Rice University

# Essay 1: Pay to Play: Unilateral Relationship-Specific Investments

# Essay 2: Escaping Bear Hugs: A New Venture's Network Building and the Effects on Its Bargaining Power

# Essay 3: Acquisition Timing and Learning in Different Types of Merger Waves

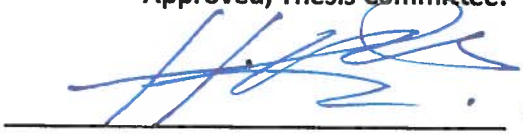
By

Toby Li

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree

Doctor of Philosophy

Approved, Thesis Committee:



Haiyang Li, Chair

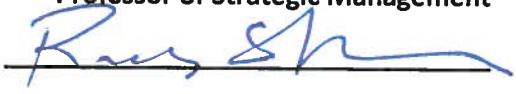
Professor of Strategic Management

Robert E. Hoskisson

Professor of Strategic Management

Prashant Kale

Professor of Strategic Management



Randy Stevenson

Professor of Political Science

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**Strategies for Investing under Uncertainties**

by

Toby Xianyu Li

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Chair of Committee:

Haiyang Li

Committee Members:

Robert E. Hoskisson
Prashant Kale
Randy Stevenson

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## PREFACE

Firms making investments face under uncertainties, yet different uncertainties pose different challenges. In general, there are two types of uncertainties: the firm faces 1) 'behavioral' uncertainty from its exchange partner acting opportunistically; and 2) 'environmental' uncertainty in its industry due to unpredictable changing market conditions that impact its investment returns. While previous research has distinguished uncertainties in these ways, identifying effective strategies to deal with them continues to be needed (Hoskisson, Gambeta, Green, and Li, 2018). This dissertation proposes some strategies and examines their outcomes.

Essays 1 and 2 of my dissertation explore firms making investments under behavioral uncertainty. Essay 1 seeks to better understand the phenomenon of new ventures investing substantially in their transacting partners in the absence of contracts protecting against opportunism. This paper argues that a new venture making such "unilateral" investments strengthens collaboration by attracting more transactions from its partner; but the tradeoff for the investing venture is accepting less favorable contractual terms on those transactions. Essay 2 studies in detail how a weaker party can bargain more favorable contractual terms with its partner - this paper proposes building different types of outside relationships for resource access. Essay 3 examines firms investing under environmental uncertainties. This paper examines how firms pursue different acquisition targets and how they time those acquisitions depending on the investment information asymmetries. In this essay, the context used is acquisitions made during merger waves across ten industries.

*ESSAY 1 OVERVIEW*

The first essay, titled "*Unilateral Relationship-Specific Investments: Understanding the Transactional Benefits and Risks*", examines how relationship-specific investments can be a strategy a firm starting in a weaker bargaining position relative to its exchange partner to gain more leverage. Unilateral investments are observed often in practice (Gulati, Khanna, and Nohria, 1994; Kang, Mahoney, and Tan, 2009); but they are difficult to rationalize using organizational economic perspectives. For instance, according to traditional transaction economics (TCE) logic, firms should avoid making unilateral investments - which are preemptive relationship-specific investments made without contractual protections - because they expose the investing party to holdup by its exchange partner in the focal transaction (i.e. Williamson, 2008).

My paper re-examines this phenomenon. Drawing on advances in TCE and exchange theory, I argue that a firm's initial unilateral investment can generate "externalities" beyond the focal transaction in the form of gaining new transactions with its exchange partner. The reasoning is that a unilateral investment signals commitment and also reduces various exchange costs, which allows the investing party to become a more attractive option for its partner on future projects. The context used is the supplier drillers and their client operators in the oil-gas industry – new drillers make unilateral investments for its client operators in the form of preemptively moving their drilling rigs next to the operators' well sites prior to securing the contractual deal on those wells.

In the case of supplier-client relationship, I find evidence that the supplier initially making unilateral investments for its client can win more subsequent projects from its client. Making "unilateral" investments can be a useful growth strategy to help firms attract new partners, especially for new ventures and startups with initially limited partners. However, the tradeoff for the

firm making unilateral investments is higher dependency on its receiving partner– the investing supplier accepts less favorable contractual terms on those deals with its client. Interestingly, I find that the investing supplier can over time secure more favorable contractual terms – or strengthen its bargaining power - by learning to achieve productivity improvements working with its client.

Among the key takeaways from the paper are: 1) firms can be economically rational to bear the up-front holdup risks when investing unilaterally because their expected transactional gains with its partner in the long-run can outweigh the associated transactional costs in the short run; 2) relatedly, understanding a firm's investment decision under behavioral uncertainty requires considering the expected outcome of not only the focal transaction but also other connected transactions in the partnership; and 3) the degree of behavioral uncertainty faced by an investing party can change as its bargaining position with its exchange partner evolves.

*ESSAY 2 OVERVIEW*

The second essay, titled "*Escaping Bear Hugs: A New Venture's Network Building and the Effects on Its Bargaining Power*", examines how a new venture can strengthen its bargaining power with its more prominent partner by engaging in strategic partnership building. The dilemma for a new venture working with a more prominent partner is that: while there are benefits such as reputation and signaling, a new venture having a prominent partner entails bargaining costs in the form of the latter appropriating more value from the former in the partnerships (Baum, Calabrese and Silverman, 2000; Diestre and Rajagopalan, 2012). This paper examines the case of a new supplier working with a more prominent client. Prior literature has focused primarily on the weaker supplier growing the number of network clients to strengthen its bargaining

power, without distinguishing the types of clients needed (i.e. Ozmel, Yavus, Reuer, and Zenger, 2017).

This paper's first solution draws on resource dependency theory (RDT) by arguing for a new supplier to build a 'competing' network of multilaterally rival clients to reduce dependency on its focal client. Multilaterally competing rival clients are characterized in this paper as those that compete in the same product and/or geographic domain. Based on RDT reasoning (Casciaro and Piskorski, 2005; Pfeffer and Salancik, 1978), I argue that a new supplier working with multi-laterally competing clients can access similar resources as those provided by the focal client – this reduces the new supplier's resource dependency on its focal client and hence strengthens dy-adic-level bargaining power. However, the new supplier working with such highly related clients offering similar expertise also creates a more homogenous knowledge network, which can de-press diverse learning – consequently, the new supplier may be stunted in its capability building to sustainability create value for its clients in the long run. Thus, the tradeoff in pursuing such partnership building strategy based on the RDT-based solution is that any gains in bargaining power for the new supplier may be short term but not sustainable in the long term.

The second solution draws on the resource-based view (RBV) by arguing to build a 'learning' network of diverse clients to enhance its value to its focal client. A new supplier work-ing with diverse clients – those operating in different product and geographic domains - offers unique expertise. Based on RBV reasoning (Coff, 1999; Lippman and Rumelt, 2003), working with such unrelated clients enables the supplier to access diverse knowledge to build broader ca-pabilities – this enables the supplier to become more valuable and hence less replaceable to its clients. However, the tradeoff for the new supplier working with diverse clients is dealing with the initial challenges of integrating less familiar knowledge. Consequently, having to pursue such

partnership building strategy based on an RDT-based solution is that any gains in bargaining power for the supplier may be delayed, and thus requires more patience in the short term.

This paper therefore reflects the inherent tradeoffs in pursuing either an RDT or RBV-based bargaining solution. We test these predictions using as our empirical context the supplier driller – client operator partnerships in the oil-gas industry. The oil-gas industry again provides an excellent context for this study due to the prevalence of supplier drillers pursuing different partnership building strategies with client operators. We find support for our predictions.

*ESSAY 3 OVERVIEW*

The third essay studies the challenges and opportunities for firms investing under environmental uncertainty. In particular, this paper examines firms making acquisitions when their industry undergoes economic contraction and expansion. During industry contractions, firms are under cost pressures and adjust by seeking consolidation – as a result, more mergers and acquisitions can happen during this period as firms in the industry seek to reduce operational duplications. During industry expansions however, firms enjoy more financial slack and risk appetite – as a result, more acquisitions can also occur because firms during this period become more exploratory in pursuing investments to diversify their businesses. This paper's focus is on the acquisitions strategies needed for acquiring firms operating under these different industry conditions to secure valuable targets. The context used in this study is merger waves, which are periods of high acquisition frequency (Carow, Heron, and Saxton, 2004).

This paper studies how phases of industry contraction and expansion can give rise to merger waves that are different in nature. Previous studies on merger waves have assumed merger waves to be homogenous, without distinguishing different underlying economic conditions driving them (i.e. McNamara, Haleblian, and Dykes, 2008). I argue and find that acquirers during

merger waves resulting from industry contractions pursue mostly targets within the same industry for consolidation purposes; while acquirers during merger waves resulting from industry expansions pursue more outside-industry targets as means to enter new businesses.

In addition, I argue and find that acquisition timing is critical for performance. While previous studies on merger waves have highlighted the importance of acquisition timing (i.e. Carow et al., 2004; McNamara et al., 2008), the emphasis has been on early movers being more advantageous that later movers. In this paper, I argue that being early movers is indeed more advantageous during contractionary-type waves because early acquirers can capture more valuable targets. However, I argue that being early movers is not more advantageous during expansionary-type waves because many valuable outside-industry targets may not be readily identified. Instead, I argue and find that later movers during expansionary-type waves achieve higher performance due to learning opportunities to better resolve their investment uncertainty in the environment.

Furthermore, this paper dives in more detail into the later-mover advantage due to learning, which I demonstrate to be specifically "learning by observing" early movers' actions. Theoretically, we draw on organizational learning and information cascade research to argue that later movers can "learn by observing" early movers' choices – later movers can pursue similar choices as successful early movers while avoiding the choices made by unsuccessful early movers. Empirically, I find that later mover acquirers are more likely to pursue targets in certain outside industries where previously early moving peers (early acquirers in the same industry) and early moving non-peers (early acquirers in other industries) have found success. Furthermore, I find that these later-moving strategic followers were also able to achieve positive returns (in terms of both market reaction and operating performance). Such later-mover advantage due to learning by

observing is more valuable when environmental uncertainty is higher, such that valuable targets are initially more difficult to evaluate.

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# ESSAY I

## Pay to Play: Examining the Consequences of Making Unilateral Relationship-Specific Investments

Research summary: A firm making preemptive investments for its partner without securing contractual safeguards – known as unilateral relationship-specific investments - is a phenomenon that is often observed in practice, but not well understood in the academic literature. According to organizational economics perspectives, making such investments would be considered irrational due to opportunistic holdup uncertainty. Using a unique dataset tracking supplier drillers and their client operators in the oil-gas industry, we explain why a firm would be rational in making such investments by understanding their benefits as well as the costs. On the one hand, we find that a driller (supplier) making unilateral investments for its partner operator (client) can strengthen collaboration by winning more projects (positive effect on contractual volume). In addition, we find this advantage to be stronger when the driller makes such investments in the early stage of its client relationship when partner exchange uncertainty is highest. However, on the other hand, we find that making unilateral investments does in fact weaken the investing driller's bargaining position relative to its client, which is reflected in the driller accepting less favorable contractual terms on those projects. Finally, we consider how the investing driller can minimize such contractual tradeoff by demonstrating productivity improvements working with its client, which can strengthen the driller's bargaining position to secure more favorable contractual terms.

## INTRODUCTION

The inter-firm partnership is fraught with behavioral exchange uncertainties that prevent each party from committing investments in the relationship, unless those investments are protected by contractual safeguards against partner opportunism. In the case of the client-supplier relationship, the supplier committing investments ex-ante for its client faces exposure to holdup by the client who can act opportunistically knowing that the supplier's investment is costly to redeploy outside the relationship (Grossman and Hart, 1986). Thus prior to committing investments that are highly relationship-specific, the investing party (i.e. the supplier) should first secure contractual safeguards on its relationship-specific investments to protect against its partner's (i.e. client's) opportunism (Williamson, 1985). Based on this reasoning, committing such relationship-specific investments in the absence of contractual safeguards would be considered highly risky, even irrational.

However despite the risks, firms in practice often do make relationship-specific investments without first securing sufficient contractual protections on those investments. In various industries, we observe firms successfully investing "unilaterally" by going beyond their contractual obligations for their exchange partner. Examples include Japanese auto suppliers who sought to win business from the prominent automaker Toyota by relocating their facilities closer to Toyota's plants without being compensated for such moves – these suppliers essentially made the upfront investments to become more attractive to Toyota in terms of costs and productivity compared to non-investing suppliers (Dyer and Nobeoka, 2000). Other examples exist in the OEM industry where new venture Chinese suppliers like Foxconn – to compete with more established OEM suppliers at the time to win business from the prominent OEM client Apple – were

known to re-tool their factories, re-train their workers, and expand production capacity to assemble Apple-specific products prior to securing the production agreements with Apple to justify such investments (Rokkan, Heide, and Wathne, 2003). When viewed through an organizational economics perspective (i.e. traditional transaction cost economics), such actions are seemingly irrational and would pose a theoretical paradox that has so far not been satisfactorily resolved.

To characterize formally, unilateral relationship-specific investment (henceforth termed unilateral investments) has two main defining features: 1) it is a preemptive investment made by one party prior to securing protections on its investment from its partner in the form of contractual guarantees and/or mutual co-investments; and 2) this investment has a high degree of relationship specificity and entails loss of value when re-applied outside the partnership (Celly, Spekman, and Kamauff, 1999; Kang, Mahoney, and Tan, 2010).

Despite firms across industries making unilateral investments, there lacks clear theoretical reasoning to understand this phenomenon. Relying on traditional TCE logic can be limiting due to its focus only on a given investment in isolation within a partnership. The focus is on minimizing partner appropriation costs for that particular investment deal, without considering that investment's effects on subsequent investments between the exchange partners. Williamson (1985) explained that any relationship-specific investment made by a party is a transaction whose outcome is the economic returns to that transaction, and that investment's returns must be protected from unfair appropriation by the receiving partner.

Interestingly, however, more recent TCE research can provide a starting point to help scholars begin to understand the phenomenon of unilateral investment. Such 'advances in TCE research' consider outcomes beyond the investing party's focal transaction to also include the

subsequent transactions that can arise with its exchange partner as a result of the initial transaction. Most notably, Williamson (2000; 2010) demonstrated his shift in thinking by arguing how transactions between partners can be "interrelated" and should not only be examined in "isolation": he explains that a party's initial investment for its partner can generate "externalities" in that relationship by reducing the costs and hence increasing subsequent collaborative engagements between the partners. Kang, Mahoney, and Tan (2010) suggest that understanding any investment decision by a firm must factor not only the expected financial returns from that focal investment but also the expected gains from that investment's "externalities" in terms of the subsequent deals that can arise between the exchange partners. Yet despite such advances in TCE research, most recent studies on relationship-specific investments continue to rely on the traditional TCE framing that treats every investment transaction and its outcome independently and separate from the other transactions between the exchange partners (i.e. Hoskisson et al., 2017).

We first highlight the need to apply advances in TCE research to study the phenomenon of unilateral investing. Furthermore, we ask what those "externalities" generated from a firm's initial unilateral investment are, and whether those "externalities" in a partnership are favorable or unfavorable to the investing party. In this paper, we argue that there are both positive and negative transaction "externalities", specify what those are, and explain how they arise.

In terms of the positive "externalities", the firm making unilateral investments (i.e. supplier) can win more projects from its partner (i.e. client) - the investing supplier's "contractual volume" increases with its client. In the case of the client-supplier relationship, a supplier that bears more exchange costs and risks – by making unilateral investments - becomes a more attractive partner to its client. In addition, we draw on reciprocity research to better understand the incentives for the receiving partner to continue engaging in repeated cooperation, as the long-term

payoff is larger for cooperation than the short-term payoff for opportunistically deviating (Axelrod, 1984; Gulati, Khanna, and Nohria, 1994; Heide and Miner, 1992). Furthermore, we argue that the positive relationship between the firm making unilateral investments and contractual volume is stronger when the supplier invests in the early stages of its client relationship when exchange risks - and hence need for such investments - are greatest (Celly et al., 1999, Kang et al., 2010).

For an investment's negative "externalities", we consider the associated costs for the investing firm in terms of its incurred contractual risks on the subsequent investments with its receiving partner. If a supplier's unilateral investment can generate positive "externalities" in terms of be awarded new deals from its client, we then ask what are the contractual terms of those new deals. Consistent with TCE logic, a party's investment can increase its dependency on its partner due to the investment's limited outside options; and we argue that such asymmetric dependency resulting from one transaction can "spillover" to their bargaining of subsequent transactions. Therefore, an investment's negative "externalities" can be reflected by the investing supplier accepting less favorable "contractual terms" with its client in their subsequent deals together. Finally, we consider how the investing firm can minimize this tradeoff resulting from making unilateral investments. We argue that the investing supplier that demonstrates productivity improvements can strengthen its bargaining position relative to its client – this is reflected by the supplier being able to negotiate more favorable contractual terms with its contracting partner over time.

We seek to make several contributions to better understand the phenomenon of unilateral investments. First, we seek to understand why a firm can in fact be rational in making unilateral investments by drawing on advances in TCE and reciprocity research. We also build

on these perspectives by demonstrating both the positive and negative "externalities" that can result from unilateral investments. A broader implication is that a firm's investment decision is a function of balancing expectations of the long-term returns from gaining subsequent deals with its partner with the contractual risks on those new deals.

We also seek to contribute to contractual bargaining research. Our findings show that, even in the absence of sufficient contractual protections, relationship-specific investing and partner reciprocity can take place under unresolved behavioral exchange uncertainty. One party's willingness to commit relationship-specific investments, even by the partner in the disadvantaged bargaining position, can be an effective non-contractual solution that can substitute for contractual ones to promote exchange reciprocity. This effectiveness is evident by unilateral investments being more effective in facilitating cooperation during the early-stage of a partnership when behavioral uncertainty is greatest. Another related contribution is acknowledging the tradeoff for the investing firm that initially subjects itself to a weaker bargaining position and providing a resolution to that tradeoff - we demonstrate that the investing party becoming more valuable to its partner by demonstrating how productivity improvements can reduce such tradeoffs.

## CONTEXT

The context we examine is drillers in the oil-gas industry. Similar to other client-supplier relationships, the client here is the operator that owns the oil well, and the supplier here is the driller that is hired to develop the well. The conventional process in developing an oil well involves the operator first selecting a driller, and then the driller committing relationship-specific investments. These investments by the driller include relocating a rig to a new well often over long distances and re-tooling the rigs to be outfitted with technology only compatible with the

well operator's specifications – these investments demand significant transportation and modification costs and can run as high as a quarter of the well drilling budget (Downey, 2009). Such investments can be considered relationship-specific because relocating and reconfiguring this asset (i.e. the driller's rig) requires significant additional costs (Joskow, 1988, Williamson, 1985; 1996). Thus, only *after* the driller has been awarded the well's contract will it move and modify its rig for its client operator. Often, the driller can even pass on much of these costs to the operator, especially during high oil price phases when oil demand is high and driller supply is low (Downey, 2009).

For some drillers however, they can seek an advantage by making the above described investments – relocating and retooling their rigs - for the wells that they hope to develop with the operator prior to securing the drilling contracts. Specifically, what these drillers are doing is incurring the rig transportation and modification costs for the operator *before* the operator even opens bidding for drillers to win the well-development contract (Li, Jacquemin, and Li, 2016). For every well, the driller is willing to invest unilaterally in these ways for its client operator because shouldering more of the operator's costs can increase the driller's chances of being awarded the contract for the client's well.

