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ESSAYS ON HOW TO MITIGATE HOLD-UPS

By

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ABSTRACT

ESSAYS ON HOW TO MITIGATE HOLD-UPS

By

Fabienne Miller

The first essay examines whether aggregated cost information provided by suppliers to buyers can mitigate the hold-up problem that occurs with idiosyncratic investments. Hold-up implies that, given the opportunity, buyers pursue a self-interested strategy and do not reimburse suppliers for their idiosyncratic investment. In essence, buyers seek to maximize their own trade surplus at the expense of suppliers. However, evidence suggests some firms pursue a fair strategy. With such firms, research suggests that hold-up can be avoided. I propose and provide empirical evidence that the level of aggregation of the supplier-provided cost information (i.e., fine or coarse) will interact with buyer strategy (i.e., self-interested or fair) to affect investment in idiosyncratic assets and trade opportunism. Results show that coarse information leads to an increase in (no change in) self-interested (fair) buyers' offers and in an increase in suppliers' investments. Thus, suppliers are better off when they disclose coarse rather than fine cost information. Findings also suggest that buyers will benefit from requesting coarse instead of fine cost information from suppliers.

The second essay presents a review of analytical and empirical hold-up literature that spans economics, accounting, finance, and supply chain by examining strategic decisions made by firms. Relationship-specific investments render parties vulnerable to potential opportunism in dyads between firms (e.g., organizational design and make or buy decisions, and inter-firm trade decisions), between divisions (e.g., intra-firm trade

and transfer pricing decisions) and between managers and their firm (e.g., resource allocation decisions). While overall results of analytical and empirical literature show that, consistent with theoretical predictions, integration, contractual terms, allocation of property rights, incentives and relational contracting are effective at mitigating hold-ups, review of the research conducted suggests two significant limitations of past research (and resulting opportunities for additional investigations). First, empirical literature has largely focused on inter-firm decisions and analytical research has targeted intra-firm decisions, but, to a large extent, resource allocation research seems to assume away the idiosyncratic nature of the investment made by managers who acquire firm-specific project information. Second, considerations of firm strategy and of private information of the investor have remained until recently absent from analyses of hold-ups and warrant further development.

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1 INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

This dissertation investigates remedies to an important economic problem: hold-ups. Hold-ups occur in small numbers bargaining when a party does not make a socially optimal relationship-specific investment because he expects that, in an environment characterized by uncertainty, his bargaining counterpart will appropriate the return generated by the investment when trade ensues. In sum, expectation of *ex post* opportunism affects the firm's *ex ante* investment decision negatively. The importance of the hold-up problem in the economy has been widely documented. However, since suboptimal investment is difficult to measure, researchers have argued that two types of evidence show that hold-ups are a problem: First, firms provide guarantees to potential customers they will not hold them up in the future; second, trade opportunism follows relationship-specific investments.

Recent examples of the guarantees suppliers provide to encourage customers to invest in new technologies (i.e., make an idiosyncratic investment) can be found when suppliers give away their technology to competitors. When switching costs are high, customers might be hesitant to invest in technology because the supplier can hold them up by choosing prices or quality unilaterally (Farrell and Shapiro 1989). Consequently, voluntarily inviting competitors into the market by licensing a product to a competitor at low royalties, or by using an open architecture, provides evidence of innovative firms' commitment not to behave opportunistically in the future (Shepard 1987; Farrell and Gallini 1988).

Examples of trade opportunism following a relationship-specific investment can

be found in the automobile industry (e.g., Klein 1988, 1996; Anderson, Glenn, and Sedatole 2000), in the railroad industry (e.g., Pittman 1991), and with franchises (e.g., Milgrom and Roberts 1992). More recently, Chang and Ive (2007) conducted a case study of the English Channel Tunnel (i.e., Chunnel). Spanning over six years, this construction project was characterized by high uncertainty. Chang and Ive find that one of the main contractors was able to threaten to delay the construction to extract compensation above and beyond the agreed amount as Eurotunnel's switching costs increased as the result of sinking more funds in the project. Hold-up of Eurotunnel by the contractor led the Chairman of Eurotunnel to conclude soon after completion and settlement (Chang and Ive 2007, 9): "I have paid £100 million more than we think they're entitled to, but it saves us a fortune in legal costs and means we don't have friction in the future."

A stylized illustration of the hold-up problem follows. Suppose that an American automobile supplier must decide whether to invest in R&D that can lead to valuable improvements in a component of a specific model of automobile produced by one of the American Big Three original equipment manufacturers (OEM). R&D is costly and does not have any value outside the relationship with this American OEM.[1] The supplier's R&D investment decision is based on expectations of payoffs from eventual purchase of the component by this American OEM. Additionally, contracts are incomplete and the

[1] In this setting, R&D constitutes an idiosyncratic asset, i.e., relationship-specific asset. In the hold-up literature, acquisition of assets, increase in production capacity, relocation of production, and investment in human capital have also been presented as examples of idiosyncratic assets.

OEM cannot credibly commit to reimburse the supplier for the R&D investment.[2] The supplier realizes that once the R&D investment is made, it becomes a sunk cost that may be ignored in trade negotiations with the OEM. In other words, the supplier anticipates that the American OEM will only pay for the component's marginal production costs and not the sunk investment in R&D (i.e., self-interested strategy). Foreseeing the potential for the American OEM's self-interested behavior during trade negotiations, the supplier under-invests in R&D in relation to the socially optimal investment (Henke 2006). Description of the hold-up problem assumes that the buyer has full knowledge of the supplier's marginal production costs (i.e., there is no private information related to marginal production costs between buyer and supplier) and that buyers are self-interested.

Mechanisms aiming to mitigate hold-ups are presented in the following two essays. In the first essay, I relax the aforementioned two assumptions (namely, full information sharing and self-interest) and test aggregation of supplier-provided cost information and buyer firm strategy as mitigating mechanisms to hold-ups. In the second essay, I review the analytical and empirical literature on mitigating mechanisms to hold-ups.

1.2 OVERVIEW OF THE FIRST ESSAY

Economics and accounting research has recently examined the role that information plays in buyer-supplier relationships, while supply chain research has focused on characteristics of the relationship (i.e., relational contracting). I build on those

[2] It would be socially optimal for the buyer to commit to reimbursing the supplier for his investment cost. Yet, such a commitment might not be credible because renegotiation is possible. Alternatively, promises to reimburse investment costs may not be honored by buyers, or may lead to opportunistic behaviors by suppliers (instead of buyers) (Roberts 2004).

literature streams to construct the first essay (i.e., Chapter 2).

More specifically, I relax the full information sharing and self-interest assumptions traditionally made by hold-up research. First, based on recent investigation from economics and accounting regarding the role played by private information (cf. Arya et al. 2000; Gul 2001), I investigate how private information of the supplier (in the form of aggregated marginal production costs and investment cost) helps mitigate hold-ups in so far as it removes information that a self-interested buyer might use opportunistically during trade to appropriate the return on investment. Second, I build on the evidence from supply chain that some firms are motivated by strategies based in part on fairness and propose that fair firm strategies eliminate the hold-up problem. Finally, I examine how the level of aggregation of the supplier-provided cost information and the firm strategy of the buyer interact to affect the trade and investment dimensions of the hold-up problem. Results from experiments support the predictions that aggregated cost information and fair firm strategy reduce trade opportunism and, accordingly, encourage investment in idiosyncratic assets (thus, mitigating hold-ups). Moreover, findings from this research suggest that, contrary to the general belief that more detailed information is better, buyers are better off asking only for aggregated cost information as it encourages suppliers to make socially optimal idiosyncratic investments.

1.3 OVERVIEW OF SECOND ESSAY

The hold-up problem has attracted considerable research directed at investigating remedies and the first essay fits in a long stream of research that originated in the 1970s. The second essay (i.e., Chapter 3) provides a comprehensive review of this literature

highlighting how the first essay complements the existing literature.

In Chapter 3, I introduce the theories that have provided support for analyses of hold-ups and present a literature review of mitigating mechanisms to hold-ups that spans the fields of economics, accounting, finance, and supply chain. I highlight how Chapter 2 fits in the overall research stream related to hold-ups and suggest avenues for future development. This literature review is organized around the strategic decisions of choice of organizational design, trade decisions and resource allocations. While the empirical literature provides support for predictions from transaction cost economics, property rights and agency theory, it has also recently offered evidence of the importance of relational contracting in buyer-supplier relationships. The review points to two limitations of past research. First, hold-up problems have been largely ignored in resource allocation research despite firm-specific investment made by managers who conduct capital project searches. Second, the role played by firm strategy in guiding behavior of individuals and the role of private information have been little investigated and constitute fruitful avenues for future research.

2 INFORMATION AGGREGATION, STRATEGY, AND INVESTMENT DECISION IN BUYER-SUPPLIER RELATIONSHIPS

2.1 INTRODUCTION

Firms enter into collaborative arrangements that span their boundaries to improve the efficiency of their value chain. Often, a collaborative arrangement presents an opportunity for one firm to make an investment that only has value with a specific trading partner, i.e., an idiosyncratic investment. This investment creates a surplus that needs to be divided between the trading partners. Fair division of this surplus is an important concern of collaborating firms (Kumar 1996; Dekker 2003). However, the information sharing necessary to collaborate (Dyer 1997; Ittner et al. 1999; Seal et al. 1999; 2004; Cooper and Slagmulder 2004) leaves firms vulnerable to the potential of self-interested behavior by their counterpart (Parkhe 1993; Roberts 2004; Anderson and Dekker 2005; Das 2006). More specifically, following an idiosyncratic investment by the supplier, a more powerful buyer might choose to appropriate the surplus generated by the investment, thus leaving the supplier worse off than before his investment. Anticipating the self-interested behavior of the buyer during trade, the seller chooses not to make the socially optimal investment (i.e., hold-up problem) (Williamson 1985).

I examine, first, whether, in the context of supplier idiosyncratic investments, supplying aggregated instead of disaggregated cost information to the buyer can help curtail the self-interested behavior of the buyer during trade. If the supplier provides disaggregated information about the marginal production costs and the sunk investment cost, then an opportunistic buyer can divide the joint surplus in such a way that only the

marginal production costs are reimbursed. However, if the supplier provides only aggregated costs by combining marginal and investment costs, the buyer will find it more difficult to pursue a self-interested strategy. As a result, the supplier should invest and the joint surplus increases. Second, I examine how the buyer's strategy (i.e., buyer follows a self-interested or fair strategy)[3] affects buyer trade offers and whether a signal sent to the supplier about the buyer's strategy will increase the likelihood of investment. Hence, I address the following two research questions. First, does aggregated supplier-provided cost information mitigate the hold-up problem? Second, how does the level of aggregation of the supplier-provided cost information (i.e., fine or coarse) interact with buyer firm strategy (i.e., self-interested or fair) to affect buyer trade offers and supplier investment in idiosyncratic assets?

I investigate two manners in which the hold-up problem might be mitigated. Importantly, since suppliers base their investment decisions on expectations of the payoffs they will derive from trade, both mitigating mechanisms aim to encourage investment in idiosyncratic assets by reducing the likelihood that buyers will behave opportunistically during trade. First, when the supplier cannot be confident *ex ante* that the buyer will not behave in a self-interested manner *ex post*, reducing the fineness of the information provided to the buyer will mitigate the risk of buyer opportunistic behavior during trade. I build on accounting research on aggregation[4] as a way of limiting

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[3] I define as fair a strategy that instructs buyers to reimburse the marginal production and investment costs incurred and to share the net surplus. Conversely, I define as self-interested a strategy that instructs buyers to only reimburse marginal production costs. I do not propose to investigate the motivations for choosing a fair or self-interested strategy.

[4] Ijiri (1975, 109) suggests, "Generally, the reduction of n-dimensional data x = {x1, x2, ...,xn} into m-dimensional data y = {y1, y2, ...,ym} by a function y = f(x) is called aggregation when m < n." In the simple hold-up example I use in this study, aggregation reduces cost information from two dimensions (investment cost and marginal cost) to one dimension (total cost).

opportunism (cf. Demski and Frimor 1999; Arya et al. 2000) and examine whether increasing the level of aggregation of supplier-provided cost information helps mitigate the hold-up problem. I predict that aggregation of supplier-provided cost information reduces the potential for self-interested behavior because aggregation removes information (namely, exact marginal production costs) that self-interested buyers might opportunistically use during trade. Thus, I propose that suppliers are more likely to invest and hold-ups are mitigated when aggregated instead of disaggregated cost information is provided to buyers.

Second, practice suggests that the hold-up problem can be eliminated by trading with a partner who has a reputation for following a fair strategy instead of a self-interested strategy (Parkhe 1993). For instance, Henke (2006) provides practice evidence that American automobile suppliers who do not invest in R&D for American Original Equipment Manufacturers (OEM) invest in R&D for Japanese OEMs because they expect that the latter will reimburse suppliers for their investment and will share some of the profits generated by the investment. Accordingly, I examine how buyer strategy affects the trade (through its effect on buyer offer) and investment (via a signal to the supplier) dimensions of the hold-up problem. I predict that buyers with a fair (self-interested) strategy will cover (not cover) the suppliers' marginal production costs and investment cost and will share (not share) the net surplus. Since suppliers anticipate the surplus they generate by investing will not be appropriated (be appropriated) by fair (self-interested) buyers, suppliers choose to make (do not choose to make) the socially optimal idiosyncratic investment. Thus, I propose that the hold-ups are avoided when suppliers believe buyers will follow a fair strategy. Additionally, I investigate how the level of

aggregation of supplier-provided cost information (i.e., fine or coarse) interacts with the firm strategy of the buyer (i.e., self-interested or fair) to affect hold-ups.

To investigate the questions of interest, first, I examine the effects of the level of aggregation of supplier-provided cost information and the buyer's trade strategy on the buyer's trade decision following an idiosyncratic investment by the supplier. The buyer learns the supplier's investment cost and expected marginal production costs either disaggregated (i.e., fine information) or aggregated (i.e., coarse information) and his actions are guided by his firms strategy. An ultimatum game, with the buyer making a take-it-or-leave-it offer to the supplier, is used to divide the surplus generated by the investment. Second, the supplier receives a signal of the buyer's strategy and learns the fineness of the cost information given to the buyer. Then, the supplier makes his investment decision. I find that supplying buyers with aggregated (disaggregated) cost information results in self-interested buyers making higher (the same) offers and suppliers investing more than (the same as) predicted by economic models. Accordingly, giving buyers aggregated cost information results in an increase of the joint surplus. Additionally, contrary to previous results from studies investigating other forms of information asymmetry (e.g., Sloof, Oosterbeek, and Sonnemans 2007), I show that aggregation of cost information interacts positively with buyer strategies to affect trade offers and investment in idiosyncratic assets.

My contribution is twofold. First, this dissertation makes a contribution to the accounting literature on incomplete contracting and opportunism in buyer and supplier relationships (e.g., Edlin and Reichelstein 1996; Baiman and Rajan 2002a; Drake and Haka 2007). While accounting research typically suggests that obtaining more detailed

information increases firm profits by reducing moral hazard and by improving the decision-making process, I suggest that aggregated cost information (in other words less detailed information) increases the joint surplus (via investment in idiosyncratic assets). Second, this dissertation contributes to the accounting literature on aggregation by highlighting and isolating the effects of buyer strategy (i.e., self-interested or fair) and by documenting an interaction between buyer strategy and levels of aggregation of supplier-provided cost information (i.e., fine and coarse) when inter-firm hold-up is of concern.

The remainder of this chapter is structured in five sections. Following the introduction, Section 2.2, a literature review, introduces the various mitigating mechanisms that have been investigated highlighting their limitations. Out of those mitigating mechanisms, I focus on buyer-supplier information difference and trading with buyers with a reputation for fairness to conclude the literature review. The third section develops hypotheses. Section 2.4 presents the research design. Experimental methods and results are described in Section 2.5. The dissertation concludes with a discussion, limitations of this research and suggestions for future development.

2.2 LITERATURE REVIEW

This section presents, first, the various mitigating mechanisms of the hold-up problem that have been investigated by economics, accounting and marketing, highlighting their limitations. Second, I suggest how investigation of aggregation of supplier-provided cost information and of buyer strategy can help inform the search for a remedy to hold-up problems.

The hold-up problem presented by transaction cost economics theory is based on

the premise that, given the right circumstances and buyer's lack of commitment not to behave opportunistically, self-interested behavior is likely to occur during the trade that follows an idiosyncratic investment (i.e., trade opportunism) (Williamson 1975, 1985). Importantly, all the mechanisms discussed below have been proposed as a means to encourage idiosyncratic investment by reducing the likelihood that buyers behave opportunistically during trade.

2.2.1 Limits of Vertical Integration, Contracts and Reputation

Vertical integration (e.g., Heide and John 1990; Baiman and Rajan 1995; Anderson, Glenn, and Sedatole 2000), contracts (e.g., Klein 1980; Joskow 1985; Edlin and Reichelstein 1995, 1996; Che and Hausch 1999; Baiman and Rajan 2002a), and reputation (e.g., Anderson and Weitz 1992) have been presented as potential ways to encourage investment by protecting investors' return on investment against the self-interested behavior of the buyer.

Although the protection mechanisms discussed above can be effective in many circumstances, they also suffer from limitations. For instance, the costs of formal mechanisms such as vertical integration and contracts might exceed their potential benefits. Furthermore, vertical integration is not always possible and hold-ups can also exist between divisions of a same firm (cf. Baldenius 2000). Moreover, contracts are inherently incomplete and cannot always offer suppliers full protection from buyers' self-interested behavior. Finally, informal mechanisms such as reputation are not always effective either. Attributing responsibility for self-interested behavior might be difficult and potential partners might not believe that past self-interested behavior is predictive of future behavior (Bensaou and Anderson 1999). Consequently, self-interested behavior

might be observed and return on investment might be appropriated by buyers without affecting the buyers' reputation. Since vertical integration, contracts, or reputation do not offer full protection from hold-ups, economics literature has recently turned to increasing the information difference between supplier and buyer as a mechanism to alleviate trade opportunism, and consequently encourage idiosyncratic investments.[5]

2.2.2 Increasing Information Difference between Supplier and Buyer

To limit the potential for trade opportunism by buyers, Gul proposes that suppliers can augment their bargaining power by increasing the information difference between supplier and buyer instead of disclosing all the supplier's information (2001). This can be achieved in two ways. It can be accomplished, first, by not communicating whether an idiosyncratic investment was made, or, second, by supplying buyers with aggregated information. Truthful reporting by the supplier is assumed. Both types of information asymmetry are detailed below.

Building on Tirole's investigation of unobservable investment (1986), Gul (2001) presents a model where the supplier makes his investment decision so as to maximize the profits he will derive from trade. The supplier does not communicate to the buyer whether he made any idiosyncratic investment. Thus, the supplier possesses private information about the size of the surplus and can extract information rents during trade (i.e., the buyer is unable to appropriate the total surplus generated by the investment and trade opportunism is limited). Gul concludes that, compared to the perfect information

[5] Importantly, as with other mitigating mechanisms, increasing the information difference is not always effective. For instance, buyers might have other means of obtaining suppliers' private information or increasing the information difference might result in loss of benefits that could be derived from knowing the suppliers' marginal production costs.

condition, investment inefficiency[6] is reduced when the supplier's investment decision is unobserved by the buyer. Conversely, unless negotiation is costless, trade inefficiency[7] increases because, since the buyer does not know whether an investment was made, he does not know the supplier's reservation price. As a result, the supplier does not benefit from his private information and overall efficiency does not improve. However, Gul suggests that keeping other information private might solve the hold-up problem.

Some information can be kept private through aggregation of information (Baiman 1975). Baiman and Rajan's (2002b) and Arya et al.'s (2000) models show that, by curtailing opportunistic behavior during trade, aggregation of supplier-provided information can serve as a potential mitigating mechanism to hold-ups.

Baiman and Rajan (2002b) model the effects of disclosing know-how in a buyer-supplier network. A buyer makes a non-relationship-specific R&D investment decision and chooses the level of disclosure of the resulting innovation to the supplier. Disclosure of innovation to the supplier helps increase the size of the joint surplus by revealing a new technology that increases the quality of the product, but also facilitates misappropriation of that innovation by the supplier who could sell the improved product directly to the outside market. Baiman and Rajan conclude that disclosing the coarse know-how generated by the innovation is optimal for certain cases of innovation realization because aggregated know-how reduces the potential for self-interested

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[6] In this paper, investment efficiency occurs when the supplier makes an investment that maximizes the potential surplus from trade net of investment costs.

[7] In this paper, trade inefficiency occurs when negotiations breakdown because only one round of negotiation is conducted. Conversely, trade is efficient if trade occurs (i.e., a joint benefit to the dyad is created and at least one party benefits). Alternatively, lengthy negotiations are another form of trade inefficiency when several rounds of negotiations are conducted.

behavior by the supplier while allowing the supplier to improve the quality of the product. Importantly, Baiman and Rajan's paper does not address whether aggregation of information would also be effective to encourage investment in idiosyncratic assets. Additionally, it is unclear whether coarsening information would encourage idiosyncratic investment when cost information, instead of know-how, is provided.

Expanding on prior literature on coarse information as a commitment device between principal and agent, Arya et al. (2000) examine the effects of aggregated accounting information on investment in idiosyncratic assets in a capital budgeting and monitoring context. In this setting, an agent needs to make an idiosyncratic investment in project search for the principal. An information system that provides only coarse and late information restricts the information available to the principal; thus, it can serve as the principal's commitment not to appropriate, *ex post,* the benefits generated by the agent's investment in project search. As a result, the agent is motivated to increase his search for a profitable project (i.e., make an idiosyncratic investment) by the prospect of obtaining budgetary slack. In other words, in a capital budgeting setting, aggregation of monitoring information reduces the potential for opportunism by the principal and, as a result, strengthens the agent's incentives to make an idiosyncratic investment.

Drake and Haka (2007) examine the effect that the information system (fine with Activity Based Costing or coarse with Volume Based Costing) can have on buyers and suppliers' propensity to share cost information under different market conditions. They find that subjects with fine cost information are less likely than subject with coarse cost information to share their information with their counterpart even though such information-sharing could benefit both parties. Drake and Haka propose that subjects'

information-sharing decisions are motivated by inequity aversion and fear of being held-up during trade. Thus, an information system that provides coarse cost information encourages sharing of information by reducing the risks the other party will appropriate trade efficiencies.

Extant literature suggests that aggregated information may help mitigate hold-ups because aggregation removes information (namely, exact marginal production costs) that self-interested buyers might opportunistically use during trade. My dissertation differs from Baiman and Rajan's research (2002b) in so far as I examine aggregation of **cost information** in the context of a **relationship-specific investment**[8] instead of aggregation of know-how. Additionally, I expect to provide different insights from Arya et al. (2000) because the purpose of the transaction I investigate is **trade between buyer and supplier** instead of monitoring of project search effort. Finally, whereas Baiman and Rajan and Arya et al. assume self-interested behavior, I expand the analysis to include strategies that induce fair behavior. My dissertation also differs from Drake and Haka (2007) for two main reasons. First, the focus of my study is the two stages of the hold-up problem (investment and trade) whereas the choice to share and its impact on trade efficiency is of interest for Drake and Haka. Additionally, I manipulate the buyers' behavior via their firm strategy. Accordingly, I can assess whether aggregation of cost information affects the buyers who follow a fair strategy differently from those who follow a self-interested strategy.

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[8] Such aggregation is likely to be possible when idiosyncratic investments take the form of investments in human capital or R&D. With these types of investment, it might be too costly for the information system to disaggregate the marginal and investment cost information. Hence, even a powerful buyer might not be able to obtain disaggregated cost information. It would, however, be more difficult if the supplier invested in relationship-specific equipment.

2.2.3 Trading with Buyer with Fair Firm Strategy

In contrast to the underlying pursuit of self-interest assumption necessary for opportunistic behavior (Williamson 1985), trading with fair buyers has been proposed as a way to avoid hold-ups. Two streams of literature have investigated the effect of fairness on hold-ups. Supply chain literature, the first stream of research, associates fair strategy with sharing of the benefits created by the relationship (e.g., Ring and Van De Ven 1992; Kumar 1996; Bensaou 1999; Dyer 1997; Dekker 2003; Langfield-Smith and Smith 2003; Cooper and Slagmulder 2004), but does not investigate the motivation for such strategic choices. Sharing of the benefits created by the relationship (e.g., cost savings or improvement in product quality) is made possible by the multiperiod nature of the exchanges between the firms. Supply chain literature observes that, whereas some firms pursue strategies that are arm's length in nature and focus on purchasing products for the lowest price possible by only reimbursing marginal production costs (i.e., self-interested strategy), others pursue more collaborative strategies (Bensaou and Venkatraman 1995; Bensaou 1999; Doz and Baburoglu 2000) characterized in part by considerations of fairness (i.e., fair strategy) (Helper 1991; Carr and Ng 1995; Kumar 1996; Bensaou and Anderson 1999; Cooper and Slagmulder 2004; Henke 2006). Fair strategies can lead to different outcomes depending on reference points and industry norms (Kahneman, Knetsch, and Thaler 1986), but, in general, a buyer with fair strategies will reimburse suppliers for their marginal production costs and past investment cost, and share some of surplus created by the investment (cf. Kumar 1996; Sako 2004). The extent of such fair strategies in the economy has, however, not yet been determined.

Experimental economics, the second stream of research, examines the behavior of

individuals and attempts to distinguish the motivation behind fair behaviors (e.g., social preferences such as reciprocity, inequity aversion, or altruism). Experimental economics goes as far as questioning the seriousness of the hold-up problem because of the extent of observed fair behavior in the laboratory. Experimental economics researchers (e.g., Berg, Dickhaut, and McCabe 1995; Ellingsen and Johannesson 2004a; 2004b; 2005) observe that, in contradiction with economic predictions, investment in relationship-specific assets is significantly greater than zero (i.e., 16% to 35% of participants invest at the socially optimal level) and offers from the party who benefited from the investment are greater than zero. Based on the offers they observe, these researchers conclude that some individuals intend to reciprocate[9] and that expectations of fairness play a role in their counterparts' investment decisions.

Yet, as pointed out by Roth and Murninghan (1982) and Ochs and Roth (1989), it is likely that such sharing of the surplus created by the investment is motivated by one of two factors: the self-interest of the individual who wants to make an offer that is likely to be accepted or the individual' s actual preferences for fairness. Those studies suffer from two important limitations. First, those studies are unable to distinguish between self-interest and actual preference for fairness as the studies do not manipulate buyer fairness. Second, they study the behavior of individuals and abstract from the fact that firms attempt to control the behavior of their employees through corporate culture and strategies.

Strategic management research investigates the relation between the guidance

[9] Alternatively, buyers might have offered more than zero and covered the investment cost not for fairness reasons, but because they suffer from the sunk cost bias, intend to signal competitors, or have other strategic reasons (Parayre 1995; Diekmann et al. 1996; Troeger 2002).

provided by the firm (i.e., culture, values and strategy) and the actions of the firm's managers. Research has focused on the creation and formulation of strategies, the congruence between individual and firm values (cf. Kristof 1996) and the association between strategy, top executives characteristics and firm performance (e.g., Thomas, Litschert, and Ramaswamy 1991). Several studies propose that strategies guide actions of managers (e.g., Floyd and Wooldridge 1992; Bourgeois and Brodwin 1984). Additionally, research proposes that for such guidance to be effective, the strategy needs to be communicated clearly, and should be associated with performance measurement and incentive compensation (Kaplan and Norton 1996). For instance, Kumar (1996) finds that Procter & Gamble motivate their managers to follow a strategy of working closely with distributors by compensating managers based on the profits of Procter & Gamble and of the distributors.

Accounting literature has focused its investigation on the relationship between accounting systems and generic firm strategies such as those presented by Gupta and Govindarajan (1984) or Porter (Porter 1985). Research has pointed to the importance of adaptability of the accounting systems to strategies (Langfield-Smith 1997) and to the life cycle of the firm (Granlund and Taipaleenmaki 2005), but little focus has been given to more specific firm-wide strategies such as strategies for dealing with suppliers. Thus, we know little about how strategies might interact with accounting system characteristics to affect individual decision-making and behavior.

Still, Liedtka (1989) finds that most managers surveyed comply with a strategy even when they experience some conflict with their values provided the strategy is strong. Thus, there is some evidence that a strong firm strategy that is clearly

communicated might induce employees to follow the firm strategy instead of their own preferences. As a result, when an employee, who has individual preferences for fairness (self-interest), is guided by a self-interested (fair) strategy, it is likely that he will follow the guidance provided by the firm instead of his own preference. Consequently, one cannot conclude, as suggested by Ellingsen and Johannesson (2004), that fairness preferences of some individuals makes the hold-up problem a rare occurrence. In this dissertation, I present evidence that a clearly communicated firm strategy can induce subjects to behave in a self-interested or fair manner in an experimental setting resulting in exacerbating or mitigating hold-ups.

