimation of contractual terms

6.1. Within-industry analysis

Investigating the impact of asset specificity and information asymmetry on contract design across industries is advantageous because it increases variation in the variables of interest. Specifically, the type of assets exchanged varies significantly across different industries. However, a concern of this research design is the potential that alternative industry factors explain the design of supply contracts. I address this issue by adding industry fixed effects to my regressions, but as a further test, I restrict my empirical analysis to firms within a single industry.

[20] For example, the buyers can visit the production facilities more often if the supplier is located closer to the buyer.
[21] The results in Tables 6 through 8 are robust to alternative measures of asset specificity (untabulated, for brevity).

I choose to investigate the pharmaceutical industry for a number of reasons. First, there is significant product variation within the pharmaceutical industry; my sample includes active pharmaceutical ingredients, healthcare equipment and machinery, drug packaging and retail pharmacies. Second, the new product start-up costs are large, making the costs of moral hazard high. Products must pass several clinical trials and must be approved by the Center for Drug Evaluation and Research (CDER), increasing the costs of switching to an alternative buyer/supplier. Third, it represents the largest portion of my sample contracts, giving me enough statistical power to run the analyses.

I include all contracts in which the buyer or the supplier belongs to the healthcare, medical equipment or drug industries.[22] My resulting sample includes 388 contracts. Table 9 reports the results for the analysis of contract duration in the pharmaceutical industry. All three measures of asset specificity are statistically significant but smaller in magnitude than my analysis in Table 5. Distance between the buyer and supplier and the private indicator variables are negatively related to contract duration. Since many of the pharmaceutical companies are privately held, I do not control for the full set of firm characteristics in order to retain a significant sample size. Table 10 presents the results from a Probit regression testing the probability that the contract will contain covenants. I find that both asset specificity and information asymmetry increase the probability that the contract will include covenants. The evidence from Tables 9 and 10 reveals that asset specificity and information asymmetry impact contract duration and the use of covenants in the predicted manner even *within* a single industry, suggesting that an omitted industry effect is not likely to be driving my main results. The

[22] This is the Fama French 10th industry portfolio from the Fama French 12 industry portfolio classifications. It includes firms in industries with the following SIC codes: 2830-2839, 3693, 3840-3859 and 8000-8099.

magnitudes of the effects on duration and the use of covenants are mitigated compared to the cross-industry analysis; this is likely the result of decreased variation in my variables of interest.

6.2 The simultaneous determination of contract duration and covenants

The analysis to this point has treated contract duration as exogenous in the covenant analysis and covenants as exogenous in the contract duration analysis, however these contractual terms are likely to be determined simultaneously. I address this potential concern by estimating a system of equations where duration and covenants are simultaneously determined. I restrict the estimation to the sample of pharmaceutical contracts because I am able to identify stronger instruments that are specific to that industry.

To instrument contract duration, I use the *Average Patent* variable. I calculate the average remaining useful life of each company's pharmaceutical patents as of the supply contract start date. I obtain the patent approval date and expiry date from the FDA Electronic Orange Book (EOB) Query data files, and I match the patent data to my dataset by company name. *Average Patent* should be related to contract duration because managers attempt to match the duration of their supply relationships with the useful life of the asset exchanged (Masten and Crocker [1985]). Further, patents ensure that there will not be direct industry competitors over a specific time period; this reduces future uncertainty regarding the product, which should increase contract duration. *Average Patent* should be exogenous to the use of covenant restrictions; it is not obvious that patents reduce the need to monitor product quality. Consistent with this, I find a positive relation between *Average Patent* and contract duration (Table 11, column 1). In untabulated analysis, I find that *Average Patent* does not load in the covenant regression.

I use *CGMP* as my instrument for covenant restrictions. *CGMP* is an indicator variable equal to one if the contract was initiated in 2002 or after, zero otherwise. In 2002, the FDA

announced a significant new initiative, the Pharmaceutical Current Good Manufacturing Practices (CGMPs), which was intended to alter the FDA's regulation of pharmaceutical quality by encouraging the early adoption of new technological advances and by facilitating industry application of quality management techniques. The initiative encourages improvements in product quality control and includes new manufacturing requirements for drugs.[23] *CGMP* should be negatively related to the use of covenant restrictions because the new regulatory requirements decrease concerns about product quality; this decreases the need for contractual monitoring through the use of covenants. The changes in regulatory requirements associated with *CGMP* should not, however, impact the duration of the supply contract. Column 2 of Table 11 supports my prediction. *CGMP* is negatively related to the probability of imposing a covenant. I also find that it does not load in the contract duration regression (untabulated).

Columns 3 and 4 of Table 11 report the results of my simultaneous estimation of contract duration and covenants. My results are consistent with my prior analysis. Asset specificity is positively related to contract duration and information asymmetry is negatively related to contract duration. In addition, both asset specificity and information asymmetry increase the probability that the parties will include a covenant restriction. It is important to note that contract duration and the use of covenants are positively related. This evidence implies that covenants can be used in longer duration contracts to shorten the effective maturity in cases of covenant default, supporting the substitutability of duration and covenants.