Our context is unique because we can observe and measure unilateral investments that are relationship-specific in nature. We can track drillers' rig movements and whether or not they position rigs next to new wells prior to the opening date of contract bidding – this allows us to observe drillers making unilateral investments. We are able to measure the distance traveled by the driller's rigs – this allows us to estimate the transportation cost incurred by the driller given market rates at the time. We have detailed well-level information – this allows us to estimate rig modification costs given the characteristics and requirements of a given well. In addition, we can

observe the type of contract awarded to the driller and how performance is incentivized and monitored. Knowing the type of contract also allows us to observe which side receives the rights to unexpected outcomes and which side bears more liability in unexpected events. Thus, the type of contract negotiated is an outcome that reflects whether bargaining power resides more on the driller's or operator's side (Ozmel et al., 2017).

## RESEARCH BACKGROUND

Prior literature has examined relationship-specific investments in general using various theories, but not specifically unilateral relationship-specific investments as characterized above. For instance, according to the relational view, partners that commit relationship-specific investments promote inter-firm resource exchange that drive value creation (Dyer and Singh, 1998; Gulati and Singh, 1999). Meanwhile, the organizational economics perspectives are more cautious about making relationship-specific investments due to exacerbating behavioral exchange hazards between partners. Specifically, traditional transaction cost economics states clearly that the party committing relationship-specific investments essentially becomes "locked-in" to the relationship due to the difficulty of re-applying its investments outside the relationship (Williamson, 1985).[1]

According to Hoskisson et al. (2017), the firm in the disadvantaged bargaining position should only commit valuable investments in its relationship when the appropriation concerns on

[1] Property rights theory (PRT) similarly speaks to the exchange hazards and believes that partnering firms facing opportunism such as unfair ex-post hold-up and unfair value appropriation can write contracts ex-ante specifying contingencies to reduce such uncertainty. According to traditional PRT, contracts written ex-ante allow the transacting parties to specify contingencies to reduce ex-post appropriations risk. Modern PRT continues to rely on the need for contracts, while it acknowledges that initial contracting is incomplete and allows such initial contracts to be renegotiated (and property rights to be reallocated ex post) by the parties (Hart, 1995).

the investment's expected returns have been fairly worked out using contracts on those investment transactions. They go on to explain that the failure to secure contractual guarantees for the investing party that protect against unfair value appropriation ex-post can reduce its willingness to invest ex-ante, which in turn depresses value creation ex-ante.[2] This prediction is similar to what Williamson (1985) calls managerial "foresight" about unfair appropriations ex-post in the absence of contractual protections that will reduce the likelihood that a firm will commit investments into its relationship in the first place.

When we apply traditional TCE logic to unilateral investments, the prediction is that a firm will not rationally make such investments without first securing contractual protections guarding against its partner's opportunism. In other words, traditional TCE would caution and even recommend against making a unilateral investment due to the absence of securing contractual protections on that transaction. Besides contractual protections, a firm may also protect its relationship-specific investments by securing other forms of investment protections such as receiving reciprocal commitments by its partner based on the mutual hostage models (Kim and Mahoney, 2006; Williamson, 1983). An illustrative case is the franchisor-franchisee relationship whereby the franchisor investing in relationship also requires the franchisee to make relationship-specific investments to align incentives (Klein and Leffler, 1981). In the absence of these protections, a firm would be "irrational" to take such gamble with its investments (i.e. Williamson, 1985).

[2] Research connecting value appropriation and value creation allows for parties in the relationship to renegotiate within the scope of their existing contract, which is also known as ex-post bargaining (see Grossman and Hart, 1990). Yet the scope of consideration does not cover unilateral investments, which take place beyond the obligations of an existing contractual transaction.

To the extent that one party is willing to preemptively commit relationship-specific investments without first securing the necessary protections, the literature has focused on the partner having more property rights in the given transaction to protect its investment. The party having more property rights means securing more ownership claims to the expected and unexpected profits generated in the partnership (Grossman and Hart, 1986). The partner in this "advantaged" bargaining position may have the incentive to act preemptively in order to break any investment deadlock in the relationship that depresses overall value creation. For instance, the owner of the production output creates a higher valued product to sell when its suppliers of the production input commit relationship-specific investments; and therefore the owner will seek to incentivize its suppliers to commit such investments by first posting economic bond itself to credibly demonstrate relationship commitment (Hoskisson et al., 2017).

While the incentives are obvious for the 'advantaged' party in the focal transaction to make such pre-emptive commitments, less is understood about pre-emptive investments made by the party in the "disadvantaged" bargaining position, which is the party that has fewer or no property rights relative to its exchange partner in a given transaction. Referring to the example mentioned above, the unclear question is why the supplier of the production input would preemptively commit relationship-specific investments for the owner of the production output who controls the claims to the returns of the output sold on the market (Jia, 2013).

Despite the lack of theoretical guidance, we observe often in practice firms making unilateral investments as their strategy to strengthen partnership collaboration. As mentioned earlier, these firms in various industries are willingly making such investments, despite facing high appropriation risk. Hence, the paradox is: why would a firm rationally act unilaterally in committing relationship-specific investments that would subject itself to holdup? In the supplier-client

relationship, it may thus appear irrational for a supplier to make a preemptive relationship-specific investment for its client before securing contractual safeguards on that investment.

## THEORY DEVELOPMENT AND HYPOTHESES

Advances in transaction cost economics research update traditional TCE by broadening the consideration of an investment's outcome to include the "externalities" that can be created in terms of subsequent transactions between the investing firm and its partner (Williamson, 1996; 1999; 2008). For instance, a supplier making investments for a given project can develop cost and efficiency advantages that can help it attract similar future projects from the same client (Jia, 2013). Therefore, the supplier's return of that initial investment, or what is termed as the investment's net present value, includes not only the returns of the focal investment with its client but also the returns from these related subsequent new deals (Kang et al., 2009). This approach examining any transaction in relation to other affected transactions at the partnership level departs from traditional TCE logic where the unit of analysis is the focal transaction that is treated in "isolation" from other related transactions (Williamson, 1996).

While advances in TCE research have highlighted the need to examine a transaction's "externalities", what remains unclear is exactly what those "externalities" are. Drawing on advances in TCE research to study the phenomenon of making unilateral investments provides an opportunity to understand these investment outcomes. We argue that making unilateral investments can result in both potential positive and negative "externalities". As we will argue in the case of the supplier-client, a supplier making unilateral investments for its client on a given project may gain advantages (such as in cost and expertise) to win future work on other related projects for that client – these are the unilateral investment's positive "externalities".

While the incentives are better understood for the partner making unilateral investments, less clear are the incentives for the receiving partner to continue transacting. Based on TCE logic, unilateral investments allow the receiving partner to occupy the advantaged bargaining position and create strong incentives for that partner to not cooperate – the receiving partner can act opportunistically when the investing party is most vulnerable. In fact, relying solely on TCE logic could arrive at the opposite conclusion: The receiving partner driven by self-interest would be advantageous to play a one-time game by acting opportunistically after the initial investments when asymmetric dependency lies in its favor.[3]

To add more clarity to the theoretical mechanism explaining how unilateral investments generate positive "externalities", we also draw on reciprocity research to examine how a relationship can stay together despite asymmetric bargaining power that initially favors one partner. While TCE logic has prioritized reducing transaction costs for exchange parties that are increasing their frequency of transactions, reciprocity research focuses on increasing value creation when partners increase transaction frequency (Axelrod, 1984; Gulati, Khanna, and Nohria, 1994; Heide and Miner, 1992). When one party pre-emptively dedicates resources for its partner, that investing party essentially signals intentions to cooperate, which then creates economic incentives for its partner to also reciprocate by committing investments in their relationship that drive overall higher value creation through this virtuous cycle of investment reciprocity (Lavie, 2006). The expected payoff for cooperating long term will be greater than the expected payoff for de-

[3] As another way to think about this is to use a game theory setting: the receiving partner can guarantee appropriating a bigger share of realized value by playing a one-time game, while waiting by playing a repeated game through multiple transactions raises uncertainty on its end. The relentless logic of the "prisoner's dilemma" where the advantage party has a strong incentive to defect from further cooperating hinders the partners from further collaborating (Celly et al., 1999; Williamson, 1985).

fecting after a single transaction (Dyer and Singh, 1998; Lorenzoni and Lipparini, 1999). As Gulati and Wang (2003) argue, both parties can have strong incentives to engage in reciprocity because growing the "size of the pie" down the road may be in the best interest of both parties than competing now to capture a bigger "slice of the pie".[4]

We also consider unilateral investment's negative "externalities", or the associated costs in terms of contracting risks for the investing firm on its subsequent transactions with its exchange partner. In the case of supplier-client relationship, while the investing supplier can gain new contracts from its client, we then ask what are the terms of those contracts for the supplier. Consistent with his traditional TCE reasoning, Williamson (1996) warned about the likelihood that the firm making a relationship-specific investment can become "asymmetrically dependent" on the receiving partner in the long run, with possible consequences on contractual bargaining on future transactions. Based on this concern, we argue that a supplier making a unilateral investment on a client's project has a negative effect on the investing supplier's negotiated contractual terms on subsequent projects with its client, due to the former's increased dependency on the latter. Finally, we consider how the investing supplier can reduce such contractual tradeoff: We argue that investing suppliers engaged in productivity improvements can over time strengthen their bargaining position to secure more favorable contractual terms from its client.

In the following sections, we argue and empirically show that there are both positive and negative "externalities" resulting from unilateral investments. We first consider the positive externalities - the investment's positive effect on the number of new project contracts

[4] When applied to game theory, the payoff for the receiving partner to cooperate is greater than the payoff for the party to defect, especially since firm making unilateral investments has already signaled its intentions to cooperate (Gulati et al., 1994). As such, the "shadows of the future" for greater overall payoffs can increase cooperative behavior for both transacting parties in the present (Axelrod, 1984; Gulati et al., 1994; Heide and Miner, 1992).

awarded to the investing supplier by the client (gaining contractual volume). This benefit of making unilateral investment is stronger when unilateral investments are timed during the early stages of the partnership. We then consider the investment's negative externalities – the investment's negative effect on the investing supplier's bargaining position to negotiate favorable contractual terms on these subsequent projects with its client (losing favorable contractual terms). This cost of making unilateral investment is alleviated if the investing supplier can demonstrate productivity improvement when working with its client. Our model is illustrated in Figure 1.

[Insert Figure 1 about here]

***I. The Benefits:***

***The effects of unilateral investments on contractual volume***

Given partnership exchange costs such as coordination and production costs, a firm that is willing to shoulder upfront those associated costs away from its partner becomes a more attractive collaborator. If given choices, the receiving partner would incur lower exchange costs by working with that has already made such relationship-specific investments compared to working with other options (Dyer and Singh, 1998). By dedicating resources into the relationship, the investing firm also lowers the opportunity cost for its receiving partner to make reciprocal investments in their relationship, rather than to invest in other relationships (Dyer and Nobeoka, 2000). In addition, the investing firm can dedicate resources that are reconfigured to have more relational applications, which further incentivizes its partner to commit reciprocal investments in those resources for overall value creation (Alexy et al., 2017). As a result, the investing firm essentially sets up a situation for its partner where the value of that partner's resource commitment is likely to be worth more when used together in complementary ways than when its resources are used outside the partnership (Eisenhardt and Schoonhoven, 1996; Lorenzoni and Lipparini, 1999).

In the case of a supplier-client relationship, a supplier that dedicates resources into its relationship with its client can help its client reduce exchange costs as coordination and production costs, which makes that supplier more attractive cost-effective option to work with compared to other non-investing suppliers (Dyer and Singh, 1998). As a result, a supplier that preemptively dedicates its resources to its client's products to often become the preferred supplier for the client's focal project as well as its other projects. Kang et al. (2006) explained that suppliers making unilateral relationship-specific investments for its client were also technically more capable due to preemptive preparations resulting from such investments. In addition, Celly et al. (1999) explained that suppliers making unilateral investments also signaled trustworthiness and commitment, which reduces their client's exchange uncertainty. Due to the above benefits, the client is likely to reciprocate by awarding more projects to the supplier that makes unilateral investments. In other words, the supplier making unilateral investments can generate "positive" externalities with its partner by attracting more of its client's projects and thereby broadening its project portfolio with that client.

***Hypothesis 1: The supplier making unilateral investments for its client is positively associated with contractual volume with that client.***

***Strategic timing of making unilateral investments: Is investing earlier in a relationship better?***

We also consider the timing of unilateral investments. As unilateral investments are "strategic moves" in capturing value, they are also gambles that have mixed results as investing firms find more success in some cases than others (Kang et al., 2009). We consider whether such "strategic moves" can also have a strategic timing component - Specifically, we examine whether unilateral investments are more effective when made in the early stage of a partnership when the investing firm and its partner begin collaborating or in the later stage of their partnership.

In the initial stage of a partnership, partners new to each other will confront higher exchange uncertainty. The lack of track record of the parties working together means that each side cannot evaluate the quality and reliability of the other. Consequently, collaboration will likely be hindered due to mutual suspicion. Also, for a client-supplier relationship, the client when choosing a supplier to work on a new project will often prefer working with more familiar suppliers having more experience working together than a new supplier having less/no history working together. Consequently, the new supplier having limited partnership experience with its client must overcome such liabilities of newness to facilitate closer collaboration.

In a relationship's early stage, unilateral investments can help the new supplier reduce its exchange uncertainty with its client. Similar to the logic in the previous section, the new supplier making unilateral investments can increase its competitiveness to become a more preferred supplier to its client compared to others by shifting more of the cost burden onto itself and away from the client. The investing supplier may also gain an edge in technologies and capabilities over others due to its preemption in resource commitment. In addition, when exchange partners are uncertain of each other's intentions, preemptive investments can serve as important means to signal relationship commitment and generate reciprocity (Jensen, 2003). Making unilateral investments can serve as such valuable signals to help facilitate reciprocal resource and information sharing. On the other hand, in a relationship's later stage when partners have more experience working together, such partnership exchange uncertainties are reduced due to factors such as increased trust. Consequently, the need for unilateral investments become less important when partners have more experience working together.

Furthermore, dedicating more resources early in the partnership can allow the investing firm more time to integrate their committed resources. The firm making preemptive relationship-

specific investments can also engage in pre-emptive learning by laying the knowledge foundations such as early familiarization with its partner's personnel and project tasks (Kang et al., 2009). As early-stage collaboration is often fraught with delays due in part to coordination and task unfamiliarity (Kale and Singh, 2009), earlier preparations can produce critical "lead times" to allow such familiarization before critical phases of collaboration work begins (Hamel, 1990, Simonin, 2004). These factors contribute to building a stronger knowledge foundation for the partnership that can then lay the ground work for "higher-order" learning to take place when the collaboration becomes more intense (i.e. more contracts).

***Hypothesis 2: The investment timing will moderate the positive relationship between unilateral investments and contractual volume - such that the positive relationship between unilateral investments and contractual volume will be stronger in the initial partnership stage.***

***II. The* Costs:**

***The effects of unilateral investments on contractual terms***

In addition to unilateral investments resulting in positive "externalities", they can also result in negative "externalities" as well. Based on the arguments in the previous section, if an investing supplier can win more contractual deals with its client, we then ask what are the contractual terms of those deals. Drawing from TCE logic, a firm's making investments without contractual safeguards can create asymmetric dependency on its receiving partner, which subjects itself to opportunistic "hold-up" in the partnership (Mahoney and McGahan, 2007; Williamson, 1996). Yet, whether asymmetric dependency resulting from one transaction in a partnership can "spillover" to lingering dependency between the partners in their subsequent transactions is the kind of negative "externality" that needs further studying (Williamson, 1999).

Going back to Milgrom and Roberts (1992), bargaining power is a function of each partner's dependency on the other, and that dependency is determined by the degree of specificity of

one side's investment commitment to that relationship rather than to a particular deal. If one party's investments have high partner switching costs, then the investing party can be forced into weaker bargaining positions when negotiating future deals with its partner, as the partner can act opportunistically on previous deals to leverage ongoing deals to its advantage (Yan and Gray, 1994). Consequently, when negotiating contractual terms on those new deals, the bargaining outcomes - as reflected by contractual terms - will shift risks and costs to the disadvantaged party (i.e. the investing supplier) while allowing the advantaged party (i.e. the receiving client) to appropriate a greater share of created value (Milgrom and Roberts, 1992).

Unilateral investments have a high degree of relationship specificity, and thus entails significant partner switching costs, due to the value of the investment's second-best use outside their relationship being lower than its value inside the partnership. Realizing that the investing party has committed itself long-term to the relationship, the receiving partner can act opportunistically against the investing party at any stage during their collaboration such as by threatening to walk away from their relationship (Argyres and Bigelow, 2007; Mahoney, 1992; Nickerson et al., 2001). Therefore, the party making unilateral investments becomes held hostage to the receiving partner – the former creates asymmetric dependency that weakens its bargaining position in negotiating its subsequent contracts with the latter.

***Hypothesis 3: The supplier making unilateral investments for its client is negatively associated with securing favorable contractual terms with that client.***

***Minimizing the contractual tradeoff: The role of productivity improvements***

While making unilateral investments allows the investing supplier to win more projects with its client, the tradeoff for the supplier is being subjected to more burdensome contractual terms on those new projects. Such tradeoff raises the question on whether the investing supplier can reduce such costs in terms of alleviating its contractual burdens. According to Williamson

(1999) asymmetrical dependency between partners does not remain static. Furthermore, a firm's evolving capabilities achieved through resource and knowledge access can alter partnership dependency, and hence shift bargaining outcomes (Hamel, 1991). For some firms, the possibility to strengthen its bargaining position with its partner over time may rationalize their willingness to endure an initially weaker bargaining position.

The investing firm can strengthen its bargaining power relative to its partner to secure more favorable contractual terms in several ways. For the investing firm to gain more leverage, it can be less replaceable to its partner, and/or its partner can be more replacement to it (Lavie, 2007; Yan and Gray, 1994). When the investing firm acquires new resources and capabilities, it can improve its productivity, which can alter such dependency with its partner in its favor. A firm that can become more productive working on tasks for its partner becomes more valuable to that partner – hence the more productive firm become less replaceable to its partner. Meanwhile, a more productive firm also becomes more attractive to other partners outside its focal relationship who can also benefit from those resources and capabilities – hence as productive firm increases its outside options, its focal partner becomes more replaceable. In the supplier-client case, the supplier that can demonstrate productivity improvements to deliver efficiency gains for its client can become more valuable to that client, as well as to others (Jia, 2013).

Making unilateral investments can directly expedite such productivity improvements by promoting information sharing between the partners that can result in learning. Especially since neither side knows the other's intent ex-ante, each side is likely to be more protective ex-ante of key assets that hinders knowledge access (Hansen, Hoskisson, and Barney, 2008). Therefore, making unilateral investments signals intent for long-term collaboration, which in turn can facilitate reciprocity in terms of information sharing (Celly et al., 1999). For the investing supplier, it

can access more information from its client and learn to respond for instance to its client's changing volume requirements and product/process technology. As the supplier gains more experience working on more projects for its client, such opportunities for productivity improvements based on learning are likely to be more abundant. Thus, the supplier that initially made the "risky" unilateral investments were later rewarded for its "price of admissions" as it became deeply involved in more activities in their client's operations (Kang et al., 2009).