2.2.4 Increasing Information Difference in the Presence of Different Firm Strategies

Building on extant experimental economics research, Sloof et al. (2007) test Gul's finding that private information in the form of unobservable investment boosts investment efficiency. Sloof et al. examine the interaction between imperfect information (i.e., unobservable investment), and fair behavior of individuals. Their results are consistent with Gul's model when investment cost is high and there is little room for fairness (i.e., suppliers are more likely to invest when investment is unobservable than when it is observable). Sloof et al. show, however, that although individuals' fairness mitigates hold-ups when investment is observable, the positive effect that buyer fairness has on the hold-up problem is negated when investment is unobservable and investment cost is low. Sloof et al. point out that buyers do not know how much suppliers gave up in order to create the gross surplus when investment is unobservable. Consequently, fair buyers are unable to reimburse suppliers for the investment they made or to share the

surplus when investment is unobservable. Importantly, Sloof et al. do not provide measures of buyer's fairness. Instead, holding the gross surplus fixed, they propose that fair (self-interested) behavior can be expected when there is a large (small) net surplus to share, i.e., small (large) investment for a fixed surplus. They also suggest suppliers might invest (not invest) because they expect reciprocity (self-interested behavior) from buyers. Alternatively, considerations of risk and returns could also explain why suppliers refrain from investing when investment costs are high.

Findings presented by Baiman and Rajan (2002) and Arya et al. (2000) lead me to propose that, with buyer-supplier relationships, an information difference that arises from aggregated supplier-provided cost information might reduce the likelihood of buyer self-interested behavior, hence encouraging idiosyncratic investment. Additionally, observations from behavioral economics (cf. Sloof, Oosterbeek, and Sonnemans 2007) suggest that the effect of aggregation of supplier-provided cost information (i.e., fine and coarse) on trade and investment is likely to depend on buyer strategy (i.e., self-interested or fair).

2.3 HYPOTHESIS DEVELOPMENT

In this section, I develop the intuition behind the predictions first for the trade decision (as expectations from trade drive investment decisions), then for the investment decision. A more formal analysis can be found in Appendix A.

Important assumptions follow. First, I examine a one-period transaction and do not take into account reputation considerations. Importantly, one-period games are appropriate to examine hold-ups because, in many alliances, one partner has a short-term

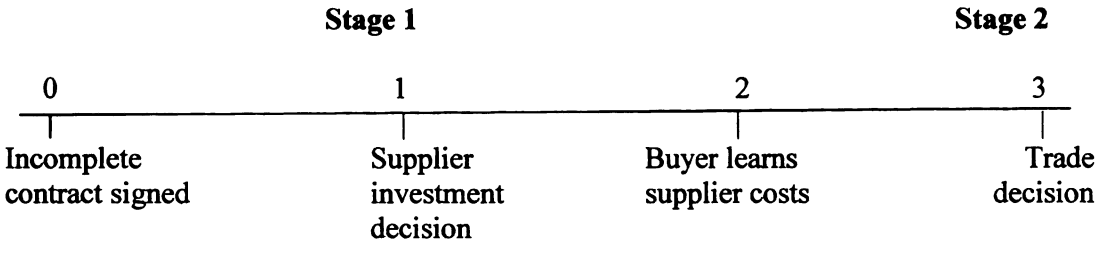
horizon (Das 2006) and because, as a result of technology or environmental uncertainty, it is often difficult to assess whether future benefits will derive from current transactions. Second, I assume that the buyer-supplier contract is incomplete and renegotiation cannot be avoided. Third, buyers have greater bargaining power than suppliers and buyers are risk averse. The following two assumptions are not central to this analysis, but are made for expositional purposes. Suppliers are assumed to be self-interested, i.e., to accept any offer that at least covers marginal costs. This simplifying assumption was made because informing buyers that they will be dealing with self-interested suppliers removes their strategic uncertainty about what constitutes an offer that will be acceptable to the supplier.[10] Thus, knowing that they are dealing with self-interested suppliers assures buyers that offers that cover marginal production costs will not be rejected. As a result, buyers who offer to reimburse marginal production costs and investment cost and to share the net surplus truly intend to follow the fair strategy and are not motivated by the expectation that offering to reimburse costs and to share the net surplus is necessary to avoid rejection of their offer. Finally, consistent with other experimental and analytical research on hold-ups, neither supplier, nor buyer has an outside option should disagreement about trade occur.

The timeline illustrating the various stages of the hold-up problem is detailed in Figure 2-1.

[10] Brenner and Vriend (2006, 629) provide empirical evidence that proposers in ultimatum games are unable to learn their part of the subgame perfect equilibrium even after 100 iterations "unless the players...behave exactly as in the subgame perfect equilibrium without ever rejecting any offer."

Figure 2-1

Timeline of the Hold-up Problem



Adapted from Hart and Moore (1988)

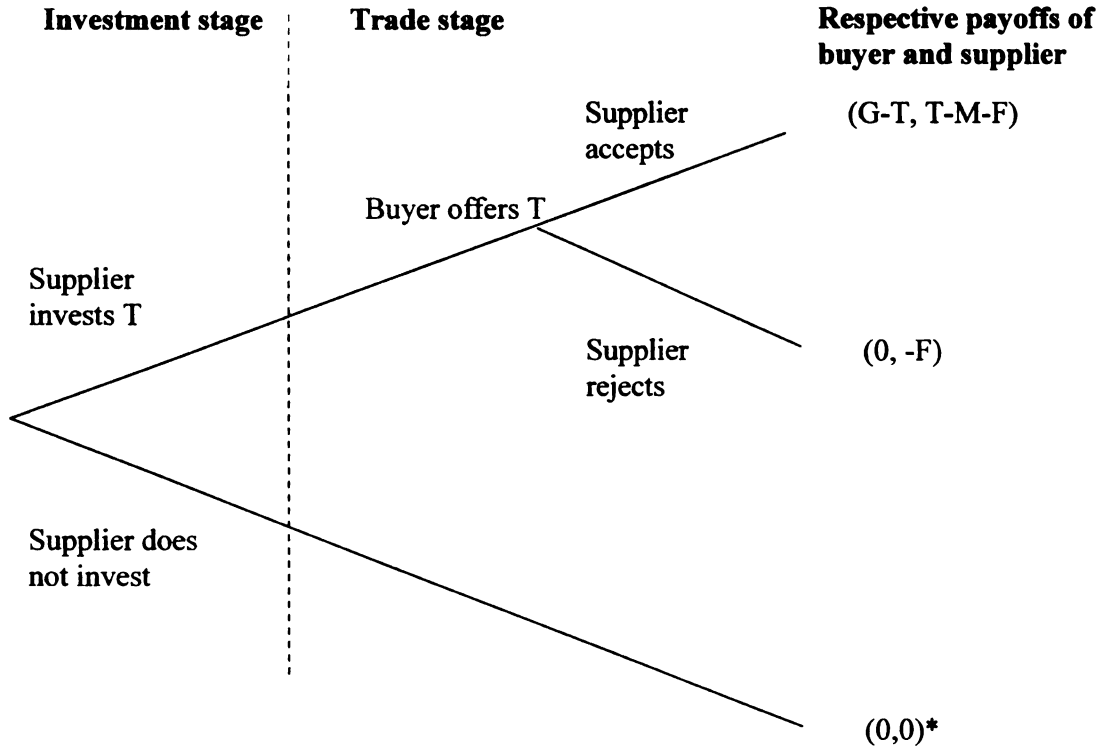
Figure 2-1 shows a contract is negotiated at time 0 for a predetermined quantity of a product. The product price cannot be specified with certainty *ex ante* because it depends on the resolution of certain parameters that cannot be predicted (e.g., success of R&D efforts). At time 1, the supplier must decide whether to make a non-contractible idiosyncratic one-period investment that will create a potential surplus from trade. Time 1 represents the investment stage. The supplier is motivated to maximize his payoff from trade (i.e., buyer's offer less marginal and investment costs) and his investment decision is based on expectations of his share of the surplus from trade to be conducted at time 3. In other words, the supplier uses backward induction to make the investment decision. The buyer learns the supplier's cost information at time 2. An ultimatum game,[11] where the buyer makes a take-it-or-leave-it offer, is used to divide the net surplus from trade at

[11] Alternatively, Nash demand games (e.g., Gantner, Gueth, and Koenigstein 2001), dictator games (e.g., Sloof, Oosterbeek, and Sonnemans 2007) and infinite horizon games with forced breakdown (e.g., Hackett 1994) have been used to model the trade stage of the hold-up problem.

time 3. Time 3 represents the trade stage. Although ultimatum games are parsimonious representations of the negotiation process (Gueth, Schmittberger, and Schwarze 1982), they capture the bargaining power differential between the buyer and supplier, an important assumption of this study. The various outcomes of this two-stage game are detailed below and shown in Figure 2-2.

Figure 2-2

Investment and Trade Stages



Where F = Investment cost
T = Buyer trade offer
G = Gross surplus from trade such that G > M + F
M= Marginal production costs

* While most papers (e.g., Berg et al. 1995; Ellingsen and Johannesson. 2004a, 2004b; Cox 2004) assume that trade doe not take place if the supplier does not invest, a few papers (e.g., Sloof et al. 2007) assume that trade occurs when the supplier does not invest and that a smaller surplus is divided.

Let G represent the gross surplus generated by the supplier's idiosyncratic investment (i.e., the surplus from trade), M the predicted marginal production costs, and F the supplier's investment cost. $G > M + F$. In other words, investment is socially efficient. Let I represent the supplier's investment decision: $I = 1$ if investment takes place, $I = 0$ otherwise. X_i represents the net monetary payoffs of player i. At time 3, the surplus from trade is as follows:

$$\begin{cases} G & \text{if } I = 1 \\ 0 & \text{if } I = 0 \end{cases}$$

Let T equal the trade offer of the buyer to the supplier. I normalize the costs incurred by the buyer (in addition to the offer he makes to the supplier) to zero. The supplier and buyer monetary payoffs are respectively X_s and X_b with:

$$X_s = \begin{cases} T - F - M & \text{if } I = 1 \text{ and supplier accepts buyer's offer} \\ -F & \text{if } I = 1 \text{ and supplier rejects buyer's offer} \\ 0 & \text{if } I = 0, \end{cases}$$

and

$$X_b = \begin{cases} G - T & \text{if } I = 1 \text{ and supplier accepts buyer's offer} \\ 0 & \text{otherwise} \end{cases}$$

I assume that firms follow a self-interested or a fair strategy. I define a self-interested strategy as a strategy that instructs buyers to cover only marginal production costs and a fair strategy as a strategy that instructs buyers to reimburse supplier for marginal production costs and investment cost, and to share the net surplus created by the investment. Firm strategies are instituted to guide the actions of individual decision makers. Accordingly, a self-interested (fair) strategy should lead to self-interested (fair)

behavior. Thus, I conduct the analysis at the individual level.

Recall that supplier's expectation of self-interested behavior by the buyer during trade drives the hold-up problem. This suggests that reducing the likelihood that the buyer behaves in a self-interested manner signals that the supplier will be reimbursed for his idiosyncratic investment. As a result, the supplier should invest. I examine two ways of mitigating hold-ups (namely, providing buyers with *aggregated supplier-provided cost information* and trading with buyers with *fair firm strategy*) and how they interact to affect buyer trade offers and supplier investment decisions.

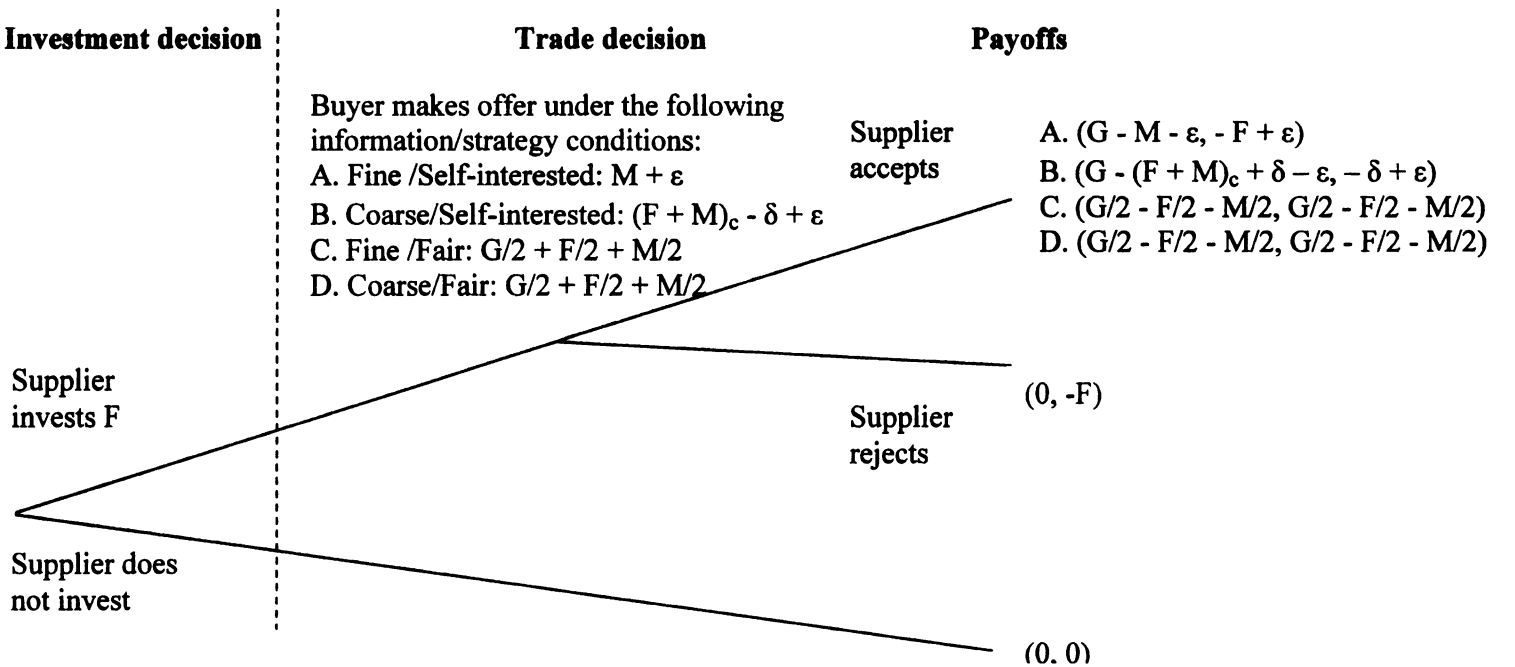
2.3.1 Trade Predictions – H1a-d

First, I examine the effect of *the level of aggregation of supplier-provided cost information*. Williamson's (1985) predictions suggest that the *self-interested buyer* who knows the supplier's marginal production costs, M, and past idiosyncratic investment cost, F, (i.e., *fine information*) will offer just enough to cover marginal production costs plus ε[12] (or $M + \varepsilon$) as presented in Figure 2-3 under item A. below. Anticipating this, the supplier will not make the socially optimal idiosyncratic investment.

[12] ε is an immaterial amount offered so that a self-interested supplier is not indifferent between accepting and rejecting the offer.

Figure 2-3

Predicted Outcomes under Various Information and Strategy Conditions



Where F = Investment cost
G = Gross surplus from trade
M= Marginal production costs
ε = Immaterial amount
δ = Buyer's expected value of F reduced by buyer's adjustment for uncertainty

I propose that a self-interested buyer who possesses *coarse cost information c* in the form of the sum of the supplier's marginal production costs and past idiosyncratic investment cost (i.e., $(F + M)_c$) will offer more than a self-interested buyer who possesses fine cost information. Knowing that a self-interested supplier has an acceptance threshold of M, a self-interested buyer would like to offer $M + \varepsilon$, but he has no prior information about the supplier's true marginal production costs, M, or investment cost, F. The buyer wants to make a low offer so as to maximize his payoffs, but, being risk averse, does not want to risk losing his share of the surplus from trade (i.e., G - T) by making an offer that does not cover marginal production costs. In essence, uncertainty about the true marginal production costs and fear of losing the surplus from trade will cause a self-interested buyer to include a substantial portion of the cost of the supplier's past investment in his offer and offer close to $(F + M)_c$. In sum, the information loss associated with coarse information limits the buyer's potential self-interested behavior; thus, resulting in higher offers than fine information. Thus, in the coarse/self-interested condition, the buyer's predicted offer is $(F + M)_c - \delta + \varepsilon$[13] with $(F + M)_c - \delta > M$ as shown in Figure 2-3 item B. above and detailed in Appendix A.

Second, I examine the effect of ***buyer strategy*** on the trade decision. Fehr and Schmidt's inequity aversion theory (1999) provides the framework to predict behaviors of buyers. Carmichael and MacLeod (2003), Ellingsen and Johannesson (2004b), and Ewerhart (2006) suggest that considerations of fairness lead some buyers to include investment cost in their payoff calculation and, as a result, in their offer calculation. In

[13] δ represents the buyer's expected value of F reduced by the adjustment the buyer makes for his uncertainty. The higher the buyer's uncertainty about M and F's true values, and the higher the potential surplus from trade, the lower δ.

other words, fair buyers reimburse marginal production costs and investment cost, and share some of the net surplus from trade. Thus, buyers who follow a fair strategy do not need to identify investment cost, F, and marginal costs, M, separately.

Consequently, offers of buyers assigned a fair strategy should not be affected by whether investment cost and marginal production costs are disclosed disaggregated (in the form of F and M) or aggregated (in the form $(F + M)_c$). As a result, the offers made by buyers with fair firm strategy who have supplier-provided coarse cost information are not expected to be significantly different from the offers made by buyers who possess fine cost information. As presented in Figure 2-3 (items C. and D.) and detailed in Appendix A, offers are predicted to be $G/2 + F/2 + M/2$.[14] Accordingly, contrary to the case of unobservable investment presented above in Section 2.2. (cf. Sloof et al. 2007), information asymmetry in the form of aggregated cost information is not expected to lead to greater trade inefficiency than fine information.

In sum, I propose that buyers will make the following offers as shown in Figure 2-3:

(i) With *fine information, buyers assigned a self-interested strategy* will offer $M + \varepsilon$, whereas *buyers assigned a fair strategy* will offer up to $G/2 + F/2 + M/2$.

(ii) With *coarse information, buyers assigned a self-interested strategy* will offer $(F + M)_c - \delta + \varepsilon$ with $(F + M)_c - \delta > M$, whereas *buyers assigned a fair strategy* will offer up to $G/2 + F/2 + M/2$.

As detailed above, an ordinal interaction between level of aggregation of supplier-provided cost information and buyer strategy is predicted. Thus, I propose that coarse

[14] $G/2 + F/2 + M/2 = M + F + (G - M - F)/2$. In other words, it is equivalent to reimbursing marginal production costs and investment costs and sharing the net surplus.

information increases the offers buyers who follow a self-interested strategy, but does not change the offers of buyers who follow a fair strategy. This prediction leads to the following hypotheses:

H1a: An interaction between level of aggregation of supplier-provided cost information and assigned buyer strategy is predicted to affect buyers' offers.

The specific predictions associated with this interaction are detailed in the hypotheses below.

H1b: When buyers are assigned a self-interested strategy, buyers who possess coarse cost information make, on average, higher offers than buyers with fine cost information.

H1c: When buyers are assigned a fair strategy, the offers of buyers do not change based on the level of aggregation of the cost information they possess.

H1d: When buyers possess coarse cost information, the mean offer of buyers assigned a fair strategy is greater than that of buyers assigned a self-interested strategy.

Hypotheses H1a-d are summarized in Table 2-1.

Table 2-1

Summary of H1a-d

Buyer trade offer	Self-interested strategy	Fair strategy
Fine information	A	B
Coarse information	C	D

Predictions:
H1a: Information x Strategy
H1b: Coarse information > Fine information if Self-interested strategy C > A
H1c: Coarse information = Fine information if Fair strategy B = D
H1d: Fair strategy > Self-interested strategy if Coarse information D > C

In sum, providing buyers with coarse instead of fine cost information can serve, for the supplier, as a protection against the buyer's potential trade opportunism. H1a-d suggest that suppliers who are somewhat uncertain about whether they will be dealing with a buyer who has a fair or self-interested firm strategy are better off disclosing only coarse cost information.

Recall that the hold-up problem has two dimensions: investment and trade. The effect of the supplier's knowledge of buyer strategy and of the level of aggregation of the supplier-provided cost information on the supplier's investment decision is examined below.

2.3.2 Investment Predictions – H2 and H3a-d

Expectations of buyer self-interested behavior during the trade stage drive under-investment by suppliers. Therefore, I predict that reducing the likelihood that buyers behave in a self-interested manner will lead suppliers to invest, thus increasing investment efficiency. Suppose that, since buyers cannot commit to not behave

opportunistically, suppliers do not know the buyers' strategy (i.e., self-interested or fair) with certainty, but can assign probabilities to each strategy. The expected utility of self-interested suppliers includes the expected offer net of marginal production costs and idiosyncratic investment cost.

(i) When the buyer possesses *fine cost information*, the supplier expects to receive $M + \varepsilon$ from a buyer assigned a self-interested strategy, and up to $G/2 + F/2 + M/2$ from a buyer assigned a fair strategy (see Figure 2-3). The supplier will invest if his expected utility is positive. I predict that that the higher the probability of the buyer strategy being self-interested and the higher the investment cost, the less likely it is the supplier will invest.

(ii) When the buyer possesses *coarse cost information*, the supplier expects to receive $(F + M) - \delta + \varepsilon$ from a buyer assigned a self-interested strategy, and up to $G/2 + F/2 + M/2$ from a buyer assigned a fair strategy (see Figure 2-3). Since δ is predicted to be significantly smaller than the supplier's investment because of the risk aversion of the buyer, the expected utility of a supplier in the coarse information condition is greater than the expected utility of a supplier in the fine information condition. Consequently, the supplier is more likely to invest in the coarse than in the fine information condition.

H2: Suppliers are more likely to make idiosyncratic investments when buyers possess supplier-provided coarse cost information than when buyers possess fine cost information.

An example illustrates supplier's expected utility calculations and the above predictions. Assume the supplier believes there is a 75% chance that the buyer is assigned a self-interested strategy and surplus from trade, G, equals170 for an idiosyncratic

investment, F, of 40 and marginal production costs, M, of 10. With *fine cost information*, supplier's expected utility calculation is as follows:

.25 * (170/2 + 10/2 + 40/2) + .75 * 10 - 40 - 10 = -15. Since the supplier's expected utility is negative, he will not invest.

However, with *coarse cost information*, supplier's expected utility calculation is as follows:

.25 * (170/2 + 10/2 + 40/2) + .75 * (10 + 40 - δ) - 40 - 10 = 15 - .75δ. The supplier's expected utility will be positive if δ is smaller than 20. Hence, the supplier invests if he expects that the offer made by the buyer will be greater than 30 (i.e., 50 - 20). The supplier should invest because, as a result of the buyer's risk aversion, δ is predicted to be small.

Additionally, H1b-c suggest that increasing the level of aggregation of supplier-provided cost information results in an increase in the offers made by buyers with self-interested strategies, but does not change the offers of buyers with fair strategies. Since expectations of trade behavior drive suppliers' investment decisions, an interaction between level of aggregation of supplier-provided cost information and buyer strategy is also predicted in relation to investment. H3a-d follow.

H3a: An interaction between level of aggregation of supplier-provided cost information and buyer strategy is predicted to affect supplier's investment in idiosyncratic assets.

The specific predictions associated with this interaction are detailed in the hypotheses below.

H3b: When suppliers know they are likely to be matched with a buyer who is

assigned a self-interested strategy, increasing the level of aggregation of the cost information provided to buyers will, on average, result in significantly larger supplier investment.

H3c: When suppliers know they are likely to be matched with a buyer who is assigned a fair strategy, supplier's mean investment does not change based on the level of aggregation of the cost information buyers possess.

Importantly, H1d predicts buyers with a fair firm strategy will make higher offers than buyers with a self-interested firm strategy when buyers possess coarse cost information. Because of this, I predict that buyers with coarse information cover a substantial portion of the marginal production costs and investment costs.[15] Accordingly, suppliers matched with buyers in the self-interested/coarse condition do not expect that buyers will be able to appropriate the entire surplus generated by their investment. It follows that suppliers in the self-interested/coarse condition are likely to invest. H3d follows.

H3d: When buyers possess coarse cost information, the mean investment of suppliers who know they have a higher probability of being matched with buyers who are assigned a fair strategy is equal to the mean investment of suppliers who have a higher probability of being matched with buyers who are assigned a self-interested strategy.

Hypotheses H2 and H3a-d are summarized below in Table 2-2.

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[15] In the coarse/self-interested condition, the buyer's predicted offer is $(F + M)_C - \delta + \varepsilon$ as shown in Figure 2-3 item B.

Table 2-2

Summary of H2 and H3a-d

Supplier investment	Self-interested strategy	Fair strategy
Fine information	A	B
Coarse information	C	D

Predictions:
H2: Coarse information > Fine information C + D > A + B
H3a: Information x Strategy
H3b: Coarse information > Fine information if Self-interested strategy C > A
H3c: Coarse information = Fine information if Fair strategy B = D
H3d: Fair strategy = Self-interested strategy if Coarse information D = C

2.4 RESEARCH DESIGN

Following protocol studies, pre-pilot tests, and pilot tests,[16] 106 students (88 MBAs, two Master students and 16 undergraduate students) were recruited on a voluntary basis from managerial accounting classes (see Table 2-8 in Appendix C for additional descriptive statistics of the participants). Participants received performance contingent compensation in addition to a $5 participation fee. Overall payoffs ranged from $5 to $15 with an average compensation of $10 for a thirty-minute session.

2.4.1 Experimental Design and Variables

A 2 x 2 between-subject design was used for the investment and trade tasks. Two separate experiments were conducted, one for buyer subjects in the trade task and the other for the supplier's investment decision. Two levels of aggregation of cost

[16] See Appendix B for more details on the pilot tests and the evolution of the experiment.

information possessed by the buyer (viz. coarse or fine information) and two levels of buyer strategy (viz. self-interested or fair) were used.

In the fine cost information condition, buyers knew the marginal production costs and the past idiosyncratic investment cost of the suppliers separately. Coarse cost information was operationalized by giving buyers only the sum of the suppliers' marginal production costs and past idiosyncratic investment cost.

Firm purchasing strategy provided the means for manipulating buyer strategy. Given that firms employ individuals of varying types ranging from self-interested to fair, firm strategy can serve as a means for providing guidance to employees concerning the expected behavior. More specifically, a strategy that instructs buyers to cover only the supplier's marginal production costs (i.e., self-interested strategy) encourages buyers to behave in a self-interested manner. Conversely, a purchasing strategy that instructs buyers to cover marginal production costs and investment cost and to share the net surplus from trade[17] (i.e., fair strategy) encourages fair behavior.

Recall that expectations that buyers will appropriate the surplus generated by the investment drive the hold-up problem. Since the surplus from trade is fixed once the investment has been made, the offer made by the buyer is a measure of how the surplus is divided. Accordingly, buyer's offer is the main dependent variable of interest for the trade task and H1a-d.

Likelihood of investing and mean investment level are the criteria of interest for the investment task. The instructions suggest that making an idiosyncratic investment is socially optimal. Accordingly, consistent with recent experimental economics hold-up

[17] Instructions suggested that buyers should share the surplus equally to remove noise. Instructing buyers to share the surplus equally was chosen to be consistent with prior research (Camerer and Loewenstein 1993).

papers (Ellingsen and Johannesson 2004b; 2004a; 2005; Sloof, Oosterbeek, and Sonnemans 2007), participants made a binary choice. They could choose between investing $0 and a specified amount F which was chosen so that M + F < G. Hence, choosing to invest is efficient by construction. The likelihood of investing is the criterion for H2, and investment level is the criterion for H3 a-d. They are measured by suppliers' investment choice and the resulting investment amount.

2.4.2 Experimental Materials and Procedure

The trade and the investment tasks were run as separate experiments to facilitate backward induction.[18] The intent of this study is not to capture how well suppliers can do backward induction. Instead, first, I test the effects of the level of aggregation of the supplier-provided cost information and the buyer's firm strategy on buyer's offer in the trade stage. Second, given that suppliers are informed of the buyers' level of information aggregation and firm strategy, I measure how this knowledge affects suppliers' investment decision in the investment stage. The trade and investment tasks were conducted as separate experiments. Fifty-two subjects took part in the trade task. Fifty-four subjects participated in the investment task. Subjects were randomly assigned to conditions for both tasks. Detailed experimental materials can be found in Appendix D.

2.4.2.1 Trade Task

Participants were assigned the role of buyer. Consistent with prior hold-up research (e.g., Gul 2001; Ellingsen and Johannesson 2004a), an ultimatum game

[18] Additionally, since it is predicted that suppliers in the fine condition do not invest (thus, trade does not occur), the effect of the level of aggregation of cost information on the trade negotiation could not be assessed for all conditions if an investment decision were to be followed by a trade decision.

represented the trade stage. The game was not repeated in order to mitigate reputation concerns that are associated with repeated exchanges.

Buyers learned they would trade with self-interested suppliers and the trade task was limited to a one-time offer. Participants made offers with the expectation that suppliers would be able to reject their offers (as in an ultimatum game) if the offers did not cover marginal production costs. Although no participant was assigned to the role of supplier in this experiment, any offer that covered marginal production costs was deemed to be accepted because self-interested suppliers would derive positive utilities from such offers. Each participant was presented with a scenario where s/he had the opportunity to purchase parts from a supplier. The participants learned that this self-interested supplier had made an idiosyncratic investment and that they would need to make a take-it-or-leave-it offer on behalf of their firm to purchase parts from that supplier. They learned the supplier's cost information (i.e., fine or coarse). They knew the expected revenue they could obtain from selling the product to the outside market. Their offer was to be guided by their firm strategy (i.e., self-interested or fair).