6.2.1 The simultaneous determination of all contractual terms

A limitation of contract design studies is that the parties can choose between multiple contracting mechanisms to overcome potential incentive problems. As discussed in Section 2, I

[23] For example, new manufacturing requirements for penicillin drugs require a control strategy designed to prevent cross-contamination with other drugs. CGMP initiatives require separation of facilities and equipment, separate air handling systems and tests for traces of penicillin when possible exposure exists.

choose to analyze the contractual tools suggested by prior theoretical literature. Additionally, I include the contractual features which appear frequently enough to generate predictive power but exclude analysis of boiler-plate restrictions. While I account for the simultaneous determination of contract duration and covenants, other contractual features are likely simultaneously determined. In order to address this issue, I estimate the duration, covenant, warranty and collateral regressions as a system of equations using a seemingly unrelated regression model, allowing the error terms in all four regressions to be correlated. My main empirical findings are robust to this estimation (untabulated).

7. Conclusions

I examine the impact of asset specificity and information asymmetry on the design of long-term supply contracts. I find that information asymmetry between the buyer and supplier leads to shorter duration contracts, while the exchange of more specific assets leads to longer duration contracts. Further, I show that when long-term contracts facilitate the exchange of relationship-specific assets, the contract includes financial covenant restrictions to limit opportunistic behavior. The contract is more likely to include covenants when direct monitoring is costly and when the assets exchanged are more specific. Moreover, covenant restrictions are imposed on both the buyer and the supplier, suggesting that both parties have incentives to behave opportunistically; the evidence is consistent with the idea that financial covenants are used to monitor product quality and the financial health of the parties. I also show that buyers and suppliers are less likely to use financial covenants and more likely to use alternative contractual tools when they are contracting with a private company, suggesting that private firms' financial statements are viewed as less reliable. The results are robust to restricting the analysis to the pharmaceutical industry, indicating that the main results are not driven by an

omitted industry factor. Finally, I address the simultaneous determination of contractual terms and show that contract duration and the use of financial covenants are substitute mechanisms.

I make three main contributions to the literature. First, I contribute to the literature on supply chain relationships by providing empirical support that asset specificity and information asymmetry impact the design of supply contracts. My hand-collected sample of contracts facilitates the comparison of these contractual hazards for firms across different industries. Second, I document the explicit use of accounting information in supply contracts, supporting the claim that financial statement information is particularly important for contracting purposes. The prior literature in economics tends to focus on contractual solutions such as duration and warranties and largely ignores the use of financial covenants as monitoring tools. Finally, I provide empirical support for the theories of information asymmetry in non-financial contracts.

Appendix A: Data Definitions

Average Patent:	The average patent life remaining at the time of contract commencement for all company owned pharmaceutical patents. I obtain information on patent award and expiry dates from www.fda.org.
Buyer (Supplier) Altman Z:	Altman Z=1.2(working capital/total assets)+1.4(retained earnings/total assets)+3.3(EBIT/total assets)+0.6(market value of equity/total liabilities)+0.999(sales/total assets).
Buyer (Supplier) CF Vol.:	The standard deviation of the buyer's (supplier's) cash flow from operations scaled by total assets over the five year period prior to entering into the contract.
Buyer (Supplier) Files:	An indicator variable equal to one if the buyer (supplier) was the party that filed the contract with the SEC, zero otherwise.
Buyer (Supplier) Private:	An indicator variable equal to one if the buyer (supplier) does not have publicly traded equity, zero otherwise.
Buyer (Supplier) Profitability:	The ratio of EBITDA to total assets, estimated in the year prior to entering into the contract.
B (S) Reputation:	An indicator variable equal to one if the buyer's (supplier's) age is above the sample median. Age is calculated as the number of years between the contract year and the year the buyer (supplier) was founded.
Buyer (Supplier) Size:	The logarithm of the buyer's (supplier's) total revenue in the year prior to entering into the contract.
CGMP:	An indicator variable equal to one if the supply contract is initiated during or after 2002, zero otherwise. 2002 was the first year of the Current Good Manufacturing Practices initiative by the FDA, which encouraged better oversight and quality control in the pharmaceutical drug industry (www.fda.org).
Collateral:	An indicator variable equal to one if the buyer is required to provide collateral, zero otherwise. This is often referred to as 'Performance Assurance' in the supply contract and can include pledged assets or security in the form of a letter of credit or other financial guarantee.
Contract Duration:	The number of years between the date that the contract commences to the date of expiry, as specified in the contract.

Distance:	The number of miles between the buyer and the supplier, calculated using the plant/office locations specified in the contract. I scale the number of miles by 100 for ease of interpretation in the empirical analysis.
Exclusive Buyer (Supplier):	An indicator variable equal to one if the contract specifies that, for the duration of the contract, the buyer (supplier) will be the exclusive buyer (supplier) of goods or services from the supplier (buyer), zero otherwise.
Financial Covenant:	An indicator variable equal to one if the contract includes at least one financial covenant, zero otherwise.
Initial Investment:	An indicator variable equal to one if the contract specifies that the buyer or supplier makes an investment related to the exchange, zero otherwise.
Product Word Count:	The total number of words used to describe the product that is exchanged between the buyer and supplier. This variable is obtained by counting the words in the "Product Specifications" section of the supply agreement. I scale the total number of words by 100 for ease of interpretation in the empirical analysis.
Reading Ease:	The Flesch reading ease score, calculated as follows: $206.876 - 1.015\left(\frac{total\ words}{total\ sentences}\right) - 84.6(\frac{total\ syllables}{total\ words})$ where a higher score indicates that the document is more readable. A score of 0.0-30.0 is best understood by university graduates, a score of 60.0-70.0 is easily understood by 13- to 15-year-old students and a score of 90.0-100.0 is easily understood by an average 11-year-old student.
Regulated:	An indicator variable equal to one if the buyer or supplier is in an industry where the product quality is regulated, zero otherwise.