***Hypothesis 4: Driller's productivity improvements will positively moderate the above negative relationship between unilateral investment and contractual terms, such that investing drillers that demonstrate greater productivity improvements will secure more favorable contractual terms.***

## METHODS

### *Data and Sample*

Data collection for this study required multiple sources. First, we collected well permits filed with the Texas Railroad Commission (TRC), which is required for all drilling activities. The TRC is the state's regulatory agency for oil-gas activities. It keeps drilling log records and copies of operator-driller contracts in the state of Texas archives. The permits provide information on operator identity, well location, and well characteristics. The drilling permits also provide detailed information on the drilling process such as the drilling direction (i.e. vertical or horizontal) and the number of feet drilled per day. The drilling log records list the start and completion dates, which helps measure drilling efficiency. There is also information on the negotiated contracts - specifying whether the contracts are "dayrate" or "turnkey" (these terms are defined later in the method section).

We also used data provided by DrillingInfo and RigData, which are Houston-based data providers for energy companies on oil-gas drilling activities in the US. These datasets provide

the identity of the driller and the rig used on a given well, which we were able to match with our TRC sample. We thus have information on every driller-operator dyad and can follow their well projects over time. These datasets also collect information that tracks drillers' location movements, which we use to construct our main measure for unilateral investments. Finally, these datasets allow us to observe the type of contract negotiated between the driller and operator pair for each well. Finally, data from the Energy Information Administration (EIA) is used for the industry's oil price levels at a given time.

In our constructed dataset, we can observe all driller-operator partnerships and their well projects in Texas from 1990 to 2015. For each driller-operator partnership, we can observe all dyad-level projects undertaken each year since the partnership's inception. We were also able to observe for each partnership the number of well projects worked on together and the contractual terms negotiated between the two sides. Finally, we followed drillers' movements using geo-spatial tracking to determine the frequency of a driller making unilateral investments in the form of pre-emptive rig movements to its partner operator's new wells prior to the opening bidding date on those wells.

**Dependent Variables:**

Our first dependent variable is *contractual volume*, which we measure as the number of project contracts given to the driller-operator partnership in each year. In a client-supplier partnership, contractual volume has been defined as the number of projects awarded to the supplier by the client (Walker and Weber, 1987). Taking on greater volume involves greater resource access and exchange.

Our second dependent variable is *favorable contract terms*, which we measure as a proportion of cost-plus "dayrate" contracts relative to other contracts for a driller-operator dyad for a

given year. In the oil-gas industry, "dayrate" contracts for the driller-operator pair are most similar to cost-plus contracts, which pays the supplier driller a base rate plus reimbursement for unexpected expenses and also entails risk sharing with the client operator. The type of contract unfavorable to the driller – and favorable to the operator – is the "turnkey" contract, which is most similar to fixed-price contracts and require the supplier driller to assume most of the operation risks. Other types of contracts include "footage" contracts that pay drillers based on the number of feet they drill.[5]

How we measure our dependent variable for favorable contractual terms for the supplier driller is illustrated in the following example. A driller-operator pair in its first year together works on five wells where none are structured using "dayrate" contracts – thus our outcome measure is 0. In the second year, the driller secures one "dayrate" contract relative to the ten wells the partners are working on – thus our outcome measure is 0.1. In this case, we argue that when using "dayrate" contracts for the pair that is increasing, the driller in the partnership is improving its bargaining position in negotiating more favorable contractual terms. What can determine how contracts are negotiated is the relative bargaining position between the driller and the

[5] In general, drillers have a strong preference for 'dayrate' contracts because they are better compensated for unexpected costs, and they assume less risk. In a typical cost-plus dayrate contract, the driller is paid for each day of operations, even during downtimes. For example, even when the rig is on standby time (due to delays), the operator must still pay for those downtimes. The drilling contractor is entitled to receive a constant dayrate compensation (in addition to any additional cost overruns) whether the rig is drilling, on standby, or rigged down, and standing idle. Furthermore, the driller is no longer in control of drilling operations, and instead the client operator has control rights – this means that most liability becomes the responsibility of the operator. When contractual terms change from non-cost-plus (i.e. turnkey or footage) to cost-plus (dayrates), such changes can mean that the investing driller shifts more cost and liability risk to its client operator. On the other hand, non-dayrate contracts are generally riskier for the driller. For instance, negotiating a fixed-price 'turnkey' contract means that the supplier (driller) oversees the operations, assumes most risks and liabilities, and covers any cost overruns – the driller assumes more risk relative to the client operator (Anderson, 1990). When an accident happens, the typical fixed-price turnkey contract requires the driller who has control rights to cover those costs, which in turn reduces their profits. Similarly, 'footage' contracts also shift more costs and risks to the driller. Consequently, fixed-price turnkey and footage contracts are known to impose much "harsher" terms for the driller (Banerjee and Dufflo, 2000). Based on qualitative interviews, the driller is usually unwilling to agree to a fixed-price turnkey or footage contracts unless it is in a weaker bargaining position (J. Strawn at Winstead Law, personal communications, January, 15, 2017).

operator (Anderson, 1990: p. 376). All the independent and control variables discussed below enter the regression with values lagged one year with respect to this dependent variable. Our unit of analysis is the dyad-year.

**Independent Variables**

Our first main explanatory variable is the *driller's unilateral investments,* which we measure by counting the number of preemptive rig moves made by the driller for its operator partner in a given year. We consider a preemptive rig move if a driller's rig was moved to the well site before the operator opens bid offers for that well. Before an operator puts out the call for contract bids to help develop a new well, we can track whether some drillers pre-emptively move their rigs to the new well as a form of unilateral relationship-specific investment. Furthermore, the move must incur substantial costs. We therefore only consider rig moved from an outside field, and not rig moves in the same field as the new well. For example, the operator in a given year can initiate ten new project wells to begin development, and one of its partner drillers preemptively moves its rigs to five of those wells – that driller's unilateral investment frequency for its operator partner in that year is 5. The larger the value means that the driller has made more unilateral investments, and thereby incurred higher costs for its partner operator.

Our second explanatory variable is the *initial partnership stage,* which we measure as a dummy variable equal to 1 if the driller makes its unilateral investments during the first year of its partnership with its client operator. The variable is equal to 0 if the driller makes its unilateral investments for its client operator in subsequent years of their partnership.

Our third explanatory variable is the driller's *productivity improvements*. We measure this variable as the performance speed of drilling a well in terms of feet drilled per day (Kellogg, 2010). For each well, we calculate this measure by taking the total depth in feet for a given well

and then dividing the total depth by the days needed to complete the well. In a given year, we take the average performance speed in developing similar wells and compare the average performance speed of similar wells in the pair's previous year – driller's learning is any positive difference in average performance. A positive value means that the driller has increased its value as a partner for its client, which demonstrates strengthening partnership collaboration as the driller assuming more responsibility.

**Controls**

We consider various controls that can affect contract choice for an operator-driller partnership. We control for *driller's prior outside operators*, which we measure as the number of previous wells drilled with other operators besides the focal operator. This measure can reveal the degree of the investing firm's initial disadvantage relative to the client operator. We use a measure based on the driller's number of previous drilling tasks divided by the number of client operators contracting those tasks. We draw on previous research such as Baum et al., (2000) that has shown that the firm with limited clients can be resource and knowledge constrained. Having limited outside clients has also been shown to weaken relative bargaining power to its transacting partner, as shown in labor mobility research (Yamaguchi, 2010).

We also control for *driller size,* which we measure as asset size in terms of the number of rigs in operations. We chose this measure instead of financial measure because most drillers are private companies and thus their financial information is unavailable. For instance, bigger drillers assume relatively less risk than smaller drillers due to having more resources and a broader customer base, and therefore bear less risk in making unilateral investments. We control for *driller field knowledge,* which we measure as the number of prior wells drilled in the same field as the current well. We also seek to account for the driller's bid price for every well, but bidding

data is confidential and cannot be observed. To gain a sense of how competitive a driller's bid may be, we control for the *driller's proposed well drilling cost*, which we can observe in the submitted well permits. We argue that drillers that work under lower costs can bid lower prices compared to those that work under higher costs. We also control for the *driller's safety record*, which we measure as the number of previous accidents. As a driller's reputation in the industry can be important to consider but difficult to measure, controlling for its safety record can serve as a proxy.

There are operator-specific factors that can also affect our outcomes of interest. We control for *operator size*, which we measure also in asset size in terms of the number of wells owned. We control for *operator's prior outside drillers*, which we measure as the number of previous wells operated prior to the current well with other drillers besides the focal one.

There are transaction factors specific to the partnership that can affect the outcomes of interest. We control for the pair's *recent projects*, which we count as the number of wells that the operator-driller pair have worked on together in the past 6 months up to the focal well project. This variable controls for the willingness for the pair to continue working together, when we cannot observe past experiences that were "good" or "bad" (Corts and Singh, 2004).

Field-level and macro-economic conditions also matter. We control for the *competitive density* in a given field that drillers face, which we measure as the number of other available drillers in a given field that could be competing with the investing driller for a given client's well. We also control for *industry oil price* levels. For instance, in a comfortable environment with high oil prices, there will be more upstream activities causing demand-supply imbalance favoring drillers, and therefore drillers will face less risk in making unilateral investments for a

particular operator, as there is most likely another operator waiting in line for the driller's services.

**Model specification:**

Our two different outcome measures require different model specification. For the first dependent variable of contractual volume (hypothesis 1 and 2), we use a negative binomial estimation to deal with the count measure. For the second dependent variable of contractual terms (hypothesis 3 and 4), we use a GLM (generalized linear model) estimation with a binomial distribution and a logit link function to deal with the proportional measure bounded between zero and one (Papke and Wooldridge, 1996). For both estimation approaches, we include fixed effects for year and random effects for the driller, operator, and driller-operator dyad. We also lagged our explanatory variables one year from the dependent variables.

$$Y_{jit} = \alpha + B_1 X_{jit-1} + B_2 M_{jit} + B_3 E_{jit-1} + f(Controls)_{jit-1} + i.Year + \gamma_j + \delta_i + \mu_{ji} + \varepsilon_{jit}$$

$Y_{jit}$: $contractual\ volume,$
$contractual\ terms\ for\ driller\ j$
$-\ operator\ i\ in\ year\ t, given\ partner\ did\ at\ least\ one\ deal\ in\ that\ year$

$X_{jit}$: $unilateral\ investment\ frequency\ made\ by\ driller\ j\ for\ operator\ i\ at\ year\ t-1$

$M_{jit}$: $productivity\ improvements\ (in\ drilling\ speed) by\ driller\ j\ working\ for\ operator\ i\ at\ year\ t$

$E_{jit-1}$: $Dummy = 1\ if\ driller\ j\ made\ unilateral\ investments\ in\ first\ year\ t-1$
$of\ its\ partnership\ with\ operator\ i$ .

$\gamma_j$: $error\ component\ for\ driller_j$

$\delta_i$: $error\ component\ for\ operator_i$

$\mu_{ji}$: $error\ component\ for\ operator_j - operator_i\ dyad;\ or\ case - control - group$

$\varepsilon_{jit}$: $idiosyncratic\ error$

In addition to using our complete sample, we also ran our estimation on a constructed sub-sample by matching driller-operator pairs with their observationally equivalents using coarsened exact matching (CEM) to minimize concern of model dependency.[6] Drillers that make unilateral investments may for unobserved reasons, such as those more capable, also choose or be chosen to work with their operators. Using CEM does not change one's estimation approach because CEM is essentially "preprocessing" one's data by "pruning" or dropping observations that did not generate matches (Iacus, King, and Porro, 2012).

CEM reduces concern of model dependency by constructing similar control groups consisting of 'synthetic counterfactual' drillers that are similar to the focal driller on multiple dimensions and 'synthetic counterfactual' operators that is similar to the focal operator on multiple dimensions. In other words, we create separate matched samples – one for the focal operator and the other for the focal driller. We then randomly combine these matched potential drillers with potential drillers to create synthetic partnerships. In other words, for any given driller-operator dyad, we thus can create observationally equivalent driller-operator pairings that are randomly matched. We can then re-estimate the treatment effect of driller-operator pairings where unilateral investments are made compared to matched control group of driller-operator pairings where unilateral investments were not made.

We matched drillers on the following characteristics: same geography, similar level of experience in the same field, year founded (age), reputation ranking, average rig technology, size (revenues, number of active rigs). We matched operators on similar characteristic: similar level of experience in the same field, reputation ranking, size (revenues, and number of active wells), degree of national or international presence, and number of upstream-downstream businesses.

[6] Recent research argues that CEM has several advantages over other techniques that match on observables, such as propensity score matching (see Iacus, King, and Porro, 2012)

For both driller and operator matching criteria, we tried "coarser" and more "fine-grained" matching, and the results remained robust. The final sample consists of 112 cases (or treatment group where drillers in these pairs made unilateral investments) and 325 controls (or control group where drillers in these pairs did not make unilateral investments). Using this sample, we then run our estimation models in similar ways - we use a negative binomial estimation for hypothesis 1 and 2, and we use a GLM estimation with a binomial distribution and logit link function for hypothesis 3 and 4. In both estimation models, we include fixed effects on year and case-control-group.

## RESULTS

The summary statistics provide interesting and encouraging results. We find that drillers working with operators in their first year together have few collaborations, and subsequent years (years 2 and 3) can vary with some drillers expanding to more operator's wells while other drillers not enjoying such growth. We also find that the majority of negotiated contracts for driller-operator partnerships in their first year are not cost-plus "dayrate" contracts - Footage contracts are most popular in the first year, while turnkey contracts are also prevalent. This suggests that initially operators are usually in stronger bargaining positions and negotiate their preferred contracts to reduce their agency risks about their new drillers. For subsequent years in the relationship (years 2 and 3), we see that on average using cost-plus "dayrate" contracts become slightly more prevalent, but not by much.

When we examine the sample of drillers making unilateral investments, the summary statistics are also interesting. We see that these drillers on average work on more wells of its partner operators in subsequent years. Furthermore, we see that driller-operator contracts in subsequent

years have more cost-plus “dayrate” contracts when the driller makes unilateral investments in the partnership’s first year.

[Insert Tables 1 about here]

Hypothesis 1 proposes that the driller making unilateral investments in its partnership is positively associated with more contractual volume. This hypothesis will be supported if the number of unilateral investments made by the driller for its partner operator is associated with increasing project volume awarded to the driller by the operator. As reported in Table 2 Model 2, the effect of making unilateral investments in the relationship on the outcome of favorable contracting terms is positive and significant ($B=0.178$; $p<0.01$). For our matched sample as reported in Table 2 Model 4, the effect of making unilateral investment on contractual volume is also positive and significant ($B=0.625$; $p<0.307$). Therefore hypothesis 1 is supported.

[Insert Table 2 about here]

Hypothesis 2 considers the timings of unilateral investments. It proposes that the positive effect of driller’s making unilateral lateral investment on contractual volume will be stronger when such investments are made in the initial stage of the partnership. This hypothesis will be supported if the interaction effect of unilateral investments and the initial partnership dummy on the outcome of contractual volume is positive and significant. As reported in Table 2 Model 3, the coefficient for the interaction effect is positive and significant ($B =0.831$; $p<0.05$). Plotting the interaction effect shows that the positive relationship of unilateral investment and contractual volume is stronger for early-stage investments.

Hypothesis 3 proposes that the driller’s unilateral investments in the relationship have a negative effect on the outcome of favorable contractual terms. This hypothesis will be supported if the number of unilateral investments made by the driller for its partner operator is associated

with decreasing proportion of favorable contracts awarded to the driller by the operator. As reported in Table 3 Model 2, the effect of making unilateral investments in the relationship on the outcome of favorable contracting terms is negative ($B = -0.122$, $p<0.01$). For our matched sample as reported in Table 3 Model 4, the effect of making unilateral investment on favorable contracting is also negative and significant ($B= -0.137$; $p<0.05$). Therefore hypothesis 3 is supported.

[Insert Table 3 about here]

Hypothesis 4 proposes that the relationship between drillers that learn from its partner operator and secure more favorable contractual terms is positive. This hypothesis will be supported if the interaction effect of unilateral investments and driller learning outcomes on contractual terms is positive and significant. As reported in Table 3 Model 3, the coefficient for the interaction effect is positive and significant ($B = 0.113$, $p < 0.05$). Thus hypothesis 4 is supported. Plotting the interaction effect show that for high levels of productivity improvements, the relationship between making unilateral investments and favorable contracting may even be positive.

[Insert Figures 2 and 3 about here]

## SUPPLEMENTARY ANALYSES

*Sample selection concerns: The effect of making unilateral investments on the outcomes of the first transaction deal struck in the partnership*

Sample selection concerns may bias our main results. One concern is partner selection bias whereby partnering firms may match on unobserved factors. Another concern may be unobserved heterogeneity such as supplier drillers that make unilateral investment may be inherently more capable than those that choose not to make such investments. To reduce such concerns, we follow Robinson and Stuart (2006) to first create a new sample that is quasi-randomized consisting of our original sample of supplier drillers making unilateral investments and the matched

sample created by using CEM of drillers that could have but did not make unilateral investments. We use the conventional one-to-one proportion of equal numbers of actual and hypothetical investing drillers. Using this new sample, we then run a Heckman two-stage selection model: the first stage models the likelihood that the supplier driller makes unilateral investments; and then the second stage uses the adjusted estimate of unilateral investment variable to predict the two main outcomes of 1) the likelihood of winning the first project contract with its client operator and 2) the likelihood of securing a favorable contract (i.e. a 'dayrate' contract) on that first project deal.

For our instrumental variable in the first stage as our exclusion restriction, we follow Bottazzi, Rin, and Hellmann (2008) to use the average general experience of other suppliers nearby to estimate a supplier's investment decision for its client: a supplier's investment decision to win deals with a client can be motivated by what its perceived competition, but the client's selection decision is not directly affected by the general and often unrelated experiences of those suppliers. While a firm's decision to make unilateral investments is endogenous, the local general experiences of drillers is exogenous. In our case, we use the average general experience of other nearby drillers in the same field as the investing supplier driller – any driller's general experience is the total number of past wells regardless of locations and clients. Similar to the exclusion logic of Bottazzi et al. (2008), our reasoning for choosing this instrument is that having on average more generally experienced drillers nearby means the focal driller will have stronger incentives to commit unilateral investments to compete. Yet the general experiences of these other

supplier drillers do not directly affect the client operator's selection criteria of choosing a supplier driller for a given well project and the type of contract on that deal.[7] The instrument we used also seems to be a strong predictor of drillers making unilateral investments – the first-stage F-statistic is over 100.

By looking at the effect of making unilateral investments on the first contract deal between the partners, we also reduce the concern that partnership experience is driving our main results. The investing supplier driller that gains more contracts can acquire more relational experience-based learning that can drive productivity and value creation (Hoang and Rothermael, 2005), which makes that driller more appealing for the client operator to continue working together on subsequent projects. Also, the investing driller gaining more contracts can secure more favorable contractual terms. One reason is that the supplier driller gaining more experience can develop more trust with its client operator, which can reduce exchange uncertainties and improve contractual terms. Considering the effect of making unilateral investments on the likelihood of winning the first contract with a client and type of contract on that first deal will minimize these concerns. Finally, by looking at the first transaction deal in the partnership, we also address other concerns of reverse causality in our main results. For instance, the supplier driller gaining more contracts can be more willing to make unilateral investments.

[7] As with any exclusion restriction, it is always possible to find some hypothetical reason why the outcome may still depend on the proposed instrument. In our case, one could conceive externalities where the experiences of the excluded drillers still matter (especially after the deal is done). However, there is no evidence of industry-held belief that such externalities exist based on our knowledge and interviews with industry insiders – while drillers may feel that general experience matters (and thus motivating making unilateral investments), client operators when awarding deals and terms consider multiple factors beyond general and often unrelated experience.