Introductory materials detailed the buyer and supplier payoffs calculations from trade given that an idiosyncratic investment had been made. The calculation of incentive compensation as a percentage of the buyer's share of the surplus from trade was also included. Following an example, pre-trade decision questions were administered to gauge the participants' understanding of the key elements in the materials (namely, existence of an idiosyncratic investment and effect of firm strategy on payoffs as detailed in Table 2-3, Panel A). Participants were encouraged to refer back to the instructions if they were unsure of their answer.

Table 2-3

Test of Subjects' Comprehension of Experimental Setting

Questions were measured on a 9-point Likert scale with 1 representing strongly disagree and 9 representing strongly agree.

Panel A – Trade Decision	**Mean**
Q: My firm's purchasing strategy affects the cash I will derive from trade.	8.12
Q: The Seller can use the project-specific machine to make parts for another buyer.	2.17
Q: If the Seller rejects my offer, my incentive compensation will be $0.	7.87
Panel B – Investment Decision	**Mean**
Q: The Buyer's firm purchasing strategy affects the net cash I will derive from trade.	8.37
Q: I can use the project-specific machine to make parts for another buyer.	1.83
Q: If I do not purchase a project-specific machine, my firm's net cash is $0.	6.48

After returning the pre-experiment questionnaire, participants made an offer decision and gave their best estimate of the lowest offer the supplier might accept. Then, participants completed a post-experiment questionnaire that included manipulation

checks and questions designed to help understand their decision process and help eliminate alternative explanations (see Appendix C). Finally, participants' personal preference for fairness were elicited with an instrument created by Messick and McClintock (1968) and updated by Liebrand (1984).

2.4.2.2 Investment Task

For the investment task, participants were assigned the role of supplier. Participants were presented with a scenario where they could purchase, on behalf of their firm, an idiosyncratic machine to manufacture parts for a specific buyer. Before making their investment decision, participants learned that, subsequent to the purchase of the machine, the buyer would make a take-it-or-leave-it offer for the parts. Participants received introductory materials detailing supplier and buyer payoff calculations should investment occur or not. Incentive compensation calculation as a percentage of the supplier's net cash was also included.

Participants knew their costs and had complete knowledge of the level of aggregation of the buyer's information (i.e., whether buyer had fine or coarse supplier-provided cost information). The materials then further explained the potential effect of buyer's firm purchasing strategy on trade by means of examples. Following these examples and pre-investment decision questions similar to those of the trade task (See Table 2-3, Panel B), participants were asked to make a one-time investment decision faced with a 75% chance of working with a buyer who is assigned a self-interested (fair) firm strategy and a 25% chance of working with a buyer who is assigned a fair (self-interested) firm strategy. The participants' expectations of the buyers' offers were also collected. As in the trade task, post-experiment questions followed (see Appendix C).

Finally, the buyer's actual strategy was selected by drawing from the distribution specified in the instructions; thus, determining suppliers' net cash and resulting incentive compensation.

2.5 RESULTS

2.5.1 Descriptive Statistics

Economic theory predicts that buyers who follow a self-interested strategy will offer just enough to cover marginal production costs plus ε. The offers of buyers in the self-interested/fine information condition are consistent with this prediction: Based on marginal production costs of $10,000 in this experiment, Table 2-4, Panel A shows that offers ranged from $10,000 to $55,000 (mean $16,857 and mode $11,000). In the self-interested/coarse information condition, offers ranged from $13,500 to $90,000 (mean $38,625 and mode $30,000).[19]

[19] Responses from one participant were omitted from the analysis. One participant in the coarse information condition used the incentive compensation formula and his estimate of the incentive pay to calculate the exact marginal production costs (in essence resulting in fine information).

Table 2-4

Descriptive Statistics

Panel A: Mean (standard deviation) Buyer Offers

	Self-interested strategy	Fair strategy	Marginal means
Fine information	\$16,857 (\$15,341) n = 14	\$107,500* (\$17,650) n = 12	\$58,692 (\$48,815) n = 26
Coarse information	\$38,625 (\$19,609) n = 12	\$105,000 (\$21,409) n = 13	\$73,140 (\$39,381) n = 25
Marginal means	\$26,904 (\$20,348) n = 26	\$106,200 (\$19,326) n = 25	\$65,775 (\$44,599) n = 51

Panel B: Mean (standard deviation) Supplier Investment

	Self-interested strategy	Fair strategy	Marginal means
Fine information	\$5,714 (\$14,525) 2/14 or 14% invest	\$36,923 (\$11,094) 12/13 or 92% invest	\$20,741 (\$20,367) 14/27 or 52% invest
Coarse information	\$34,285 (\$14,525) 12/14 or 86% invest	\$36,923 (\$11,094) 12/13 or 92% invest	\$35,556 (\$12,810) 24/27 or 89% invest
Marginal means	\$18,571 (\$20,315) 14/28 or 50% invest	\$36,923 (\$10,970) 24/26 or 92% invest	\$28,148 (\$18,436) 38/54 or 70% invest

Self-interested strategy: Buyer's firm strategy is to cover supplier's marginal production cost.

Fair strategy: Buyer's firm strategy is to share the net surplus equally with the supplier and cover supplier's marginal production costs and investment cost.

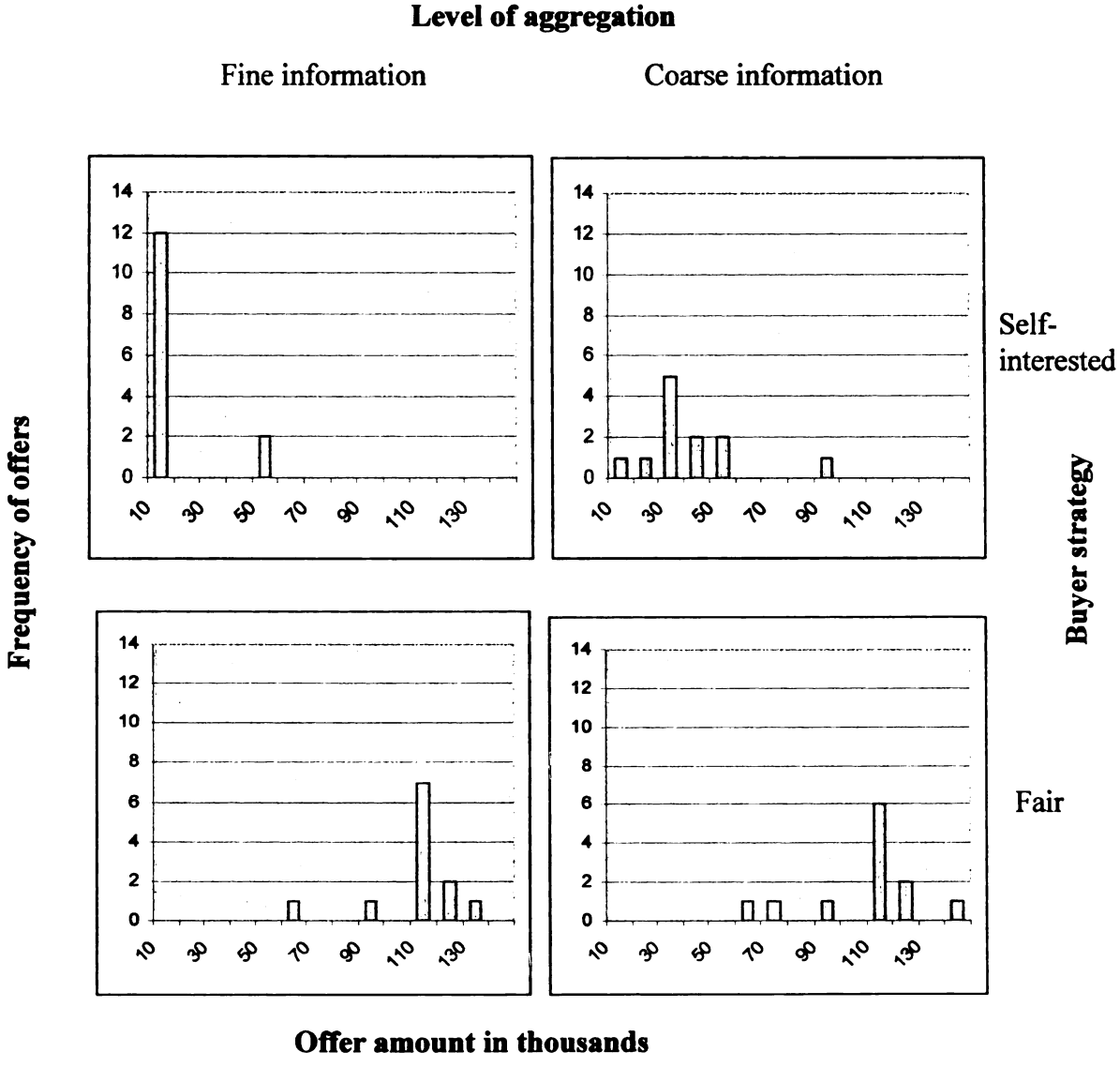
Fine information: Buyer knows supplier's marginal production costs and investment cost.

Coarse information: Buyer knows the sum of supplier's marginal production costs and investment cost.

* The mean offer of \$107,500 observed in the fine information/fair strategy condition is equivalent to reimbursing marginal production and investment costs in the amount of \$50,000 and sharing the net surplus (i.e., \$170,000 less \$50,000) almost equally. These results are consistent with prior literature where buyers who possess fine information and behave fairly offer to suppliers about half of the net surplus above and beyond the costs incurred by the suppliers (cf. Berg, Dickhaut, and McCabe 1995; Ellingsen and Johannesson 2004; Sloof, Oosterbeek, and Sonnemans 2007).

Figure 2-4*

Distribution of Buyer Offers



* Variables are defined in Table 2-4.

Additionally, economic predictions suggest that self-interested suppliers paired with buyers who are assigned a self-interested strategy will not make the socially optimal idiosyncratic investment (i.e., investment of $40,000 per experimental instructions). In the self-interested/fine information condition, two out of fourteen (or 14%) suppliers invest and mean investment amount is $5,714 as detailed in Table 2-4, Panel B. On the other hand, twelve out of fourteen (or 86%) suppliers invest in the self-interested/coarse information condition with a mean investment amount of $34,285.

In essence, the observed behavior of participants in the self-interested strategy and fine information conditions is broadly consistent with economic predictions[20] (i.e., offers of $10,000 and no investment). Conversely, participants in the self-interested strategy and coarse information conditions make significantly higher offers and investment inefficiency is significantly lower than predicted by economic models; thus, providing initial support for H1b and H3b ($t = 5.06$, $p < .001$ and $t = 8.83$, $p < .001$, respectively).

2.5.2 Manipulation Checks

Level of aggregation of cost information possessed by buyers was measured with post experiment questions by asking participants about their perception of the buyer knowledge of exact marginal production costs. Perceived buyer knowledge of exact marginal cost was rated significantly higher in the fine information condition than in the coarse information condition as detailed in Table 2-5, Panel A for both trade and investment tasks ($t = 7.78$, $p < .001$ and $t = 4.64$, $p < .001$, respectively).

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[20] Importantly, these results differ from prior empirical research (cf. Berg, Dickhaut, and McCabe 1995; Ellingsen and Johannesson 2004a; 2004b; Sloof, Oosterbeek, and Sonnemans 2007) because, in those experiments, buyer and supplier types were neither manipulated nor measured. Additionally, prior research did not inform participants of their counterparts' type (i.e., self-interested or fair). Hence, in these studies, sharing of the surplus was commonly observed as participants did not know the acceptance threshold of their counterparts.

Table 2-5

Manipulation Checks*: Level of Aggregation of Information and Buyer Strategy

Panel A: Level of Aggregation of Information

Questions	Mean	
Trade decision	Fine	Coarse
Q: I knew exactly what Seller Z's expected production costs were. Q: I knew with certainty what was the lowest offer Seller Z would accept. Q: I knew the total of Seller Z's expected production costs and machine costs but did not know Seller Z's exact expected production costs (reverse coded).	6.67	2.93 (t = 7.78, df = 48, p < .001)
Investment decision	Fine	Coarse
Q: I believed Buyer B knew exactly what my expected production costs were. Q: Even if Buyer B's firm policy was to offer just enough to cover production costs, there was a chance I might get reimbursed for the cost of the machine I purchased (reverse coded). Q: I believed Buyer B knew the total of my expected production costs and machine costs but did not know my exact expected production costs (reverse coded).	6.76	4.07 (t = 4.64, df = 48, p < .001)

Panel B: Buyer Strategy

Questions	Mean	
Trade decision	Self-interested	Fair
Q: My firm's purchasing strategy is to offer sellers just enough to cover expected production costs. Q: My firm's purchasing strategy is to share the net cash from trade evenly between Seller and Buyer firms (reverse coded).	7.75	2.79 (t = 9.32, df = 48, p < .001)
Investment decision	Self-interested	Fair
Q: Buyer B's firm purchasing strategy is to cover expected production costs. Q: Buyer B's firm purchasing strategy is to share the net cash evenly between both firms (reverse coded).	6.0	4.04 (t = 2.74, df = 48, p < .01)

* Questions were measured on a 9-point Likert scale with 1 representing strongly disagree and 9 representing strongly agree. Responses to the questions in Panels A and B were averaged for each decision. Variables are defined in Table 2-4. Additional questions and their responses are analyzed in Appendix C.

Additionally, participants were asked to state their understanding of the buyer strategy. As detailed in Table 2-5, Panel B, participants in the self-interested strategy condition were more likely to agree with the statement that buyers would offer just enough to cover marginal production costs than participants in the fair strategy condition for both trade and investment tasks ($t = 9.32$, $p < .001$ and $t = 2.74$, $p < .01$, respectively).

Importantly, I propose that the supplier's investment decision is driven by the level of aggregation of the information possessed by the buyer and the strategy assigned to the buyer, not by trust considerations. Consistent with March and Olsen (1989) and Williamson (1993) analyses of trust, I posit that the investment decision can be equated to a gamble with given probabilities of different outcomes and is therefore calculative in nature. In support for this opinion, while several participants mentioned they conducted expected utility calculations, none referred to trusting intentions (cf. Mayer, Davis, and Schoorman 1995).

2.5.3 Hypotheses Tests

2.5.3.1 Trade Decisions – H1a-d

H1a predicts that the effect of level of aggregation of supplier-provided cost information on buyer offers depends on buyer strategy. To test H1a, the interaction between level of aggregation of cost information and firm strategy is examined. ANOVAs are run on buyers' offers with aggregation level and buyer strategy as between-subject factors. As detailed in Table 2-6, Panel A, the interaction between aggregation level and buyer strategy is significant ($F = 5.42$, $p = .02$).[21] I conducted additional tests to determine whether results were driven by the buyer strategy specified in the instructions

[21] Results remain qualitatively the same when demographics variables (gender: $F = 5.06$ and $p = .029$, GPA: $F = 4.86$ and $p = .033$, nationality: $F = 5.53$ and $p = .023$) are included as a covariate.

or by personal preferences of the participants for fairness. Personal preferences for fairness was measured by using an instrument that uses decomposed games to measure social value orientation and classify individuals as self-interested or fair (Messick and McClintock 1968; Liebrand 1984; De Dreu and van Lange 1995). Whether these preferences matched the buyer strategy was used as a covariate in the analysis and results were substantially the same ($F = 4.89$, $p = .032$). Hence, I conclude that the effect of level of aggregation of cost information on buyer offers depends on buyer strategy.

Table 2-6

Tests of H1a-d

Dependent variable: Buyer offer

Panel A -Trade Decision – ANOVA Test of H1a

Source	Sum of Squares	df	Mean Square	F-statistic	Significance of F	Eta squared
Aggregation level	1178495181	1	1178495181	3.42	.071	.068
Buyer strategy	78263973411	1	78263973411	226.82	.000	.828
Aggregation level x buyer strategy	1178495181	1	1178495181	5.42	**.024 Test of H1a**	.103
Explained	83240282242	3	27746760747	80.43	.000	.837
Error	16214263072	47	344984320			
Total	99454545314	50				

Adjusted R^2 = .827

Panel B – Trade Decision – Planned Contrast Tests

Hypothesis	Comparison	Statistic	df	p-value
H1b	Coarse versus Fine Information (Self-interested Strategy condition)	t = 3.18	24	.002 (one-tailed)
H1c	Coarse versus Fine Information (Fair Strategy condition)	t = .32	23	.75
H1d	Fair versus self-interested Strategy (Coarse Information condition)	t = 8.06	23	< .001

Level of aggregation of information:

Buyers know marginal production costs and investment cost separately (Fine Information), or know only the sum of marginal production costs and investment cost (Coarse Information).

Buyer strategy:

Buyer's firm strategy is to cover only supplier's marginal production cost (Self-interested Strategy), or Buyer's firm strategy is to share the net surplus equally with the supplier and cover supplier's marginal production costs and investment cost (Fair Strategy).

I used planned contrasts to test H1b through H1d by examining pairwise mean comparisons. As detailed in Table 2-6, Panel B, when buyers are assigned a self-interested strategy, the mean offer in the coarse condition is statistically significantly greater than the mean offer in the fine condition ($t = 3.18$, $p = .002$ one-tailed). Thus, H1b is supported. Additionally, the mean offer difference between fine and coarse information is not significant for buyers in the fair strategy condition ($t = .32$, $p = .75$); thus, results are consistent with H1c. Finally, when buyers possess coarse cost information, the mean offer of buyers in the fair strategy condition is statistically significantly greater than the mean offer of buyers in the self-interested strategy condition ($t = 8.06$, $p < .001$). Thus, H1d is supported. In sum, providing buyers with coarse cost information increases the offers made by buyers with a self-interested strategy, but does not change the offers of buyers with a fair strategy.

2.5.3.2 Investment Decisions – H2 and H3a-d

H2 predicts a main effect of level of aggregation of cost information on suppliers' investment decision. As predicted and detailed in Table 2-7, Panel A, results from a logistic regression provide evidence that suppliers who knew they were paired with buyers who possessed coarse cost information were more likely to invest than suppliers who knew they were paired with buyers with fine cost information (Wald statistic: 7.68, $p = .006$).

Table 2-7

Tests of H2 and H3a-d

Dependent variables: Supplier investment decision and investment amount

Panel A – Investment Decision* - Test of H2

Hypothesis	Wald Statistic	β	Significance
Main effect of aggregation level on likelihood of investing	7.68	2.0	.006

Panel B - Investment Decision* - ANOVA Test of H3a**

Source	Sum of Squares	df	Mean Square	F-statistic	Significance of F	Eta squared
Aggregation level	2751322751	1	2751322751	16.30	.000	.246
Buyer strategy	3860968660	1	3860968660	22.87	.000	.314
Aggregation level x buyer strategy	2751322751	1	2751322751	16.30	**.000 Test of H3a**	.246
Explained	9575254375	3	3191751458	18.91	.000	.53
Error	8439560439	35	168791208			
Total	18014814814	53				

Adjusted R^2 = .503

Panel C - Investment Decision* – Planned Contrast Tests of H3b-d

Hypothesis	Comparison	Statistic	df	p-value
H3b	Coarse versus Fine Information (Self-interested Strategy condition)	t = 5.20	26	< .001 (one-tailed)
H3c	Coarse versus Fine Information (Fair Strategy condition)	t = 1	24	1.0
H3d	Fair versus Self-interested Strategy (Coarse Information condition)	t = .53	25	.603

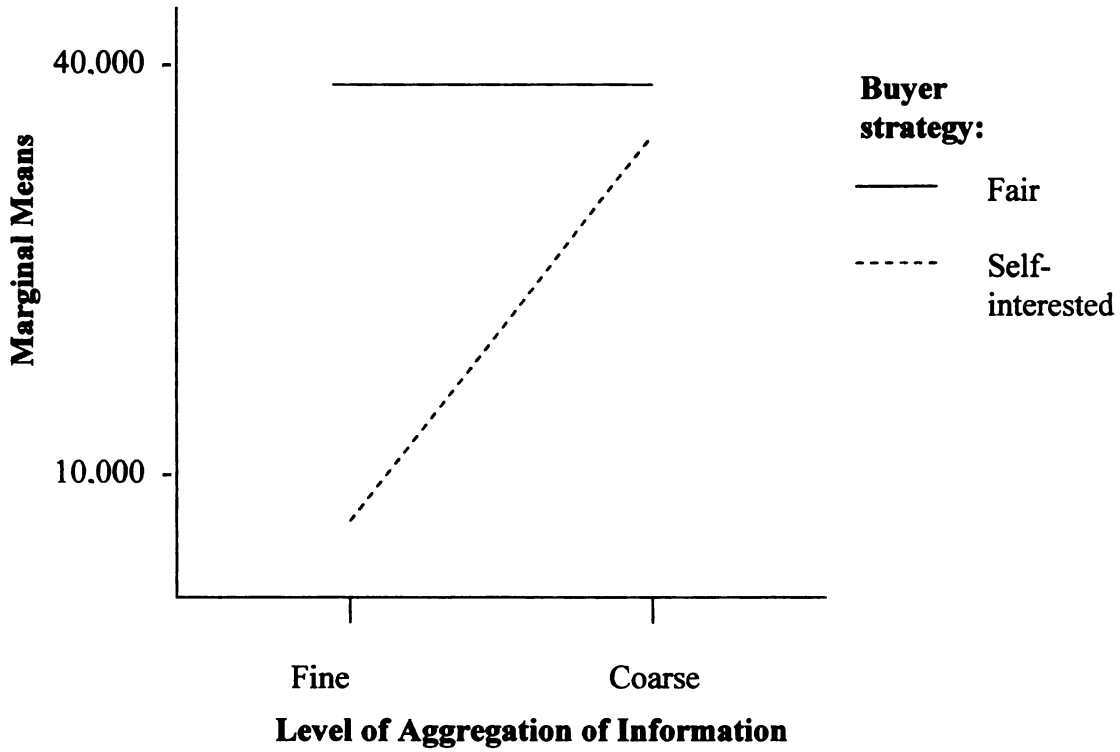
* Variables are defined in Table 2-6.

** Results from logistic regression are qualitatively equivalent (Wald statistic: 3.85 significant at .05 level).

H3a predicts that the effect the level of aggregation of cost information of the buyer has on the supplier idiosyncratic investment depends on buyer strategy. To examine the interaction ANOVAs are run on investment level with level of aggregation of cost information and buyer strategy as between-subject factors. Results provide evidence of an interaction ($F = 16.30$, $p < .001$). Thus, H3a is supported as detailed in Table 2-7, Panel B and Figure 2-5.

Figure 2-5*

Suppliers' Mean Investment



* Variables are defined in Table 2-4.

I used planned contrasts to test H3b through H3d by examining pairwise mean comparisons. Results are presented in Table 2-7, Panel C. When suppliers are likely to be matched with buyers with a self-interested strategy, the mean investment for the coarse information condition is statistically significantly greater than the mean investment in the fine information condition ($t = 5.20$, $p < .001$). Thus, H3b is supported. Additionally, the mean investment difference between fine and coarse information is zero when buyers have a higher probability of being assigned a fair strategy and all participants invest. Thus, H3c cannot be rejected. Finally, when buyers possess coarse information, the mean investment when buyers have a higher probability of being assigned a fair strategy is not statistically significantly different than the mean investment when buyers are more likely be assigned a self-interested strategy ($t = .53$, $p = .60$). Thus, H3d cannot be rejected.

2.5.4 Supplementary Analysis

Post experiment questions were used to assess the soundness of the investment strategy of the suppliers. As detailed in Table 2-11 and 2-12 Panels B, participants appropriately took into account the potential effect of their actions on their firm net cash and their own payoffs and did not ignore the 25% chance that the buyer's firm might have a different strategy.

Trade efficiency (i.e., agreement from trade) cannot be directly measured since no participant takes on the role of suppliers in the trade task and suppliers do not actually reject or accept offers. However, trade efficiency is of concern because it has been proposed (Gul 2001) and observed (Sloof, Oosterbeek, and Sonnemans 2007) that partial sharing of information impairs trade efficiency. In this dissertation and experimental instructions, suppliers are assumed to be self-interested. Accordingly, given that an

idiosyncratic investment has already been made, any offer that is greater than marginal production costs should be accepted by suppliers (i.e., efficient trade). Moreover, as detailed in the trade predictions above, it is unlikely that buyers will offer less than marginal production costs. Thus, in contrast with Gul's predictions, I propose that trade will be efficient. The minimum offer acceptable by a self-interested supplier is $10,000, i.e., the marginal production costs, in this experiment. Therefore, any offer that is equal to or greater than $10,000 will be accepted and will, accordingly, result in efficient trade. With coarse cost information, the lowest offer observed was $13,500. In other words, all buyers offered more than suppliers' marginal production costs suggesting that acceptance by self-interested suppliers would follow. Hence, the results of this experiment are consistent with efficient trade despite aggregation of information. Additionally, $30,000 is the modal offer observed. Interestingly, based on the figures used in this experiment, $30,000 is also the lowest offer that provides sufficient incentives for a self-interested supplier to invest when he is faced with a 75% chance of being paired with a buyer who is assigned a self-interested strategy.

It was proposed earlier that, in the coarse information condition, self-interested *buyers' offers* would be equal to $(F + M)_c - \delta + \varepsilon$ with $\delta \geq 0$ and δ significantly smaller than F. Thus, buyers' trade offers should be significantly greater than M and close to the sum of marginal and investment costs (i.e., $(F + M)_c$) for participants in the coarse and self-interested conditions. The mean offer of buyers assigned a self-interested strategy in the coarse information condition (i.e., $38,625) is not significantly different than the sum of marginal and investment costs (F + M) (i.e., $50,000) ($t = 1.60$, $p = .14$) (after eliminating one observation where the subject used his prior experience to estimate the

marginal production costs). Thus, results provide evidence that buyers who possess coarse cost information make offers close to the sum of marginal production costs and past investment cost, even when they are instructed to only cover marginal production costs and to maximize their firm surplus (i.e., self-interested strategy condition).

Additionally, the mean *investment of suppliers* who had a higher probability of being paired with buyers with a self-interested strategy and coarse cost information ($34,286) is not significantly lower than socially optimal investment of $40,000 (t = 1.47, one-tailed p = .083).

Hypotheses 2 and 3a-d above rely on the prediction that suppliers would *anticipate receiving higher offers,* from buyers assigned a self-interested strategy, in the coarse information condition than in the fine information condition. Consistent with this prediction, suppliers matched with buyers who are likely to have a self-interested strategy and who possess coarse cost information expect, on average, offers of $47,278. On the other hand, suppliers matched with probably self-interested buyers who possess fine cost information expect, on average, offers of $26,946. The mean difference is significant (t = 1.93, one-tailed p = .033). Additionally, the expectations of suppliers who had a higher probability of being matched with buyers with a fair strategy do not change with the level of aggregation of information (t = .22, p = .827). In sum, the prediction that the level of aggregation of the information possessed by buyers with a self-interested strategy affects the supplier's trade expectations is supported.

Post-experiment questions help eliminate the *sunk cost bias* as a potential explanation for the buyers' offers being higher than predicted by economic theory. Participants were asked to indicate (on a scale of 1 to 9) their agreement with statements

that suppliers would reject offers that did not cover their expected production costs and machine cost, and that, once a seller has purchased a project-specific machine, this purchase should be reimbursed by the buyer no matter what the buyer's firm purchasing strategy is (See Table 2-12). Participants selected their answer from a 1 to 9 Likert scale. Participants' mean answers are not significantly greater than 5 in all conditions (mean = 4.66). This finding provides evidence that offers that are greater than marginal costs are not the result of the sunk cost bias of participants.

2.6 DISCUSSION AND CONCLUSIONS

Successful alliances, networks and other types of close buyer-supplier relationships are often characterized by extensive sharing of information (Baiman and Rajan 2002a; Kulmala 2002). Management accounting information plays an important role in this information sharing as exchange of cost information has helped firms diagnose problems, reduce costs and improve performance (Carr and Ng 1995; Kumar 1996; Seal et al. 1999; Dekker 2003). Yet, contracts are incomplete and suppliers who disclose their cost information to more powerful buyers cannot use contract terms to protect themselves fully against the potential self-interest of their counterpart. Anticipating *ex post* self-interested behavior from their counterpart, firms have, *ex ante*, avoided to make idiosyncratic investments that would be socially optimal (i.e., hold-up problem) (Williamson 1985).

This research investigates the effects of the level of aggregation of supplier-provided cost information (i.e., fine or coarse) and of trading with buyers with certain firm strategies (i.e., self-interested or fair) on the hold-up problem. Results provide

empirical evidence that aggregating idiosyncratic investment and marginal production costs (i.e., coarse information) instead of disaggregating costs (i.e., fine information) helps suppliers overcome their reluctance to make idiosyncratic investments. First, because of information loss associated with aggregation, buyers with a self-interested strategy who possess coarse cost information are unable to determine the sunk past investment cost when making a trade offer. Consequently, their offers are significantly greater than marginal production costs and greater than the offers of buyers with fine cost information. Second, anticipating that buyers with coarse cost information will not be able to behave opportunistically *ex post*, the suppliers matched with such buyers are more likely *ex ante* to invest than suppliers matched with buyers who possess fine cost information. In essence, buyers' information loss associated with coarse cost information helps curtail buyers' self-interested behavior during trade and, consequently, provides investment incentives for suppliers; thus, mitigating the hold-up problem and improving overall efficiency of the transaction. Importantly, increasing the level of aggregation of cost information does not change the trade offers of buyers in firms with a fair strategy or the investment decision of suppliers who had a higher probability of being matched with them.