Appendix B: Asset Specificity Examples for Product Word Count

Example 1: Pharmaceutical packaging (contract duration=1 year)
Bitech Pharma Inc. Packaging Supply Agreement with Guizhou Qianye Rubber and Plastics Co., LTD

Product name, specification, quantity, amount, and date of (pick up):

No.	Product Name	Specs	Unit	Unit Price	Remarks
1	PET Bottles	100ML	Set	0.42	Incl. the bottle, cap, and cup

Example 2: Coal (contract duration=1 year)
Addington Resources Inc. Coal Supply Agreement with Cincinnati Gas and Electric Company

Coal Specifications:
Size:
Coal sold and purchased under this Agreement shall be high-volatile, fully washed, partially washed, or run-of-mine, bituminous coal. Each shipment shall consist of coal crushed to a top size not larger than two (2) inches, shall average no more than 35% - %"x 0 fines, shall have no intermediate sizes removed or added and shall be clean, free of extraneous material, and free flowing upon unloading by Buyer.

Analysis:

Heating Value (BTU/lb.):	12,200 minimum
Ash (%) (Dry):	13.00 maximum
Sulfur (lbs. of SO2/mmBTU):	1.60 maximum
Moisture (%):	8.00 maximum
Volatile (%):	30.00 minimum
Ash Fusion Temperature:	2450 minimum
Hardgrove Grindability Index:	45 minimum
Chlorine (%):	0.12 maximum

Example 3: Pharmaceutical drug product (contract duration=5 years)
Pharmaceutical Supply Agreement between Vaxgen, Inc. and Celltrion, Inc. (5 year contract)

Exhibit A
Technical Description of AIDSVAX(TM) "Product":
Recombinant gp120 (rgp120) is the recombinant form of an envelope glycoprotein of human immunodeficiency virus 1 (HIV-1). The rgp120 glycoprotein has an apparent molecular mass of approximately 120,000 daltons. Approximately 50% of the molecular mass is accounted for by extensive glycosylation of the protein.

The rgp120 glycoproteins used in the production of AIDSVAX(TM) are highly purified mixtures produced by recombinant DNA technology using a Chinese Hamster Ovary (CHO) cell line. The CHO cell-secreted rgp120 sequences are recovered from the harvested cell culture fluid and purified according to standard techniques, including immunoaffinity chromatography.

The CHO cells express the sequences of MN rgp120, GNE8 rgp120 or A244 rgp120. MN rgp120 is a 502 amino acid derivative of the envelope glycoprotein gp120 found in the MN
(continued on next page)

(Subtype B) isolate of HIV-1. GNE8 rgp120 is a 485 amino acid derivative of the gp120 found in the GNE8 (Subtype B) isolate of HIV-1. A244 rgp120 is a 503 amino acid derivative of the gp120 found in the A244 (Subtype E) isolate of HIV-1. The molecules bind to CD4 with high affinity and are heavily glycosylated. Analysis of the sequence data demonstrated the predicted amino acid sequence of GNE8 differed by 15% from MN and A244 differed by 30% from MN.

Each lot of product must comply with FDA and VaxGen specifications for sterility, identity, purity, potency and safety.

Example 4: Hydrogen, nitrogen, overhead liquid and steam (contract duration=30 years)
Supply Agreement between Premcor Refining Group (Clark) and Port Arthur Coker Company

Clark R&M shall supply the Coker Company's first requirements for hydrogen ("Clark High Pressure Hydrogen") for use at the Coker Complex. Clark High Pressure Hydrogen shall be delivered to the Coker Company for use in HCU 942 from the Spill Stream Hydrogen System owned and operated by Air Products for Clark R&M up to the maximum capacity of the Spill Stream Hydrogen System estimated to be 6.0 MMSCF/D. Clark High Pressure Hydrogen shall meet the following specifications:

Property	Specification	Test Method
Hydrogen	99.9% Mole Minimum	UOP-539

Clark R&M shall supply the Coker Company's additional requirements for hydrogen ("Clark Hydrocracker Purge Hydrogen") for use at the Coker Complex. Clark Hydrocracker Purge Hydrogen shall be delivered to the Coker Company for use in DCU 843 Naphtha Hydrotreater from the High Pressure Hydrogen Purge Gas from HCU 942. Clark Hydrocracker Purge Hydrogen shall meet the following specifications:

Property	Specification	Test Method
Hydrogen	80.0% Mole Minimum	UOP-539
Higher Heating Value	500 BTU/SCF Typical	UOP-539