Using the new sample constructed using CEM and then running the two-stage selection model, our results are consistent with our main results of unilateral investments having both positive and negative outcomes. We find that making unilateral investment has a positive and significant effect on the likelihood for the supplier driller to win the first contract deal with its client ($b= 0.417$, $p<0.05$). Furthermore, making unilateral has a negative effect on securing a favorable contract on that deal ($b= -0.183$, $p<0.05$).

[Insert Table 4 here]

*Alternative outcome variable of favorable contractual terms:*

In addition to measuring bargaining outcomes using contract type, we examine specifically the terms of those contracts. The partner with stronger bargaining power can make the contractual terms more favorable for itself by shifting more risks and liabilities on its partner, and the partner with stronger bargaining power can thereby improve its value appropriation terms (Lafontaine and Shaw, 1999). Here, we examine a random subsample of 317 contracts that were available in their complete form at the Texas Railroad Commission. After filtering out contracts that were not fully legible or completed, we arrived at 221 useable contracts to run our analyses. We examine again the relationship between drillers making unilateral investments on this new outcome measure for contractual terms.

Specifically, we determine five major risks provisions listed in the operator-driller contracts, where the investing driller's relative bargaining power determines whether the client operator or the driller assumes those costs. For every transaction, we take the count of the number of provisions that favor the driller, which gives us an ordinal rank score between 0 and 5 – higher

the value means contractual terms more favorable to the driller.[8] We take an ordinal rank measure by counting the net number of liability provisions in the contract that is assigned to the operator rather than the driller, which favors the driller due to shifting away risk (Ozmel et al., 2017). In our case, this is done by taking the total number of contractual provisions favoring the investing driller minus the total number of provisions favorable for the client operator. We used two other independent coders to make such a determination based on reading company descriptions about their business operations. The inter-rater reliability for coding this variable was 0.96, thereby indicating strong inter-rater agreement.

We use an ordered logit selection model with our dependent variable as contractual risk provisions favoring the driller and the same explanatory variables as our main analysis. The results further support our hypotheses. Table 4 Model 2 shows that the direct effect of the driller's unilateral investment in the relationship on the outcome of contractual liability provisions is negative and significant ($B = -0.937$, $p<0.01$). This result adds further support to hypothesis 3. Furthermore, we examine again the effect of drillers making unilateral investments that also demonstrate productivity improvements to secure more favorable contractual terms. We test the interaction effect on this new outcome measure for contractual terms. Table 4 Model 3 shows that this interaction effect has a positive and significant effect on the driller's contractual liability provisions ($B = 0.362$, $p<0.1$).

[Insert Table 5 about here]

[8] The five major cost provisions negotiated between the client operator and investing driller are the following. 1) Cost for mobilization and demobilization of equipment during the drilling process (labor, materials, and equipment costs). 2) Cost for installation and removal of temporary pipeline, pumping, and supporting equipment to move water, and onsite storage for drilling fluid. 3) Cost to conduct geophysical surveys after 3000 feet of drilling (labor, materials, and equipment costs). 4) Downtime provisions for the driller - whether or not the operator will make "day-rate" payments to the driller for unforced downtime provision. 5) Blowout provisions - the extent that the operator will cover the liability of pollution cleanup costs, damage to driller's equipment, and well control costs such as extinguishing and cementing a hole.

*The possibility that the investing driller having private information about its client operator's preferences:*

A major concern is the possibility that investing drillers may have private information about its client's preferences and have negotiated prior to formally opening up the contract bids. If this is the case, then it could be the effect of "backroom dealings" between the driller and operator that results in favorable contracting, rather than the driller making unilateral investments, which can bias our estimated effect of unilateral investments resulting in favorable contracting. Due to the illegality of such "backroom dealings" in the industry, observing and testing this possibility are difficult.

To alleviate concerns that this might be the case, we compare and perform two analyses. First, we examine the frequency of drillers making initial unilateral investments at different stages of their relationship with operator clients. If drillers acted on private information, we would expect them to make their initial investments in the relationship's later stages rather than in the early stages when the pair becomes more familiar and trusts one another. On the other hand, if drillers also make their initial unilateral investments in the early stage of their partnerships, then the likelihood that the drillers are acting on private information is much less due to their lack of familiarity and trust. We find that drillers make almost as much unilateral investments in the partnership's early stage as in later stages (see in Figure 4).

Furthermore, our main analysis provides evidence showing that unilateral investments are more effective securing favorable contracts in the initial partnership stage. In addition, our above analysis shows unilateral investments to be effective for the investing driller to secure its first project contract with its client. Finally, we tested using logit estimation whether drillers having worked longer with a client operator were more likely to make unilateral investments. If the driller acted on private information with its client operator, then the effect of their time working

together on likelihood of the driller making unilateral investments on that operator's subsequent projects would be significant. However, results from the logit estimation are not significant. This result is available upon request. Therefore, such findings would suggest that drillers acting on private information about their client operators - to the extent that the driller gains more private information about its client by working longer together - are less likely to be driving our observed effects.

## DISCUSSION AND CONCLUSION

Our paper seeks to understand the positive and negative externalities (benefits and costs) for firms making unilateral investments. We find that supplier drillers making unilateral investments for its client operators are associated with winning more client operators' projects (increasing contractual volume). In addition, this benefit for the driller is stronger when investing in the early stages of its partnership due to exchange uncertainty being highest. Thus, we show that the firm making unilateral investments can strategically time their investments.

We also consider unilateral investment's associated costs in terms of the investing supplier becoming more dependent on its operator and consequently suffers weaker bargaining positioning. We find that drillers making more unilateral investments are associated with securing less favorable contractual terms when negotiating with their operator on their subsequent deals together. Finally, we demonstrate that drillers that engage in more productivity improvements can strengthen its bargaining position with its operator, which can result in the drillers securing more favorable contractual terms from their operator partners.

We seek to make several contributions in this paper. First, we aim to better understand the phenomenon of firms making unilateral relationship-specific investments. For the party without sufficient ownership or control rights of the primary invested asset, the paradox has been

why the investing firm would subject itself to greater hold-up risk by its partner (Kang et al, 2009). We build on advances in TCE and reciprocity research to study this phenomenon by moving beyond what investing firms expect and examining the realized outcomes of making unilateral investments – these realized outcomes are the transactional gains and costs for the investing party beyond the focal investment to the partnership's subsequent investments.

We also contribute to contractual bargaining research by demonstrating how a firm initially in a weaker bargaining position with its partner can strengthen its position over time by demonstrating productivity improvements, which suggests a role for learning-related strategies. Early work on bargaining shows contractual outcomes between partners to be static due to the equilibrium condition achieved by negotiating parties, while more recent works have relaxed that assumption to consider how positions can change (Ozmel et al., 2017). Within this dynamic approach to bargaining positioning, the research focus has been on what a firm can do outside its partnership - such as building ties with other firms to increase outside options - to reduce its dependency on its focal client and strengthen its bargaining position (i.e. Lavie, 2007; Ozmel et al., 2017). However, according to recent research on contractual bargaining, there are opportunities within a relationship for the firm to strengthen its bargaining position with its partner (Agryes and Mayer, 2002). One way for firms to strengthen its bargaining position, especially those without many external ties such as new ventures, is engaging in learning to strengthen its capabilities by working with its partner and becoming more valuable in the partnership - this is reflected by demonstrating productivity improvements. As Williamson (1999) urged, a deeper understanding of inter-firm learning and their outcomes such as productivity improvements are needed to understand inter-firm bargaining dynamics.

Thus, we show that, contrary to the dangers of "lock-in", the investing firm can engage in deliberate strategic "lock-in" with its partner. Originally, we asked why drillers are willing to incur such costs and risks, and what incentives motivate them to do so? Our results suggest that developing an oil well requires close collaboration between the driller and operator involving intense knowledge and technology sharing to accomplish a complex task (Kellogg, 2011). This opportunity allows the driller to learn valuable new knowledge and improve productivity. Such strategy of engaging in strategic "holdup" for learning opportunities can be especially valuable for start-ups and new entrants looking to secure prominent partners and expand.

Finally, our paper also contributes to contractual bargaining research by demonstrating the importance of non-contractual solutions in the absence of contracts to addressing the underinvestment problem in partnerships due to exchange uncertainty. Contracts have been the primary solution - whereby property rights can be re-allocated according to each party's contributions to the value creation process. Meanwhile, non-contractual solutions are often assumed to serve as complements to these contractual safeguards (Hoskisson et al., 2017). Our study demonstrates that unilateral investments in the absence of such contractual safeguards – made even by the partner in the disadvantaged bargaining position having fewer ownership rights - can independently provide a non-contractual mechanism to strengthen collaboration by facilitating partner reciprocity.

We see several opportunities for future research. One question to examine is the type of firms that are likely to make unilateral investments. One is studying the importance that making unilateral investments can have on firm survival, especially for new ventures. While established firms can pursue unilateral investments, new ventures can have stronger incentives to commit such investments due to having greater risk appetite when their survival is threatened. When we

examined in our supplementary analysis the type of firms more likely to make unilateral investments, we find that new venture suppliers indeed are more likely to commit such investment gambles than established firms having client bases. Future studies can thus test whether new ventures making unilateral investments can increase their likelihood of survival. Future studies can also examine what kind of partners these new ventures are likely to choose to target their unilateral investments.

Future studies can also examine other types of unilateral investments that can help firm survival and growth. For instance, researchers can build on recent works on a new venture's engagement in "strategic openness" with its partner to generate value creation and strengthen collaboration by first "forfeiting" some control of its internal resources for its partner to use in order to gain later on access to its partner's resources (Alexy et al., 2017). This idea extends Dyer and Singh (1998), who not only define resource value as generated by recombining resources contained within the boundaries of an individual firm, but they also stressed the importance of dedicating one's resources to secure external resources such as those used in combination with other firms through partnerships.

Another important question is who are the receiving firms that unilateral investments are intended to target. In this paper, these target firm that we have observed and used as examples in this paper suggest that they are prominent players in their respective industries (i.e. Chevron, Apple, and Toyota). However surprisingly, this was not the case when we examined our data in more detail. In the oil-gas industry, investing supplier drillers target the majority of their unilateral investments to middle-sized client operators in terms of assets. Meanwhile, the top ten per-

centile client operators in terms of largest assets were ranked second in receiving unilateral investments. The bottom ten percentile client operators in terms of smallest assets received the lowest proportion of unilateral investments. Future research can further examine these issues.

Finally, future research can determine how investing firms choose their targets. One possible approach would be to track the employment history of the investing company's top management team. For instance, it is plausible that a supplier is more likely to choose a client to commit unilateral investments if the investing supplier's CEO has previously worked as an executive in that client firm and maintains strong social ties with that company.

In conclusion, unilateral investments present an exciting phenomenon to study. In addition to the oil-gas industry, it would be worthwhile to explore other industries in which such investments take place. There are opportunities for scholars to re-examine the traditional notions of the investment process within a partnership and contribute to theory building to better explain such phenomenon.

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## Table 1a: Summary Statistics

| | Number of Obs. | Min | Max | Mean | Median | Std. Dev. |
|---|---|---|---|---|---|---|
| For the driller, number of total operator partners | 1,325 | 1 | 31 | 8 | 12 | 16.2 |
| For the driller, number of total wells worked | 1,325 | 1 | 311 | 58 | 47 | 96.8 |
| For the driller, number of total unilateral investments made | 1,325 | 0 | 96 | 52 | 46 | 97.1 |
| For the driller, number of cost-plus dayrate contracts | 1325 | 0 | 293 | 68 | 53 | 79.2 |
| *For the driller-operator partnership, the driller made no unilateral investments* | | | | | | |
| Number of operator's wells worked by driller | 1,325 | 1 | 212 | 42 | 45 | 91.3 |
| Number of cost-plus contracts | 1,325 | 0 | 132 | 33 | 29 | 41.1 |
| *For the driller-operator partnership, the driller made unilateral investments* | | | | | | |
| Number of operator's wells worked by driller | 1,325 | 1 | 311 | 78 | 52 | 81.6 |
| Number of cost-plus contracts | 1,325 | 0 | 293 | 82 | 71 | 60.1 |
| *Driller-operator partnership in early stage (year 1)* | | | | | | |
| Number of wells worked by driller | 1,325 | 1 | 34 | 8 | 11 | 15.3 |
| Number of cost-plus dayrate contracts | 1,325 | 0 | 8 | 1 | 1 | 5.8 |
| Number of unilateral investments made | 1,325 | 0 | 32 | 21 | 25 | 37.2 |
| *Driller-operator partnership in later stage (after year 1)* | | | | | | |
| Number of wells worked by driller | 1,325 | 1 | 277 | 51 | 42 | 85.3 |
| Number of cost-plus dayrate contracts | 1,325 | 0 | 285 | 53 | 49 | 64.3 |
| Number of unilateral investments made | 1,325 | 0 | 64 | 46 | 57 | 92.3 |

**Table 1b: Summary Statistics of Major Driller-Operator Partnerships for Projects in Texas and Gulf of Mexico (2005-2015)**

| | Drillers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Operator company | Nabors | Helmerich and Payne | Patterson-UTI | Pioneer | Unit Drilling | Union Drilling | Bronco Drilling | Other Drillers | Total for Operator |
| Chevron | 66(29) 11 | 34(18) 2 | 72(21) 7 | 81(32) 12 | 73(28) 3 | 59(25) 5 | 42(19) 4 | 128(51) 40 | 512(184) 84 |
| Vastar Res | 40(17) 9 | 16(6) 0 | 31(12) 2 | 22(8) 0 | 44(21) 3 | 33(16) 2 | 31(12) 0 | 42(15) 8 | 231(105) 24 |
| Newfield Exploration | 36(14) 8 | 24(8) 0 | 19(10) 1 | 31(16) 3 | 34(12) 0 | 39(12) 0 | 29(16) 0 | 51(19) 9 | 128(56) 21 |
| Apache Corp. | 6(1) 0 | 17(5) 0 | 41(20) 2 | 39(12) 1 | 29(11) 0 | 16(3) 0 | 24(5) 1 | 53(22) 12 | 205(97) 16 |
| Basin Exploration | 30(16) 8 | 10(2) 0 | 27(12) 0 | 28(8) 0 | 30(16) 1 | 32(11) 0 | 21(9) 0 | 38(17) 8 | 157(59) 17 |
| Exxon Mobil | 10(2) 0 | 103(39) 6 | 53(22) 3 | 63(24) 2 | 119(44) 9 | 38(5) 1 | 113(49) 11 | 144(67) 52 | 526(209) 84 |
| Burlington Res | 2(0) 0 | 16(4) 0 | 21(8) 0 | 32(16) 3 | 15(2) 0 | 16(2) 0 | 17(9) 0 | 34(15) 7 | 125(48) 10 |
| BP | 10(2) 0 | 44(19) 1 | 39(18) 2 | 46(23) 1 | 18(3) 1 | 68(27) 0 | 12(3) 1 | 106(39) 31 | 359(126) 36 |
| Union Pacific Res | 4(0) 0 | 24(8) 0 | 17(6) 0 | 12(1) 0 | 20(9) 0 | 14(1) 0 | 13(2) 0 | 29(12) 6 | 119(36) 6 |
| Anadarko | 10(2) 0 | 22(4) 0 | 39(15) 1 | 23(11) 0 | 10(2) 0 | 31(12) 0 | 29(12) 2 | 68(25) 12 | 235(91) 15 |
| Shell | 3(0) 0 | 22(5) 0 | 63(25) 2 | 43(19) 2 | 53(26) 4 | 33(16) 0 | 44(18) 3 | 127(42) 26 | 241(138) 37 |
| Other Operators | 241(103) 59 | 324(162) 71 | 198(87) 22 | 223(106) 36 | 256(103) 29 | 364(152) 31 | 232(123) 44 | 131(38) 32 | 1938(865) 309 |
| Total for Driller | 517(192) 87 | 322(131) 80 | 367(156) 42 | 411(204) 60 | 426(192) 49 | 522(214) 39 | 427(192) 66 | 786(217) 243 | 3874(1129) 659 |

Each entry in this table represents the number of projects undertaken by the driller in that column for the operator company in that row. The figure in parentheses gives the total number of these well projects carried out under cost-plus "dayrate" contracts. The figure to the right in italics is the total number of "unilateral" investments made by that driller for that operator in terms of preemptively moving its rig to a new well. For clarity of presentation in this table, firm-level data are displayed here only for the largest driller-operator pairs. The other drillers have been aggregated under "Other drillers", and the other operators have been aggregated under "Other operators".

**Table 1c: Description of Key Variables**

| Variables | Description |
|---|---|
| Contractual Volume | The number of project contracts awarded to the driller by its partner operator. |
| Contractual Terms | Ratio of cost-plus "dayrate" contracts over total number of projects contracts for a given operator-driller pair in a year. |
| Driller's unilateral investment | The number of wells for a given operator-driller pair in a year where the driller preemptively moved its rig before the well's contract bidding date. |
| Driller's initial partnership stage | Dummy variable =1 if driller makes unilateral investment for its client operator during the first year of their relationship, and 0 if the investment is made during subsequent years of their relationship. |
| Driller's productivity improvement | The percentage change in additional wells that the driller is awarded by the operator in a given year compared to the previous year. |

## Table 1d: Correlation Statistics

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Contractual volume | 32.2 | 11.5 | 1.00 | | | | | | | | | | | | | | | | |
| 2. Contractual terms | 5.41 | 1.25 | 0.21 | 1.00 | | | | | | | | | | | | | | | |
| 3. Driller's unilateral investments | 6.12 | 2.08 | 0.17 | -0.20 | 1.00 | | | | | | | | | | | | | | |
| 4. Initial partnership stage | 2.4 | 1.10 | -0.12 | -0.18 | 0.02 | 1.00 | | | | | | | | | | | | | |
| 5. Driller's productivity improvement | 5.68 | 4.36 | 0.19 | 0.23 | 0.18 | 0.25 | 1.00 | | | | | | | | | | | | |
| 6. Operator prior outside drillers | 0.06 | 0.26 | 0.09 | 0.15 | 0.22 | 0.02 | 0.21 | 1.00 | | | | | | | | | | | |
| 7. Operator size | 21.07 | 12.29 | 0.13 | -0.16 | 0.11 | -0.03 | -0.04 | 0.16 | 1.00 | | | | | | | | | | |
| 8. Driller prior outside operators | 0.01 | 0.32 | 0.10 | 0.13 | 0.18 | 0.16 | 0.03 | 0.24 | 0.23 | 1.00 | | | | | | | | | |
| 9. Driller size | 15.56 | 9.32 | 0.15 | 0.27 | -0.24 | 0.03 | 0.08 | 0.31 | 0.01 | 0.03 | 1.00 | | | | | | | | |
| 10. Driller field knowledge | 10.16 | 5.37 | 0.16 | 0.15 | 0.21 | -0.01 | 0.21 | -0.02 | 0.01 | 0.02 | 0.02 | 1.00 | | | | | | | |
| 11. Driller proposed well cost | 6.23 | 2.15 | -0.16 | -0.26 | 0.19 | 0.02 | 0.05 | 0.09 | 0.0.1 | 0.16 | -0.22 | 0.33 | 1.00 | | | | | | |
| 12. Driller safety record | 12.60 | 10.5 | -0.19 | -0.16 | -0.09 | 0.01 | 0.03 | 0.04 | 0.06 | -0.11 | -0.15 | -0.22 | 0.02 | 1.00 | | | | | |
| 13. Recent projects | 0.41 | 0.16 | 0.15 | 0.15 | 0.08 | 0.21 | 0.06 | 0.23 | 0.03 | -0.02 | 0.11 | 0.22 | 0.19 | 0.11 | 1.00 | | | | |
| 14. Well type | 0.68 | 0.47 | 0.11 | -0.06 | 0.10 | -0.16 | 0.11 | -0.09 | -0.13 | 0.17 | 0.15 | 0.00 | 0.15 | -0.01 | 0.01 | 1.00 | | | |
| 15. Well depth | 1.05 | 0.27 | 0.09 | 0.09 | -0.09 | 0.11 | -0.01 | 0.12 | 0.16 | -0.21 | -0.10 | 0.02 | -0.12 | -0.03 | -0.02 | 0.15 | 1.00 | | |
| 16. Competitive density | 8.81 | 4.22 | 0.18 | -0.16 | 0.18 | 0.11 | 0.15 | 0.03 | 0.01 | -0.02 | 0.01 | 0.12 | -0.19 | -0.08 | 0.03 | 0.01 | 0.01 | 1.00 | |
| 17. Industry oil price | 26.26 | 34.45 | 0.19 | 0.08 | -0.22 | 0.23 | -0.05 | -0.03 | 0.15 | 0.13 | 0.09 | 0.01 | 0.18 | 0.07 | 0.17 | -0.16 | 0.02 | 0.21 | 1.00 |

n = 1,325. Correlations greater than 0.20 are significant at 0.05, and those greater than 0.17 are significant at 0.10.