Laboratory testing allows simplification of the context, identification of optimal behavior and manipulation and controlling of the buyer strategy (i.e., self-interested or fair), but it also suffers from the limitations associated with any experimental work. Additionally, coarsening cost information might reduce the potential benefits of providing cost information. Thus, it is important to examine the cost-benefit tradeoffs of coarsening cost information prior to implementing this mitigating mechanism.

This research contributes to the literature on hold-ups by intentionally abstracting from communication or any reputation concerns associated with close buyer-supplier relationships. As a result, this dissertation contributes to the literature on incomplete contracting and opportunism in buyer-supplier relationships by providing evidence that aggregated supplier-provided cost information provides suppliers with incentives to make a socially optimal idiosyncratic investment in the context of small numbers bargaining. Finally, my research contributes by isolating and manipulating buyer strategy. By assigning buyers a firm strategy to guide their actions, this dissertation successfully induces trade offers consistent with economic predictions when there is no private information and buyers are assigned a self-interested strategy. Additionally I document an interaction between level of aggregation of supplier-provided cost information and buyer strategy.

I assume that the level of aggregation of supplier-provided cost information is exogenous. Letting suppliers decide whether they would like to disclose fine or coarse information, and the effect of their decision on the relational contracting aspect of their relationship with buyers warrants further investigation. Additionally, to complement this research, the effect of other types of partial disclosure of information (e.g., through mechanisms such as reduced precision and reduced timeliness) on inter-firm relationships could be investigated.

APPENDIX A

Detailed Calculations of Trade and Investment Predictions

In this study, following a fair strategy is defined as reimbursing marginal production costs and investment costs and sharing the net surplus. Although Fehr and Schmidt's (1999) theory of inequity aversion examines fairness at the individual level instead of the firm level, their results can be adapted to analyze expected individual outcomes of employees that follow a fair firm strategy. Fehr and Schmidt (1999) suggest that, for some individuals, their utility function includes disutility when his own payoff is not equal to their counterpart's. Importantly, the Fehr and Schmidt's model of inequity aversion proposes that disutility is greater when the payoff difference is disadvantageous than when it is advantageous to oneself. Hence, Fehr and Schmidt suggest that the utility function of player i is of the following form:

$$U_i = x_i - \alpha_i \max(x_j - x_i, 0) - \beta_i \max(x_i - x_j, 0) \qquad (1)$$

$i \neq j$ and j is the other player. $\alpha_i \geq \beta_i$ and $1 > \beta_i \geq 0$. x_i is the net monetary payoff of player i. $\alpha_i \geq \beta_i$ suggests that the buyer's trade offer will not give the supplier an amount greater than half the net joint surplus. Accordingly, I expect the buyer's payoffs to be larger than (or equal to) the supplier's payoffs. Consequently, $x_s \leq x_b$ and $\alpha_b \max(x_s - x_b, 0) = 0$. Thus, from equation (1), it follows that the utility function of buyer b, U_b, is of the following form:

$$U_b = x_b - \beta_b \max(x_b - x_s, 0) \qquad (2)$$

Let G represent the gross surplus generated by the supplier's idiosyncratic

investment (i.e., the surplus from trade), M the predicted marginal production costs, and F the supplier's investment cost. G > M + F. In other words, investment is socially efficient. Let I represent the supplier's investment decision: I = 1 if investment takes place, I = 0 otherwise. X_i represents the net monetary payoffs of player i. The surplus from trade is as follows:

$$\begin{cases} G & \text{if } I = 1 \\ 0 & \text{if } I = 0 \end{cases}$$

Let T equal the trade offer of the buyer to the supplier.

I define a **self-interested buyer** as a buyer who intends to make an offer that just covers production costs M plus ε.[a] For a self-interested buyer, equation (2) applies with $\beta_b = 0$.[b] Consequently, the utility function of the buyer who is self-interested is of the following form:

$$U_b = x_b$$

$U_b = x_b = G - T$ if trade takes place. Alternatively, $U_b = x_b = 0$ if trade breaks down.

Trade Predictions

First, I examine the effect of the ***level of aggregation of supplier-provided cost information.*** Williamson's (1985) predictions suggest that the *self-interested buyer* who knows the supplier's marginal production costs, M, and past idiosyncratic investment

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[a] ε is an immaterial amount offered so that the supplier is not indifferent between accepting and rejecting the offer.

[b] Alternatively, if the utility function of a buyer takes the form of $U_b = x_b - \beta_b \max(x_b - x_s, 0)$ with $\beta_b < .5$, the buyer will maximize his utility by making offers of M + ε. Accordingly the buyer will behave in a manner similar to buyers whose utility function includes $\beta_b = 0$. Thus, buyers with $\beta_b < .5$ are included in the above definition of self-interested buyers.

cost, F, (i.e., *fine information*) will offer just enough to cover marginal production costs plus ε (or M + ε). Anticipating this, the supplier will not make the socially optimal idiosyncratic investment.

I propose that a self-interested buyer who possesses *coarse cost information c* in the form of the sum of the supplier's marginal production costs and past idiosyncratic investment cost (i.e., $(F + M)_c$) will offer more than a self-interested buyer who possesses fine cost information. Knowing that a self-interested supplier has an acceptance threshold of M, a self-interested buyer would like to offer M + ε (where ε is immaterial), but he has no prior information about the supplier's true marginal production costs, M, or the investment cost, F. The buyer wants to make a low offer so as to maximize his payoffs, but, being risk averse, does not want to risk losing his share of the surplus from trade (i.e., G -T) by making an offer that does not cover marginal production costs. Hence, his trade offer, T, is as follows: $T = (F + M)_c - \delta + \varepsilon$ with $\delta = E(F) - \theta$. δ is such that $\delta \geq 0$. δ represents the buyer's expected value of F (E(F)) reduced by the adjustment the buyer makes for his uncertainty, θ. The higher the buyer's uncertainty about M and F's true values, and the higher the surplus from trade, the higher θ, and the lower δ. Additionally $(F + M)_c - \delta > M$ for values of F sufficiently large.[c] In essence, uncertainty about the true marginal production costs and fear of losing the surplus from trade will cause a self-interested buyer to include most of the cost of the supplier's past investment in his offer and offer close to $(F + M)_c$. In sum, the information loss associated with coarse information limits the buyer's potential self-interested behavior; thus, resulting in higher

[c] The hold-up problem would be a non issue if idiosyncratic investments were small.

offers than fine information.

Second, I examine the effect of ***buyer strategy***. Extant research (Carmichael and MacLeod 2003; Ellingsen and Johannesson 2004; Ewerhart 2006) suggests that fair buyers will reimburse past investment costs.[d] Consequently, I define a fair buyer as a buyer who intends to share the net joint surplus (i.e., potential surplus from trade less marginal production costs and past investment cost) and to reimburse the supplier for marginal production costs and investment cost. Thus, for a fair buyer, equation (2) applies with $\beta_i > .5$.[e]

Hence, the utility function of a fair buyer is of the form:

$$U_b = x_b - \beta_b \max(x_b - x_s, 0) = G - T - \beta_b (G - T - (T - (F + M)), \text{ with } \beta_b \geq .5$$

When the buyer shares the surplus equally (i.e., offers G/2 + F/2 + M/2), G - T - (T - (F + M)) = 0. As a result, the buyer's utility is maximized and $U_b = G - T$ when the buyer offers a price that covers up to half of the net surplus and reimburses the supplier for his marginal production costs and investment cost. Thus, the buyer does not need to identify F and M separately in order to make his offer.

Consequently, the utility of a fair buyer is maximized when he shares the net surplus equally whether he possesses fine (i.e., F and M) or coarse (i.e., the sum $(F + M)_c$) cost information. Thus, offers of fair buyers should not be affected by whether investment and marginal costs are disclosed disaggregated (in the form of F and M) or

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[d] Alternatively, Troeger (2002) and Ellingsen and Robles (2002) have presented evolutionary models where, as a result of repeated interactions, sunk costs are included in the buyers' offers and investment is efficient. Still, not only do those papers assume much repetition of transactions whereas the hold-up problem is typically defined as a one-shot problem, but these papers also fail to explain why the surplus would be shared between buyer and supplier (Ellingsen and Johannesson 2004).

[e] The case of $\beta_b = .5$ leads buyers to be indifferent between any value of T provided that $x_s \leq x_b$

aggregated (in the form $(F + M)_c$). As a result, the offer made by fair buyers who have coarse cost information is not expected to be significantly different from the offer made by fair buyers who possess fine cost information.

Investment predictions

Suppliers will not know buyers' type (i.e., self-interested or fair) with certainty. Recall that, consistent with economics models, suppliers are assumed to be self-interested. Accordingly, equation (1) applies with $\alpha_s = \beta_s = 0$. Consequently, suppliers' utility function is of the form:

$$U_s = x_s = T - F - M$$

Let q be the probability that the buyer is self-interested. (1 - q) is the probability that the buyer is fair.

(i) When the buyer possesses *fine* cost information, f, the supplier, s, has q probability of receiving $T = M + \varepsilon$ and (1-q) probability of receiving $T = [(G - F - M)/2 + F + M]$ during trade. Thus, the supplier's expected utility from trade ($E(U_{sf})$) is the following:

$E(U_{sf}) = q(M + \varepsilon) + (1 - q)[(G - F - M)/2 + F + M] - F - M$. The supplier will invest if his expected utility is positive. $E(U_{sf}) \geq 0$ is equivalent to:

$$(G - F - M)/2F \geq q/(1 - q) \qquad (3)$$

Hence, the higher the probability of the buyer being self-interested (i.e., q) or the higher the investment cost (i.e., F), the less likely the supplier will invest.

(ii) When the buyer possesses *coarse* cost information, c, in the form $(F + M)_c$, the supplier, s, has q probability of receiving $T = (F + M)_c - \delta + \varepsilon$ and (1 - q)

probability of receiving $T = (G - (F + M)_c)/2 + (F + M)_c$ during trade.

Thus, the supplier's expected utility from trade ($E(U_{sc})$) is greater than or equal to $q((F + M)_c - \delta + \varepsilon) + (1 - q)[(G - (F + M)_c)/2 + (F + M)_c] - F - M$. He will invest if his expected utility is positive. $E(U_{sc}) \geq 0$ is equivalent to:

$$(G - F - M)/2\delta \geq q/(1 - q) \qquad (4)$$

The value of δ is an empirical question. It remains however that $\delta < F$ as explained above. Consequently, $E(U_{sc}) > E(U_{sf})$ and the supplier is more likely to invest in the coarse than in the fine condition.

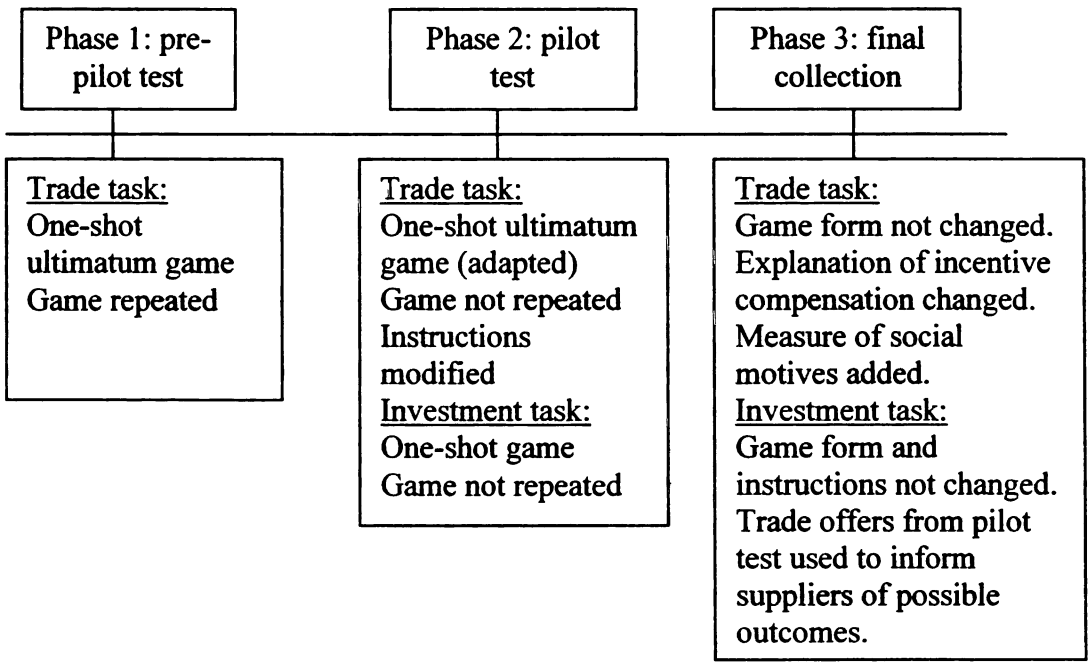
APPENDIX B

Documentation of the Process Followed

The final experiment was conducted subsequent to several tests that resulted in changes to the form of the game, the instructions and the way the experiment was administered. This evolution is detailed below in Figure 2-6.

Figure 2-6

Evolution of Testing



The effects of the level of aggregation of supplier-provided cost information and buyer strategy on the hold-up problem were tested by conducting a trade experiment and an investment experiment separately. While this departs from prior papers who combined both tasks in one experiment (e.g., Berg, Dickhaut, and McCabe 1995; Ellingsen and Johannesson 2004; Sloof, Oosterbeek, and Sonnemans 2007), this makes for a more

efficient use of subjects as prior experiments were unable to make use of one set of participants (namely, buyers) when suppliers had not invested. The evolution of Phases 1, 2 and 3 presented in Figure 2-6 is detailed below.

Phase 1: Pre-pilot Tests

I chose to examine trade first because suppliers base their investment decision on expectations from trade and I needed to be able to give suppliers information about the outcome of the trade negotiations. Once the Human Subject Review Board approval was obtained and protocol studies conducted with PhD and MBA students, undergraduate students enrolled in a business class and MBAs participated in the pre-pilot test conducted during summer of 2006.

The Game

Participants preferences for fairness were elicited by using a an instrument from social psychology developed by Messick and McClintock (1968) and adapted by Liebrand (1984). Trade was examined at a later date by means of an ultimatum game. Participants were randomly assigned to the role of buyer or seller. A buyer paired with a supplier made a one-time offer which could be rejected by the supplier. Subjects were re-paired and buyers negotiated with another supplier. The game was repeated nine times.

Administration of the Experiment

A computerized web-based experiment was conducted with several groups. This ensured portability of the experiment which could be run from students' individual laptops or any computer lab. Programming was written by a computer science student using Flash. Frequent testing by the administrator was performed. Computerization of the

experiment enabled the researcher to record all actions taken by the participants, to test their understanding of the instructions and not allow them to proceed until they were able to answer questions correctly, and to assess whether participants cared more about their outcome than the their counterpart's (as they had to click on cells to reveal payoffs of each party).

Results, Problems Encountered and Remedies

Although results were generally consistent with predictions that offers of participants with coarse cost information were higher than those of buyers with fine cost information. Several significant problems were encountered:

- A high rate of no-shows and late arrivals made pairing of subjects difficult each time the experiment was run.
- Participants had difficulty answering certain pre-experiment questions as shown by the frequency of wrong answers. Instructions were clarified and/or questions rephrased.
- Participation of foreign students who took longer to comprehend instruction delayed the re-pairing and not all sessions could be run (in one case delay was such that only one session was run).
- Although the sessions were supposed to be independent as subjects were re-paired, buyers seemed to make higher offers in response to prior rejections; thus, data could only be used from the first session.
- Consistent with prior research (e.g., Berg, Dickhaut, and McCabe 1995), buyers who did not know the type of the supplier they were trading with (i.e., self-interested or fair) made offers higher than predicted by economic models even in the complete information condition.

- Participants seemed to focus on net payoffs and ignored the breakdown of marginal and sunk costs.

- Cells were not balanced as fewer than 30% of the participants could be classified as fair.

The problems encountered were addressed with Phase 2.

Phase 2: Pilot Tests

The Human Subject Review Board approval for the trade and investment task was received as a new project. Undergraduate students from managerial accounting classes, MBAs and PhD students participated in the pilot test conducted during fall of 2006.

Changes Implemented

Instructions for the trade task were revised and payoff tables removed to avoid participants focusing on payoff tables and to ensure that the aggregation manipulation was effective.

Participants' preferences for fairness were manipulated through firm strategy instead of being measured.

The Game

The format of the ultimatum game related to the trade task was altered so that, consistent with economic models, buyers knew with certainty that suppliers would be self-interested. The administrator took the role of the supplier and any offer greater than marginal production cost was accepted. Since results from experiments were several sessions were conducted had not previously been independent, only one session was conducted

Investment decision was also a one-period decision. Backward induction was facilitated by giving participants example of possible trade outcomes.

Administration of the Experiments

Experiments were administered with paper and pencil so as to avoid delays due to programming and need for computer laboratory space to conduct experiments.

Results and Problems Encountered

Manipulations of aggregation of cost information and firm strategy were effective as documented with results from manipulation checks questions. Results were consistent with predictions. However, two observations could not be used because one subject in the coarse information condition used the incentive compensation formula to calculate exact marginal production costs and another indicated he refused to follow the firm strategy because of strongly held preferences. The problems encountered were remedied when Phase 3 was administered.

Phase 3: Final Data Collection

MBAs from a managerial accounting class participated in the final data collection conducted during spring of 2007. Few changes to the instructions were needed and no additional Human Subject Review Board approval was necessary.

Changes Implemented

First, participants preferences for fairness were elicited subsequent to the experiment by using an instrument from social psychology developed by Messick and McClintock (1968) and adapted by Liebrand (1984). This measure was to be used as a covariate in the analyses. Second, the incentive compensation formula was altered so that

participants in the coarse condition could no longer infer the exact marginal production cost during the trade task. Third, actual trade offers obtained during the pilot test were used to give examples of possible outcomes to suppliers who made an idiosyncratic investment decision.

The Game and Administration of the Experiments

The format of the games and the way the experiments were administered were the same as for the pilot test.

Results and Problems Encountered

Manipulations of aggregation of cost information and firm strategy were effective as documented with results from manipulation checks questions. Results were consistent with predictions.

APPENDIX C

Additional Data Collection and Analysis

Some data were collected to be used as covariates in the analyses, to assess participants' understanding of the instructions and to provide insight about the participants' decision-making process should results not conform to expectations. The analyses are detailed below in tables 2-6 to 2-9.

Table 2-8

Sample Demographics

Panel A: Frequency

	*Frequency - Trade Task**	*Frequency – Investment Task*
Male	38	39
Female	13	15
Undergraduate	16	0
Graduate	35	54
North America	35	34
Europe	1	2
Asia	14	12
Other	1	6

*One observation missing

Table 2-8 Continued

Panel B: Mean Comparisons of Demographics between Conditions

	Self-interested Strategy		Fair Strategy		Overall Mean	T-tests
	Fine	Coarse	Fine	Coarse		
Trade Task						**Expectation: No significant difference among cells at .05 (ns)**
Grade point average	3.52	3.63	3.55	3.65	3.59	ns*
Number of managerial accounting courses taken	1.07	2.45	1.17	.83	1.35	ns
Investment Task						**Expectation: No significant difference among cells at .05 (ns)**
Grade point average	3.59	3.66	3.58	3.49	3.59	ns
Number of managerial accounting courses taken	1	.69	1	.92	.91	ns

*ns: No significant difference at .05

Table 2-9

Analysis of Pre-decision Questions for Comparisons between Conditions

Pre-decision questions were used to assess whether participants understood instructions and to encourage them to revisit the instructions that might have been unclear to them. Pre-decision questions were measured on 9-point Likert scale (with 1 representing strongly disagree and 9 strongly agree).

Pre-decision Questions: 1-9 Likert scale	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**	**T-tests**	
	Fine	**Coarse**	**Fine**	**Coarse**		**Expectation: Mean > 5**	**Expectation: No significant fine-coarse difference (ns)**
Trade Task							
If the Seller rejects my offer, my incentive compensation will be $0.	7.43	8.58	8.92	7.15	7.98	$t = 9.74$, $p < .001$	ns
I am confident that my computation of my firm's net cash is correct.	7.64	6.73	8	6.85	7.32	$t = 8.89$, $p < .001$	Coarse < Fine ($t = 2$, $p = .025$)
I am confident that my computation of my compensation is correct.	8.07	7.36	7.17	6.85	7.38	$t = 8.46$, $p < .001$	ns
Investment task						**Expectation: Mean > 5**	**Expectation: Coarse < Fine**
In the Buyer X example, I am confident that my computation of my firm's net cash is correct.	8.07	7.29	8.23	5.92	7.39	$t = 9.50$, $p < .001$	$t = 3.29$, $p < .001$
In the Buyer Z example, I am confident that my computation of my firm's net cash is correct.	8	8	8.54	6.54	7.78	$t = 10.8$, $p < .001$	$t = 1.92$, $p = .031$ (one-tailed)
I am confident that my computation of my compensation is correct.	7.43	7.57	8.08	6.08	7.30	$t = 8.62$, $p < .001$	$t = 1.7$, $p = .048$ (one-tailed)

Table 2-10

Analysis of Decision-related Questions for Differences between Treatments

Open ended questions	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**	**T-tests**	
	Fine	**Coarse**	**Fine**	**Coarse**			
Trade Task						**Expectation: Coarse > Fine**	**df**
What is the lowest offer you think Seller Z would accept?	16,393	30,625	50,500	63,154	39,686	$t = 2.06$, $p = .022$ (one-tailed)	49
Investment task						**Expectation: Coarse > Fine**	**df**
If Buyer B's firm strategy is to offer just enough to cover expected production costs, what do you think Buyer B will offer you?	11,000	50,375	11,231	42,654	28,884	$t = 8.63$, $p < .001$	26
If Buyer B's firm strategy is to offer just enough to cover expected production costs, what will your firm's net cash be if you accept Buyer B's offer?	-39,714	2,517	-38,769	269	-18,912	$t = 8.18$, $p < .001$	26
How much do you anticipate Buyer B will offer you?	26,946	47,278	82,250	85,096	59,762	$t = 1.93$, $p < .033$ in self-interested condition	25

Table 2-10 Continued

Open ended questions	Self-interested Strategy		Fair Strategy		Overall Mean	T-tests	
	Fine	Coarse	Fine	Coarse			
Investment task						**Expectation: No significant difference among cells at .05 (ns)**	**df**
If Buyer B's firm strategy is to share the overall net cash between Buyer and Seller firm evenly, what do you think Buyer B will offer you?	110,000	95,000	110,000	92,000	101,778	Fine > Coarse $t = 3.08$, $p < .001$*	26
If Buyer B's firm strategy is to share the overall net cash between Buyer and Seller firm evenly, what will your firm's net cash be if you accept Buyer B's offer?	60,000	52,857	60,000	42,769	54,000	Fine > Coarse $t = 2.79$, $p = .01$ **	26
What is the lowest offer you would accept?	56,732	46,000	40,846	54,923	49,759	ns	51

* All answers are greater than 50,000. Thus, the investment decision should not be affected.

**All answers are positive. Thus, the investment decision should not be affected.

Table 2-11

Post-decision Investigation of Trade and Investment Task Perception

Panel A: Trade Task

Participants were asked to allocate 100 points between seven statements in order to help assess the importance of inequity aversion, fairness and self-interest in their utility function.

100 points allocated among the following statements:	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**	**T-tests**	
	Fine	**Coarse**	**Fine**	**Coarse**			
						Expectation: Fair > Self-interested	**df**
I believed the difference between the cash earned by my firm and the cash earned by Seller Z's firm should be small.	2.36	17.92	27.83	33.46	19.94	$t = 3.70$, $p < .001$	40
I wanted to reimburse Seller Z for the cost of the project-specific machine he/she purchased.	10.79	10.42	24.42	15.77	15.18	$t = 2.21$, $p = .016$ (one-tailed)	49
						Expectation: Self-interested > Fair	**df**
I did not want to make too low an offer because it would be rejected and my firm's cash and my incentive compensation would be $0.	26.86	28.33	13.33	13.46	20.61	$t = 3.16$, $p < .01$	36
I wanted to maximize my firm's cash and my own compensation.	40.29	25.83	17.92	17.69	25.86	$t = 2.77$, $p < .01$	49
Making an offer of a few thousand dollars allowed me to maximize my firm's cash and my incentive compensation.	15.79	12.92	9.17	4.62	10.71	$t = 1.78$, $p = .042$ (one-tailed)	41

Table 2-11, Panel A Continued

100 points allocated among the following statements:	Self-interested Strategy		Fair Strategy		Overall Mean	T-tests
	Fine	Coarse	Fine	Coarse		
						Expectation: No significant difference among cells at .05 (ns)
Seller Z purchased a machine and I did not. As a result, my firm's cash from this trade should be lower than Seller Z's.	2.5	2.92	4.58	5.46	3.84	ns
Other	1.43	1.67	2.75	1.85	1.9	ns

Table 2-11 Continued

Panel B: Investment Task

Participants were asked to allocate 100 points between eight statements in order to help assess the importance of inequity aversion, fairness and self-interest in their utility function.

100 points allocated among the following statements:	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**	**T-tests**	
	Fine	**Coarse**	**Fine**	**Coarse**			
						Expectation: Fair > Self-interested	**df**
I believed the difference between the net cash earned by my firm and the net cash earned by Buyer B's firm should be small.	10	12.93	10.38	10.38	10.94	No significant difference between fair and self-interested	52
						Expectation: Fine > Coarse	**df**
I was concerned that Buyer B would not reimburse me for the project-specific machine cost.	29.64	16.50	19.46	13.08	19.8	$t = 2.14$, $p = .02$ (one-tailed)	36
						Expectation: No significant difference among cells at .05 (ns)	
I considered my opportunity to earn an incentive compensation greater than $4.	8.79	10.71	11.38	18.08	12.15	ns	
I considered the opportunity to generate a large overall net cash to share with Buyer B's firm.	16.43	13.57	15.62	12.31	14.50	ns	

Table 2-11, Panel B Continued

100 points allocated among the following statements:	Self-interested Strategy		Fair Strategy		Overall Mean	T-tests
	Fine	Coarse	Fine	Coarse		
						Expectation: No significant difference among cells at .05 (ns)
I considered the opportunity for my firm to earn a positive net cash.	21.21	27.64	33.77	33.08	28.76	ns
I took into account my risk of earning incentive compensation lower than $4.	7.14	9.29	6.15	8.08	7.69	ns
I made an investment and Buyer B did not. As a result, my firm's net cash should be larger than Buyer B's.	6.07	7.21	1.69	5.00	5.06	Fair > Self-interested t = 2.2, p = .033
Other	.71	2.14	1.54	0	1.11	ns

Table 2-12

Investigation of Decision-making Perceptions between Conditions

Post-decision questions were measured on 9-point Likert scale (with 1 representing strongly disagree and 9 strongly agree).

Panel A: Trade Task

Post-decision Questions: 1-9 Likert scale	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**		
	Fine	**Coarse**	**Fine**	**Coarse**			
						Expectation: Highest in Self-interested x Fine	
I used my knowledge of Seller Z's expected production costs to make Seller Z an offer that just covered expected production costs.	7.36	4.92	3.33	3.00	4.76	yes	
Seller Z took a risk in purchasing a project-specific machine because he/she might not be reimbursed for his/her purchase.	7.79	7.42	7.25	7.25	7.38	Difference is not significant among cells at .05	
						Expectation: Fair < Self-interested	**df**
I believed that the machine cost was a sunk cost and should not affect the amount I offered Seller Z.	5.71	6.08	3.33	3.25	4.64	$t = 4.12$, $p < .001$	48
I considered the risk of my offer being rejected by Seller Z if it did not cover Seller Z's expected production costs.	8.57	8.25	6.83	6.58	7.60	$t = 3.41$, $p < .001$	30

Table 2-12 Continued

Panel B: Investment Task

Post-decision Questions: 1-9 Likert scale	**Self-interested Strategy**		**Fair Strategy**		**Overall Mean**		
	Fine	**Coarse**	**Fine**	**Coarse**			
						Expectation: Mean > 5, no significant difference among cells at .05 (ns)	**df**
I would invest if I knew with certainty that Buyer B would share the overall net cash evenly.	8.64	7.50	8.62	7.46	8.06	Mean > 5, Coarse < Fine t = 2.44, p = .02	36
I believed Buyer B's net cash would be much higher if I purchased the machine and accepted his offer than if I rejected his offer.	7.57	8.14	7.77	7.15	7.67	Mean > 5 ns	
						Expectation: Mean < 5, no significant difference among cells at .05 (ns)	
I ignored the 25% chance that Buyer B's firm might have a different purchasing strategy.	2.93	4.43	2.92	4.46	3.69	Mean < 5, Fine < Coarse t = 2.15, p = .036	52
						Expectation: Fair < Self-interested	
I believed Buyer B would use his knowledge of my expected production costs to make me a low offer.	6.79	6.14	5.58	5.38	5.99	t = 1.74, p = .044 (one-tailed)	52
I believed any offer from Buyer B that covers expected production costs and ignores machine cost would be unreasonable because all related costs (past machine cost and expected production costs) should be covered.	7.43	7.36	6.25	5.54	6.68	t = 2.53, p < .01 (one-tailed)	51

APPENDIX D

Experimental Materials

Part 1. Trade instructions (Fine Information/Self-interested Strategy and Fair Strategy)

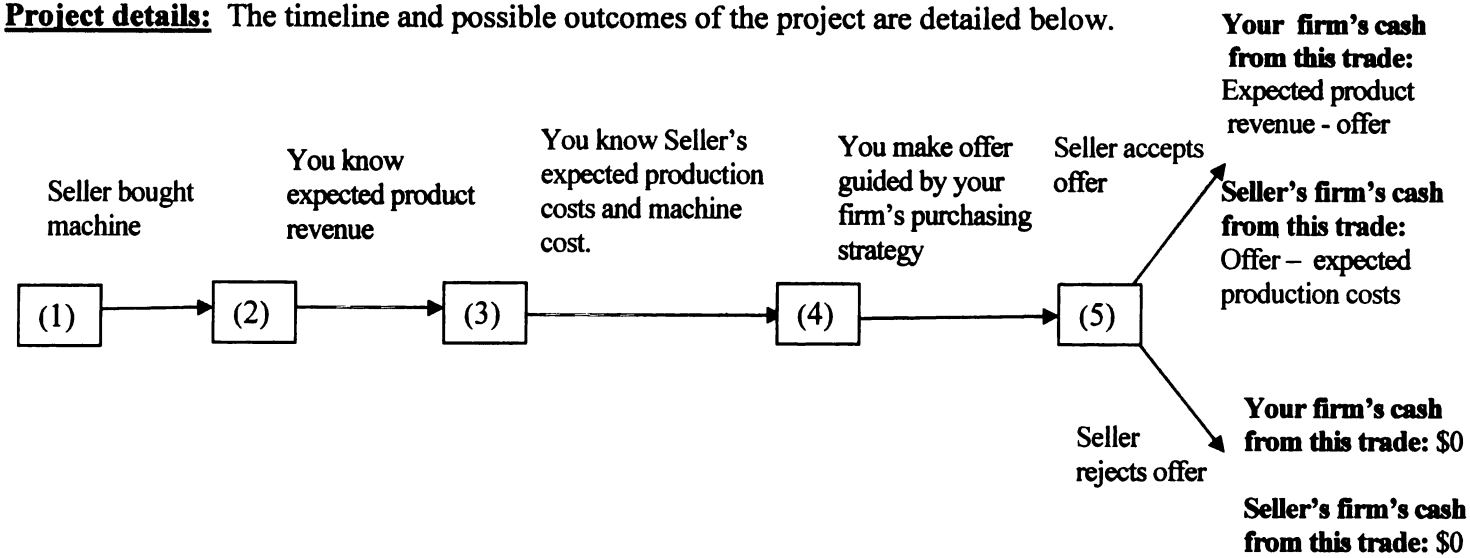
You are assigned the role of Buyer. The Buyer buys parts from sellers and assembles them into a final product sold to the outside market.