Clark R&M shall supply the Coker Company's requirements for hydrogen ("Clark Low Pressure Hydrogen") for use at the Ancillary Equipment and GFU 241. Clark Low Pressure Hydrogen shall be delivered to the Ancillary Equipment and GFU 241 from the Clark Hydrogen Gathering System. Clark Low Pressure Hydrogen shall meet the following specifications:

Property	Specification	Test Method
Hydrogen	70.0% Mole Minimum	UOP-539
Higher Heating Value	650 BTU/SCF Typical	UOP-539

Supply of the full nitrogen requirements of the Coker Company for use at the Coker Complex meeting the following specifications:
(Continued on next page)

Component	Specification
Nitrogen and Inerts	99.999 Mole % Minimum
Oxygen	10.0 ppm maximum 8.0 ppm minimum
Moisture (dew point)	-80 [degrees] Fahrenheit or below

Clark R&M shall supply the Coker Company's requirements of overhead liquid from GFU 244 to AVU 146 ("Overhead Liquid") which is expected to have the following specifications:

Property	Typical	Test Method
API Gravity	41.1 Typical	ASTM D-1298

Steam Services: Clark R&M shall supply the full steam requirements of the Coker Company for use at the Heavy Oil Processing Facility.
The steam accounting system at the Refinery is based on energy content. All actual pounds of steam are converted to Standard Steam. All costs (from the appropriate cost centers in Clark R&M's accounting system) in producing steam are then divided by the pounds of Standard Steam.

One pound of Standard Steam is defined as the steam at the conditions whereby ten pounds of steam generate 1 KWH of electricity at 100% efficiency when exhausted through a turbine to a pressure of 2.5" mercury absolute.

The Standard Steam conversion factors are then calculated as illustrated in the following example.

(1) 850 PSIG, 800F steam at 100% efficiency requires 6.837 pounds of actual steam to generate a KWH of electricity
(2) The Standard Steam factor equals 10 (the theoretical steam rate of Standard Steam) divided by 6.837 (the theoretical steam rate of 850 PSIG, 800F steam), or 1.463.

This means 100,000 pounds of 850 PSIG, 800F steam would equal 146,300 pounds of Standard Steam.

The energy basis for Standard Steam factors can be calculated by the following formula:

$$\text{Standard Steam Factor (energy basis)} = \frac{Ha - 568.409\,Ea + 5.777}{341.275}$$

Where: Ha = Enthalpy of actual steam (BTUs/lb)
The basis for this formula is that enthalpy versus entropy for steam-water mixture at 2.5" mercury absolute is a straight line for values of entropy of 1.34 to 1.96BTUs/lb F.

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Table 1: Sample selection
This table presents my sample selection process.

Filters	Contracts	Unique Firms
SEC Filing Search[1]	4,927	
Random Sample[2]	1,500	
Excluding Duplicates and Other Contracts[3]	923	
Excluding filers with missing data[4]	852	1,471

1. For the period January 1996 to May 2010, I search SEC filings for exhibits with the words "Supply" or "Procurement" in the title and "Buyer" and "Supplier" or "Seller" in the first paragraph.
2. I randomly select 1500 contracts for inclusion in my sample.
3. Some firms file the same contract in multiple filings; I eliminate identical contracts filed by the same filer on different dates. In addition, my search criteria are intentionally broad in order to ensure an inclusive sample. As a second filter, I read the first paragraph of each contract and eliminate observations that are not supply contracts.
4. I require the public filer to have non-missing Compustat data and all contract-specific variables.

Table 2: Distribution of firms by industry

This table reports the distribution of firms by industry. The first two columns report the distribution of unique buyers and suppliers from my random sample of 852 contracts. The third and fourth columns report the distribution of unique filing firms for the entire sample of 4,927 contracts from my initial SEC supply contract search.

		Selected Sample		Total SEC Search Results	
SIC	Industry Description	Number (1)	% Frequency (2)	Number (3)	% Frequency (4)
08	Forestry	3	0.20%	12	0.30%
10	Metal mining	2	0.14%	38	0.96%
12	Coal mining	27	1.84%	42	1.06%
13	Oil and gas extraction	14	0.95%	54	1.36%
14	Nonmetallic minerals, except fuels	1	0.07%	8	0.20%
20	Food and kindred products	33	2.24%	134	3.37%
21	Tobacco manufacturers	4	0.27%	9	0.23%
22	Textile mill products	4	0.27%	20	0.50%
23	Apparel and other textile products	79	5.37%	112	2.82%
24	Lumber and wood products	3	0.20%	21	0.53%
25	Furniture and fixtures	1	0.07%	12	0.30%
26	Paper and allied products	25	1.70%	40	1.01%
27	Printing and publishing	2	0.14%	18	0.45%
28	Chemicals and allied products	311	21.14%	1,014	25.53%
29	Petroleum and coal products	17	1.16%	36	0.91%
30	Rubber and miscellaneous plastic products	30	2.04%	56	1.41%
32	Stone, clay, glass, and concrete products	10	0.68%	19	0.48%
33	Primary metal industries	32	2.18%	76	1.91%
34	Fabricated metal products	11	0.75%	46	1.16%
35	Industrial machinery and equipment	63	4.28%	162	4.08%
36	Electrical and electronic equipment	201	13.66%	344	8.66%
37	Transportation equipment	36	2.45%	187	4.71
38	Instruments and related products	149	10.13%	348	8.76%
39	Miscellaneous manufacturing industries	7	0.48%	86	2.17%
40	Railroad transportation	2	0.14%	9	0.23%