## Table 2: Negative Binomial Regression Results with Fixed and Random Effects (Hypothesis 1 and 2 Results)

| Dependent Variable: Contractual Volume | (Model 1) Controls | (Model 2) Hypothesis 1 | (Model 3) Hypothesis 2 | (Model 4) CEM Sample |
|---|---|---|---|---|
| *Controls:* | | | | |
| Constant | 4.331 | 4.329 | 4.325 | 3.298 |
| | (2.962) | (2.962) | (2.881) | (2.356) |
| Operator prior outside drillers | 3.612 | 3.642 | 3.122 | 3.106 |
| | (6.026) | (7.128) | (6.523) | (5.263) |
| Operator size | 7.076** | 7.065** | 7.016* | 8.252 |
| | (3.251) | (3.462) | (3.778) | (5.328) |
| Driller prior outside operators | 0.321 | 0.318 | 0.231 | 0.527 |
| | (0.671) | (0.673) | (0.321) | (0.298) |
| Driller size | 0.368 | 0.368 | 0.316 | 0.463 |
| | (0.223) | (0.213) | (0.228) | (0.312) |
| Driller field knowledge | 1.667** | 1.632** | 1.612** | 2.506** |
| | (0.821) | (0.818) | (0.801) | (1.417) |
| Driller proposed well cost | -1.286* | -1.153* | -1.051* | -1.336* |
| | (0.745) | (0.662) | (0.581) | (0.757) |
| Driller safety record | -2.395* | -2.157* | -2.155* | -2.160* |
| | (1.328) | (1.139) | (1.138) | (1.140) |
| Recent projects | 3.252** | 3.243** | 3.168** | 2.977* |
| | (1.601) | (1.622) | (1.608) | (1.667) |
| Well type | 5.251 | 5.254 | 5.232 | 7.651 |
| | (6.018) | (6.019) | (6.010) | (5.967) |
| Well depth | 2.426 | 2.424 | 2.193 | 1.059 |
| | (1.867) | (1.863) | (1.201) | (1.568) |
| Competitive density | -1.352* | -1.331* | -1.330* | -1.328* |
| | (0.747) | (0.721) | (0.720) | (0.719) |
| Industry oil price | 3.487* | 3.481* | 3.246* | 2.354 |
| | (1.937) | (1.865) | (1.721) | (1.758) |
| *Predictors:* | | | | |
| Driller's unilateral investments | | 1.178*** | 1.019*** | 0.625** |
| | | (0.455) | (0.368) | (0.312) |
| *Initial partnership stage* | | | 0.214 | 0.361 |
| | | | (0.302) | (0.293) |
| *Moderating effect:* | | | | |
| Driller's unilateral investment X Initial partnership stage | | | 0.831** | 0.529* |
| | | | (0.403) | (0.301) |
| Driller's unilateral investment X Driller productivity improvement | | | | |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Driller Random Effects | Yes | Yes | Yes | No |
| Operator Random Effects | Yes | Yes | Yes | No |
| Dyad Random Effects | Yes | Yes | Yes | No |
| Case-Control-Group Effects | No | No | No | Yes |
| Observations | 1,325 | 1,325 | 1,325 | 437 |
| R-squared | 0.225 | 0.361 | 0.382 | 0.116 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

## Table 3: GLM with Logit Link Results with Fixed and Random Effects (Hypothesis 3 and 4 Results)

| Dependent Variable: Contractual Terms | (Model 1) Controls | (Model 2) Hypothesis 3 | (Model 3) Hypothesis 4 | (Model 4) CEM Sample |
|---|---|---|---|---|
| *Controls:* | | | | |
| Constant | 0.236 | 0.235 | 0.216 | 0.325 |
| | (0.151) | (0.153) | (0.132) | (0.241) |
| Operator prior outside drillers | 0.322** | 0.319** | 0.312** | 0.196* |
| | (0.150) | (0.149) | (0.145) | (0.107) |
| Operator size | -0.681** | -0.680** | -0.619** | -0.728* |
| | (0.316) | (0.312) | (0.311) | (0.392) |
| Driller prior outside operators | 0.258** | 0.253** | 0.235** | 0.128** |
| | (0.125) | (0.119) | (0.116) | (0.062) |
| Driller size | 0.316 | 0.315 | 0.312 | 0.571 |
| | (0.185) | (0.182) | (0.178) | (0.354) |
| Driller field knowledge | 0.656*** | 0.651** | 0.647** | 0.421*** |
| | (0.247) | (0.309) | (0.301) | (0.159) |
| Driller proposed well cost | -0.221 | -0.219 | -0.216 | 0.423 |
| | (0.210) | (0.208) | (0.207) | (0.351) |
| Driller safety record | -0.773* | -0.698* | -0.697* | -0.695* |
| | (0.421) | (0.382) | (0.380) | (0.377) |
| Recent projects | 0.353** | 0.306** | 0.301** | 0.237* |
| | (0.171) | (0.152) | (0.147) | (0.135) |
| Well type | 0.516 | 0.515 | 0.581 | 0.611 |
| | (0.439) | (0.438) | (0.460) | (0.572) |
| Well depth | 0.214 | 0.211 | 0.191 | 0.387 |
| | (0.165) | (0.163) | (0.121) | (0.221) |
| Competitive density | -0.338* | -0.335* | -0.333* | -0.330* |
| | (0.186) | (0.179) | (0.178) | (0.175) |
| Industry oil price | 0.325** | 0.322* | 0.295* | 0.325 |
| | (0.152) | (0.198) | (0.166) | (0.249) |
| *Predictors:* | | | | |
| Driller's unilateral investments | | -0.122*** | -0.115*** | -0.137** |
| | | (0.046) | (0.042) | (0.061) |
| *Driller's productivity improvement* | | | 0.238* | 0.217* |
| | | | (0.143) | (0.124) |
| *Moderating effect:* | | | | |
| Driller's unilateral investment X Driller productivity improvement | | | 0.113** | 0.098** |
| | | | (0.054) | (0.043) |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Driller Random Effects | Yes | Yes | Yes | No |
| Operator Random Effects | Yes | Yes | Yes | No |
| Dyad Random Effects | Yes | Yes | Yes | No |
| Case-Control-Group Effects | No | No | No | Yes |
| Observations | 1,325 | 1,325 | 1,325 | 437 |
| R-squared | 0.227 | 0.359 | 0.389 | 0.126 |

## Table 4: The effect of making unilateral investment on the driller's likelihood of winning its first contract and favorable contract type with client operator

Logit function parameter estimates with coefficients measured as log odds. Sample constructed using 1:1 CEM matched sample consisting of drillers that made first unilateral investment for their clients prior to starting their first project. The first dependent variable of the likelihood of winning first project contract with client is coded as: winning first contract = 1, not winning first contract = 0. The second dependent variable of the likelihood of securing favorable contract type is coded as: first contract type is 'dayrate' = 1, non-'dayrate' = 0. The Heckman two-stage estimation is used where the first stage (not shown) is the likelihood of making unilateral investments and the instrument used is the average general experience of rivals; and the second-stage is the effect of the adjusted measure of unilateral investments on the main outcome variables. Standard coefficients are reported. Standard errors are in parentheses. We use ***, **, * to denote significance at the 1%, 5%, and 10% levels, respectively.

| Logit estimation with fixed effects on driller and operator | | |
|---|---|---|
| | Model 1<br>Winning first contract with client | Model 2<br>Securing favorable type on first contract with client |
| *Controls:* | | |
| Constant | 0.131 | 0.019 |
| | (0.148) | (0.028) |
| Driller's size | 0.275* | 0.032* |
| | (0.148) | (0.016) |
| Driller prior outside operators | 0.017 | 0.015 |
| | (0.015) | (0.011) |
| Driller age | 0.867 | 1.795 |
| | (0.980) | (1.392) |
| Driller field knowledge | 0.502** | 0.186** |
| | (0.221) | (0.085) |
| Driller proposed well cost | 0.022 | 0.003 |
| | (0.035) | (0.012) |
| Driller's recent projects in same field | 0.148* | 0.032* |
| | (0.086) | (0.015) |
| *Predictor:* | | |
| Adjust driller's unilateral investment | 0.417** | -0.183** |
| | (0.205) | (0.092) |
| Driller Fixed Effects | Yes | Yes |
| Operator Fixed Effects | Yes | Yes |
| *Adjusted R-squared* | 0.352 | 0.126 |
| *N* | 2,650 | 2,650 |

## Table 5: Supplementary Analysis - Ordinal Logit Regression Results (for Hypothesis 3 and 4)

| Dependent Variable: Contractual liability provisions | (Model 1) Controls | (Model 2) Hypothesis 3 | (Model 3) Hypothesis 4 |
|---|---|---|---|
| *Controls:* | | | |
| Constant | 1.197 | 1.224 | 1.358 |
| | (1.815) | (1.149) | (1.426) |
| Initial partnership stage | 0.315 | 0.259* | 0.212 |
| | (0.512) | (0.151) | (0.201) |
| Operator prior outside drillers | 3.57 | 0.945** | 0.956** |
| | (2.002) | (0.402) | (0.414) |
| Operator size | -1.224** | -1.217** | -1.211** |
| | (0.606) | (0.596) | (0.592) |
| Driller prior outside operators | -0.319 | 0.263** | 0.214 |
| | (0.519) | (0.112) | (0.319) |
| Driller field knowledge | 0.903** | 0.871** | 0.862** |
| | (0.445) | (0.412) | (0.415) |
| Driller size | -0.357 | -0.512 | 0.516 |
| | (0.219) | (0.345) | (0.327) |
| Driller proposed well cost | 1.292 | 1.225 | 1.248 |
| | (1.051) | (0.911) | (0.815) |
| Recent projects | 0.763** | 0.729** | 0.732** |
| | (0.397) | (0.378) | (0.383) |
| Well type | 1.125 | 1.112 | 1.114 |
| | (1.016) | (1.401) | (1.578) |
| Well depth | 1.124 | 1.119 | 1.186 |
| | (1.015) | (1.158) | (1.125) |
| Industry drilling price | 2.346* | 2.336* | 2.325* |
| | (1.237) | (1.199) | (1.215) |
| *Predictors:* | | | |
| Driller's unilateral investments | | -0.937*** | -0.616** |
| | | (0.305) | (0.311) |
| Driller's productivity improvement | | | 0.145* |
| | | | (0.078) |
| Driller's unilateral investment X Driller's productivity improvement | | | 0.362* |
| | | | (0.192) |
| Year Fixed Effects | Yes | Yes | Yes |
| Driller Random Effects | Yes | Yes | Yes |
| Operator Random Effects | Yes | Yes | Yes |
| Dyad Random Effects | Yes | Yes | Yes |
| Observations | 221 | 221 | 221 |
| R-squared | 0.367 | 0.381 | 0.397 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

**FIGURE 1: Conceptual Model of Unilateral Partner Investment**

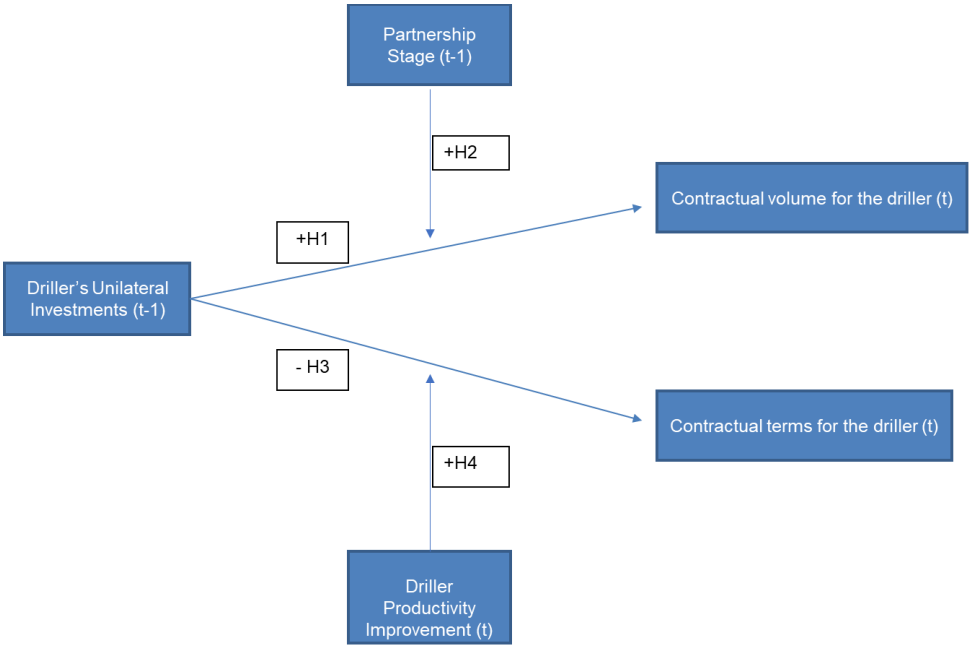



**FIGURE 2: Drillers making unilateral investments on contractual volume and investment timing interaction**

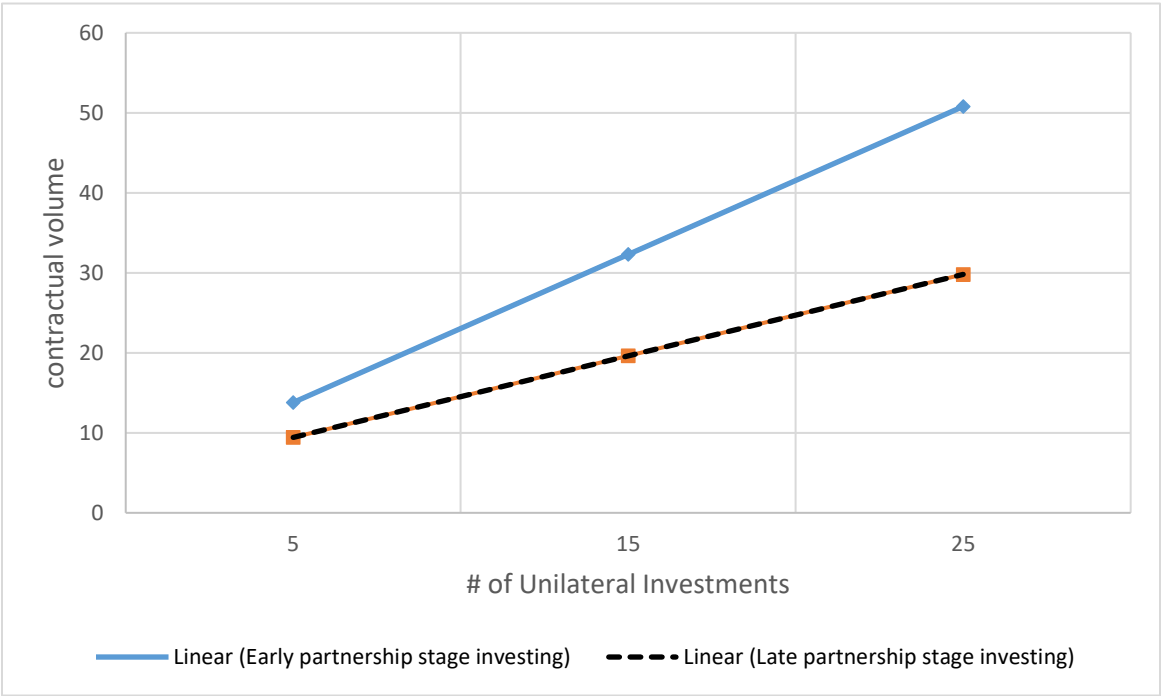


**FIGURE 3: Drillers making unilateral investments on contractual terms and productivity learning interaction**

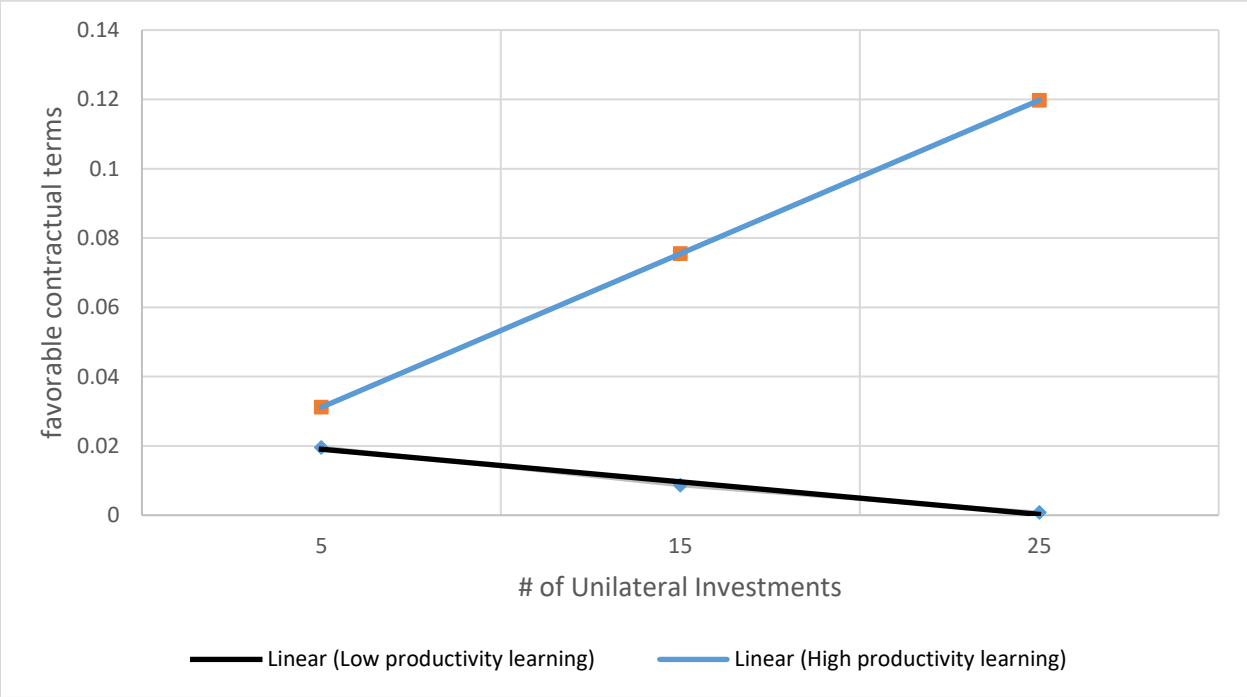
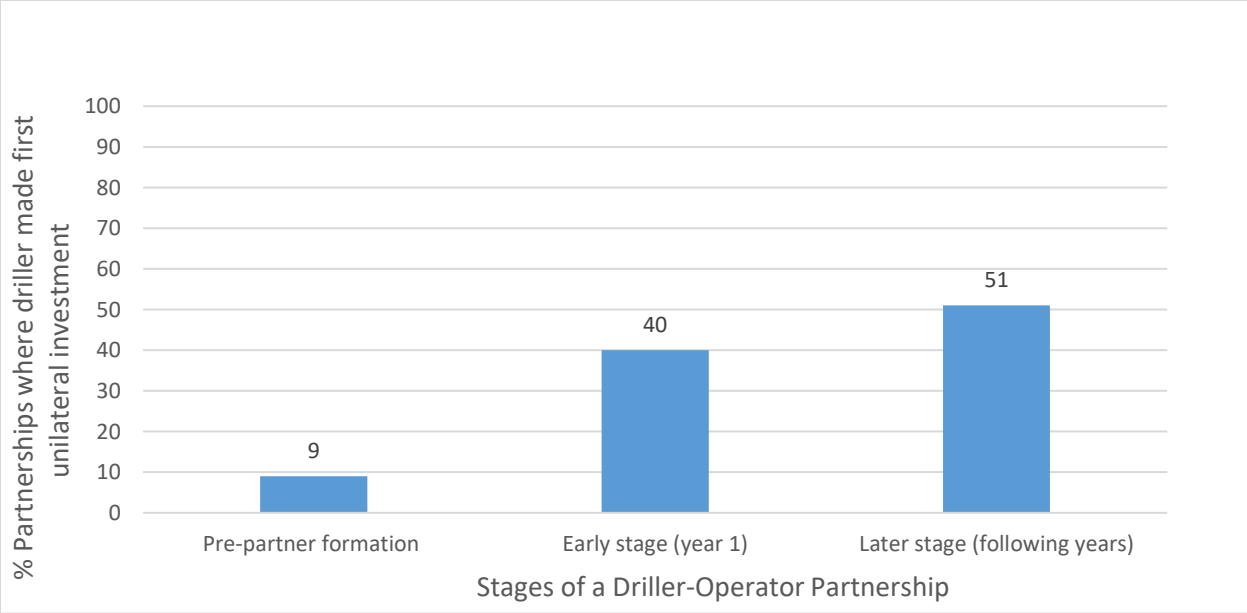