You have an opportunity to undertake a project with a Seller. This project required the Seller to purchase a machine to improve the quality of the parts the Seller manufactures. The machine the Seller purchased is project-specific and can only be used to make the parts you need. It has no value outside this project with you. You cannot purchase these parts from another seller and the Seller cannot sell these parts to another buyer.

Your task is to decide how much to offer the Seller for the parts. Your offer should be guided by your firm's purchasing strategy. Your firm's cash is calculated by deducting the amount you offer the Seller from the revenue you can earn for selling the final product.

You will work through an example before deciding how much to offer the Seller.

Project details: The timeline and possible outcomes of the project are detailed below.



(1) The Seller has already purchased the project-specific machine. The Seller knows his/her expected production costs, his/her machine cost and the revenue your final product is expected to generate. The Seller's goal is to maximize his/her firm's cash from trade. Hence, the Seller is unlikely to accept an offer that does not cover **expected production costs** and would result in negative cash for his firm.

(2) You know your expected revenue from selling the final product.

(3) You know the Seller's expected production costs and machine cost.

(4) You will make the Seller an offer for the parts in increments of $1,000. Your offer should be guided by your firm's purchasing strategy.

(5) The Seller will accept or reject the offer but cannot make a counteroffer. The Seller is unlikely to accept an offer that does not cover his/her expected production costs.

Your compensation is composed of two parts.
1) A fee of $5 that you collect for participating in this research project.
2) In addition, you can earn some incentive compensation. Your incentive compensation is calculated as follows: your firm's cash from this trade/30,000.

INSTRUCTION SHEET

Practice example:

Your offer should be guided by the purchasing strategy of your firm.

Self-interested Strategy condition

Your firm's purchasing strategy is to offer sellers just enough to cover expected production costs. Your firm usually ignores past machine cost. Your goal is to maximize your firm's cash.

Fair Strategy condition

Your firm's purchasing strategy is to share the net cash evenly between seller and buyer firm. Your firm usually reimburses the Seller for past machine cost and expected production costs.
Your firm calculates overall net cash as follows: Expected product revenue – expected production costs – machine cost.

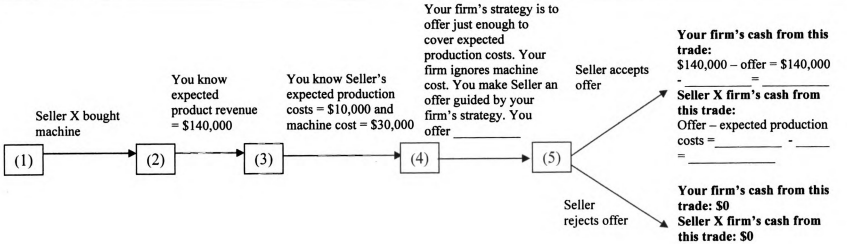
Below is a practice example that highlights the decision you will be making and its possible outcomes.

Please propose an offer consistent with your firm strategy (4) and calculate the outcome of the trade (5) in the timeline below. You will then look at the effect of this offer on your incentive compensation.

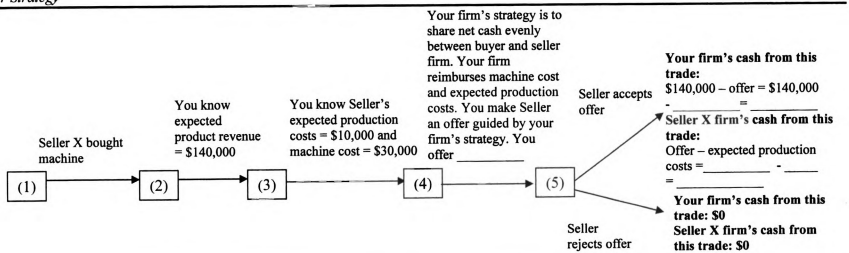
Seller X has already purchased a project-specific machine to manufacture parts for you. Seller's goal is to maximize his firm's cash from this trade. Hence, **Seller X is unlikely to accept an offer that does not cover *expected production costs* and would result in negative cash for his firm.**

Your expected revenue from selling the final product is $140,000. You know the Seller's expected production costs are $10,000 and machine cost was $30,000.

Self-interested Strategy



Fair Strategy



Recall that your incentive compensation is calculated as follows: Your firm's cash from this trade/30,000.

If following your offer, the Seller's firm's cash is greater than $0, Seller X accepts your offer. You receive: ($140,000 – offer)/30,000 = ($140,000-_____ _____/30,000 = $_____

If following your offer, the Seller's firm's cash is less than or equal to $0, Seller X rejects your offer. You receive: $0.

QUESTIONS

Before you decide how much to offer the Seller, please complete the section that follows. The questions are intended to capture how well you understand the important dimensions of this task.

If you are uncertain how to answer the question please consult the appropriate page number:

1. Please check one:

_____ I am a Seller.
_____ I am a Buyer. p. 1

Please circle the extent to which you agree or disagree with each statement.

2. My firm's purchasing strategy affects the cash I will derive from trade.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1

3. The seller can use the project-specific machine to make parts for another buyer.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1

4. If following my offer, the Seller's cash from trade is $0 or negative, he will reject my offer.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1 & 2

5. If the Seller rejects my offer, my incentive compensation will be $0.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

6. I am confident that my computation of my firm's net cash is correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

7. I am confident that my computation of my compensation is correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

OFFER DECISION

<u>Your task:</u> Making an offer to Seller Z

Here are details about this prospective project with Seller Z.

Seller Z has already purchased a project-specific machine. This machine has no value outside this project with you. Seller Z will incur expected production costs if he/she accepts your offer. Seller's goal is to maximize his firm's cash from this trade. Hence, **Seller Z is unlikely to accept an offer that does not cover *expected production costs* and would result in negative cash for his firm.**

Recall that your offer should be guided by the purchasing strategy of your firm.

Self-interested Strategy condition

Your firm's strategy is to offer sellers just enough to cover expected production costs. Your firm usually ignores past machine cost. Your goal is to maximize your firm's cash.

Fair Strategy condition

Your firm's purchasing strategy is to share the net cash evenly between seller and buyer firm. Your firm usually reimburses the Seller for past machine cost and expected production costs.

You know you can sell the final product for $170,000. You know the Seller's expected production costs are $10,000 and the machine cost was $40,000.

Please make an offer to Seller Z (your trade decision) and answer the following questions.

How much do you offer Seller Z?_____

What will your firm's cash from this trade be if Seller Z accepts your offer? _____

What will your firm's cash from this trade be if Seller Z rejects your offer? _____

What is the lowest offer you think Seller Z would accept? _____

WRAP UP QUESTIONS

During the task you just performed, how much did you offer Seller Z?

_____

Please explain how you came to this decision.

Please answer the following demographic questions. All information will be kept anonymous and confidential.

1. Sex (circle one): M F

2. What degree are you currently pursuing (circle one)?

Undergraduate Masters MBA Ph.D.

3. Grade point average: _____

4. National/cultural background:
United States or Canada ___
Europe ____
Asia ____
Latin America ___
Other (please specify) ____

4. How many 3-credit managerial accounting classes have you taken? _____

How important where each of the following in your decision?
Please allocate points to the following factors so that the points total 100. Base your allocation on how important these factors were when you made your trade decision.

	Point allocated
1. I believed the difference between the cash earned by my firm and the cash earned by Seller Z's firm should be small.	
2. I wanted to reimburse Seller Z for the cost of the project-specific machine he/she purchased.	
3. I did not want to make too low an offer because it would be rejected and my firm's cash and my incentive compensation would be $0.	
4. I wanted to maximize my firm's cash and my own compensation.	
5. Seller Z purchased a machine and I did not. As a result, my firm's cash from this trade should be lower than Seller Z's.	
6. Making an offer of a few thousand dollars allowed me to maximize my firm's cash and my incentive compensation.	
7. Other. Please explain:	
Total points allocated (Total must equal 100)	

Answer the following questions related to the decision you just made regarding Seller Z. Please circle the extent to which you agree or disagree with each statement. (1= strongly disagree and 9= strongly agree):

1. My firm's purchasing strategy is to share the net cash from trade evenly between Seller and Buyer firms.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

2. I knew exactly what Seller Z's expected production costs were.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

3. I used my knowledge of Seller Z's expected production costs to make Seller Z an offer that just covered expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

4. Once a seller has purchased a project-specific machine, this purchase should be reimbursed by the buyer no matter what the buyer's firm purchasing strategy is.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

5. My firm's purchasing strategy is to offer sellers just enough to cover expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

6. Seller Z took a risk in purchasing a project-specific machine because he/she might not be reimbursed for his/her purchase.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

7. I knew with certainty what was the lowest offer Seller Z would accept.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

8. I knew the total of Seller Z's expected production costs and machine costs but did not know Seller Z's exact expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

9. I believed that Seller Z would reject offers that did not cover his/her expected production costs AND machine cost.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

10. I believed that the machine cost was a sunk cost and should not affect the amount I offered Seller Z.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

11. I considered the risk of my offer being rejected by Seller Z if it did not cover Seller Z's expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

Part 2: Trade instructions (Coarse Information/Self-interested Strategy and Fair Strategy)

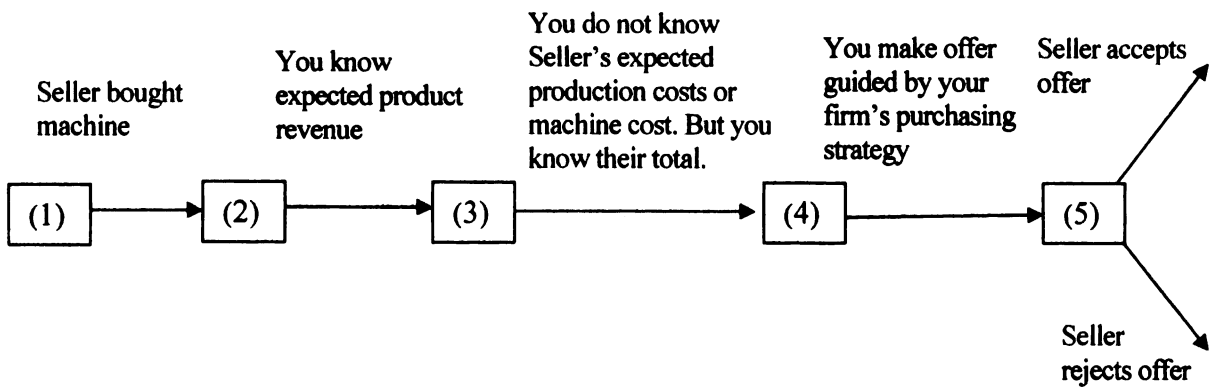
You are assigned the role of Buyer. The Buyer buys parts from sellers and assembles them into a final product sold to the outside market.

You have an opportunity to undertake a project with a Seller. This project required the Seller to purchase a machine to improve the quality of the parts the Seller manufactures. The machine the Seller purchased is project-specific and can only be used to make the parts you need. It has no value outside this project with you. You cannot purchase these parts from another seller and the Seller cannot sell these parts to another buyer.

Your task is to decide how much to offer the Seller for the parts. Your offer should be guided by your firm's purchasing strategy. Your firm's cash is calculated by deducting the amount you offer the Seller from the revenue you can earn for selling the final product.

You will work through an example before deciding how much to offer the Seller.

Project details: The timeline and possible outcomes of the project are detailed below.



Your firm's cash from this trade: Expected product revenue - offer

Seller's firm's cash from this trade: Offer – expected production costs

Your firm's cash from this trade: $0
Seller's firm's cash from this trade: $0

(1) The Seller has already purchased the project-specific machine. The Seller knows his/her expected production costs, his/her machine cost and the revenue your final product is expected to generate. The Seller's goal is to maximize his/her firm's cash from trade. Hence, the Seller is unlikely to accept an offer that does not cover **expected production costs** and would result in negative cash for his firm.

(2) You know your expected revenue from selling the final product.

(3) You do not know either the Seller's expected production costs or machine cost. However, you know their total.

(4) You will make the Seller an offer for the parts in increments of $1,000. Your offer should be guided by your firm's purchasing strategy.

(5) The Seller will accept or reject the offer but cannot make a counteroffer. The Seller is unlikely to accept an offer that does not cover his/her expected production costs.

Your compensation is composed of two parts.

1) A fee of $5 that you collect for participating in this research project.

2) In addition, you can earn some incentive compensation. Your incentive compensation is calculated as follows: your firm's cash from this trade/30,000.

INSTRUCTION SHEET

Practice example:

Your offer should be guided by the purchasing strategy of your firm.

Self-interested Strategy condition

Your firm's purchasing strategy is to offer sellers just enough to cover expected production costs. Your firm usually ignores past machine cost. Your goal is to maximize your firm's cash.

Fair Strategy condition

Your firm's purchasing strategy is to share the net cash evenly between seller and buyer firm. Your firm usually reimburses the Seller for past machine cost and expected production costs.
Your firm calculates overall net cash as follows: Expected product revenue – expected production costs – machine cost.

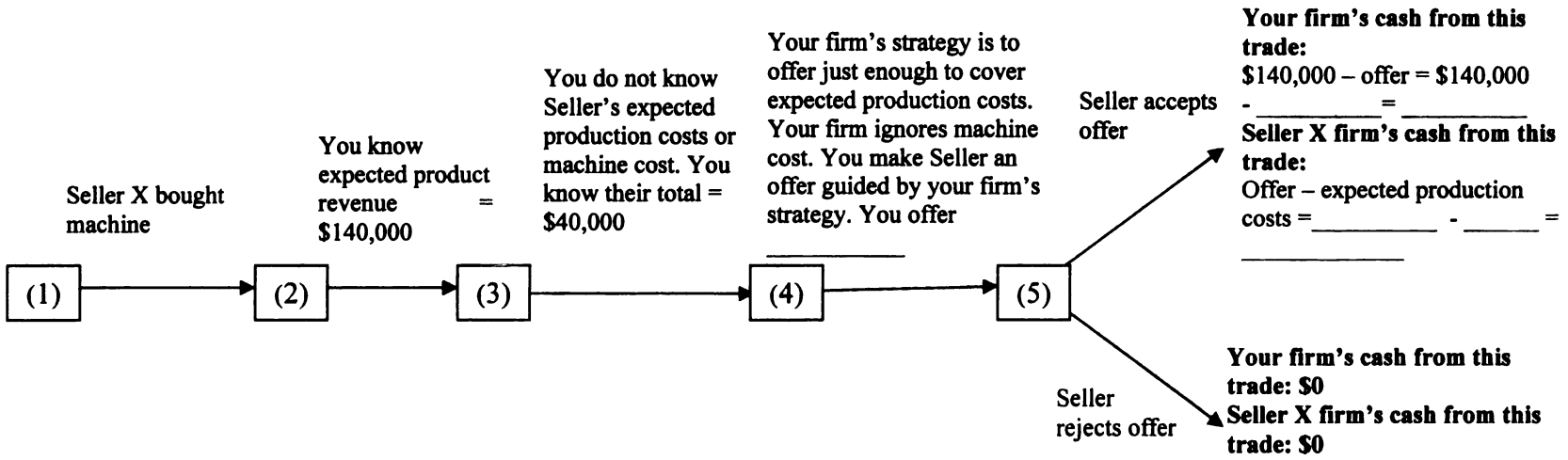
Below is a practice example that highlights the decision you will be making and its possible outcomes.

Please propose an offer consistent with your firm strategy (4) and calculate the outcome of the trade (5) in the timeline below. You will then look at the effect of this offer on your incentive compensation.

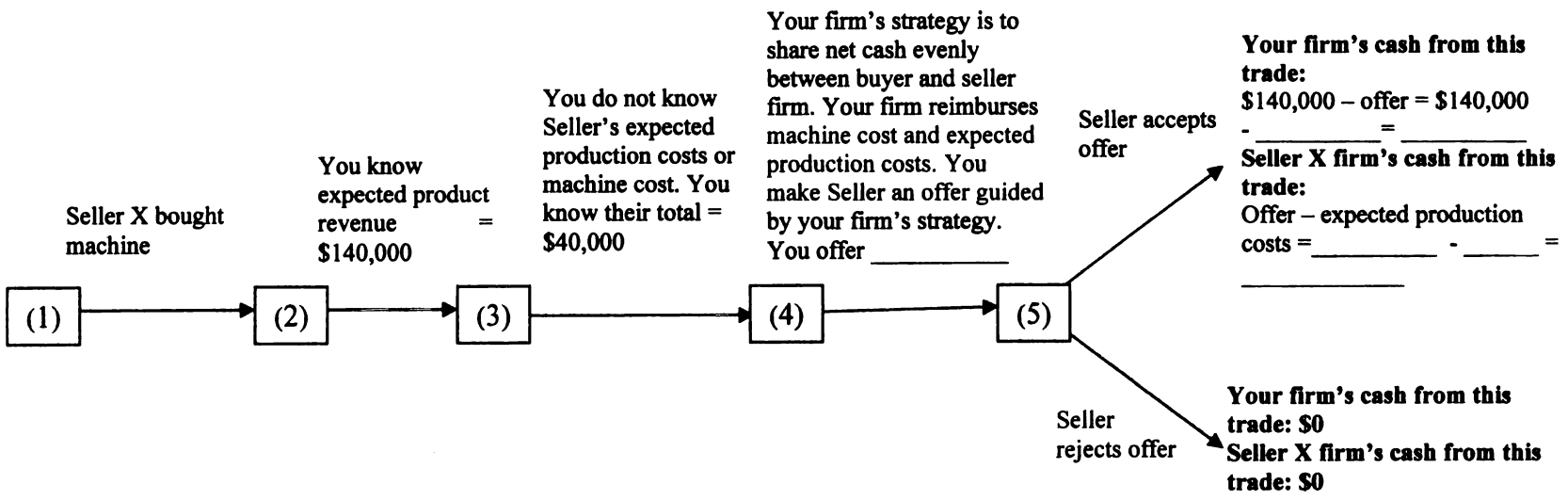
Seller X has already purchased a project-specific machine to manufacture parts for you. Seller's goal is to maximize his firm's cash from this trade. Hence, **Seller X is unlikely to accept an offer that does not cover *expected production costs* and would result in negative cash for his firm.**

Your expected revenue from selling the final product is $140,000. You do not know either the Seller's expected production costs or machine cost. However, you know their total is $40,000.

Self-interested Strategy



Fair Strategy



Recall that your incentive compensation is calculated as follows: Your firm's cash from this trade/30,000.

If following your offer, the Seller's firm's cash is greater than $0, Seller X accepts your offer. You receive: ($140,000 – offer)/30,000 = ($140,000-_____ _____/30,000_= $_____

If following your offer, the Seller's firm's cash is less than or equal to $0, Seller X rejects your offer. You receive: $_____

QUESTIONS

Before you decide how much to offer the Seller, please complete the section that follows. The questions are intended to capture how well you understand the important dimensions of this task.

If you are uncertain how to answer the question please consult the appropriate page number:

1. Please check one:

_____ I am a Seller.
_____ I am a Buyer.

p. 1

Please circle the extent to which you agree or disagree with each statement.

2. My firm's purchasing strategy affects the cash I will derive from trade.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1

3. The seller can use the project-specific machine to make parts for another buyer

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1

4. If following my offer, the Seller's cash from trade is $0 or negative, he will reject my offer.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 1 & 2

5. If the Seller rejects my offer, my incentive compensation will be $0.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

6. I am confident that my computation of my firm's net cash is correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

7. I am confident that my computation of my compensation is correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	p. 2

OFFER DECISION

<u>Your task:</u> Making an offer to Seller Z

Here are details about this prospective project with Seller Z.

Seller Z has already purchased a project-specific machine. This machine has no value outside this project with you. Seller Z will incur expected production costs if he/she accepts your offer. Seller's goal is to maximize his firm's cash from this trade. Hence, **Seller Z is unlikely to accept an offer that does not cover *expected production costs* and would result in negative cash for his firm.**

Recall that your offer should be guided by the purchasing strategy of your firm.

Self-interested Strategy condition

Your firm's strategy is to offer sellers just enough to cover expected production costs. Your firm usually ignores past machine cost. Your goal is to maximize your firm's cash.

Fair Strategy condition

Your firm's purchasing strategy is to share the net cash evenly between seller and buyer firm. Your firm usually reimburses the Seller for past machine cost and expected production costs.

You know you can sell the final product for $170,000. You do not know either the Seller's expected production costs or machine cost. However, you know their total is $50,000.

Please make an offer to Seller Z (your trade decision) and answer the following questions.

How much do you offer Seller Z?_____

What will your firm's cash from this trade be if Seller Z accepts your offer?_____

What will your firm's cash from this trade be if Seller Z rejects your offer? _____

What is the lowest offer you think Seller Z would accept? _____

WRAP UP QUESTIONS

During the task you just performed, how much did you offer Seller Z?

_____

Please explain how you came to this decision.

Please answer the following demographic questions. All information will be kept anonymous and confidential.

1. Sex (circle one): M F

2. What degree are you currently pursuing (circle one)?

Undergraduate Masters MBA Ph.D.

3. Grade point average: _____

4. National/cultural background:
United States or Canada ___
Europe ____
Asia ____
Latin America ___
Other (please specify) ____

4. How many 3-credit managerial accounting classes have you taken? _____

How important where each of the following in your decision?
Please allocate points to the following factors so that the points total 100. Base your allocation on how important these factors were when you made your trade decision.

	Point allocated
1. I believed the difference between the cash earned by my firm and the cash earned by Seller Z's firm should be small.	
2. I wanted to reimburse Seller Z for the cost of the project-specific machine he/she purchased.	
3. I did not want to make too low an offer because it would be rejected and my firm's cash and my incentive compensation would be $0.	
4. I wanted to maximize my firm's cash and my own compensation.	
5. Seller Z purchased a machine and I did not. As a result, my firm's cash from this trade should be lower than Seller Z's.	
6. Making an offer of a few thousand dollars allowed me to maximize my firm's cash and my incentive compensation.	
7. Other. Please explain:	
Total points allocated (Total must equal 100)	

Answer the following questions related to the decision you just made regarding Seller Z. Please circle the extent to which you agree or disagree with each statement. (1= strongly disagree and 9= strongly agree):

1. My firm's purchasing strategy is to share the net cash from trade evenly between Seller and Buyer firms.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

2. I knew exactly what Seller Z's expected production costs were.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

3. I used my knowledge of Seller Z's expected production costs to make Seller Z an offer that just covered expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

4. Once a seller has purchased a project-specific machine, this purchase should be reimbursed by the buyer no matter what the buyer's firm purchasing strategy is.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

5. My firm's purchasing strategy is to offer sellers just enough to cover expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

6. Seller Z took a risk in purchasing a project-specific machine because he/she might not be reimbursed for his/her purchase.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

7. I knew with certainty what was the lowest offer Seller Z would accept.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

8. I knew the total of Seller Z's expected production costs and machine costs but did not know Seller Z's exact expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

9. I believed that Seller Z would reject offers that did not cover his/her expected production costs AND machine cost.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

10. I believed that the machine cost was a sunk cost and should not affect the amount I offered Seller Z.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

11. I considered the risk of my offer being rejected by Seller Z if it did not cover Seller Z's expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

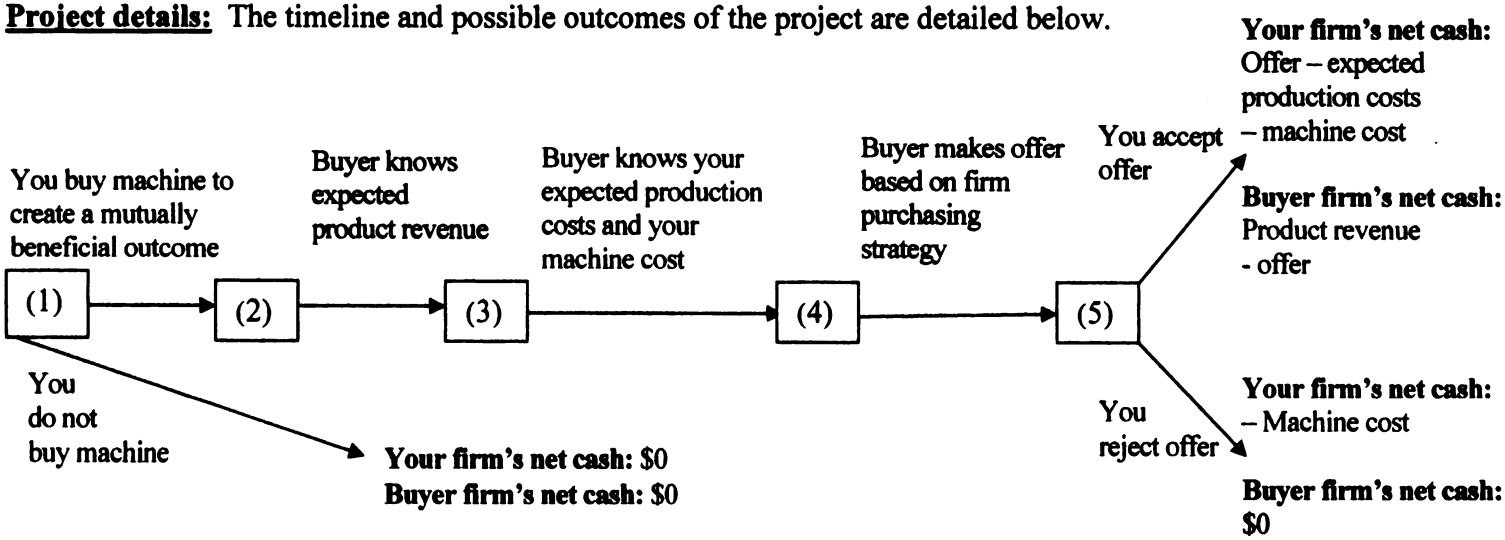
Part 3: Investment instructions (Fine Information/Self-interested Strategy and Fair Strategy)

You are assigned the role of Seller. The Seller manufactures parts and sells parts to buyers. You have an opportunity to undertake a project with a Buyer. This project could be mutually beneficial. This project requires you to purchase a machine to improve the quality of the parts you manufacture. If you purchase the machine, the Buyer will purchase the parts from you and assemble them into a final product sold to the outside market. You cannot sell these parts to another buyer and the Buyer cannot purchase these parts from another seller.

Your task is to decide whether to purchase the machine that improves the quality of the parts you manufacture for the Buyer. This machine is project-specific and can only be used to make the parts the Buyer needs. It has no value outside this project with the Buyer. Your goal is to maximize your firm's net cash, and thus your own compensation, by capturing as much of the net cash as possible. Your firm's net cash is calculated by deducting your costs from the amount the Buyer offers you for the parts.

You will work through some examples before making your investment decision.

Project details: The timeline and possible outcomes of the project are detailed below.



(1) **If you purchase the machine** – You believe the project will be mutually beneficial. The machine substantially increases the quality of the parts you manufacture. The Buyer will be interested in purchasing parts from you. You know your expected production costs, the machine cost and the product revenue to be generated by the Buyer.

(2) Buyer knows expected revenue from selling the final product.