45	Transportation by air	3	0.20%	18	0.45%
46	Pipelines, except natural gas	1	0.07%	8	0.20%
47	Transportation Services	2	0.14%	28	0.70%
48	Communication	24	1.63%	96	2.41%
49	Electric, gas, and sanitary services	176	11.96%	210	5.29%
50	Wholesale trade – durable goods	18	1.22%	104	2.63%
51	Wholesale trade – nondurable goods	38	2.58%	44	1.11%
53	General merchandise stores	12	0.82%	62	1.56%
54	Food stores	8	0.54%	24	0.60%
55	Automotive dealers and service stations	6	0.41%	10	0.25%
56	Apparel and accessory stores	1	0.07%	8	0.20%
58	Eating and drinking places	12	0.82%	28	0.70%
59	Miscellaneous retail	8	0.54%	62	1.56%
80	Health services	84	5.71%	287	7.23%
87	Engineering and management services	11	0.75%	80	2.01%
		1,471	100%	3,972	100%

Table 3: Descriptive Statistics
This table presents the descriptive statistics for the sample of 852 contracts.

	N	Mean	Standard Deviation	25%	Median	75%
Contract Characteristics						
Term	852	6.85	3.93	3.00	5.00	10.00
Financial Covenant	852	0.47	0.50	0	0	1
Product Word Count (hundreds)	730	3.11	3.84	1.01	2.87	8.32
Investment	852	0.27	0.44	0	0	1
Reading Ease	852	31.01	9.10	24.40	30.20	37.30
Distance (hundreds)	852	17.67	21.63	0.37	8.54	25.00
Excl. Buyer	852	0.24	0.43	0	0	0
Excl. Supplier	852	0.29	0.46	0	0	1
Firm Characteristics						
Buyer Private	852	0.15	0.36	0	0	0
Supplier Private	852	0.26	0.44	0	0	1
Buyer Age	852	28.36	33.48	6.00	15.00	43.00
Supplier Age	852	26.73	29.32	7.00	16.5	44.00
Buyer Size ($M Revenue)	809	7158.05	27,905.54	26.50	319.71	2627.92
Supplier Size ($M Revenue)	768	4483.09	17,331.53	17.79	233.99	1750.75
Buyer CF Vol.	724	0.16	0.36	0.03	0.07	0.17
Supplier CF Vol.	635	0.14	0.27	0.03	0.06	0.12
Buyer Profitability	724	0.06	0.09	0.02	0.05	0.14
Supplier Profitability	635	0.09	0.14	0.03	0.07	0.16
Buyer Leverage	724	0.21	0.26	0.00	0.15	0.30
Supplier Leverage	635	0.23	0.38	0.02	0.15	0.29
Buyer Altman Z	724	5.41	10.83	1.05	2.91	6.96
Supplier Altman Z	635	3.36	16.71	1.16	2.78	5.50

Table 4: Descriptive Covenant Analysis

In this table, I report the covenant frequencies for seven different covenant categories. In columns 1 and 2, I report the covenant frequencies for the total sample of supply contracts that have covenant restrictions. There are 519 total covenant restrictions included in 400 distinct supply contracts. In columns 3 and 4, I report the covenant frequency for covenants imposed on the buyer, and in columns 5 and 6, I report the covenant frequency for covenants imposed on the supplier.

	Total Sample		Covenant on Buyer		Covenant on Supplier	
	Number	%Frequency	Number	%Frequency	Number	%Frequency
	(1)	(2)	(3)	(4)	(5)	(6)
Profitability Covenants *(Level of EBITDA, No Net Loss)*	223	43.0%	47	21.1%	176	59.5%
Net Worth Covenants *(Net Worth, Tangible Net Worth)*	136	26.2%	76	34.1%	60	20.3%
Debt and Leverage Covenants *(Senior Debt, Leverage, Interest Coverage, Debt/Cash Flow, Debt/EBITDA)*	44	8.5%	41	18.4%	3	1.0%
Asset Sale Restriction *(No Asset Sales, Minimum Level Assets)*	36	6.9%	10	4.5%	26	8.8%
Cash Flow Covenants *(Cash Flow, Cash Flow from Operations)*	34	6.6%	14	6.3%	20	6.6%
Liquidity Covenants *(Quick Ratio, Current Ratio, Working Capital)*	34	6.6%	25	11.2%	9	3.0%
Dividend Restriction *(No Stock Dividends, No Cash Dividends)*	12	2.3%	10	4.5%	2	0.7%
Total	519	100%	223	100%	296	100%

Table 5: The impact of asset specificity and information asymmetry on contract duration

In this table, I report the results from the contract duration analysis. In Panel A, I restrict the sample to contracts between public buyers and public suppliers. Columns 1 through 4 report the results for different specifications of asset specificity. In columns 5 through 7, I add industry fixed effects. In Panel B, I include both public and private buyers and suppliers. In columns 1 through 4, I test whether information asymmetry impacts contract duration, and in columns 5 and 6, I test whether firm reputation mitigates the impact of information asymmetry on contract duration. All regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the filing firm level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