**FIGURE 4: Initial Unilateral Investment Timing in Pre-formation, Early or Later Partnership Stage**



# ESSAY II

## Escaping Bear Hugs: A New Venture's Network Building and the Effects on Its Bargaining Power

Research summary: A new supplier having a more prominent client, while critical for its survival and growth, also results in weaker bargaining power to appropriate value through that client. Prior literature has focused primarily on the weaker supplier growing the number of network clients to strengthen its bargaining power, without distinguishing the types of clients needed. This paper proposes two network-based solutions for the weaker supplier that draw on resource dependence theory (RDT) and the resource-based view (RBV): 1) building a 'competing' network of multilaterally rival clients to reduce dependency on its focal client, or 2) developing a 'learning' network of diverse clients to enhance its value to its focal client, respectively. This paper also explores the challenges for the supplier in accessing each network type to draw dyadic-level bargaining power. A supplier accessing a 'competing' network - based on dependence reduction using similar resources - results in more immediate short- run bargaining advantage, but not in the long run due to limited diverse learning. Meanwhile, a supplier accessing a 'learning' network - based on enhancing value by acquiring more heterogeneous knowledge resources – this results in more sustainable long-run bargaining advantage, but it can sacrifice more immediate short-run gains due to initial integration adjustments needed for diverse learning. This paper thus reflects the inherent tradeoffs in pursuing either an RDT or RBV-based bargaining solution. We test and find support for these predictions using supplier driller – client operator partnerships in the oil-gas industry as our empirical context.

## INTRODUCTION

A firm having a more prominent partner, one that is centrally connected in its network, can derive greater value creation and legitimacy benefits (Baum, Calabrese, and Silverman, 2000; Stuart, 2000); but it also incurs greater value appropriation costs imposed by the more prominent partner due to asymmetric dependency (Diestre and Rajagopalan, 2012; Katila, Rosenberger, and Eisenhardt, 2008). Such a tradeoff is especially noticeable for a new venture working with a more prominent partner, which is reflected by the former accepting onerous contractual terms imposed by the latter (Ozmel, Yavus, Reuer, and Zenger, 2017).

Resolving this tradeoff requires a new venture to strengthen its bargaining power when negotiating with its more prominent partner. Relevant research has drawn on the bargaining power perspective[9], which has emphasized building external partnerships for resource access to reduce dependency (Adegbesan and Higgins, 2010; Hamel, 1996; Ozmel et al., 2017). Many proposed solutions have been network-based, and they emphasize the importance of growing the number of network partners to improve its dyadic-level bargaining power (i.e. Lavie, 2007; Wassman, 2010). Relatedly, other proposals require the firm to reposition itself more prominently in its industry network, which similarly means establishing new ties (i.e. Ozmel et al., 2017). Yet these proposals leave ambiguous the types of partners needed. Having the wrong network partner type can further weaken the new venture bargaining power with its partner (Vandaie and Zaheer, 2014).

This paper examines in more detail the types of network partners needed for a new venture to strengthen its dyadic-bargaining power. A closer examination of the bargaining power

[9] The bargaining power perspective used in the management field draws from various foundational theories. These include resource dependence theory, social exchange theory, the resource-based view, contract theory, and game theory. In this paper, we draw primarily on two of these theories: resource dependence theory and the resourced-based view (with an emphasis on the learning aspect of this view).

perspective's foundational theories – particularly resource dependence theory (RDT) and the resource-based view (RBV) – reveals different sources of bargaining power. While both RDT and RBV-based solutions argue for external resource access via additional partnerships, each differs in the types of resources, and hence the types of partners, needed for bargaining power purposes. As we will explain, RDT focuses on how the weaker party can reduce resource dependency on its focal partner by finding alternative providers of those similar resources (Pfeffer and Salancik, 1978). Alternatively, RBV is concerned primarily on how the weaker party can become more valuable and less replaceable to its focal partner by accessing diverse heterogeneous resources to achieve superior complementarities with that partner (Coff, 1999; Lippman and Rumelt, 1992). Given these sources of bargaining power, we consider the type of network partners that can affect learning and the nature of the contractual relationship.

Our first proposal is for the new supplier to build a network of clients that are multilateral competitors. These are clients that operate in the same geographic and product domain as the supplier's focal client – as a result, they engage in significant multilateral competition with each other. These competing clients – by sharing highly related experiences and functional expertise – offer the supplier similar resources, which allows the supplier greater substitution for resource access between clients. Thus, having a multilateral competitive network is believed to enable the supplier to achieve advantageous brokerage positioning that allows it more to easily switch between clients (Burt, 2012; Lavie, 2007). Such gains in bargaining power - achieved through such dependency reduction - are more aligned with RDT reasoning.

One example is a new supplier initially working for Toyota then transitioning to working with Toyota's direct auto competitors in Japan. This supplier can apply similar processes, equipment, and workers training without much re-tooling across its clients that have similar demands

(Dyer and Nobeoka, 2000). Having such a 'competing' network enables the new supplier to strengthen its dyadic-level bargaining power by creating more alternative client options that reduces its dependency on its prominent client.

Our second proposal for the new supplier to strengthen its dyadic-level bargaining power is to build a 'learning' network of diverse clients that operate in different geographic and product domains. These diverse clients have more distinct functional expertise, and are able to offer the supplier more heterogeneous resources, especially knowledge-based resources (Powell, Koput, and Smith-Doerr, 1996). As diverse knowledge is embedded in these network partnerships, the role of learning becomes critical to access such knowledge and use them to develop new capabilities (Coff, 1999). Even though a supplier may also learn in a 'competing' network described above, such learning is likely to be more incremental due to its partners having significant knowledge and experience overlap. The supplier working with more diverse unrelated clients can acquire broader capabilities to engage in more value-creating and complementary activities with its focal client – this enables what RBV scholars would characterize as the supplier becoming more valuable and less replaceable by its client (Lippman and Rumelt, 1992).

As an example, some materials suppliers to Boeing chose to collaborate with smaller manufacturers of single-seat airplane bodies around the world. These suppliers expanded their network of clients to work with diverse clients ranging from large manufactures of commercial aircrafts to manufactures of smaller private jets. Compared to other suppliers that only worked with Boeing and a few other commercial manufacturers like Airbus, these suppliers having diverse client experiences accessed the latest technologies like lighter metals and eventually mastered producing them, which became highly coveted by Boeing when designing its own airplanes (Mishina, 1999).

Building each network type also entails associated challenges, which we argue can impact how quickly the supplier can access, or use, each network to drive bargaining power. The supplier building a 'competing' network involving highly related clients strengthens its bargaining power by seeking resource homogeneity that enables greater substitution among clients and hence less dependency on each client. The tradeoff here can be limiting access to heterogeneous resources from such a network of partners that constrains diverse learning. As a result, we argue that such a network's effect on the supplier's bargaining power can strengthen in the short run due to the 'dependency-reducing' effect, but such network may constrain the 'value-enhancing' effect from capability building that can drive bargaining power gains more sustainable in the long run.

Meanwhile, the supplier building a 'learning' network can encounter the opposite tradeoff in accessing its network for bargaining power purposes. Working with diverse unrelated clients – those having different product experiences and functional expertise – requires initially greater integration efforts and adjustments. While there are benefits to having a network offering heterogeneous resources, using such a network to derive bargaining power may take the supplier some time. Such initial challenges would be more minimal had these suppliers sought access to a network of more related partners offering access to more homogenous resources. As a result, we argue that the supplier accessing a 'learning' network to drive bargain power may be limited in the short run, but can serve as a sustainable source in the long run.

This paper seeks to contribute to the bargaining power perspective by unpacking its underlying theoretical foundation to determine the types of networks conducive for bargaining power purposes. In particular, we study and compare two of this perspective's foundational theo-

ries, resource dependence theory and the resource-based view. We explore their differing mechanisms on how a weaker party can strengthen its bargaining power with its stronger transacting partner. As our first contribution, we propose how certain types of networks partners can drive bargaining power gains in accordance with these mechanisms. We compare the theoretical origins of the two types of networks and find that they both reduce dependence, but do so in different ways; one based on related nature of clients with which it works and the other based on the diverse nature among the clients in its client network. As our second contribution, we also examine the challenges associated with building these network types and how their outcomes differ. These challenges affect how quickly and sustainability each network can be used for driving bargaining power. In particular, one network is short-term oriented through interrelated learning and is based on RDT, while the other trades off less short-term reduction in dependence for more long-term reduction through learning and is based on the tents of RBV. We test our hypotheses through a data set of drillers who are contracting with more prominent operators in the oil and gas industry.

## THEORETICAL BACKGROUND AND EMPIRCAL CONTEXT

Bargaining power dynamics have been studied by various theories that have collectively been characterized in the management field as the bargaining power perspective (Adegbesan and Higgins, 2010; Hamel, 1996; Ozmel et al., 2017; Yan and Gray, 1994). Among the primary foundational theories that this perspective draws upon are resource dependence theory and the resource-based view. Resource dependence theory (RDT) would explain a firm's weaker bargaining power with its more prominent partner as a result of the latter's control of critical re-

sources needed by the former (Pfeffer and Salancik, 1978). The weaker party should act to reduce dependency on its partner by seeking alternative providers of similar resources that can substitute for what its focal partner can offer (Casciaro and Piskorski, 2005).

The resource-based view (RBV) examines a firm's bargaining power with its partner as a function of how replaceable that firm is to its partner in the relationship. According to RBV, the weaker firm can strengthen its bargaining power by developing more inimitable capabilities to achieve greater complementarities with that partner, which others cannot easily replicate (Lippman and Rumelt, 2003). Like RDT, RBV also seeks to alter asymmetric dependency; but its focus is more on how a weaker party can make its partner more dependent on it. Specifically, acquiring knowledge-based resources – with a greater emphasis on organizational learning – can be a significant source of such capability building (and hence bargaining power) because the expertise that the focal party can provide to its partner will be more difficult to imitate by others (Coff, 1999).

In both theories, resources are key for strengthening bargaining power and a firm's network of partnerships is critical for accessing needed resources. According to RDT, the weaker party finding outside partnerships can gain more "power" over its transacting partner by finding alternative providers of critically needed resources that the focal partner offers (Pfeffer and Salancik, 1978).[10] Similarly according to RBV, a party's outside partners are critical for accessing the latest knowledge and innovations to build inimitable capabilities (Coff, 1999).

These theories however differ in the type of resources needed for bargaining power purposes and ultimately the type of network partners that can provide them. According to RDT, a weaker party should find alternative providers offering similar resources that are close substitutes

[10] RDT also draws insights from social exchange theory, which argues that "power" is derived more from the property of a party's network of relationships, rather than the attributes of that party (Emerson, 1962).

to those provided by the focal partner; otherwise the weaker party will remain dependent on its focal partner (Casciaro and Piskorski, 2005). According to RBV, a weaker party should seek to access more heterogeneous resources - especially diverse knowledge-based resources - to develop unique capabilities and achieve superior complementarities with its partner, compared to others (Adegbesan and Higgins, 2010; Lippman and Rumelt, 2003). Given the importance of knowledge-based resources, RBV also incorporates insights on organizational learning to explain how the firm can acquire those resources (Coff, 1999). For our paper, unlike RDT's emphasis on network partner relatedness to achieve resource substitutability for dependency reduction, RBV stresses more partner unrelatedness to access more heterogenous resources for broader capability building and value creation.

Yet despite these critical differences in RDT and RBV, management research drawing on the bargaining power perspective has so far been ambiguous on the types of network partnerships needed. So far, most studies on a firm's network effect on its bargain power have demonstrated the benefits for the firm to grow the absolute number of its network ties. For instance, pharmaceutical firms with more extensive alliance portfolios have more bargaining power relative to their partners because they are less reliant on any one firm (McGrath and Nerkar, 2004). Other studies have discussed bargaining power gains for the firm by increasing the number of its direct and indirect ties. The firm that becomes more centrally positioned in its industry network – also characterized as having more network prominence – can improve its bargaining position (Gulati, 1998; Kogut, Shan and Walker, 1992; Stuart, 1998; 2000; Podolny, 2001; Hsu, 2006). Recently, Ozmel et al. (2017) demonstrated that a venture adding more ties to become more prominent in its industry network can strengthen its bargaining position with that partner by signaling higher quality resources and good future prospects.

The importance of a firm's type of network partnerships is underscored by research suggesting that choosing the wrong network partners can be detrimental to the venture's performance. For instance, Vandaie and Zaheer (2014) showed that a smaller firm being resource constrained can actually hurt its long-term growth prospects by forming alliances with larger well-endowed partners - such alliances can foster dependency and complacency by diverting the smaller firm's attention away from competing for resources in the competitive factor markets. Research has also examined the weaker firm adding other prominent partners to gain more leverage relative to its focal partner (Hsu, 2004; Nicholson et al., 2005). However, for a new venture, such strategy may create more challenges by merely inviting more "sharks" to compete for value appropriation (Diestre and Rajagopalan, 2012). Consequently, resolving the original appropriation dilemma for the new venture risks making such a dilemma worse.

To address the above issues, this paper draws on arguments from RDT and RBV to identify the types of network partners needed to help a new venture overcome its contractual asymmetry with its more prominent partner. Our empirical context is studying new suppliers in the oil-gas industry, where the different network-building strategies are prevalent. In this industry, the supplier (driller) works closely with its client (operator) in helping its client drill its oil wells (Corts and Singh, 2004). Competition and expertise in this industry are highly location based because every oil field has distinct geological characteristics (Kellogg, 2011). Operators producing from the same oil fields are considered more direct competitors due to the similarity of their product offerings, which is the same type and quality of oil produced from those fields. For a new driller, working with more a prominent operator is critical for survival and growth; yet the tradeoff for the new driller is often accepting unfavorable contractual terms to drill the operator's

oil wells. Expanding one's client network is critical for the new driller to strengthen its bargaining power with its focal client operator. But the question for the new driller is what types of client operators are likely to create an effective result.

The tale of two new drillers demonstrates different paths for building client networks for bargaining power purposes. Both Crown Exploration and SPN Well Services of Texas when first entering the industry secured Anadarko, a prominent operator, as one of their first clients. While this initially was a boon for both new drillers struggling to survive, they sacrificed by accepting unfavorable contracts to drill Anadarko's wells. Both drillers knew that they needed to expand their client base to reduce its dependency on Anadarko, and hence improve their bargaining position. But each driller chose different strategies in expanding its client network. Crown Exploration chose to stay focused by targeting only nearby operators that competed in the same oil fields as Anadarko, emphasizing the Texas and Oklahoma Panhandles. Meanwhile, SPN Well Services chose a different network building strategy: it purposely pursued geographically distant operators throughout the southwest region that required distinctly different sets of expertise due to different geological conditions. While both drillers eventually survived and grew, their rationale for pursuing these network building strategies and their effectiveness in dealing with its clients like Anadarko are not well understood.

## HYPOTHESES

We start by offering a baseline hypothesis that a new venture is in a poor bargaining position relative to a prominent client. As we noted, a new venture seeking to strengthen its bargaining power with its focal partner can draw on several sources of power. One source is for the disadvantaged party to create alternative outside options to access similar resources as those provided by its focal partner – compared to only working with its focal partner, the weaker party

having alternative close substitutes providing similar resources can reduce its dependency on that partner (Casciaro and Piskorski, 2005; Pfeffer and Salancik, 1978). Our first non-baseline hypothesis focuses on a new supplier building a 'competing' network - composed of multilaterally competing clients operating in the same geographic and product domain – to strengthen bargaining power by increasing its immediate alternative options, which reduces its dependence on its focal client. As noted, the theoretical base derives from resource dependence theory.

[Insert Figure 1 here]

Our second non-baseline hypothesis focuses a new supplier building a diverse 'learning' network - composed of unrelated clients operating in different geographic and product domains – strengthens bargaining power by facilitating capability development, which raise its value to its focal client. The theoretical base derives from the resource-based view with a focus on acquiring knowledge-based resources through learning. In particular, the party acquiring diverse knowledge-based resources can contribute and complement more of its partner's activities, and hence become more valuable and less replaceable than before to its partner (Adegbesan and Higgins, 2010; Coff, 1999; Lippman and Rumelt, 2003).

While both RDT and RBV-based solutions help strengthen bargaining power, pursing one solution can preclude the other from being pursued. A supplier seeking to foster multilateral network competition – by working with rival clients having significant resource overlaps to allow for access to substitutable resources - gives rise to a more homogenous knowledge network that can constrain diverse learning for capability building. Consequently, any bargaining power gains for the supplier achieved by reducing resource dependency on its focal client as theorized by RDT - may be short lived and not sustainable in the long run due to the same mechanism that

can limit its diverse learning and long-term value creating potential. Meanwhile, a supplier seeking to foster diverse learning may have a more delayed effect on driving bargaining power due to initially requiring knowledge integration and adjustments - thus achieving bargaining power gains in the long-term may require sacrificing short-term gains. As such, we provide addition hypotheses, as shown in Figure 1 that indicated different tradeoffs relative to short-run and long-run effectiveness of these two contrasting network building approaches.