(3) Buyer knows your expected production costs and your machine cost.

(4) Buyer makes you an offer for the parts in increments of $1,000. Offer is based on Buyer's firm purchasing strategy.

(5) You will accept or reject the offer but cannot make a counteroffer.

(1) **If you do not purchase the machine** – Buyer will not make you an offer.

Your compensation is composed of two parts.
1) A fee of $5 that you collect for participating in this research project.
2) In addition, you can earn up to $10 more of incentive compensation based on the net cash generated for your firm. You are endowed with 40,000 experimental dollars to start. The calculation of your incentive compensation is as follows: (40,000 + net cash)/10,000

INSTRUCTION SHEETS

Examples of prior experience with similar projects:

Each Buyer's offer depends on the purchasing strategy of his/her firm. Below are details about previous experiences you've had with two other buyers when you made a project-specific purchase.

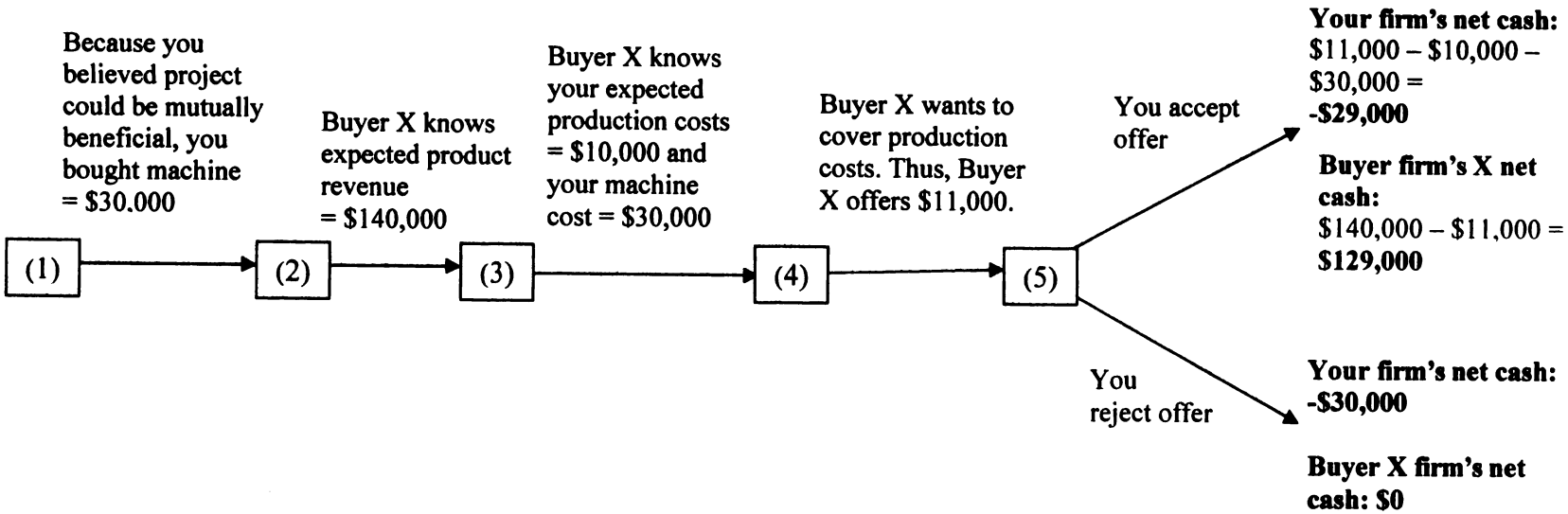
Example 1:

You purchased a project-specific machine for $30,000 to manufacture parts for Buyer X because you believed Buyer X would trade in a manner that was mutually beneficial. Buyer X's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer X knew that your expected production costs were $10,000 and your machine cost was $30,000.

Buyer X's firm purchasing strategy is to offer sellers just enough to cover expected production costs. Buyer X usually ignores machine costs.

Buyer X assumes you normally will not accept an offer that does not cover production costs.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

If you accepted Buyer X's offer, you received: (40,000 -29,000)/10,000= **$1.10**

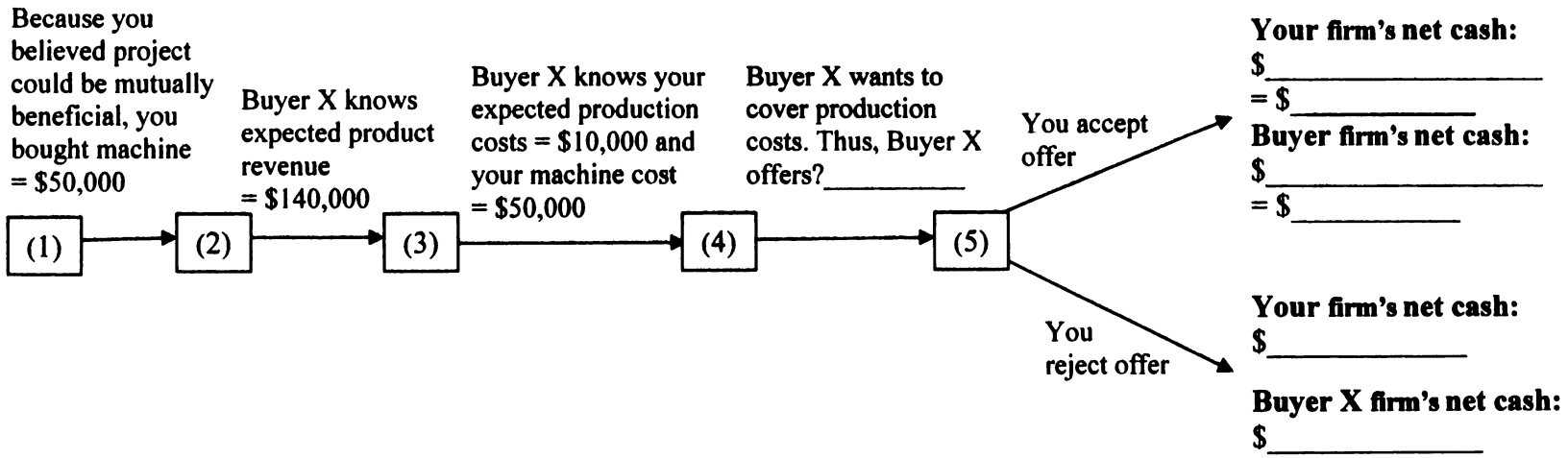
If you rejected Buyer X's offer, you received: (40,000 -30,000)/10,000= **$1.00**

If you had not bought the machine, you would have received: (40,000 + 0)/10,000= **$4.00**

Use your prior experience with Buyer X.
Use the information Buyer X possesses to predict the offer Buyer X will make (4) and to calculate the outcome of the trade (5) in the timeline below.

You purchased a project-specific machine for $50,000 to manufacture parts for Buyer X because you believed Buyer X would trade in a manner that was mutually beneficial. Buyer X's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer X knows that your expected production costs are $10,000 and your machine cost was $50,000.
Assume that Buyer X's firm strategy is to offer sellers just enough to cover expected production costs. Buyer X usually ignores machine costs. Buyer X assumes you normally will not accept an offer that does not cover production costs.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

Please calculate your incentive compensation:
If you accept Buyer X's offer: _____

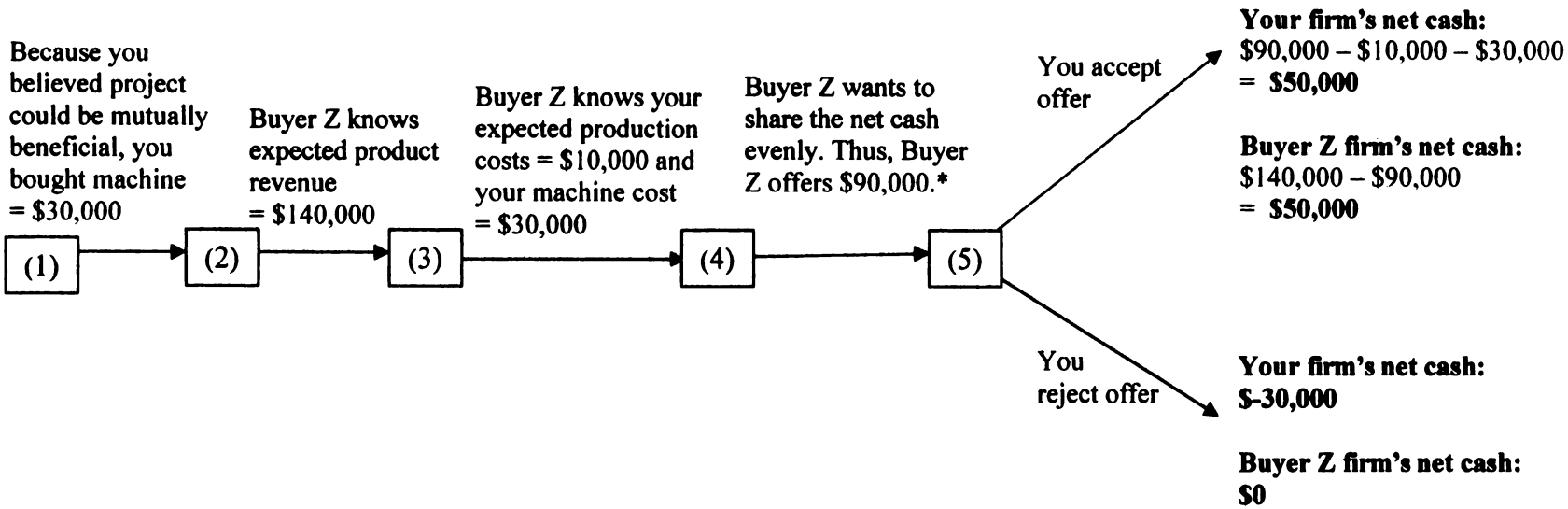
If you reject Buyer X's offer: _____

If you had not bought the machine: _____

Example 2:

You purchased a project-specific machine for $30,000 to manufacture parts for Buyer Z because you believed Buyer Z would trade in a manner that was mutually beneficial. Buyer Z's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer Z knew that your expected production costs were $10,000 and your machine cost was $30,000.
Buyer Z's firm purchasing strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

If you accepted Buyer Z's offer, you received: (40,000 +50,000)/10,000= **$9.00**

If you rejected Buyer Z's offer, you received: (40,000 -30,000)/10,000= **$1.00**

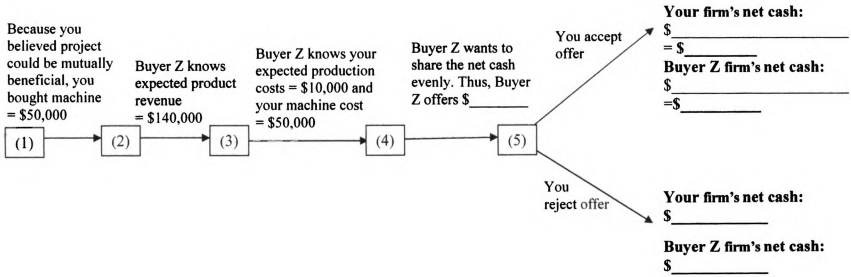
If you had not bought the machine, you would have received: (40,000 + 0)/10,000= **$4.00**

*(revenue – expected production costs - machine cost)/2 + expected production costs + machine cost = ($140,000 – 10,000 – 30,000)/2 + 10,000 + 30,000 = $90,000

Use your prior experience with Buyer Z.
Use the information Buyer Z possesses to predict the offer Buyer Z will make (4) and to calculate the outcome of the trade (5) in the timeline below.

You purchased a project-specific machine for $50,000 to manufacture parts for Buyer Z because you believed Buyer Z would trade in a manner that was mutually beneficial. Buyer Z's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer Z knows that your expected production costs are $10,000 and your machine cost was $50,000.
Assume that Buyer Z's firm strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

Please calculate your incentive compensation:
If you accept Buyer Z's offer: _____

If you reject Buyer Z's offer: _____

If you had not bought the machine:_____

QUESTIONS

Before you make an investment decision, please complete the section that follows. The questions are intended to capture how well you understand the important dimensions of this investment task.

If you are uncertain how to answer the question please consult the appropriate page number:

1. Please check one:

_____ I am a Seller.
_____ I am a Buyer. Page 1

Please circle the extent to which you agree or disagree with each statement

2. The Buyer's firm purchasing strategy affects the net cash I will derive from t

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Page 1

3. I can use the project-specific machine to make parts for another Buyer.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Page 1

4. If I do not purchase the project-specific machine, my firm's net cash is $0.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Page 1

5. In the Buyer X example, I am confident that my computation of my firm's n correct

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Pages 2 & 3

6. In the Buyer Z example, I am confident that my computation of my firm's n correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Pages 4 & 5

7. I am confident that my computation of my compensation is correct.

Strongly disagree								Strongly agree	
1	2	3	4	5	6	7	8	9	Pages 2 to 5

INVESTMENT DECISION

Your task
Buyer B asked you to make a project-specific purchase decision. This project could be mutually beneficial.
Here are further details about your prospective project with Buyer B.

You have not worked with Buyer B before.

Self-interested Strategy

You believe that there is a 75% chance that Buyer B's firm purchasing strategy is to offer just enough to cover expected production costs. You believe there is a 25% chance that Buyer B's purchasing strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.

Fair Strategy

You believe that there is a 75% chance that Buyer B's firm purchasing strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly. You believe there is a 25% chance that Buyer B's firm purchasing strategy is to offer sellers just enough to cover expected production costs.

The amount of sales revenue that Buyer B can expect for the final product is contingent upon whether you purchase the project-specific machine:

Your machine cost	Buyer B sales revenue
$0 (no purchase made)	$0
$40,000	$170,000

If you purchase the machine –
This machine has no value outside this project with Buyer B. In addition to the machine cost of $40,000, you expect to incur production costs of $10,000 if you accept Buyer B's offer.

If you do not purchase the machine – Your firm's net cash will be $0.

Please use the information Buyer B knows to answer the following questions.

Buyer B knows he/she can sell the final product for $170,000.

Buyer B knows that your expected production costs are $10,000 and your machine cost is $40,000.

If Buyer B's firm strategy is to offer just enough to cover expected production costs, what do you think Buyer B will offer you? _____
What will your firm's net cash be if you accept Buyer B's offer? _____

If Buyer B's firm strategy is to share the overall net cash between Buyer and Seller firm evenly, what do you think Buyer B will offer you? _____
What will your firm's net cash be if you accept Buyer B's offer? _____

Please make your investment decision.

Select the cost of the machine you would like to purchase:
___$0 (equivalent to no purchase made)

___$40,000

How much do you anticipate Buyer B will offer you? _____

What is the lowest offer you would accept? _____

WRAP UP QUESTIONS

During the task you just performed, did you decide to purchase the project-specific machine?
__Yes __ No

Please explain how you came to this decision.

Please answer the following demographic questions. All information will be kept anonymous and confidential.
1. Sex (circle one): M F

2. What degree are you currently pursuing (circle one)?

Undergraduate Masters MBA Ph.D.

3. Grade point average: _____

4. National/cultural background:
United States or Canada ___
Europe ____
Asia ____
Latin America ___
Other (please specify) ____

4. How many 3-credit managerial accounting classes have you taken? _____

How important where each of the following in your decision of whether to purchase the machine?
Please allocate points to the following factors so that the points total 100. Base your allocation on how important these factors were when you made your purchase decision.

	Point allocated
1. I believed the difference between the net cash earned by my firm and the net cash earned by Buyer B's firm should be small.	
2. I was concerned that Buyer B would not reimburse me for the project-specific machine cost.	
3. I considered my opportunity to earn an incentive compensation greater than $4.	
4. I considered the opportunity to generate a large overall net cash to share with Buyer B's firm.	
5. I considered the opportunity for my firm to earn a positive net cash.	
6. I took into account my risk of earning an incentive compensation lower than $4.	
7. I made an investment and Buyer B did not. As a result, my firm's net cash should be larger than Buyer B's.	
8. Other. Please explain:	
Total points allocated (Total must equal 100)	

Answer the following questions related to the investment decision you just made regarding Buyer B. Please circle the extent to which you agree or disagree with each statement.
(1= strongly disagree and 9= strongly agree):

1. I believed purchasing the machine and subsequently trading with Buyer B was likely to be mutually beneficial.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

2. Buyer B's firm purchasing strategy is to share the net cash evenly between both firms.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

3. I would invest if I knew with certainty that Buyer B would share the overall net cash evenly.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

4. Buyer B's firm purchasing strategy is to cover expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

5. I believed Buyer B knew exactly what my expected production costs were.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

6. Even if Buyer B's firm policy was to offer just enough to cover production costs, there was a chance I might get reimbursed for the cost of the machine I purchased.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

7. I believed Buyer B would use his knowledge of my expected production costs to make me a low offer.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

8. I believed any offer from Buyer B that covers expected production costs and ignores machine cost would be unreasonable because all related costs (past machine cost and expected production costs) should be covered.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

9. I believed Buyer B's net cash would be much higher if I purchased the machine and accepted his offer than if I rejected his offer

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

10. I believed Buyer B knew the total of my expected production costs and machine costs but did not know my exact expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

11. I ignored the 25% chance that Buyer B's firm might have a different purchasing strategy.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

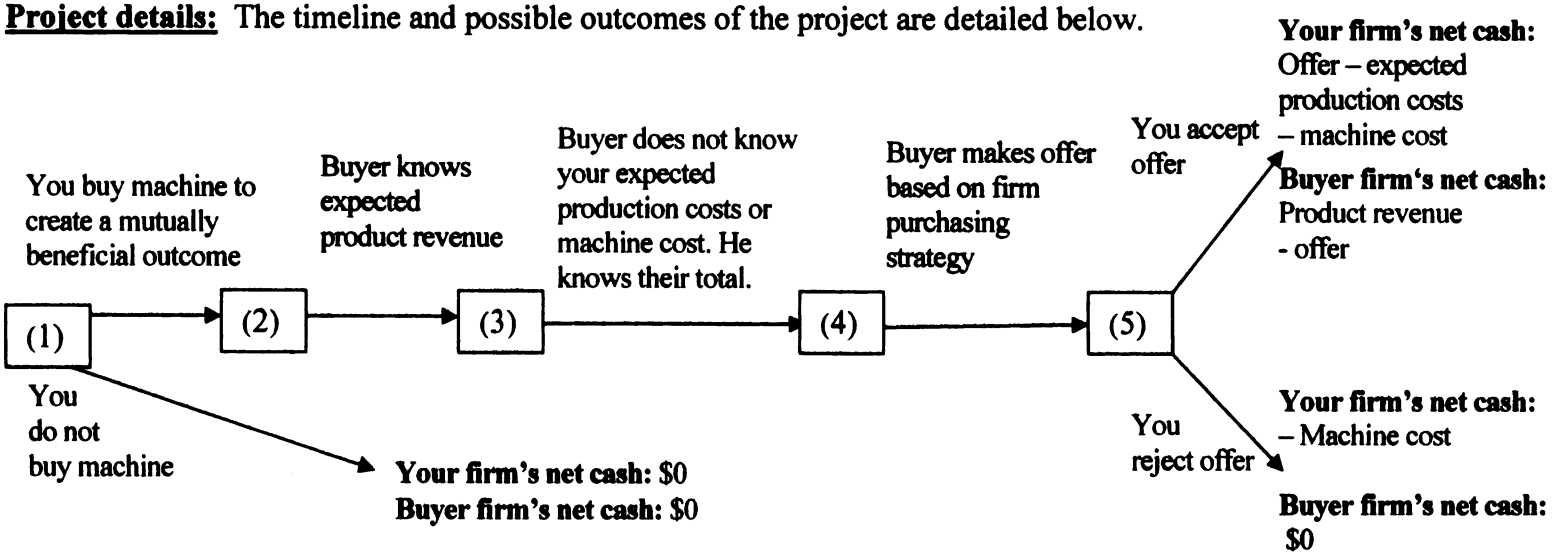
Part 4: Investment instructions (Coarse Information/Self-interested Strategy and Fair Strategy)

You are assigned the role of Seller. The Seller manufactures parts and sells parts to buyers. You have an opportunity to undertake a project with a Buyer. This project could be mutually beneficial. This project requires you to purchase a machine to improve the quality of the parts you manufacture. If you purchase the machine, the Buyer will purchase the parts from you and assemble them into a final product sold to the outside market. You cannot sell these parts to another buyer and the Buyer cannot purchase these parts from another seller.

Your task is to decide whether to purchase the machine that improves the quality of the parts you manufacture for the Buyer. This machine is project-specific and can only be used to make the parts the Buyer needs. It has no value outside this project with the Buyer. Your goal is to maximize your firm's net cash, and thus your own compensation, by capturing as much of the net cash as possible. Your firm's net cash is calculated by deducting your costs from the amount the Buyer offers you for the parts.

You will work through some examples before making your investment decision.

Project details: The timeline and possible outcomes of the project are detailed below.



(1) **If you purchase the machine** – You believe the project will be mutually beneficial. The machine substantially increases the quality of the parts you manufacture. The Buyer will be interested in purchasing parts from you. You know your expected production costs, the machine cost and the product revenue to be generated by the Buyer.

(2) Buyer knows expected revenue from selling the final product.

(3) Buyer does not know either your expected production costs or your machine cost. He knows their total.

(4) Buyer makes you an offer for the parts in increments of $1,000. Offer is based on Buyer's firm purchasing strategy.

(5) You will accept or reject the offer but cannot make a counteroffer.

(1) **If you do not purchase the machine** – Buyer will not make you an offer.

Your compensation is composed of two parts.
1) A fee of $5 that you collect for participating in this research project.
2) In addition, you can earn up to $10 more of incentive compensation based on the net cash generated for your firm. You are endowed with 40,000 experimental dollars to start. The calculation of your incentive compensation is as follows: (40,000 + net cash)/10,000

Examples of prior experience with similar projects:

Each Buyer's offer depends on the purchasing strategy of his/her firm. Below are details about previous experiences you've had with two other buyers when you made a project-specific purchase.

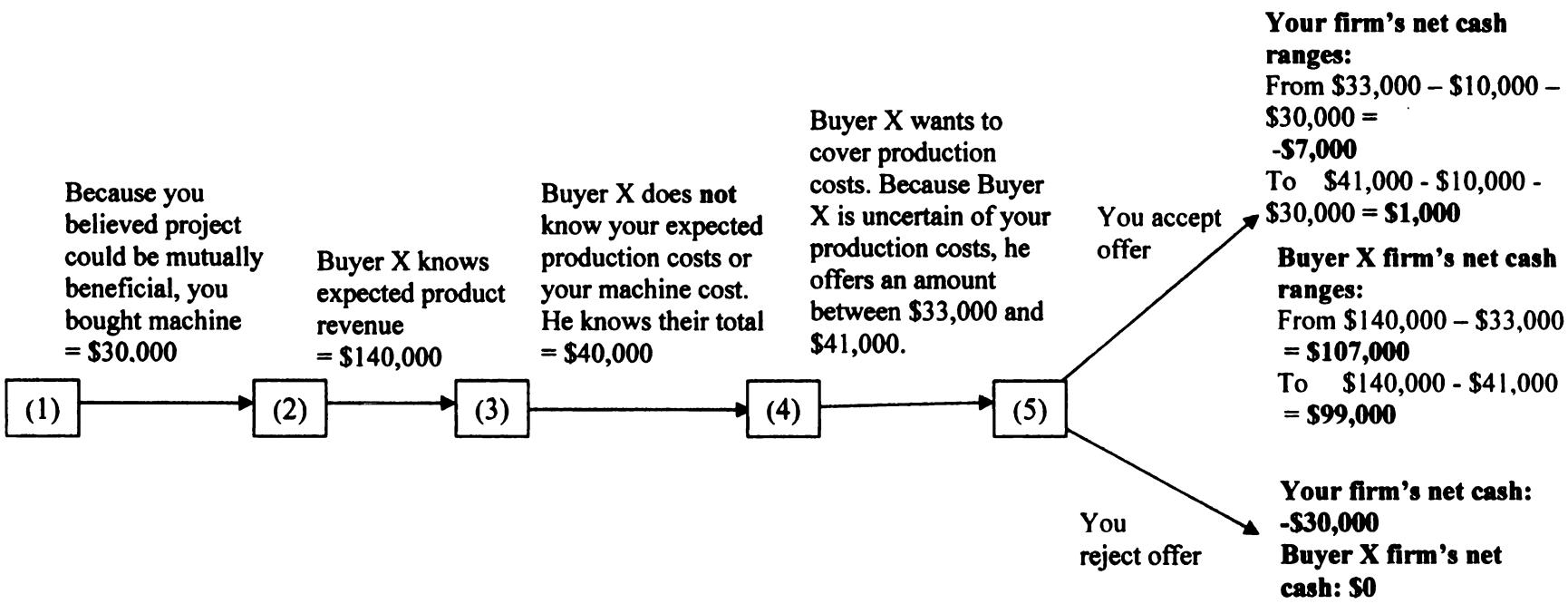
Example 1:

You purchased a project-specific machine for $30,000 to manufacture parts for Buyer X because you believed Buyer X would trade in a manner that was mutually beneficial. Buyer X's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer X did not know either your expected production costs or your machine cost. However, he knew their total was $40,000.

Buyer X's firm strategy is to offer sellers just enough to cover expected production costs. Buyer X's firm usually ignores machine costs.

Buyer X assumes you normally will not accept an offer that does not cover production costs.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment

If you accepted Buyer X's offer, you received: between (40,000 -7,000)/10,000= **$3.30** and (40,000 + 1,000)/10,000 = **$4.10**

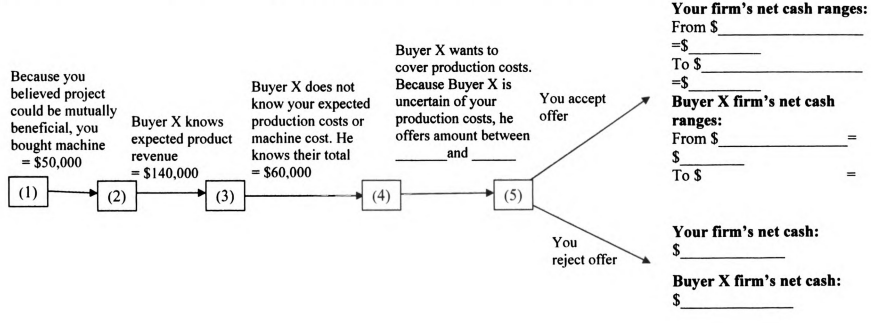
If you rejected Buyer X's offer, you received: (40,000 -30,000)/10,000= **$1.00**

If you had not bought the machine, you would have received: (40,000 + 0)/10,000= **$4.00**

Use your prior experience with Buyer X.
Use the information Buyer X possesses to predict the offer Buyer X will make (4) and to calculate the outcome of the trade (5) in the timeline below.

You purchased a project-specific machine for $50,000 to manufacture parts for Buyer X because you believed Buyer X would trade in a manner that was mutually beneficial. Buyer X's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer X does not know either your expected production costs or your machine cost. However, he knows their total is $60,000. **Assume that Buyer X's firm strategy is to offer sellers just enough to cover expected production costs. Buyer X's firm usually ignores machine costs.** Buyer X assumes you normally will not accept offers that do not cover production costs.



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

Please calculate your incentive compensation:
If you accept Buyer X's offer: Between $_____ and $_____

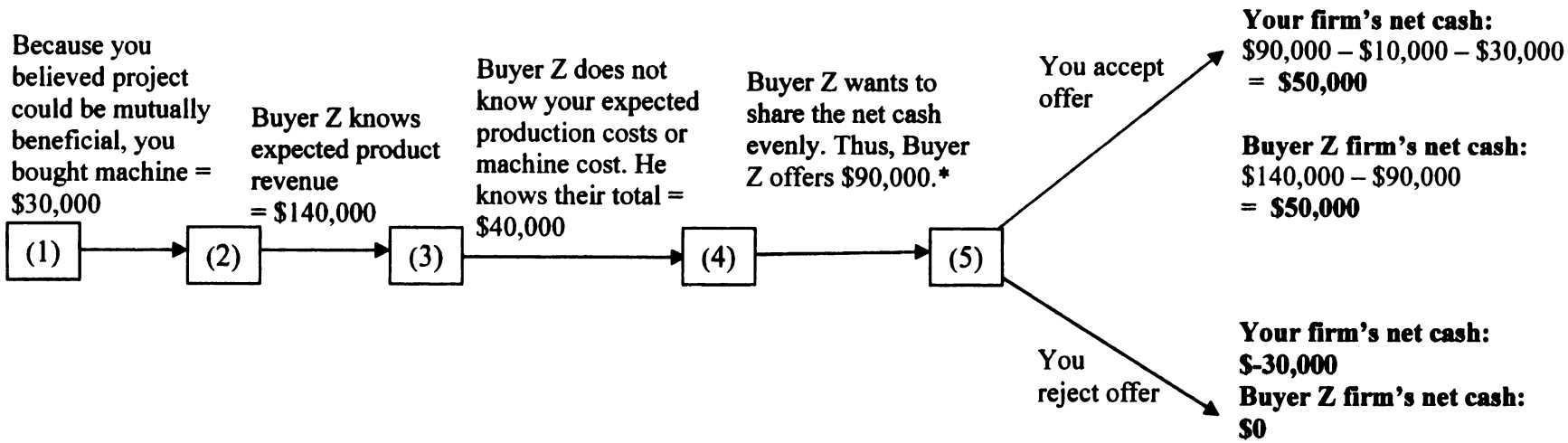
If you reject Buyer X's offer: _____

If you had not bought the machine: _____

Example 2:

You purchased a project-specific machine for $30,000 to manufacture parts for Buyer Z because you believed Buyer Z would trade in a manner that was mutually beneficial. Buyer Z's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer Z did not know either your expected production costs or your machine cost. However, he knew their total was $40,000. **Buyer Z's firm strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.**



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

If you accepted Buyer Z's offer, you received: (40,000 +50,000)/10,000= **$9.00**

If you rejected Buyer Z's offer, you received: (40,000 -30,000)/10,000= **$1.00**

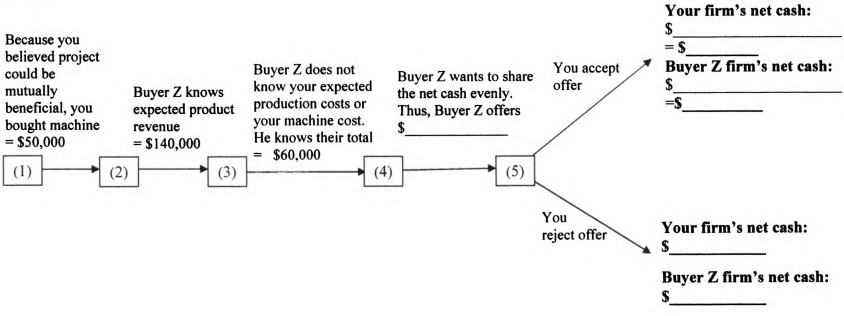
If you had not bought the machine, you would have received: (40,000 + 0)/10,000= **$4.00**

*(revenue – total of expected production costs and machine cost)/2 + total of expected production costs and machine cost = ($140,000 – 40,000)/2 + 40,000 = $90,000

Use your prior experience with Buyer Z.
Use the information Buyer Z possesses to predict the offer Buyer Z will make (4) and to calculate the outcome of the trade (5) in the timeline below.