Table 5: Panel A

	Contract Duration (Years)						
	Public/Public	*Public/Public*	*Public/Public*	*Public/Public*	*Public/Public*	*Public/Public*	*Public/Public*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product Word Count	0.305**	0.454**			0.243**		
	(0.02)	(0.03)			(0.03)		
Initial Investment	6.672***		5.602***			4.838***	
	(0.00)		(0.00)			(0.00)	
Reading Ease	-0.042			-0.086**			-0.078*
	(0.45)			(0.05)			(0.06)
Distance	-0.036**	-0.027**	-0.039**	-0.020**	-0.011**	-0.005**	-0.013*
	(0.04)	(0.03)	(0.02)	(0.03)	(0.04)	(0.05)	(0.08)
Financial Covenant	3.394***	4.455***	2.416***	3.944***	4.604***	2.343***	3.916***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Buyer Size	0.445***	0.209**	0.390***	0.339***	0.427**	0.441***	0.341*
	(0.01)	(0.05)	(0.00)	(0.01)	(0.04)	(0.01)	(0.07)
Supplier Size	0.294*	0.014	0.023	-0.047	0.004	0.076	-0.081
	(0.06)	(0.93)	(0.83)	(0.71)	(0.98)	(0.61)	(0.61)
Buyer CF Vol.	-0.723	-0.041	-0.331	-0.480	-1.197	-1.201	-2.470
	(0.29)	(0.96)	(0.42)	(0.71)	(0.70)	(0.58)	(0.73)
Supplier CF Vol.	-1.050*	-1.225**	-1.126**	-1.347*	-1.965**	-1.537**	-2.517**
	(0.06)	(0.05)	(0.03)	(0.08)	(0.02)	(0.02)	(0.04)
Buyer Profitability	2.572**	1.493*	2.197**	1.717**	1.803*	1.534***	0.917**
	(0.04)	(0.07)	(0.05)	(0.04)	(0.07)	(0.01)	(0.04)
Supplier Profitability	0.020	0.272*	0.793*	0.599	1.868	1.601	2.346*
	(0.98)	(0.06)	(0.10)	(0.15)	(0.13)	(0.15)	(0.06)
Buyer Altman Z	-0.022	0.064**	0.032	0.061***	0.060**	0.032*	0.058***
	(0.30)	(0.02)	(0.12)	(0.01)	(0.04)	(0.10)	(0.01)
Supplier Altman Z	0.017**	-0.001	0.024*	0.002	-0.001	0.024*	0.009
	(0.04)	(0.91)	(0.07)	(0.87)	(0.85)	(0.07)	(0.50)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes	Yes
Number Observations	481	481	507	507	481	507	507
Adj. R-Square	49.67%	26.73%	37.32%	17.11%	41.35%	46.78%	35.47%

Table 5: Panel B

	Contract Duration (Years)					
	Public/Private	*Public/Private*	*Public/Private*	*Public/Private*	*Public/Private*	*Public/Private*
	(1)	(2)	(3)	(4)	(5)	(6)
Product Word Count	0.286***	0.268***	0.236***	0.270***	0.235***	0.266***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Buyer Pvt.	-1.012**		-0.989**		-1.406**	
	(0.03)		(0.05)		(0.05)	
Supplier Pvt.		-1.589**		-0.904*		-1.885**
		(0.02)		(0.06)		(0.05)
Buyer Pvt.* B Reputable					1.097*	
					(0.09)	
Supplier Pvt.*S Reputable						0.480
						(0.66)
B Reputable					0.581***	
					(0.01)	
S Reputable						0.711
						(0.27)
Financial Covenant	4.006***	2.424***	4.435***	2.974***	4.461***	2.390***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Buyer Size		0.056***	0.161*	0.132*		0.042**
		(0.01)	(0.07)	(0.08)		(0.02)
Supplier Size	0.093		-0.140	0.036	0.070	
	(0.43)		(0.28)	(0.94)	(0.67)	
Buyer CF Vol.		0.012		0.211		0.008
		(0.99)		(0.79)		(0.99)
Supplier CF Vol.	-1.566**		-2.314*		-1.612	
	(0.03)		(0.08)		(0.23)	
Buyer Profitability		0.173**		1.757*		0.097
		(0.05)		(0.07)		(0.36)
Supplier Profitability	0.827***		0.914***		0.789***	
	(0.00)		(0.00)		(0.01)	
Buyer Altman Z		0.055**		0.061**		0.054**
		(0.02)		(0.04)		(0.02)
Supplier Altman Z	0.012		0.013		0.013	
	(0.17)		(0.15)		(0.16)	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number Observations	584	627	561	591	584	627
Adj. R-Square	44.75%	36.73%	41.65%	34.67%	45.52%	36.89%

Table 6: The impact of asset specificity and information asymmetry on the use of covenants
In this table, I report the results from the multivariate covenant analysis. I restrict the sample to contracts with public buyers and public suppliers and run a Probit regression where the dependent variable is equal to one if the contract contains at least one covenant, zero otherwise. Column 1 reports the results for my primary specification and column 2 augments the model with an indicator variable for regulated industries. Regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the filing firm level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