**I. The New Supplier's Weaker Bargaining Power with Its Prominent Client**

As a baseline hypothesis, as shown in Figure 1, we examine how the new venture initially working with a prominent partner suffers weaker bargaining power. The focal firm's bargaining power with its partner is determined by changes in asymmetric dependency: the firm altering dependency on its partner, and also that partner altering dependency on the focal firm based on each's alternative options (Milgrom and Roberts, 1992; Yan and Gray, 1994). The new venture is highly dependent on its prominent partner due to its limited network of partnerships and thus having few alternatives outside options. The firm's limited alternative outside options results in increasing its dependency on its prominent partner and reducing its bargaining power with that partner. Given this risk, new ventures are often willing to make concessions to the demands imposed by its prominent partner (Nicholson, Danzon, and McCullough, 2005; Hsu, 2006). Consequently, new ventures become especially vulnerable to opportunism by their prominent partners.

Meanwhile, the venture' prominent partner being centrally connected in its network to many firms has many alternative options that allows them to be less dependent on each of its inter-firm relationships (e.g., Gulati, 1998). The prominent partner also has no shortage of potential new firms willing to work with it due to the affiliation benefits such as signaling and resource access (Ozmel et al., 2013; Podolny, 1993, 1994). Taken together, this means that - unlike the

new venture - the prominent partner will have many alternative options outside the relationship. The new venture's weaker bargaining power with its prominent partner is reflected by the new venture accepting unfavorable contractual conditions – these conditions primarily involve accepting less upfront payments.

***Hypothesis 1: For a new supplier driller, the greater its focal client's level of network prominence, the weaker its bargaining power with that client in terms of securing less favorable contractual payments.***

**II. The New Supplier Building a 'Competing' Network**

Our first moderating hypothesis, based on resource dependence theory, suggests that the new supplier building a 'competing' network, composed of multilaterally competing clients, can strengthen the supplier's bargaining power by increasing its immediate alternative options, which reduces its dependence on its focal client. As noted above, multilateral competition in a network involves highly related firms that operate in the same product domains and provide similar functional expertise (Burt, 2012; Lavie, 2007). For a supplier, working with multilaterally competing clients thus enables a greater degree of client standardization, which in turn can lower switching costs transitioning from one client to another. In many industries, the supplier developing a standard set of processes, routines, and equipment used for one client can also be applied to a significant degree to its other clients competing in the same product domain (Dyer and Nobeoka, 2000; Mishina, 1999).

By having viable alternative options as stressed in resource dependence theory, a new supplier can strengthening its positioning when negotiating with its focal client by simply threatening to switch to its rivals. This idea is also supported by negotiations modeled in game theory, the party possessing such "close next best partners" can credibly signal those threats and such signaling shown to increase its bargaining power vis-à-vis its current exchange partner (Nash,

1953). This signaling ability also enables a supplier working with competing clients to enjoy brokerage positioning, which allows the supplier to play one client off against others (Burt, 2012; Lavie, 2007). The presence of multiple competing clients in the focal supplier's portfolio can also attenuate opportunistic behavior by each client due to large-numbers exchange conditions (Williamson, 1975). Therefore, a new supplier fostering multilateral competition in its client network is one way to strengthen its bargaining power by creating alternative options to alter its asymmetric dependency on its focal client.

***Hypothesis 2: The negative main relationship between the prominence of the new driller's focal client and the driller's bargaining power is weakened by the driller working with multilaterally competing clients.***

**III. The New Supplier Building a Diverse 'Learning' Network**

Our second moderating hypothesis is based on the idea that a new supplier building a 'learning' network - composed of diverse clients operating in different geographic and product domains - can also strengthen bargaining power with its focal client over time. While research has emphasized network diversity's value creation benefits (i.e. Powell, Koput and Smith-Doerr, 1996; Stuart, 1999), value creation can be also be a source of bargaining power according to the resource-based view (Adegbesan and Higgins, 2010; Lippman and Rumelt, 2003). The new supplier working with such diverse clients can access new knowledge and technologies, which helps develop new capabilities – the supplier having stronger capabilities enables it to be more valuable to its focal client, and hence less replaceable to that client.

A supplier engaged in new learning also becomes more valuable to its client by being more effective at managing project uncertainties for its client. By gaining experiences working with different clients on different projects, the supplier learns to solve a broader range of prob-

lems when performing its task under various conditions. In the case of performing complex projects involving interconnected tasks, a small failure anywhere in the system may create a significant accident in the whole system (Watkins and Bazerman, 2003). Like any complex project, the drilling process in our context is highly intricate and requires broad understanding of various contingencies – supplier drillers that have worked in different oil fields develop more generalizable capabilities in dealing with different contingencies, compared with those that only work in the same field (Kellogg, 2011). As a result, the supplier having broader experiences solving problems at different parts of the system – rather than deeper experience solving one problem – are more valuable to its client because it is better positioned to address these small failures before major breakdowns occur.

***Hypothesis 3: The negative main relationship between the prominence of the new driller's focal client and the driller's bargaining power is weakened by the driller working with diverse learning clients operating in different geographic and product domains than its focal client.***

**IV. Choosing Short-Term Bargaining Power Advantage Over Long-Term**

In the following hypotheses, we compare the associated tradeoffs of deriving bargaining power based on the mechanisms of resource dependence theory and the resource-based view. A new supplier working with multilaterally competing clients can immediately begin to leverage these relationships to strengthen its dyadic-level bargaining power. As explained above, multilaterally competing clients are inherently highly related and offer similar resources due to operating in the same geographic and product domains. The supplier switching between these highly related clients also require less learning adjustments. Therefore, a new supplier accessing a network of multilaterally competing clients can result in short-term impact on strengthening its bargaining power. This process is consistent with the resource dependence theory reasoning.

However, the same group of network clients needed to foster multilateral competition can also be ones that constrain the diverse learning necessary to develop valuable capabilities in the long run. The same clients that share similar experiences and offer similar functional expertise – which helps foster competition - can also give rise to a homogenous knowledge network offering informational and knowledge redundancies (Dyer and Nobeoka, 2000; Gomes-Casseres, 1994). Fostering multilateral competition also risks creating a "closed" network that can hinder information sharing and new information access because competing clients are more protective of their knowledge (Burt, 1992; Hamel, 1991; Hernandez et al., 2015). While such a supplier may still learn from working with related clients, such learning is likely to be more incremental and less sustainable for value creation in the long run. Consequently, bargaining power that is achieved this way - by reducing resource dependence alone without significantly enhancing the supplier's value to its client - results in achieving more short-term bargaining advantage, rather than securing sustainable long-term advantage.

***Hypothesis 4: A new supplier adding multilaterally competing clients has a stronger effect strengthening barging power in short term than in the long term.***

## V. Choosing Long-Term Bargaining Power Advantage Over Short-Term

A new supplier choosing to build a diverse 'learning' network involves working with diverse unrelated clients and can require greater initial learning adjustments. Integrating new knowledge and applying them to build new capabilities take time (Pisano, 1997). Developing capabilities is often a slow and gradual process - while a supplier accessing some new knowledge can quickly enhance existing capability, building new capabilities can be more incremental requiring more time to establish (Kogut and Zander, 1992). Relatedly, research on absorptive capacity also argues for a slower process of knowledge integration to sufficiently build and deploy valuable capabilities (Lane and Lubatkin, 1998).

Over time however, a supplier building a diverse 'learning' network will have overcome most of its initial learning adjustments and is able to develop new capabilities to becoming more valuable and less replaceable to its client. As explained, a new supplier working with diverse clients can access more heterogeneous resources such as acquiring different expertise via learning from its clients (Coff, 1999). This delayed process – in accordance with the resource-based view – requires sacrificing more immediate gains in bargaining power for sustainable long-term gains in bargaining power.

***Hypothesis 5: A new supplier adding diverse clients for learning has a stronger effect strengthening bargaining power in the long term than in the short term.***

## DATA AND METHODS

Our unit of analysis is the driller-operator-year. We combined several datasets. The Texas Railroad Commission (TRRC) provided records that detailed information on every well drilled in Texas since 1990. The main variables of interests in the TRRC well records are well identification based on API number, well location, well depth, drilling start and end dates. TRRC also provided permit records detailing the type of contract used to develop the wells. Between 1990 to 2005, TRRC also has records for most wells of the drillers filing permission to survey and potentially drill those wells – these permission requests are required whenever drillers submit bids to work on a given well. Data by DrillingInfo, which is a data provider company based in Houston, Texas, supplied the identities of the supplier driller and client operator partnerships that worked on all the wells in Texas. Drillinginfo also provided the type of contract negotiated by the operator-driller partner for every well that they worked together. Finally, we used COMPUSTAT data for financial information about the operator and driller if they are publicly traded firms.

Using this data, we track new drillers that enter the industry over a five-year period. We start tracking drillers when they first appear in the dataset, which we assume to be the first year they enter the industry. We then follow their growth in the first five years by counting their number of client operators in each of those years to observe how their networks evolve. We also follow their well projects each year and count each type of contract.

The final matched dataset consisted of 1,325 wells and amounts to approximately one-quarter of the original TRRC sample. These wells are spread over 1,606 fields, 779 producers, and 123 drillers. The time period of our study is between 1990 and 2005. Looking at the distribution on the types of negotiated contracts, the 'dayrate' contracts are used in 2,636 wells, while other contracts such as 'turnkey' and 'footage' are used in 4,923 wells.

Our first objective is to test the main relationship between the supplier's contractual bargaining and its focal client's prominence and the interaction effects (Hypothesis 1, 2, and 3). To do this, we use OLS with fixed-effects for the driller, operator, field and year to account for their unobserved heterogeneity. Our second objective is to test how different the interaction effects (of having different network structures) are to each other in the early stage of the driller's network building effort versus the later stage of its network building effort. To compare relative effect sizes of moderators, we derive coefficient estimates in our main analyses above and then use predicted marginal estimates on sub-samples across time for drillers in the early stage of its network building effort (which we define as within the first three years of client network expansion) compared to the later stage of such effort (which we define as after the third year).

In addition, we seek to examine how a supplier driller's dyadic-level bargaining power derived from having each network structure changes over time (Hypothesis 4 and 5). Here, we also used a time-split model. We split our sample into two time periods: early stage versus later

stage of the new driller's network building effort. We define the cut off between the partnership's early stage and late stage using several cut off year: after year 1, after year 2 and after year 3s. For example, we estimate the interaction effect of a driller network's level of multilateral competition and its focal client's prominence level on the driller's favorable contractual payment for the first year of the driller's network building effort (when it starts working with additional client). Then we estimate the moderating effect again that includes the second year of the driller's network building effort. We use the same procedure for the third and fourth year of the driller's network building effort and the results remain robust.

**Dependent Variables**

We analyze the bargaining power outcomes between the new venture and its focal prominent partner. Studies on bargaining power have studied negotiated contracts to observe changing bargaining power between transacting partners (Adegbesan and Higgins, 2011; Akins et al., 2018; Corts and Singh, 2004; Gopal et al., 2003). In particular, the contractual payment terms negotiated ex-ante can proxy for how much value capture rights specified in the contractual terms that can be secured by a negotiating party (Ozmel, Yavuz, Reuer, and Zenger, 2017).

Our dependent variable is the supplier driller's *bargaining power* with its focal client operator, which we measure as the average contractual payment secured by the driller from its focal client for similar project wells in a given year. Specifically, we measure this variable as the difference between the new driller's average contractual payment in terms of bid price secured from its focal client operator and average payment given to that client's other drillers to perform similar project wells in the same oil field in a given year. In the oil industry, a driller's bid price on a

given well is the accepted payment for the driller to perform its expected tasks. Like other supplier-client bargaining, the driller seeks to secure higher bid prices, while the operator seeks to counter with lower bid prices for a given well project.

**Independent Variables**

Our first independent variable is the driller's *focal client operator's prominence* at founding year, which is the firm's position within its network relative to its peers. We use the centrality measure of Bonacich (1987) calculated as a standard measure for an organization's prominence in networks of social relationships (Podolny, 1993, 1994, 2001). The centrality measure of Bonacich (1987) incorporates not only an organization's direct partnerships, but also its indirect relationships in its network. The centrality of client operator 'o' in founding year 'f' is measured using all of the direct and indirect syndicate ties formed between client operator 'o' in founding year 'f':

$$Focal\ client\ operator's\ prominence\ level = \sum_{o=1}^{N} (\alpha_f + \delta_t C_{o,f}) R_{d,o,f}$$

Where Cj,f is the centrality of the client operator o at founding year f; R d,o,t is the relationship matrix entry indicating the number of co-investments between supplier driller d and client operator o during the last five years; δ is the weighting coefficient, which is set equal to three quarters of the reciprocal of the largest eigenvalue of R (e.g., Podolny, 1993; Jensen, 2003); and α is the scaling factor, which assures that the maximum centrality for each year is equal to 1 across all the client operators.

Our second independent variable is the focal driller's *multilateral competition network* among the supplier driller's client operators. We measure the degree of multilateral competition – in our context between the supplier driller's additional group of clients and its focal client - as

the degree of shared overlap in their business operations (Lavie, 2007). Specifically, this variable is operationalized as the sum of squared proportions of this group of additional clients' sales in each geographic and product segment that is shared with the focal client. This is a concentration measure that resembles the inversed Berry-Herfindahl diversification index. In our context, geographic and product domains are highly related - every oil field (geography) produces a different quality of crude oil (product), which determines differentiation and pricing among competitors (Kellogg, 2011). Therefore, we consider the degree of shared operations in the same oil fields among client operators to measure their degree of competition with each other. For example, if a new driller's additional clients produced their oil in the same oil fields as the driller's focal prominent operator, then this measure receives a value of 1. If on the other hand a new driller's additional clients produced oil in different oil fields than the driller's focal prominent operator, then this measure receives a value of 0.[11]

Our third independent variable is the focal driller's *diverse learning network*, which we measure as the driller's number of unique client operators operating in different product domains. Specifically, this measure is calculated as the number of oil fields where a driller has a distinct client operator at year t-1. For example, a driller having rigs in a total of 10 different oil fields with at least a distinct client operator in each field will receive a value of 10. On the other hand, a driller having rigs in 10 different oil fields, but only 5 of those fields have distinct client operators (while the other 5 have the same clients as the other fields) will receive a value of 5. Table 1 provides descriptions of our main variables.

[Insert Table 1 about here]

[11] We also measured multilateral competition - between the driller's group of additional clients and its focal client operator - as the percentage of the group's fleet of rigs that are working in the same oil field as the focal client operator at year t-1. The results remain robust.

Our fourth independent variable is the *short-term period*, which is a dummy variable equal to 1 for the initial three years since the new supplier began growing its partnerships of clients. The dummy variable equals to 0 for the subsequent years up to at least ten years of the new supplier's survival.

**Controls Variables**

We include various control variables at the focal firm, dyad and project levels to address other determinants of bargaining power. At the focal firm-level, we control for the *driller's age* because newer ventures are subject to greater liability of newness (Carroll and Hannan, 2000).

At the partner level, we control for the *operator's age*, which we count in months since its inception, because older organizations may be more embedded in the industry or they can suffer from organizational inertia (Carroll and Hannan, 2000). We control for the *operator's size*, which we count the number of wells currently under development. We control for the *operator's experience*, which we count the number of wells developed prior to the focal well.

At the dyad level, we control for the number of *additional partnerships* for the new venture driller, which we measure as a count of the number of operator partners that it works with in a given year. Because prior ties can enhance trust and mitigate agency costs (Gulati, 1995), we also control for *prior outside partnerships* between the driller and its operator by taking the log of the number of prior alliances in outside oil fields between partners in each pair during the past five years,. We control for *additional partners' prominence*, which we measure as the average prominence level of the new driller's additional clients excluding the focal client. Because larger projects give client operators more leverage in negotiating with drillers, we controlled for *deal size*, which we measure as the amount invested in the project.

At the project level, we control for *cost reimbursement*, which is the amount that the supplier driller is compensated ex-post for unexpected outcomes after project completion. A supplier and its client often negotiate for the supplier to receive a mix of ex-ante upfront payment for the project uncertainties it assumes and ex-post cost-reimbursement for the project uncertainties that it does not assume from its client (Ben-Shahar and White, 2006; Kalnins and Mayer, 2004). We also control for *contractual strictness*, which was measured by the number of contingency provisions imposed on the supplier driller for a given project contract. It is possible the new supplier's increasing contractual payments is due in part to simply bearing more project risks. The change in payments can be driven in part by risk-shifting rather than bargaining power being exercised, as the client is essentially paying the new supplier more for bearing more risk (Kalnins and Mayer, 2004).

We also control for *deal transaction*, which we determine to be majority debt financed or not. We control for *well type*, which we determine to be either an oil well or an oil-gas well. We also control for *drilling cost*, which we measure by the average industry cost for drillers every month to develop a typical well.

## RESULTS

Table 2 shows the descriptive statistics and correlation coefficients for all variables in our study. We can see the stark differences between the new venture drillers and the established client operators. We see that the average prominence of a new venture in an alliance network is 0.04, where the maximum is 1. While the average prominence of an operator is 0.19. On average, each new venture driller partners with 2 client operators in the previous five years; while each operator on average works with 15 drillers during the previous five years. New ventures that had

affiliations with prominent clients tend to have less favorable contractual terms, which is consistent with our expectations. In addition, the new venture drillers secure more favorable contracts terms when the driller's network of client operators share competitive overlap, which is also consistent with our expectations.

[Insert Table 2 about here]

Table 3 show the results of the main regression models. Table 3 Model 1 tests Hypothesis 1 by showing the effect of the focal client operator's prominence level on the driller's dyad-level bargaining power, which we measure in terms of contractual payments. The results show that the prominence of the client operator has a negative and significant effect on the driller's bargaining power with that client ($B= -1.218$, $p<0.01$).

Table 3 Model 2 tests Hypothesis 2 by including the variable of the new driller's additional multilaterally competing client operators and examining its interaction effect with the focal client's prominence level on the new driller's contractual payment. The results show that the interaction effect of the driller's degree of network multilateral competition and its focal client operator's prominence on the driller's bargaining power is positive and significant ($B= 1.768$, $p<0.05$). This means that the main negative relationship for the supplier driller between the prominence of its focal client operator and its securing less contractual payment is weakened when the new driller increases its degree of multilaterally network client competition.

Table 3 Model 3 tests Hypothesis 3 by including the variable of the new driller's degree of diverse learning network and examining its interaction effect with the focal client's prominence level on the new driller's contractual payment. The results show that the interaction effect of the new driller's degree of diverse learning network and its focal operator's prominence on the driller's bargaining power is positive and significant ($B=1.449$, $p<0.01$). This means that the

main negative relationship for the supplier driller between its client's prominence and its securing less contractual payment is weakened when the new driller increases the degree of its diverse learning network.

[Insert Table 3 here]

Table 3 Model 4 tests Hypothesis 4 by including the dummy variable of short-term period, where we examine the main interaction effect of the new supplier having a multilaterally competing network on its bargaining power in the short term compared to the long term. The results show that this triple interaction effect is positive and significant ($B=0.849$; $p<0.05$). This suggests that the effect of having a multilaterally competing network on bargaining power is stronger in the short-term period compared to the long-term period.

Table 3 Model 5 tests Hypothesis 5 by again including the dummy variable of short-term period, where we examine the main interaction effect of the new supplier having a diverse learning network on its bargaining power in the short term compared to the long term. The results show that this triple interaction effect is negative and significant ($B= -0.675$; $p<0.05$). This suggests that the effect of having a multilaterally competing network on bargaining power is stronger in the long-term period compared to the short-term period.