You purchased a project-specific machine for $50,000 to manufacture parts for Buyer Z because you believed Buyer Z would trade in a manner that was mutually beneficial. Buyer Z's final product had expected revenues of $140,000. Your expected production costs were $10,000.

Buyer Z does not know either your expected production costs or your machine cost. However, he knows their total is $60,000. **Assume that Buyer Z's firm strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.**



Recall that your incentive compensation is calculated as follows: (40,000 + net cash)/10,000. 40,000 is your initial endowment.

Please calculate your incentive compensation:
If you accept Buyer Z's offer: _____

If you reject Buyer Z's offer: _____

If you had not bought the machine:_____

QUESTIONS

Before you make an investment decision, please complete the section that follows. The questions are intended to capture how well you understand the important dimensions of this investment task.

If you are uncertain how to answer the question please consult the appropriate page number:

1. Please check one:

_____ I am a Seller. Page 1

_____ I am a Buyer.

Please circle the extent to which you agree or disagree with each statement

2. The Buyer's firm purchasing strategy affects the net cash I will derive from t

Strongly disagree								Strongly agree	Page 1
1	2	3	4	5	6	7	8	9	

3. I can use the project-specific machine to make parts for another Buyer.

Strongly disagree								Strongly agree	Page 1
1	2	3	4	5	6	7	8	9	

4. If I do not purchase the project-specific machine, my firm's net cash is $0.

Strongly disagree								Strongly agree	Page 1
1	2	3	4	5	6	7	8	9	

5. In the Buyer X example, I am confident that my computation of my firm's n correct

Strongly disagree								Strongly agree	Pages 2 & 3
1	2	3	4	5	6	7	8	9	

6. In the Buyer Z example, I am confident that my computation of my firm's n correct.

Strongly disagree								Strongly agree	Pages 4 & 5
1	2	3	4	5	6	7	8	9	

7. I am confident that my computation of my compensation is correct.

Strongly disagree								Strongly agree	Pages 2 to 5
1	2	3	4	5	6	7	8	9	

INVESTMENT DECISION

Your task

Buyer B asked you to make a project-specific purchase decision. This project could be mutually beneficial. Here are further details about your prospective project with Buyer B.

You have not worked with Buyer B before.

Self-interested Strategy

You believe that there is a 75% chance that Buyer B's firm purchasing strategy is to offer just enough to cover expected production costs. You believe there is a 25% chance that Buyer B's purchasing strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly.

Fair Strategy

You believe that there is a 75% chance that Buyer B's firm purchasing strategy is to make an offer that shares the overall net cash between Buyer and Seller firms evenly. You believe there is a 25% chance that Buyer B's firm purchasing strategy is to offer sellers just enough to cover expected production costs.

The amount of sales revenue that Buyer B can expect for the final product is contingent upon whether you purchase the project-specific machine:

Your machine cost	Buyer B sales revenue
$0 (no purchase made)	$0
$40,000	$170,000

If you purchase the machine –
This machine has no value outside this project with Buyer B. In addition to the machine cost of $40,000, you expect to incur production costs of $10,000 if you accept Buyer B's offer.

If you do not purchase the machine – Your firm's net cash will be $0.

Please use the information Buyer B knows to answer the following questions.

Buyer B knows he can sell the final product for $170,000.

Like Buyer X and Buyer Z, Buyer B does not know either your expected production costs or your machine cost. However, Buyer B knows their total is $50,000.

If Buyer B's firm strategy is to offer just enough to cover expected production costs, what do you think Buyer B will offer you? _____
What will your firm's net cash be if you accept Buyer B's offer? _____

If Buyer B's firm strategy is to share the overall net cash between Buyer and Seller firm evenly, what do you think Buyer B will offer you? _____
What will your firm's net cash be if you accept Buyer B's offer? _____

Please make your investment decision.

Select the cost of the machine you would like to purchase:
___$0 (equivalent to no purchase made)

___$40,000

How much do you anticipate Buyer B will offer you? _____

What is the lowest offer you would accept? _____

WRAP UP QUESTIONS

During the task you just performed, did you decide to purchase the project-specific machine?
__Yes __ No

Please explain how you came to this decision.

Please answer the following demographic questions. All information will be kept anonymous and confidential.
1. Sex (circle one): M F

2. What degree are you currently pursuing (circle one)?

Undergraduate Masters MBA Ph.D.

3. Grade point average: _____

4. National/cultural background:
United States or Canada ___
Europe ____
Asia ____
Latin America ___
Other (please specify) ____

4. How many 3-credit managerial accounting classes have you taken? _____

How important where each of the following in your decision of whether to purchase the machine?
Please allocate points to the following factors so that the points total 100. Base your allocation on how important these factors were when you made your purchase decision.

	Point allocated
1. I believed the difference between the net cash earned by my firm and the net cash earned by Buyer B's firm should be small.	
2. I was concerned that Buyer B would not reimburse me for the project-specific machine cost	
3. I considered my opportunity to earn an incentive compensation greater than $4	
4. I considered the opportunity to generate a large overall net cash to share with Buyer B's firm.	
5. I considered the opportunity for my firm to earn a positive net cash	
6. I took into account my risk of earning incentive compensation lower than $4	
7. I made an investment and Buyer B did not. As a result, my firm's net cash should be larger than Buyer B's.	
8. Other. Please explain:	
Total points allocated (Total must equal 100)	

Answer the following questions related to the investment decision you just made regarding Buyer B. Please circle the extent to which you agree or disagree with each statement.
(1= strongly disagree and 9= strongly agree):

1. I believed purchasing the machine and subsequently trading with Buyer B was likely to be mutually beneficial.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

2. Buyer B's firm purchasing strategy is to share the net cash evenly between both firms.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

3. I would invest if I knew with certainty that Buyer B would share the overall net cash evenly.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

4. Buyer B's firm purchasing strategy is to cover expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

5. I believed Buyer B knew exactly what my expected production costs were.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

6. Even if Buyer B's firm policy was to offer just enough to cover production costs, there was a chance I might get reimbursed for the cost of the machine I purchased.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

7. I believed Buyer B would use his knowledge of my expected production costs to make me a low offer.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

8. I believed any offer from Buyer B that covers expected production costs and ignores machine cost would be unreasonable because all related costs (past machine cost and expected production costs) should be covered.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

9. I believed Buyer B's net cash would be much higher if I purchased the machine and accepted his offer than if I rejected his offer.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

10. I believed Buyer B knew the total of my expected production costs and machine costs, but did not know my exact expected production costs.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

11. I ignored the 25% chance that Buyer B's firm might have a different purchasing strategy.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9

3 REVIEW OF THE HOLD-UP LITERATURE IN THE CONTEXT OF STRATEGIC DECISION-MAKING

3.1 INTRODUCTION

"Suppose the production of a particular product requires a large capital equipment which is, however, specialized insofar that it can only be used for the particular product concerned or can only be readapted at great cost. Then, the firm producing such a product for one consumer finds itself faced with one great risk - that the consumer may transfer his demand elsewhere or that he may exercise his monopoly power to force down the price..."
Coase correspondence to Ronald Fowler in 1932.

In this essay, I review and classify analytical and empirical research aimed at finding and testing mitigating mechanisms to hold-ups. This research is organized around strategic decision-making such as organizational design, trade decisions, and resource allocations. Such a review is warranted despite recent reviews by Shelanski and Klein (1995) and Coeurderoy and Quélin (1997) for at least three reasons: (1) First, those reviews presented case studies and archival research, but did not incorporate findings from analytical or experimental studies. (2) Second, extant reviews did not extend outside the fields of law, economics, marketing, and management. (3) Third, research has evolved in two new directions recently: Research has focused increasingly on relational contracting and has just started to investigate how investor private information affects opportunism.

I propose that integrating findings from various disciplines is necessary as each discipline has preferred areas of investigation, but only provides a partial picture of the status of research in other disciplines. For instance, findings from intra-firm and transfer pricing research conducted by accounting are not included in analyses from economics or

supply chain. Additionally, results from other disciplines can help point to weaknesses and suggest boundaries of prior research. To that effect, Che and Hausch (1999) show that establishing an initial contract (a solution to hold-ups proposed by accounting research (cf. Edlin and Reichelstein 1995)) encourages idiosyncratic selfish investment but is ineffective with cooperative investments. Finally, since research in accounting is organized by types of strategic decision, scholars risk missing insights from research conducted to address another decision even though both address hold-up problems. For instance, aggregation of information helps mitigate opportunism in a resource allocation setting (cf. Arya et al. 2000), but it is not until the first essay presented herein that the effectiveness of this solution was examined with a trade decision.

Accordingly, this essay has three main objectives. First, although transaction cost economics has provided the dominating framework for analyzing hold-ups, this essay reviews the various theoretical perspectives that have been used to support analyses of hold-ups highlighting their common features and differences. Second, I integrate research from the fields of economics, experimental economics, accounting, finance and supply chain and organize it around decisions such as organizational design, trade decisions, and resource allocations. Third, I suggest avenues for future investigation.

Firms make strategic decisions such as organizational design, trade decisions, or resource allocations on a regular basis. These strategic decisions are often associated with investments in idiosyncratic assets (i.e., relationship-specific investments) by one or both of the parties involved. Relationship-specific investments can generate a surplus when the investor subsequently deals with a specific economic partner. However, these investments lose most, if not all, their value in alternative uses. Economic theories (i.e.,

transaction cost economics, property rights, and agency theories) predict that the investor anticipates that the specific economic partner will behave in an opportunistic manner by appropriating most of the surplus generated by the investment. As a result, the investor will bear the cost of the relationship-specific investment and only receive a small portion of the surplus created by his investment. Accordingly, he under-invests (i.e., hold-up problem).[1] The hold-up problem studied herein is composed of three elements: (a) a socially optimal relationship-specific investment by one party which creates quasi-rents, (b) lack of credible commitment by the non-investor to refrain from appropriating those quasi-rents, and (c) opportunism leading to appropriation of a portion of the quasi-rents by the non-investor.

Scholars propose that opportunistic behavior by the non-investing party can be curtailed if interdependence between the parties is increased or there is protection of the investor. Thus, various theories prescribe integration and centralization, detailed and long-term formal contracts, allocation of property rights, incentives, and social norms as ways to reduce the likelihood that the surplus generated by the investment will be appropriated. Scholars also developed analytical models and tested the predictions of those theories with empirical studies. While their findings are generally consistent with the economic and relational contracting theories, they also show that information characteristics can play a role in mitigating hold-ups.

Section 3.2 presents the hold-up problem in greater detail and provides theoretical predictions from the field of economics and law with presentation of transaction cost

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[1] Although the term of hold-up was first used by Goldberg (1976), the concept originated with Coarse (1937) and evolved from Goldberg's original meaning of appropriation of surplus to underinvestment in idiosyncratic assets because of anticipation of subsequent appropriation.

economics, property rights, agency and relational contracting theories. Section 3.3 details investigations and findings from research aimed at curtailing the hold-up problem. It is organized around strategic decisions of organizational design, trade decisions, and resource allocations. Section 3.4 concludes.

3.2 HOLD-UP AND OVERVIEW OF THEORIES

Early economic investigations initiated by Coase (1937) examined relationships between firms and focused on explaining antecedents of organizational boundaries and contracting arrangements by investigating governance structures ranging from arm's length relationships (price based governance and outcome-based contracts) to integration (governance through a unified authority structure). The premise of this research stream is that organizational boundaries are the result of cost minimizing decisions. Theories were refined much later with transaction cost economics (Williamson 1975), property rights (Hart and Moore 1990), agency (Jensen and Meckling 1976), and relational contracting (Macneil 1980) theories. Theories that analyze the issues associated with relationship-specific investments are presented below following a detailed description of relationship-specific investments and hold-ups.

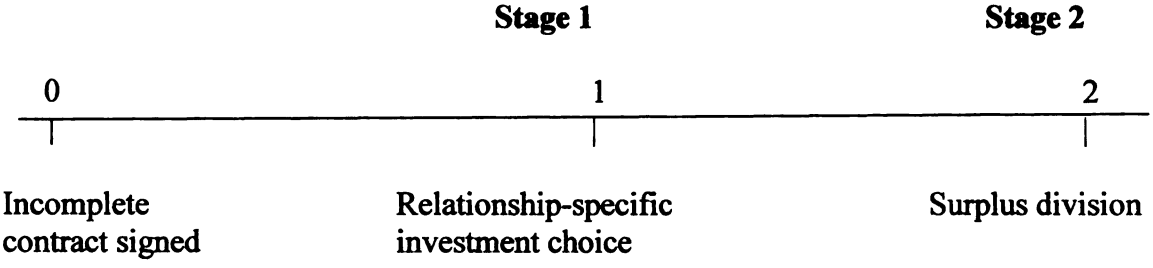
3.2.1 Description of Hold-ups

Per Williamson (1983; 1991), relationship-specific investments take the form of site specificity (e.g., collocation of electricity generating facility next to a coal mine (Joskow 1987)), capital asset specificity (e.g., special tooling (Monteverde and Teece 1982)), a dedicated asset for one customer, human capital (e.g., training of personnel to distribute or service products (Anderson 1985; Jensen and Rothwell 1998)), brand name

capital (e.g., goodwill (Anderson 1994)), and temporal specificity (e.g., threats of delays as a way to extract price concessions (Masten, Meehan, and Snyder 1991; Pirrong 1993)). When a firm makes a relationship-specific investment, the more specific the cost is, the lower the value of the investment in alternative uses.[2] Expectations of self-interested behavior once a relationship-specific investment has occurred lead to under-investment in idiosyncratic assets and the hold-up problem as detailed in Figure 3-1 below.

Figure 3-1

Simplified Timeline of the Hold-up Problem



Adapted from Hart and Moore (1988)

A contract was negotiated at time 0 (for a predetermined quantity of a product, or price, or provision of certain effort). The price or quantity cannot be specified with certainty *ex ante* because they depend on the resolution of certain parameters that cannot be predicted (e.g., success of R&D efforts). At time 1, one party must decide whether to make a non-contractible idiosyncratic one-period investment that will create a surplus

[2] Importantly, what determines whether an investment is relationship-specific is not whether the costs incurred are fixed or variable, but whether the asset can be redeployed and what its value in alternative uses is.

should a trade or compensation agreement follow. Time 1 represents the investment stage. The investor's goal is to maximize his payoff from negotiation. Accordingly, his investment decision is based on expectations from the negotiation to be conducted at time 2. In other words, the investor uses backward induction to make his investment decision. The parties divide the surplus at time 2. Time 2 represents the negotiation stage. Once a relationship-specific investment has been made, it is less attractive for the parties to negotiate outside the relationship than within. Additionally, negotiating parties cannot be fully protected by contracts because contracts are inherently incomplete. Contract incompleteness arises, first, because of uncertainty. Uncertainty means that it might not be possible to include all possible contingencies in contracts. Second, performance might be difficult and costly to monitor as outcomes are unobservable or unverifiable (Klein 1980). Because of the incomplete nature of contracts, court enforcement of contracts is difficult (Klein 1996) and contracts cannot fully protect the investor from opportunism by his counterpart. Thus, a bilateral monopoly is created *ex post* whereby the most powerful party can appropriate the surplus generated by the investment if cooperative behavior is not consistent with self-interested behavior (Tirole 1988).

An example of the hold-up problem suggested by the automobile industry follows. Suppose that an automobile supplier must decide whether to invest in R&D that can lead to valuable improvements in a component of a specific model of automobile produced by an original equipment manufacturers (OEM). R&D is costly and does not have any value outside the relationship with this OEM.[3] The supplier's R&D investment decision is based on expectations of payoffs from eventual purchase of the component by

[3] In this setting, R&D constitutes an idiosyncratic asset, i.e., relationship-specific asset.

this OEM. Additionally, contracts are incomplete and the OEM cannot credibly commit to reimbursing the supplier for the R&D investment. The supplier realizes that once the R&D investment is made, it becomes a sunk cost that may be ignored in trade negotiations with the OEM. In other words, the supplier anticipates that the OEM will only pay for the component's marginal production costs and not the sunk investment in R&D. Foreseeing the potential for the OEM's self-interested behavior during trade negotiations, the supplier under-invests in R&D in relation to the socially optimal investment.[4] Henke finds evidence to that effect when conducting an annual survey of American automobile suppliers and American OEMs relationships (cf. Henke 2004, 2006).

Analyses of hold-ups are grounded in four main theories. Transaction cost economics, property rights, agency and relational contracting theories view hold-ups are an agency problem whereby self-interested behavior dominates to the detriment of cooperative behavior. All propose to explain antecedents to hold-ups and offer possible solutions to the hold-up problem.

3.2.2 Transaction Cost Economics

Transaction cost economics (thereafter TCE) focuses on efficiency and minimizing the transaction costs that are incurred *ex ante* when contracts are written and negotiated, and *ex post* as a result of monitoring and enforcing contracts or of any contract breach (cf. Klein, Crawford, and Alchian 1978; Williamson 1975, 1979, 1985). The unit of analysis is the transaction. TCE is based on assumptions of bounded rationality of the negotiating parties (i.e., contracts are inherently incomplete) and

[4] Making a socially optimal investment (i.e., the investment that maximizes the potential surplus from trade net of investment costs) defines investment efficiency.

uncertainty (environmental, technological and related to information asymmetry). Transaction cost economics also assumes that, as a result of incomplete contracting, parties cannot credibly commit to not renegotiate although it would be optimal to do so. Finally, an important premise of transaction cost economics is that parties are motivated by self-interest. Thus, given the opportunity, the non-investor will behave in an opportunistic manner: Since the idiosyncratic investment generates quasi-rents (i.e., value above and beyond value in next best use (Klein, Crawford, and Alchian 1978)), the non-investor will appropriate the quasi-rents generated by the idiosyncratic investment.

Thus, the idiosyncratic nature of the asset creates a safeguarding problem of the quasi-rents and mechanisms must be designed to minimize the risk of opportunism by the non-investing party. TCE predicts that when uncertainty is high, frequency of transactions is high and significant relationship-specific investment are necessary, firms (who intend to minimize the sum of transaction costs and production costs) are more likely to be organized in hierarchies (i.e., vertical integration), to write detailed and long-term contracts, or use breach remedies in the form of penalties to help protect the investor (i.e., governance structure) (Williamson 1975, 1985). In essence, TCE focuses on mitigating *ex post* opportunistic behavior through governance structure. TCE provides theoretical support for the majority of the empirical research concerned with hold-ups (cf. Shelanski and Klein 1995). In their review of TCE's empirical research, Shelanski and Klein (1995) and Coeurderoy and Quélin (1997) note that, while studies experience some measurement problems related to uncertainty and the degree of specificity of the investment, the evidence overwhelmingly lends support to TCE's theoretical predictions.

3.2.3 Property Rights Theory

The property rights literature (cf. Grossman and Hart 1986; Hart and Moore 1990) also assumes incomplete contracting, non-contractible investment, and self-interest (thus, potential opportunistic behavior). However, property rights theory deviates from TCE in so far as property rights theory emphasizes that ownership of an asset confers its owner residual rights of control over the asset and, thus, is associated with the rights to appropriate returns from the assets. The unit of analysis is the asset. Additionally, property right theory assumes that, since knowledge of payoffs is common and since bargaining is costless, the ownership of the property rights and the contract will dictate the distribution of the surplus. Consequently, allocation of the surplus will be efficient. In other words, property rights theory focuses on avoiding the distortion of the *ex ante* investment instead of attempting to limit the *ex post* opportunism that occurs when the surplus is distributed. This leads Whinston (2001, 184) to argue that property rights theory is better suited to the analysis of intra-firm hold-ups than TCE.

3.2.4 Agency Theory

The agency literature similarly relies on assumptions of self-interested behavior. Yet, an important distinction from TCE is that agency theory focuses on *ex ante* mechanisms and contracting to help anticipate the hazards due to separation of ownership and control and to align interests of principal and agent (cf. Jensen and Meckling 1976; Lambert 2001). The unit of analysis is the contract. Contract terms and incentives are the focus of agency analyses. Thus, contrary to transaction cost economics and property rights theory which assume that contracts are incomplete, agency theory assumes that contracts are complete, costless and, accordingly, enforceable by courts (Baiman 1990).

Risk preference of the principal and agent, and private information of the agent play an important role in agency theory predictions. Agency literature suggests that incentives and extensive exchange of information help curb opportunism by the agent. In summary, agency theory points to contracting as a simple solution to hold-ups (e.g., Edlin and Reichelstein 1995).

Overall, various economic theories do not systematically lead to different predictions, but some of the variables of interest that differ from one theory to the other can help explain certain findings. For instance, Eisenhardt (1989) observes that the risk neutrality of the principal, a variable of interest of agency theory, provides a good explanation for Walker and Weber's (1987) finding that uncertainty does not affect make or buy decisions for components when assets were highly specialized (i.e., dies). However, those findings could not be explained by transaction cost economics.

Whereas economic theories such as TCE, property rights and agency theories study the limits to opportunistic behavior through formal mechanisms (such as governance structure, assignment of ownership rights, or incentives), relational contracting theory relies on informal mechanisms (e.g., social norms, context of the relationship) to explain limited opportunistic behavior.

3.2.5 Relational Contracting Theory

Relational contracting theory takes into account the historical and social context in which the relationship takes place (Macneil 1980). The relationship between two firms or divisions is the unit of analysis. Relational contracting does not view each transaction as independent, but as embedded in a relationship where there is mutual interest. Relational contracting assumes that preservation of the relation matters and cooperation

is instrumental. Additionally, it assumes that breach remedies cannot be specified and that investment is not contractible *ex ante*. While informal contracts such as a verbal agreement and a handshake are extreme examples of relational contracts (Palay 1985), Macneil (1986) proposes that relationships between firms include a relational dimension that complements the formal aspect of contracts. MacNeil further specifies that "relational exchange ... creates circumstances where the long-run *individual* economic (material) interests of each party conflict with any short run desires to maximize individual utility respecting the goods in any particular exchange; the more relational the exchange, the more artificial becomes the idea of maximization" (1986, 578). This can be associated with the idea of reputation, trust, or social norms.

A number of firms (e.g., Xerox, General Motors, Black & Decker, and Nieman Marcus) have demonstrated their focus on relational contracting by concentrating their transactions with a few carefully chosen suppliers (Sheth and Sharma 1997). Sheth and Sharma argue that drastically reducing the size of the firm's supply base (by as much as 90% for Xerox) is associated with increased trust, cooperation and social bonds which are sine qua non for competitive positioning. Although Williamson (1979; 1985) touches on the social component of exchanges that are neither strictly arm's length nor hierarchies, relational contracting theory develops much further the process by which the social dimension of the relationship mitigates the likelihood of opportunistic behavior (Bradach and Eccles 1989).

Literature in the fields of economics, accounting, finance, and supply chain has used the theories presented above to create models and gather empirical evidence about alleviating the hold-up problem encountered when firms make decisions ranging from

organizational design and trade decisions to resource allocations. Their findings are detailed in the section below.

3.3 STRATEGIC DECISION-MAKING ASSOCIATED WITH IDIOSYNCRATIC INVESTMENTS

The analytical models and empirical evidence presented below highlight developments to the hold-up literature subsequent to Shelanski and Klein's (1995), and Coeurderoy and Quélin's (1997) reviews. Findings of analytical research are detailed in Table 3-1. Findings of empirical studies are presented in Table 3-2. In tables 3-1 and 3-2, the hold-up literature is organized around the strategic decisions of organizational design, trade, and resource allocations and by the types of mitigating mechanisms proposed by each study. This organization is motivated by two factors. First, each strategic decision chosen is representative of a stream of accounting research. Second, mitigating mechanisms can be grouped in two categories. Formal mechanisms of vertical integration, joint ownership, contracts, pricing mechanisms, incentives and interdependence are mostly representative of economics theories (i.e., transaction costs economics, property rights, and agency theory). On the other hand, investigations of informal mitigating mechanisms are supported by private information and relational contracting theory.

Table 3-1

Analytical Papers and Hold-ups Mitigating Mechanisms

	Formal Mechanisms						Informal Mechanisms			Proposed Solutions
	Integration	Joint Ownership	Contracts	Pricing Mechanisms	Incentives	Interdependence	Private Information	Relationship Characteristics	Personal Characteristics	
Organizational design										
None subsequent to 1995										
Trade decisions										
Inter-firm trade										
Edlin (1996)			X			X				Initial contract & upfront payment (under expectation damages)
Edlin & Reichelstein (1996)			X							Initial contract and breach remedies (expectation damages and specific performance)
Baiman & Rajan (2002a)		X	X			X				Initial contract (if selfish investment) Joint ownership and equity stake.
Gul (2001)							X			Unobservable investment (if costless negotiations and repeated offers)

Table 3-1 Continued

	Formal Mechanisms						Informal Mechanisms			Proposed Solutions
	Integration	Joint Ownership	Contracts	Pricing Mechanisms	Incentives	Interdependence	Private Information	Relationship Characteristics	Personal Characteristics	
Trade decisions										
Intra-firm trade										
Edlin & Reichelstein (1995)			X							Initial contract
Baldenius et al. (1999)				X						Negotiation or cost-based transfer pricing depending on verifiability of cost information
Baldenius (2000)			X							Allocation of bargaining power
Anctil & Dutta (1999)					X					Compensation based on divisional and firm-wide profit
Baldenius (2006)					X					Combination of incentives and empire benefits
Resource allocations										
Stein (2002)	X									Allocation of decision rights based on type of information
Baiman & Rajan (1995)	X									Allocation of decision rights based on investment magnitude
Arya et al. (2000)							X			Late and coarse information system

Table 3-2

Empirical Papers and Hold-ups Mitigating Mechanisms

	Formal Mechanisms						Informal Mechanisms			Observations
	Integration	Joint Ownership	Contracts	Pricing Mechanisms	Incentives	Interdependence	Private Information	Relationship Characteristics	Personal Characteristics	
Organizational design										
Jensen & Rothell (1998)	X									Difficult monitoring and high idiosyncratic investments are associated with internally sourcing.
Coles & Hesterly (1998)	X									High uncertainty and high idiosyncratic investments are associated with internally sourcing.
Anderson et al. (2000)	X							X		High uncertainty (given idiosyncratic investments) is associated with outsourcing.
Dyer (1997)		X						X		Evidence of close relationships and joint ownership when idiosyncratic investments are high.

Table 3-2 Continued

	Formal Mechanisms						Informal Mechanisms			Observations
	Integration	Joint Ownership	Contracts	Pricing Mechanisms	Incentives	Interdependence	Private Information	Relationship Characteristics	Personal Characteristics	
Trade decisions										
Stump & Heide (1996)						X		X		Supplier selection and bilateral investment
Artz & Brush (2000)								X		Collaboration, expectation of continuity and communication
Jap & Anderson (2003)						X		X		Bilateral investment, goal congruence, trust
Krishnan et al. (2007)			X					X		Contract completeness and collaborative contracting
Berg et al. (1995)									X	Expectation of reciprocity, trust and reciprocity
Ellingsen & Johannesson (2004)								X	X	Communication and inequity aversion
Sloof et al. (2007)							X		X	Unobservable investment and fairness
Drake & Haka (2007)							X		X	Coarse accounting system and choice to share information.
Miller (2007)							X	X		Aggregated cost information and fair firm strategy
Resource allocations										
No empirical paper										

Analytical models and empirical evidence identify and investigate mitigating mechanisms to hold-ups. These studies appear in economics, accounting, finance, supply chain and marketing fields and are organized in the tables around strategic decisions of organizational design, trade and resource allocations. Each category of decision provides a setting in which hold-ups are likely to occur albeit with some variations.