	P(Covenant)=1	
	Public/Public	*Public/Public*
	(1)	(2)
Distance	0.017**	0.018**
	(0.03)	(0.03)
Product Word Count	0.029**	0.028**
	(0.02)	(0.03)
Distance*Product Word Count	0.001*	0.001
	(0.06)	(0.16)
Exclusive Buyer	0.210*	0.191
	(0.08)	(0.27)
Exclusive Supplier	0.079**	0.090**
	(0.05)	(0.02)
Contract Duration	0.116***	0.113***
	(0.00)	(0.00)
Regulated		0.169**
		(0.02)
Buyer Size	0.017	0.024
	(0.73)	(0.53)
Supplier Size	-0.080*	-0.196
	(0.07)	(0.55)
Buyer CF Vol.	0.174*	0.259**
	(0.06)	(0.03)
Supplier CF Vol.	0.306*	0.123*
	(0.04)	(0.08)
Buyer Profitability	-0.250*	-0.196**
	(0.09)	(0.04)
Supplier Profitability	0.492	0.377
	(0.26)	(0.34)
Buyer Altman Z	-0.014	-0.014
	(0.37)	(0.33)
Supplier Altman Z	-0.042*	-0.045*
	(0.09)	(0.10)
Year FE	Yes	Yes
Industry FE	Yes	No
Number Observations	481	481
Pseudo R-Square	26.77%	24.13%
Norton et al. [2004] correction for the mean interaction effect:		
Distance*Product Word Count	0.0004*	0.0003
	(0.10)	(0.15)

Table 7: The impact of asset specificity and information asymmetry on restrictions imposed on the buyer

In this table, I report the results from the analysis of covenant restrictions and collateral requirements for the buying firm. Columns 1and 2 are Probit regressions where the dependent variable is equal to one if the contract contains at least one covenant imposed on the buyer, zero otherwise. In column 1, I restrict the sample to public buyers and use *Distance* as a proxy for information asymmetry. In column 2, I include public and private buyers and use *Buyer Pvt.* as a proxy for information asymmetry. Column 3 is a Probit regression where the dependent variable is equal to one if the buyer is required to provide collateral, zero otherwise. I include both public and private buyers in the sample and test whether collateral substitutes for covenants when the buyer is private. Regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the buyer level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

	Buyer Covenant=1 *Public Buyers*	Buyer Covenant=1 *Public/Private*	Collateral=1 *Public/Private*
	(1)	(2)	(3)
Distance	0.002		
	(0.81)		
Buyer Pvt.		-0.437***	0.325**
		(0.01)	(0.04)
Product Word Count	0.021*	0.029**	0.023*
	(0.07)	(0.05)	(0.09)
Distance*Product Word Count	0.002**		
	(0.03)		
Buyer Pvt.*Product Word Count		0.044	0.020**
		(0.26)	(0.02)
Exclusive Buyer	0.532**	0.534**	0.640***
	(0.03)	(0.04)	(0.00)
Contract Duration	0.032***	0.052***	0.022*
	(0.00)	(0.00)	(0.09)
Buyer files	0.409*	0.510***	0.272*
	(0.06)	(0.01)	(0.06)
Buyer Size	-0.025*	-0.021*	-0.044*
	(0.07)	(0.07)	(0.08)
Buyer CF Vol.	0.262		
	(0.24)		
Buyer Profitability	-0.303**		
	(0.04)		
Buyer Altman Z	-0.007*		
	(0.07)		
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Number Observations	627	712	712
Pseudo R-Square	20.21%	17.93%	18.70%
Norton et al. [2004] correction for the mean interaction effect:			
Distance*Product Word Count	0.0004***		
	(0.01)		
Buyer Pvt.*Product Word Count		0.031	0.004
		(0.58)	(0.42)

Table 8: The impact of asset specificity and information asymmetry on restrictions imposed on the supplier

In this table, I report the results from my analysis of covenant restrictions and warranties provided by the selling firm. Columns 1and 2 are Probit regressions where the dependent variable is equal to one if the contract contains at least one covenant imposed on the supplier, zero otherwise. In column 1, I restrict the sample to public suppliers and use *Distance* as a proxy for information asymmetry. In column 2, I include public and private suppliers and use *Supplier Pvt.* as a proxy for information asymmetry. Column 3 is a Probit regression where the dependent variable is equal to one if the supplier offers a product warranty, zero otherwise. I include both public and private suppliers in the sample and test whether product warranties substitute for covenants when the supplier is private. Regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the supplier level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