3.3.1 Organizational Design

Empirical economics research has traditionally aimed to test the validity of TCE predictions by examining the organizational design choices firms make. In this setting, hold-up can occur when one firm must decide whether to make a relationship-specific investment followed by trade with a specific firm. The investment is not contractible, contracts are incomplete and thus, it is not possible for the trade partner to commit to not behave opportunistically. As a result, the firm decides whether to use integration or detailed contracts to avoid potential opportunism by its trade partner.

Economics research has provided empirical evidence supporting TCE's claim that governance structures that take the form of vertical integration and detailed, long-term contracting encourage investment in idiosyncratic assets (when uncertainty is high) (cf. Shelanski and Klein 1995). Results of empirical research subsequent to the reviews by Shelanski and Klein (1995) and Coeurderoy and Quélin (1997) are summarized in table 3-2. Jensen and Rothwell (1998) have added to this research by conducting detailed task-related analyses of the operation of nuclear power plants and examining what factors lead firms to use their own employees instead of subcontractors. They find that, consistent with TCE predictions, plants are more likely to internally source production of critical tasks (i.e., vertical integration) when monitoring is difficult and firm-specific investments

are high.

Accounting and finance research has recently contributed to this stream of research by investigating how relationship-specific investments affect firms' outsourcing decisions. Coles & Hesterly (1998) is one of the early studies that examines the interaction between two important attributes of transactions, namely uncertainty and relation-specific investment. From a mail survey sent to hospitals, Coles and Hesterly measure the degree of routinization of performance characteristics and rate of technological change (i.e., uncertainty), and physical and human asset specificity. Their results are consistent with TCE's predictions in so far as increasing uncertainty in the presence of asset specificity significantly increases the probability that the transaction will be internally sourced (for private hospitals). In sum, Coles and Hesterly propose that vertical integration serves as a formal safeguard against hold-ups as shown in Table 3-2.

Anderson, Glenn and Sedatole (2000) also study the relationship between uncertainty and relationship-specific investment (i.e., dies) and outsourcing decisions, albeit in the automobile industry. The premise of their study is that all in-process dies are transaction-specific; consequently, the sourcing decision should be driven by uncertainty. They improve on prior measures of uncertainty by measuring part and subassembly complexity, and the difficulty of measuring contract performance. In conflict with theoretical predictions and prior empirical evidence, they find that the greater the uncertainty, the greater the likelihood of outsourcing. To explain this counter intuitive result, they suggest that their study provides insights about the sourcing decision for parts given the existence of capacity, whereas prior empirical evidence examined investments in long-term capacity. In other words, the sourcing decision they examine is not based on

minimizing the sum of production and transaction costs because their setting violates the separability of production and transaction costs, an implicit assumption of TCE. Their finding is classified under integration in Table 3-2. Additionally, an important contribution of their study is their attempt to measure opportunistic behavior by the non-investor (i.e., frequency of rework by supplier required and delay between firm request for delivery and actual delivery). They do not find evidence of opportunistic behavior by OEM following idiosyncratic investment in dies made by suppliers and attribute this finding to relational contracting (earlier involvement of suppliers in relationship).

Dyer's study (1997) of the relationship between Japanese automobile OEMs and their suppliers has also documented the importance of relational contracting as a safeguard to hold-ups. Dyer (1997) conducts an exploratory study of fifty Japanese and American supplier-OEM relationships. The results from interviews and surveys provide evidence that, in Japan, relationships deepen over time and are characterized by information sharing and trust (i.e., dimensions of relationship characteristics) between Japanese OEMs and small groups of suppliers. Since Japanese OEM can use promises of high volume and repeated business to encourage idiosyncratic investment, the need for *ex ante* contracting and *ex post* negotiating over the surplus is greatly reduced. Additionally, Dyer finds evidence of joint ownership in idiosyncratic assets by OEM and supplier (a formal mechanism). In sum, Dyer finds preliminary evidence in support of relational contracting theory as well as property rights theory.

Hence, as shown in Table 3-2, consistent with transaction cost theory, research provides evidence that organizational design decisions attempt to mitigate hold-ups mostly through formal mechanisms such as vertical integration (i.e., internally sourcing

products). Additionally, this stream of research demonstrates the importance of informal safeguards to hold-ups such as close relationships and provides support for relational contracting.

While archival empirical papers provide evidence consistent or reconcilable with the theories presented above, Whyte (1994) proposes that cognitive biases of the investors, and not fear of hold-ups, are at the source of integration decisions. Results from an experiment in which subjects were asked to make a vertical integration decision demonstrate the influence of the sunk cost bias in the choice of governance structure, thus providing an alternative explanation of integration choices. Roodhooft and Walop (1999) provide additional evidence about how the sunk cost bias affects outsourcing decisions. In the experiment conducted by Roodhooft and Walop, manager-subjects incorporate past sunk costs and asset specificity to make their sourcing decision. Thus, both asset specificity and existence of sunk cost hinder outsourcing. Still, Troeger (2002) shows, with an evolutionary model, that the sunk cost bias can actually encourage investment in idiosyncratic assets over the long-run as investors benefit from the non-investors propensity to include sunk costs in their offer decision.

3.3.2 Trade Decisions

The trade decisions (i.e., price and quantity negotiations) that follow a relationship-specific investment have been the subject of extensive scrutiny in the context of inter-firm as well as intra-firm transactions. Tables 3-1 and 3-2 group research on trade decisions by trade between firms (i.e., inter-firm research) and trade between divisions (intra-firm and transfer pricing research) as these two streams have evolved in different directions as suggested below.

3.3.2.1 Inter-firm Trade Decisions

Researchers have studied hold-ups between firms using analytical and empirical methods. Analytical papers are presented first in Table 3-1. They are followed by empirical papers in Table 3-2). In this setting, hold-up can occur when one firm must decide whether to make a relationship-specific investment followed by trade with a specific firm. Inter-firm hold-up papers rely on assumptions of noncontractible investment, incomplete contracting and resulting inability of the non-investor to commit to not behave opportunistically.

3.3.2.1.1 Analytical models

Scholars model hold-ups between two parties in a single period. Analytical models have initially focused on using contractual mechanisms to alleviate the hold-up problem. Edlin (1996) and Edlin and Reichelstein (1996) borrow from the literature on remedies to breach of contracts and propose to counterbalance the underinvestment associated with relationship-specific investment with the overinvestment created by breach remedies (this stream of literature argues that breach remedies encourage investment even when it is not efficient for the parties to trade). More specifically, Edlin (1996) demonstrates that, under expectation damages (i.e., damages that provide full compensation of victim of breach), relationship-specific investment will be encouraged when parties can sign an initial contract that specifies very high quality and quantity and the non-investor makes an up-front payment. This up-front payment creates interdependence between the parties and makes it more attractive for the non-investor to finish performance of the contract than to breach it. Thus, the investor is the only one likely to breach the contract. As such, the investor has incentives to maximize his share

of the surplus that will remain once the damages have been paid. As a result, he invests efficiently. Importantly, the formal mitigating mechanisms proposed by Edlin (i.e., contracts and interdependence as shown on Table 3-1) assume that courts have sufficient information to estimate expectation damages.

Edlin and Reichelstein (1996) build on Edlin's finding to introduce specific performance as an additional breach remedy with one-sided and bilateral investment. They conclude that, with one-sided investment, a non-contingent fixed price contract provides investment incentives under specific performance or expectation damages breach remedies. On the other hand, bilateral investment can only be encouraged with application of specific performance. In sum, choosing an initial contract (a formal mechanism) and the appropriate breach remedies prior to investing should alleviate the hold-up problem provided damages can be estimated *ex ante*.

Although the nature of the idiosyncratic investment is not expanded upon in most papers (with the notable exception of Baiman and Rajan (2002a)), noteworthy insights from Che and Hausch (1999) point to limitations of the value of initial contracting as a mitigating mechanism to hold-ups. Che and Hausch highlight how the effectiveness of contracting arrangements, as a safeguard to opportunistic behavior, varies depending on whether the investment made generates a benefit for the investor (i.e., selfish investment such as investment resulting in cost reduction for the investor) or whether it generates a benefit for the non-investor (i.e., cooperative investment such as R&D investment). Che and Hausch point out that although several papers argue that incomplete contracting may solve the hold-up problem, such a solution is only effective with selfish investments.

In their 2002 paper, Baiman and Rajan survey the literature that addresses how to mitigate inter-firm hold-up problems and illustrate those problems in term of bargaining power (i.e., making a selfish relationship-specific investment weakens the investor's bargaining power). Baiman and Rajan propose that a simple non-contingent contract that specifies the quantity to be exchanged and the price at which the exchange will take place eliminates the hold-up problem. As in the intra-firm setting studied by Edlin and Reichelstein (1995), Baiman and Rajan argue that this initial contract changes the relative bargaining position of the investor in so far as it improves the investor's status quo outcome; thus, leading the investor to receive what was guaranteed in the initial contract plus a share of the surplus from renegotiations. Such an initial contract (a formal mechanism) would however have no value with cooperative investments. As shown in Table 3-1, Baiman and Rajan also point to additional formal mechanisms such as joint ownership of the asset and interdependence with the buyer taking an equity stake in the supplier.

In sum, as presented in Table 3-1, the aforementioned papers present some form of formal contracting as a solution to the hold-up problem in the tradition of agency theory. Some economists (e.g., Che and Hausch 1999), however, argue that although complete contracting would eliminate hold-ups, many contracts are incomplete and associated with cooperative investments. Accordingly, mitigating mechanisms other than contracting must be considered.

Scholars have begun investigating information asymmetry as an informal mechanism to induce socially optimal investment. Gul (2001) examines how information asymmetry (i.e., investment is unobservable to the non-investor) can provide an

alternative to increasing the investor's bargaining power and, accordingly, helps solve the hold-up problem. The intuition is that private information of the investor allows him to obtain information rents which provide incentives to invest. The private information of the investor, however, hinders trade negotiation and the hold-up problem is not mitigated. Still, Gul demonstrates that when negotiations are costless and the non-investor makes repeated take-it-or-leave-it offers, the hold-up problem is eliminated when the idiosyncratic investment is unobservable to the non-investor.

The empirical investigation of the mechanisms proposed above has been rather sparse: While analytical models have focused on alleviating trade opportunism and encouraging relationship-specific investment through contractual mechanisms and private information of the investor, empirical research has introduced evidence supporting social norms and trust as mitigating mechanisms to hold-ups. The empirical literature can be organized in two streams. First, archival research focuses on relational contracting and informal mechanisms such as the importance of the quality of the relationships between the trading partners. Second, experimental research borrows from negotiation and economics literature and examines how characteristics of the negotiators (e.g., various forms of fairness and propensity to trust) and private information of the investor might help curtail hold-ups.

3.3.2.1.2 Archival empirical evidence

Archival empirical literature related to inter-firm trade is presented in Table 3-2. A survey of chemical manufacturers by Stump and Heide (1996) investigating trade behavior highlights that ex post opportunistic behavior can be averted by supplier selection (thus, qualification programs are an important element of buyer-supplier

relationships) and formal interdependence encouraged through bilateral investments. Artz and Brush (2000) administered surveys to machinery and electronic equipment OEMs. They find evidence that the positive relation between asset specificity and uncertainty and negotiation costs is mediated by informal relational elements such as collaboration, expectations of continuity, and communication.

Still following this stream of research, Jap and Anderson (2003) surveyed buyer-supplier relationships of four Fortune 50 manufacturing companies. Buyers and suppliers were asked to report on opportunistic behavior they have encountered during trade. Jap and Anderson find that goal congruence, interpersonal trust and bilateral idiosyncratic investment act as safeguards against opportunism. In essence informal relationship characteristics (i.e., goal congruence and interpersonal trust) and formal interdependence (i.e., bilateral investment) serve as a commitment device and are associated with relationships with longer time horizon. Krishnan, Miller, and Sedatole's (2007) examination of formal contracts a Fortune 500 firm has with its customers leads them to conclude that the supplier is more likely to own idiosyncratic asset when contracts are collaborative or more complete (thus, lending simultaneous support to informal methods of relational contracting and to more formal methods of transaction cost economics). Additionally, Krishnan et al. show that, as suggested by TCE and agency theory, collaborative contracting is more likely to be observed when monitoring and performance measurement is difficult.

In sum, as with decisions related to organizational design, archival empirical research related to inter-firm trade decisions finds evidence consistent with predictions of economic theories. It also provides overwhelming evidence demonstrating the importance

of relationship characteristics, and supporting relational contracting theory, as shown in Table 3-2.

3.3.2.1.3 Experimental empirical evidence

Empirical evidence related to trade decisions appears in Table 3-2. Experimental empirical research has examined how personal characteristics of the negotiators and private information can help mitigate hold-ups. The seminal work of Berg, Dickhaut, and McCabe (1995) provides an early investigation of hold-ups in an experimental setting. In the tradition of experimental economics, they conduct a two-stage version of a dictator game. The first set of subjects decides how much of their show up fee to send to an anonymous counterpart (i.e., relationship-specific investment). Any money they forward to their counterpart is tripled. Their counterpart then decides how much (if anything) s/he would like to return to the sender. The game is not repeated and communication is not allowed so as to avoid any reputation concerns. Whereas economic theory predicts that subjects should not send money to their counterpart as s/he will appropriate the whole amount, Berg et al. observe that 30 out of 32 subjects forward money. Additionally, Berg et al. observe that 16 out of 28 returned at least as much as they received (the remainder returned trivial amounts or nothing). In a second experiment, knowing the previous behavior of the group that received the money changed the dispersion of the offers and increased the correlation between the amount sent and the amount returned. Berg et al. conclude that informal mechanisms related to personal characteristics affected hold-ups. In particular, the subjects' expectations of reciprocity led them to trust their counterparts and send a portion of their show up fees to other subjects (i.e., invest). Additionally, some subjects reciprocated (i.e., did not behave opportunistically). Variations of this

experiment have since been conducted (e.g., Malhotra 2004; Cox 2004) and obtained similar results.

Ellingsen and Johannesson (2004) enrich Berg et al.'s analysis by examining the informal effect of communication (a dimension of relationship characteristics) on hold-up. Their observations and conclusions are consistent with Berg et al.'s. More specifically, they find some investment and some evidence of inequity aversion where non-investors reimburse the investment cost and share the surplus with the investor when communication is not possible. Moreover, in Ellingsen and Johannesson's experiment, the investor is not made worse off by investing than by choosing not to invest. With communication, offers are even higher. In sum, as shown in Table 3-2, Ellingsen and Johannesson find that relationship characteristics (in the form of communication) and individual characteristics (in the form of inequity aversion) help mitigate hold-ups.

Sloof, Oosterbeek, and Sonnemans (2007) test Gul's model and the prediction that private information in the form of unobservable investment reduces investment inefficiency. They construct a two-stage experiment and, keeping the surplus generated by the investment constant, they vary the informal information characteristic of investment observability (private information) in combination with the cost of the investment. As predicted by Gul, Sloof et al. observe that, when investment cost is high, subjects do not invest when the investment is observable, but do invest when it is unobservable. However, when investment cost is low, subjects invest. Those results lead Sloof et al. to conclude that economic predictions hold when fairness and reciprocity consideration are low (i.e., high investment costs for a fixed surplus), but not when there is room for fairness (i.e., low investment costs for a fixed surplus). They also observe

that, during trade, some subjects reimburse the investor for his investment and share the surplus. Sloof et al. further suggest that their study documents an interaction between fairness (i.e., a personal characteristic) and observability of the investment (i.e., private information) that affects the likelihood of investment.

Drake and Haka (2007) conduct an experiment in a setting that includes product architectural interdependence and asymmetric information between two trading partners. First, Drake and Haka study the effects the type of accounting system used (i.e., coarse as Volume Based Costing or finer as Activity Based Costing) and the economic setting of the firm have on the propensity of negotiating individuals to share information. Second, they examine how those two factors affect the individuals' ability to capture available trade efficiencies. They provide evidence that, because of individual concerns about inequitable outcomes (personal characteristics in Table 3-2), information asymmetry (i.e., private information) that takes the form of coarse accounting systems mitigates trade opportunism. Thus, they lend support to the role of coarse information in hold-ups but do not measure the participants' individual preferences for fairness.

In sum, experimental papers provide evidence that personal characteristics of the individual such as social preferences and private information of the investor help mitigate hold-ups. They show that, under certain circumstances, individuals include sunk cost in their calculations during trade and that investors, anticipating that they will not be worse off if they invest, invest in relationship-specific assets to a greater extent than predicted by economics. Researchers should, however, be cautious before concluding that, because of fairness preference of individuals, hold-ups are not as severe as predicted by economics. As suggested by Liedtka (1989), managers are not left to follow their own

preferences but their actions within a firm are guided by corporate culture and strategy. Thus, the role of personal preferences for fairness as safeguard against hold-ups might have been somewhat overstated by extant experimental research.

Miller (2007) attempts to address this limitation by investigating the effects of firm induced strategy (an informal relationship characteristic that takes the form of fair or self-interested strategy) on hold-ups. Additionally, she builds on Sloof et al.'s study by examining whether private information in the form of aggregated supplier-provided cost information, another informal mechanism, alleviates hold-ups. She documents that aggregation of cost information has a positive effect on the investment decision of the supplier. Additionally, she finds evidence that the level of aggregation of supplier-provided cost information and firm strategy interact to effect trade and investment decisions.

Overall, findings of archival and empirical research find some evidence consistent with economic predictions. They also provide evidence that characteristics of the relationship, of the individual and private information offer additional safeguards against hold-ups as shown in Table 3-2. They further suggest (as proposed by relationship contracting theory) that social norms and social preferences of the negotiators mediate the relation between characteristics of transactions, such as asset specificity, and opportunistic behavior. They have, however, to a great extent ignored how firm strategy might be used to induce individual to behave in a manner that might not be consistent with their personal preference. Interestingly, research on inter-firm trade does not propose that incentives can be used to mitigate hold-ups. Yet, Kumar (1996) presents

anecdotal evidence that firms such as Procter & Gamble use incentives to motivate managers to refrain from holding-up their trading partners.

3.3.2.2 Intra-firm Trade Decisions and Transfer Pricing

Accounting research has overwhelmingly focused on investigating safeguards to hold-ups in intra-firm relationships. In models of intra-firm trade, i.e., transfer pricing, divisional managers choose whether to make an investment that will benefit the entire firm, but has little value with external customers (i.e., a relationship-specific investment). At the time the investment must be made, the managers do not possess sufficient information to determine the size of the transfer needed (i.e., investment is not contractible), contracts between the divisions are incomplete and the non-investing division cannot commit to not behave opportunistically. Analysis of transfer pricing mechanisms has suggested that negotiated transfer pricing lead to underinvestment as the divisions split the surplus generated by the investment made by one division. Initial transfer pricing models proposed commitment (i.e., absence of renegotiation) between the divisions (Rogerson 1992) or a centralized mechanism of profit allocation with intervention of headquarters as remedies to the hold-up problem. More recently, scholars have investigated how contracting, transfer price mechanisms, and incentives can help alleviate hold-ups. Their findings are summarized in Table 3-1.

3.3.2.2.1 Contracting and Transfer Price Mechanisms

The first set of analytical papers discussed below assumes information symmetry between investor and non-investor divisions. As shown in Table 3-1, they propose that formal mechanisms of initial contracts and cost-based transfer pricing alleviate hold-ups,

but must be supplemented by other mechanisms in order to address problems of trade distortion and moral hazard.

Edlin and Reichelstein (1995) assume that two divisions of the same firm have equal bargaining power. They find that investment will be efficient if the divisions sign a fixed-price contract prior to investing (provided the investor can insist the contract will be fulfilled) and negotiate on quantity once all uncertainty has been resolved. In sum, as shown in Table 3-1, formal contracts can help mitigate hold-ups in an intra-firm setting. Furthermore, when divisional managers are subject to moral hazard, Edlin and Reichelstein show that division negotiation of the transfer payment and compensation of the managers based on divisional income helps align the interests of the firm and the managers.

Baldenius, Reichelstein and Sahay (1999) do not investigate contracting as a safeguard against trade opportunism. Instead, Baldenius et al. turn to pricing mechanisms and compare the effectiveness of negotiated and cost-based transfer pricing as a safeguard against hold-ups. Under their model of cost-based transfer pricing, the selling division presents the cost report and the buying division decides how many units to purchase. Baldenius et al. point out that, although cost-based transfer pricing encourages investment in idiosyncratic assets by one division, it creates an additional problem. First, should the selling division invest and have monopolistic pricing power (i.e., trade distortion), the buying division will reduce the quantities purchased; thus, reducing the selling division investment incentives. Second, should the buying division invest, the selling division can appropriate part of the return generated by the investment by charging higher transfer prices (assuming that costs of the selling division are not

verifiable). However, when the selling division is constrained in the costs it can report, cost-based transfer pricing is preferred. In sum, whether a negotiated or cost-based transfer pricing mechanism is preferred depends in part on the verifiability of the cost information provided by the selling division.

Baldenius (2000) extends the analysis to models with asymmetric information. He concludes that bargaining power should reside with the investing division to alleviate hold-up and that bargaining power should reside with the division with the most private information to minimize trade distortion. Formal contracts can provide the means to allocate the bargaining power to the supplier or the buyer.

In sum, as presented in Table 3-1, this stream of transfer pricing literature relies on formal contracting and pricing mechanisms to mitigate hold-ups. Still, empirical research could provide insights on how contracts are actually used between divisions to encourage relationship-specific investments.

3.3.2.2.2 Incentives

Building on findings from agency theory, a few papers presented in Table 3-1 have analyzed how incentives can be used to formally align the interests of division managers and the firm. Anctil and Dutta (1999) investigate incentive compensation as safeguard against hold-up under information symmetry. They demonstrate that the optimal compensation contract is based on divisional profit as well as firm-wide profit with the former allowing for some risk-sharing between risk-averse divisional managers. Thus, they conclude that formal incentives can help divisions mitigate hold-ups.

Baldenius (2006) further expands the analysis under asymmetric information to include the scenario where managers payoffs are comprised of incentives and empire

building (i.e., managers derive benefits of control from the assets they manage provided the assets are productive). Baldenius suggests that the propensity of managers to take advantage of their private information to distort trade (i.e., sellers ask for more than their reservation price and buyers bid less than their reservation price) is reduced by their wish for trade to take place so they can derive empire building benefits. Baldenius demonstrates that, even in the absence of firm-wide profit sharing, low-powered incentives result in division managers valuing empire benefits more. As a result, cooperative bargaining is encouraged and, consequently, relationship-specific investment takes place (i.e., alleviating hold-up problems). In sum, counterbalancing formal incentives with empire building can help safeguard divisions against hold-ups.

Analytical research has shown that formal mechanisms such as contracts, transfer price mechanisms and incentives can help mitigate hold-ups when firms make intra-firm trade decisions as shown in Table 3-1. However, our understanding of how divisions actually deal with those issues could benefit from empirical research.

3.3.3 Resource Allocations

Resource allocation decisions are intra-firm decisions that can require an idiosyncratic investment by the manager who presents a capital project to the principal. In this setting, hold-up can occur when the manager must acquire firm-specific information about a capital project. The manager's project search is followed by the firm choosing which capital project to allocate resources to. The manager acquisition of information is often noncontractible, and the principal cannot commit to reward the manager for his project search investment and not behave opportunistically.

Although much acquisition of information by the manager conducting a project search is specific to the firm the manager works for, most of the capital budgeting literature assumes away the idiosyncratic nature of the gent's investment. In much of the resource allocations literature, the manager is endowed with private information about the productivity of the capital project (Lambert 2001, 79; Antle and Fellingham 1997, 905). In that stream of literature, the effort decision of the manager is based on the information he possesses and the investment decision is based on the information elicited by the principal, but the manager does not need to exert any effort to acquire information.

A few capital budgeting papers assume that investment in information search is endogenous. They propose that the agent needs to exert effort to gain knowledge about the proposed project and that this knowledge only has value for this specific firm (i.e., relationship-specific investment). The first group of papers (Lambert 1986; Kim 2006) assumes that the principal can use contracts to commit to share the quasi-rents with the manager. Lambert (1986) proposes that allocation of risk to the agent can, in certain circumstances, motivate the agent to exert effort to acquire information and to select the best project. Kim (2006) shows that when information acquisition costs are large, auditing the agent's report (independent of whether the agent reports high or low productivity) reduces the opportunity costs of becoming informed. Auditing and allocation of more capital to the project help motivate the agent to invest in information search. In sum, although Lambert and Kim assume that acquisition of information is firm-specific, they propose that contracts can serve as a commitment device. As a result, opportunistic behavior by the principal is not considered and hold-ups are not examined.

Still, managers who invest in firm-specific acquisition of information risk not deriving any benefit from their investment as the principal or other managers might appropriate the quasi-rents generated by their investment. The second group of papers (Baiman and Rajan 1995; Arya et al. 2000; Stein 2002) assumes that the principal cannot commit to reward the manager for his firm-specific investment in information acquisition. Thus, they encompass the main characteristics of hold-up problems (i.e., relationship-specific investment that creates appropriable quasi-rents and lack of commitment by the non-investor not to appropriate the quasi-rents). They do, however, vary in the role they give to opportunistic behavior. Results from this stream of research are presented in Table 3-1 under the heading of resource allocations.

Stein (2002) models how bank managers can be encouraged to acquire firm-specific information about the projects of their customers. He argues that, when information is soft (i.e., cannot be easily passed on to headquarters), the manager who exerts effort to acquire information risks having his research effort wasted if headquarters chooses not to allocate funds to the projects he proposes. Stein recommends that formal decentralization, classified in Table 3-1 under integration, is the preferred mechanism to encourage manager investment in information acquisition as it gives the manager authority to allocate funds and to obtain the quasi-rents from his investment.

Baiman and Rajan (1995) model a capital investment decision where the manager is required to invest in firm-specific human capital, thus obtaining private information about a capital investment project for his firm. The manager's firm-specific investment is followed by a capital investment in the project. The project outcome is a function of the level of investment, the manager's effort and some state outcome. Baiman and Rajan

examine two possible inefficiencies. On the one hand, assigning capital investment decision rights to the manager can result in moral hazard. On the other, assigning capital investment decision rights to the owner can result in the owner acting opportunistically and appropriating the manager's quasi-rents when the owner designs the manager's compensation package. Baiman and Rajan conclude that the size of the manager's firm specific human capital investment drives the assignment of capital investment decision rights (i.e., centralized if no specific investment, shared if moderate investment and delegated to the manager if large investment). Thus, as shown by Stein in the context of soft information, Baiman and Rajan propose that allocation of decision rights (a form of integration) can under circumstances alleviate hold-ups.

Arya et al. (2000) address the same problem of potential appropriation of the manager's quasi-rents, but turn to how the owner might be able to commit not to behave opportunistically. They propose that a manager can be motivated to increase his search for a profitable project (i.e., firm-specific human capital investment) if the owner's information system provides coarse and late information. Such a system would create slack for the manager, and, thus, would provide incentives for the manager to increase his project search effort. Arya et al. conclude that the interaction between fineness and timing of information helps mitigate the hold-up problem because it creates private information that guarantees the manager that the principal will not be able to appropriate the surplus generated by his investment in project search.

Thus, in addition to providing support for economic theories by showing the importance of allocating decision rights (a formal integration mechanism), analytical papers point to informal mechanisms of private information as a potential mitigating

mechanism to hold-ups as shown in Table 3-1. However, our understanding of how hold-ups might be mitigated when resource allocation decisions are made could benefit from more analytical as well as empirical research.

3.4 CONCLUSIONS

Transaction cost economics, property rights, and agency theories have until recently provided the framework for analyzing hold-ups. They have suggested solutions to the hold-up problem in the form of formal mechanisms such as vertical integration, detailed and long-term contracts, allocation of property rights, and incentives. While analytical research and early empirical research (cf. Shelanski and Klein 1995; Coeurderoy and Quélin 1997) have, to a great extent, supported the predictions of economic theories, recent developments in empirical research have focused more on relational contracting theory and informal mechanisms. They have documented that characteristics of the relationship and of the individual limit firms' and individuals' tendency to behave opportunistically and to appropriate the surplus generated by an idiosyncratic investment. Furthermore, observing that most individuals do not behave in a self-interested manner in laboratories, experimental research has gone as far as questioning if hold-up problems are as severe as economic theories lead us to believe.

Still, hold-ups are an organizational problem and it would behoove us to understand better the relationship between fairness preferences of individuals and inter-firm and inter-division investment decisions. Additionally, recent theoretical developments (cf. Arya et al. 2000; Gul 2001) suggest that further investigations of private information and of the effects information characteristics (e.g., fineness, precision, timeliness) have on hold-ups should be a fruitful avenue for future research.

The proliferation of analytical research that views contracts as a safeguard against hold-ups compared to the scarcity of the related empirical research (with the notable exceptions of Joskow (1985), Anderson et al. (2000) and Krishnan et al. (2007)) suggests that additional empirical investigation of contracts would help enrich our understanding of the dangers associated with incomplete contracting and of ways to curtail risk of *ex post* opportunism. Finally, although relationship-specific investments are incurred in the areas of organizational design, trade and resource allocations, some streams of research assume away the idiosyncratic nature of the investment (e.g., resource allocations) or provide little empirical investigation of hold-up mitigating mechanisms (e.g., intra-firm trade and resource allocations). Conducting additional research in these areas would give us a more in-depth understanding of how to address the hold-up problem.

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