	Supplier Covenant=1	Supplier Covenant=1	Warranty=1
	Public Suppliers	*Public/Private*	*Public/Private*
	(1)	(2)	(3)
Distance	0.028***		
	(0.00)		
Supplier Pvt.		-0.387***	0.246**
		(0.00)	(0.05)
Product Word Count	0.016***	0.022**	0.058***
	(0.01)	(0.04)	(0.00)
Distance*Product Word Count	0.008**		
	(0.04)		
Supplier Pvt.*Product Word Count		-0.025	0.031*
		(0.55)	(0.07)
Exclusive Supplier	0.154	0.215***	0.164*
	(0.42)	(0.01)	(0.08)
Contract Duration	0.053***	0.020**	0.005
	(0.01)	(0.03)	(0.68)
Supplier files	0.501**	0.270**	0.400***
	(0.03)	(0.05)	(0.01)
Supplier Size	0.032	-0.020*	-0.051***
	(0.92)	(0.08)	(0.01)
Supplier CF Vol.	0.425*		
	(0.09)		
Supplier Profitability	-0.031**		
	(0.02)		
Supplier Altman Z	-0.002		
	(0.24)		
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Number Observations	584	701	701
Pseudo R-Square	20.87%	18.10%	14.93%
Norton et al. [2004] correction for the mean interaction effect:			
Distance*Product Word Count	0.003**		
	(0.02)		
Supplier Pvt.*Product Word Count		-0.005	0.017**
		(0.53)	(0.02)

Table 9: The impact of asset specificity and information asymmetry on contract duration for the pharmaceutical industry

In this table, I report the results from the contract duration analysis restricted to the pharmaceutical industry. I use different proxies for asset specificity in columns 1 through 3. All regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the filing firm level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

	Contract Duration (Years)		
	(1)	(2)	(3)
Product Word Count	0.173**		
	(0.03)		
Initial Investment		3.651***	
		(0.00)	
Reading Ease			-0.118***
			(0.00)
Distance	-0.002*	-0.041	-0.005*
	(0.06)	(0.22)	(0.09)
Buyer Pvt.	-1.147*	-0.976**	-0.919*
	(0.06)	(0.04)	(0.09)
Supplier Pvt.	-0.153	-0.320*	-0.450
	(0.28)	(0.09)	(0.61)
Financial Covenant	4.027***	2.877***	4.028**
	(0.00)	(0.00)	(0.04)
Buyer Size	0.069	0.091	0.201*
	(0.53)	(0.38)	(0.07)
Supplier Size	0.162*	0.178*	0.141
	(0.09)	(0.10)	(0.21)
Year FE	Yes	Yes	Yes
Number Observations	302	356	356
Adj. R-Square	23.78%	21.48%	17.50%

Table 10: The impact of asset specificity and information asymmetry on the use of covenants for the pharmaceutical industry

In this table, I report the results from the Probit regression for covenants in pharmaceutical contracts. The dependent variable is equal to one if the pharmaceutical contract contains at least one covenant, zero otherwise. Regressions include year fixed effects and standard errors are heteroskedasticity robust, clustered at the filing firm level. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively. All variables are defined in Appendix A.

	P(Covenant)=1		
Product Word Count	0.013**		
	(0.05)		
Investment		0.919***	
		(0.00)	
Reading Ease			-0.001
			(0.12)
Distance	0.017***	0.020***	0.019***
	(0.00)	(0.00)	(0.00)
Buyer Pvt.	0.035	0.199	0.158
	(0.91)	(0.51)	(0.59)
Supplier Pvt.	-0.614**	-0.448*	-0.442*
	(0.02)	(0.06)	(0.06)
Contract Duration	0.088***	0.070***	0.089***
	(0.01)	(0.00)	(0.00)
Buyer Size	-0.046*	0.036	-0.049*
	(0.10)	(0.19)	(0.07)
Supplier Size	-0.007	0.017	0.022
	(0.83)	(0.55)	(0.42)
Year FE	Yes	Yes	Yes
Number Observations	302	356	356
Pseudo R-Square	18.13%	23.16%	17.32%

Table 11: Simultaneous estimation of contract duration and covenants for the pharmaceutical industry

In this table, I report the results of the simultaneous estimation of the contract duration and covenant models. Columns (1) and (2) present the results of the first stage estimation of the duration and covenant models, respectively. Columns (3) and (4) present the estimation of the contract duration and covenant regressions as a system of two equations. I use the *Average Patent* variable as my instrument for duration and *CGMP* as my instrument for covenants. All variables are defined in Appendix A. P-values are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

	Duration	Covenant=1	Duration	Covenant=1
	(1)	(2)	(3)	(4)
Product Word Count	0.174***	0.012**	0.166***	0.075**
	(0.00)	(0.03)	(0.00)	(0.04)
Distance	-0.009*	0.014***	-0.021*	0.026*
	(0.09)	(0.01)	(0.07)	(0.09)
Buyer Pvt.	-1.443*	-0.269*	-1.986*	-0.143
	(0.06)	(0.08)	(0.10)	(0.85)
Supplier Pvt.	-0.233	-0.278*	-0.096	-0.539**
	(0.55)	(0.07)	(0.93)	(0.04)
Financial Covenant			1.113**	
			(0.04)	
Contract Duration				0.043**
				(0.05)
Buyer Size	0.123	-0.011*	0.085	0.055
	(0.30)	(0.10)	(0.44)	(0.43)
Supplier Size	0.174*	-0.034	0.105*	-0.090
	(0.08)	(0.26)	(0.10)	(0.27)
Average Patent	0.118***		0.170**	
	(0.01)		(0.02)	
CGMP		-1.223***		-1.692***
		(0.00)		(0.00)
Number Observations	302	302	302	302
Adj./Pseudo R-Square	21.95%	16.71%	22.59%	18.05%
Partial F Test	7.59***	12.41***		
Pr>F	0.01	0.00		