In Table 4, we further compare between the two network building strategies by comparing each network's moderating effects on the supplier's bargaining power in the short run versus the long run. The 'short-run' effect is defined as the first three years of the supplier's network growth; and the 'long-run' effect is defined as after the initial three years (and up to at least ten years) of that network's growth – we do not include in the sample for suppliers that fail within ten years of their founding. For the driller building a 'competing' network, we find that the positive moderating effect on its bargaining power is significantly higher in the 'short run' compared

to the ‘long run’ (difference= -1.39; $p<0.1$). For the driller building a diverse ‘learning’ network, we find that the network’s positive moderating effect on its bargaining power is significantly higher in ‘long run’ compared to the ‘short run’ (difference = 2.12, $p<0.05$).

In Table 4, we also compare the moderating effects between the network types in the short run period and then in the long run period. Based on Hypothesis 4, we expect that in the short run building a ‘competing’ network is more advantageous than building a ‘learning’ network. Based on Hypothesis 5 however, we expect that in the long run building a ‘learning’ network is more advantageous than building a ‘competing’ network. We find that the positive moderating effect of a driller building a ‘competing’ network in the short run is stronger than the positive moderating effect of a driller building a diverse ‘learning’ network (difference = 1.43, $p<0.1$). We then compare the differences in changes for these two networks’ long-run effects on bargaining power. We find that the positive moderating effect of drillers in long run of building a diverse ‘learning’ network is stronger than the positive moderating effect of drillers building a ‘competing’ network (difference= -3.51, $p<0.05$).

[Insert Table 4 here]

**Supplementary Analyses**

**Different network sizes.** The observed network effects may require the new driller to have a sufficient number of new client operators before being effective in strengthening its dyadic-level bargaining power. In other words, we ask whether there is a critical mass of additional clients needed, and if so where is that threshold. We examine the bargaining changes between the new driller and its focal client under small network sizes in the driller’s first year of its network building. We test a subsample of drillers having only one additional client; then another subsample of drillers having two additional clients – and other subsamples of drillers having up

to five additional clients. We find that the effect of having multilaterally competing clients on strengthening the driller's bargaining power still holds in these subsample analyses – the coefficient results are smaller than the main results but still remain significant (at $p<0.1$ for all subsamples). However, we find that the effect of having diverse learning clients on the driller's bargaining power hold only after having three additional clients – thus suggesting that there is a critical mass of clients needed for a 'learning' network to be effective.

**Different prominence levels of clients**. The observed network effects may be driven in large part by some network clients who are prominent. We test whether our results still hold for a subsample of network clients that are low in prominence level. We operationally define client operators to have low prominence when their prominence measure is lower than one standard deviation from the average network prominence in the industry. We find that our results still hold. The interaction effect of a driller's multilateral competition network and its client's prominent on the driller's bargaining power is still positive and significant ($B=1.501$, $p<0.1$). The interaction effect of a driller's diverse learning network and its client's prominent on the driller's bargaining power is also still positive and significant ($B=1.016$; $p<0.1$).

**Different second-order ties to rival drillers.** Another consideration is how the network of the new supplier's clients impacts the main relationships. While the new venture's direct partners affect its dyadic-level bargaining dynamics, the venture's partner's partners (or the partners' networks) can also matter. We consider both the focal venture's direct network partners (its 'first-order' network ties) and also its partners' partners (its 'second-order' network ties). In the case of the supplier-client relationship, a new supplier building partnerships with 'first-order' clients' may become exposed to greater 'second-order' competitive threats from those clients' other

suppliers – due to risks such as knowledge-information leakage, which can strengthen the supplier's rivals also working with the same clients. If the new supplier's additional clients also work with the supplier's rivals, then we examine whether the above main moderating effects improve such that the new supplier's bargaining power is weakened.

We find some evidence of this effect. We measure the degree of competition between the focal driller and rival drillers by the percentage of their rig fleets operating in the same oil fields. When competition between drillers increases, we find that the positive moderating effect for drillers having a 'competing' network on its bargaining power weakens a bit, compared to results from the main analysis, but still remains positive and significant ($B = 0.926$; $p<0.1$). When competition between drillers increases, we find that the positive moderating effect for drillers having a 'learning' network on its bargaining power also weakens a bit, compared to results from the main analysis, but also still remains positive and significant ($B = 0.778$; $p<0.05$).

## DISCUSSION AND CONCLUSION

While there are benefits for a new venture working with a prominent partner, there are also appropriation burdens in terms of the new venture suffering weaker bargaining power. To strengthen bargaining power, the network-based solutions proposed in the literature emphasize that the venture grows the number of partnership ties but it is unclear about the types of ties needed. This paper proposes two types of network partnerships for a new supplier to strengthen its bargaining power: the new supplier building a network of multilaterally competing clients and building a network of unrelated clients for diverse learning. We argue that both network building strategies can help a new supplier increase its bargaining power against its prominent client. However, we also argue that there are associated challenges with each network type. We argue that these challenges will be reflected in how quickly or sustainably a new supplier can draw on

these networks to derive bargaining power. In particular, we argue that having a 'competing' network based on reducing dependency on its client results in stronger immediate gains in bargaining power, while having a diverse 'learning' network based on enhancing value to its client results in stronger gains in the long run.

We seek to contribute to the bargaining power perspective. The traditional literature in the management field has examined changes in bargaining power between two transacting parties (dyadic-level bargaining power dynamics) by focusing on 'internal' dyadic-level characteristics - such as relative size, knowledge, patent portfolio (i.e. Adegbesan and Higgins, 2010; Hamel, 1991; Yan and Gray, 1994). More recent efforts have considered factors 'external' to the partnership that can impact bargaining power. Network research is playing an increasingly important role in the bargaining power perspective. These scholars claim that the weaker party can strengthen its bargaining power by growing its network, in terms of increasing the number of partners (i.e. Ozmel, et al., 2017; Vandaie and Zaheer, 2014). Unanswered so far is the type of network partners that are effective. We build on this effort by drawing on two foundational theories of the bargaining power perspective – resource dependence theory and the resource-based view – to propose certain types of network partners that a new supplier can use to derive stronger bargaining power.

We also explore the differences between RDT and RBV-based bargaining solutions in terms of a firm's short-term and long-term access to those networks to derive bargaining power. We argue that building a 'competing' network – in accordance to RDT reasoning – inherently give rise to a more homogenous knowledge network. Consequently, such an approach may be appropriate for new ventures willing to accept more short-term bargaining gains, while sacrificing long-term gains. Meanwhile, we argue that building a 'learning' network – in accordance to

RBV reasoning – inherently creates greater unfamiliarly and adjustments to integrate more heterogeneous resources. Consequently, such an approach may be appropriate for new ventures able to exhibit more strategic patience by sacrificing short-term bargaining gains for sustainable long-term ones.

Future research can study the decision antecedents for new ventures choosing one network type over the other. In our paper, we suggested that the difference between the two network types are the different timing effects on its bargaining power. We argue that building a 'competing' network based on resource dependence theory seems to be more effective when a new supplier seeks more immediate bargaining power gains, while building a diverse 'learning' network based on the resource-based view seems to be more effective in creating sustainable long-term bargaining power gains. Future researchers can examine whether new ventures are more likely to choose the former network type when their partnership timeline with its clients is expected to be shorter, while those that choose the latter network type are more likely when their partnership timeline with clients is expected to be longer.

Future research can also examine in more detail the interdependencies of a firm's network growth and their effects on the firm's dyadic-level bargaining dynamics within a relationship. A firm's network consists of its direct partners (first-order ties) and also its partner's partners (second-order ties). Yet whether a firm's second-order ties are beneficial or not remains unclear. On the one hand, increasing both the supplier's number of both its first-order and second-order ties can be beneficial. For instance, research on structural embeddedness such that a firm's linkages to common third parties provide social control that facilitates trust, resource sharing cohesion, and relationship stability (Gulati and Gargiulo, 1999). However, from a competitive

standpoint, a supplier's efforts to build its 'first-order' network of client partnerships can also expose that supplier to the 'second-order' network of rival suppliers.

Future researchers can examine in more details how a supplier's indirect ties to rival suppliers can impact its bargaining power. One start is to build on what we did in our supplementary analysis. We demonstrated that a supplier building out its network of clients can also become exposed to competitive pressure from more rival suppliers, through their mutual connections with the shared clients – this can result in the weakening of the positive network effects in our main analysis. We suggested, but did not test, one explanation: a supplier working with clients, who are connected to other rival suppliers, risks leaking proprietary knowledge to its rivals, which can result in the transfer of competitive advantage. Future researchers can empirically test this knowledge leakage effect by demonstrating how the focal supplier's direct rivals can learn from that supplier to improve their own performance.

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**Figure 1: Theoretical Framework**

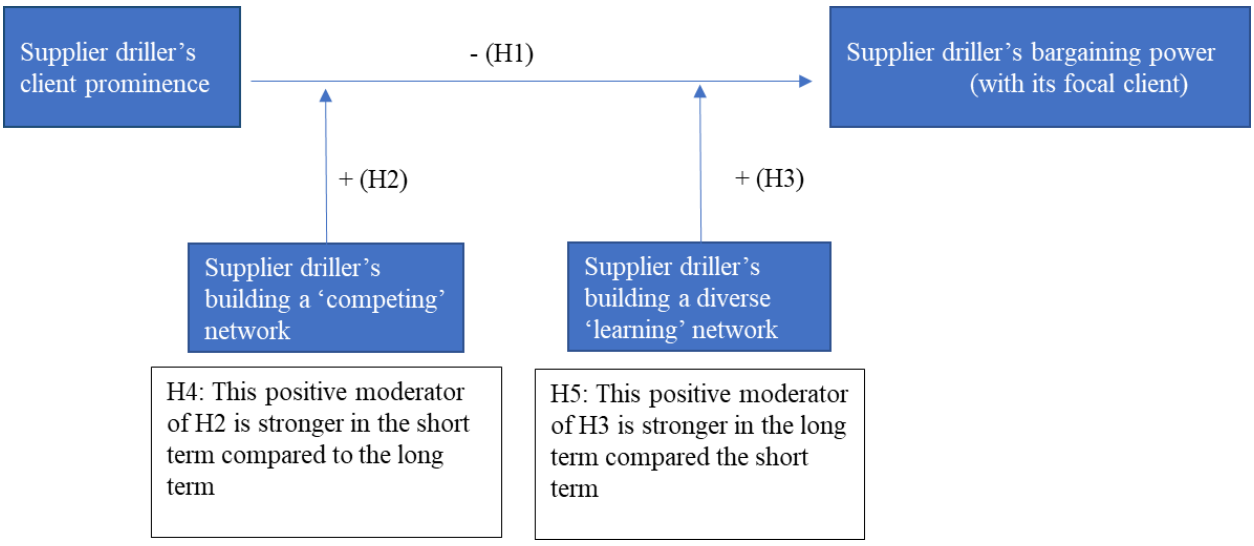


**Figure 2: Changes in supplier-client bargaining power by focal client operator's prominence and additional multilaterally competing clients**

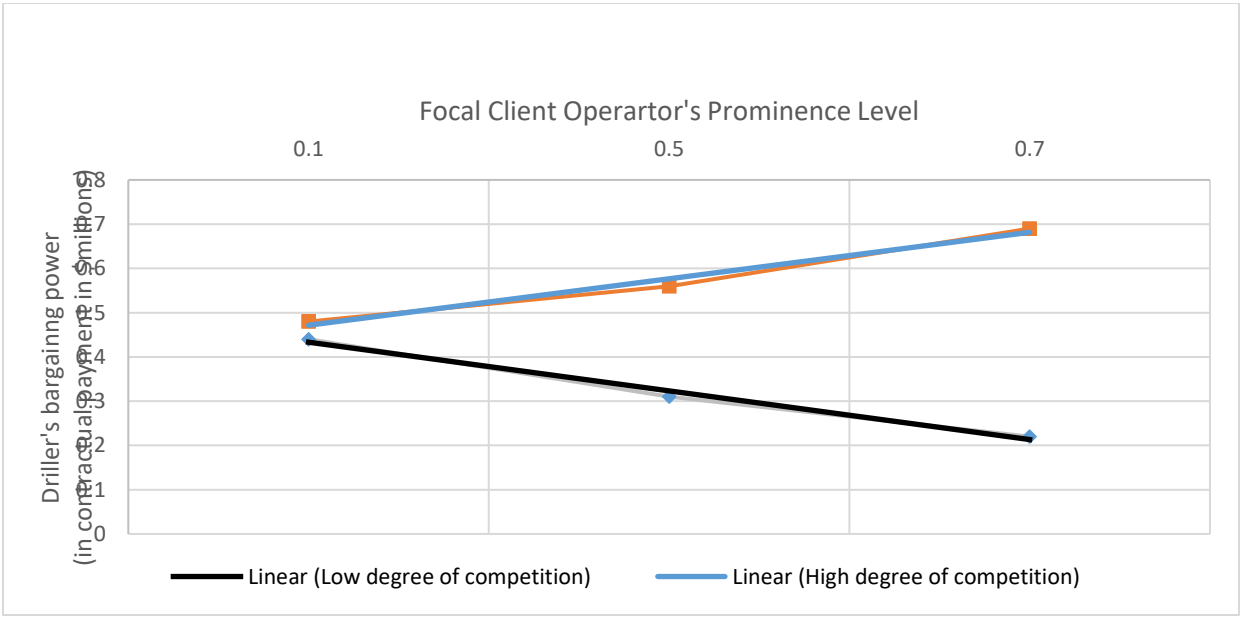

**Figure 3: Changes in supplier-client bargaining power by focal client operator's prominence and additional diverse learning clients**

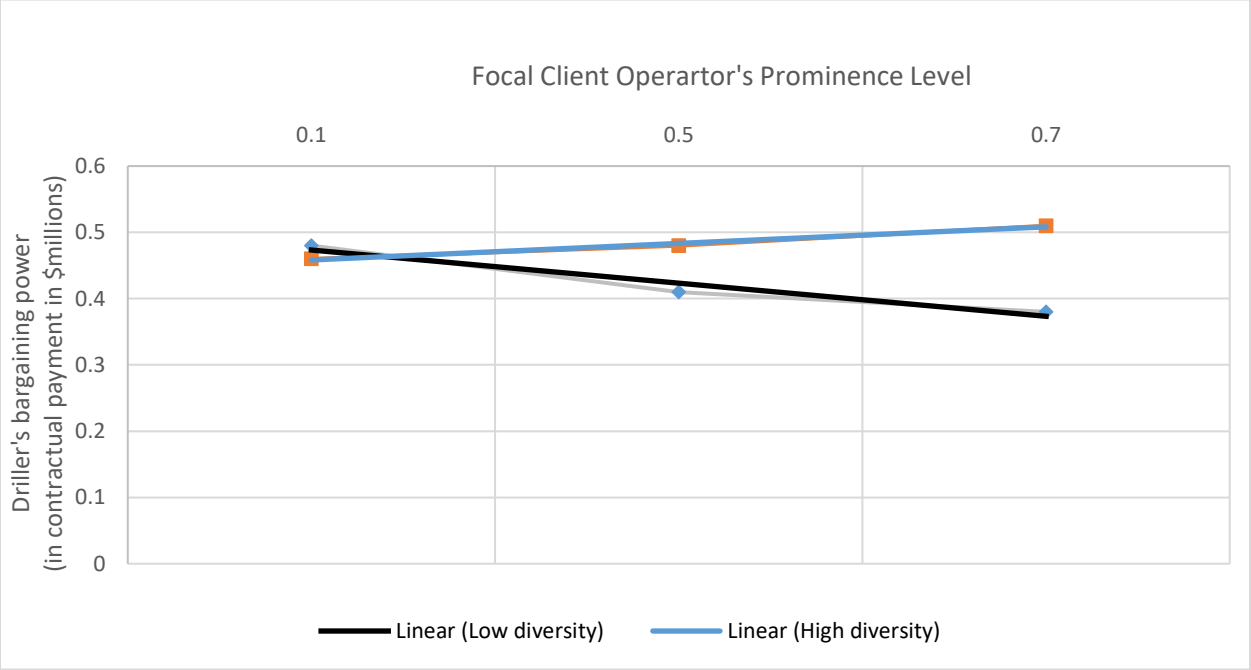

**Table 1: Measures of Key Variables**

| | |
|---|---|
| Driller's bargaining power | The difference between the new driller's average contractual payment in terms of bid price secured from its focal client operator and average payment given to that client's other drillers to perform similar project wells in the same oil field in a given year. |
| Driller's focal client operator's prominence | The centrality of client operator 'o' at partnership founding year 'f' measured using all of the direct and indirect syndicate ties formed by client operator 'o' at year 'f'. |
| Driller's multilateral competition network | The average of the proportion of these additional operators' revenues that come from producing oil in the same fields as the focal client operator at year t-1. |
| Driller's learning network | The driller's number of unique client operators operating in different product domains. Specifically, this measure is calculated as the number of oil fields where a driller has a distinct client operator at year t-1. |
| Short term period | Dummy variable equal to 1 if within initial three years of the supplier driller adding clients beyond its focal client operator. |

## Table 2: Summary Statistics

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Supplier driller's bargaining power | 0.32 | 0.25 | 1.00 | | | | | | | | | | | | | | | |
| 2. Focal operator's prominence | 0.12 | 0.08 | -0.32 | 1.00 | | | | | | | | | | | | | | |
| 3. Network multilateral competition | 0.01 | 0.10 | 0.28 | 0.16 | 1.00 | | | | | | | | | | | | | |
| 4. Diverse learning network | 3.36 | 0.16 | 0.22 | -0.19 | 0.01 | 1.00 | | | | | | | | | | | | |
| 5. Driller's age | 5.68 | 4.36 | 0.23 | 0.10 | 0.18 | 0.25 | 1.00 | | | | | | | | | | | |
| 6. Operator's age | 0.06 | 0.26 | -0.15 | -0.08 | 0.22 | 0.02 | 0.01 | 1.00 | | | | | | | | | | |
| 7. Operator's size | 0.07 | 0.29 | 0.06 | -0.15 | 0.27 | -0.03 | 0.01 | -0.04 | 1.00 | | | | | | | | | |
| 8. Operator's experience | 0.01 | 0.32 | -0.23 | -0.13 | 0.18 | 0.16 | 0.00 | 0.03 | 0.24 | 1.00 | | | | | | | | |
| 9. Additional partnership ties | 0.56 | 0.32 | 0.27 | 0.06 | 0.21 | 0.31 | 0.03 | 0.23 | 0.31 | 0.01 | 1.00 | | | | | | | |
| 10. Additional partners prominence | 0.07 | 0.09 | -0.14 | 0.21 | 0.04 | -0.03 | 0.06 | 0.05 | 0.01 | -0.06 | -0.03 | 1.00 | | | | | | |
| 11. Cost reimbursement | 0.63 | 0.31 | -0.36 | 0.09 | 0.08 | 0.21 | 0.19 | 0.06 | 0.23 | 0.03 | -0.02 | 0.11 | 1.00 | | | | | |
| 12. Contractual strictness | 16.20 | 8.62 | 0.33 | 0.28 | 0.12 | 0.23 | -0.09 | -0.12 | -0.08 | 0.12 | 0.08 | 0.15 | 0.02 | 1.00 | | | | |
| 13. Deal size | 0.41 | 0.16 | -0.15 | 0.09 | 0.08 | 0.21 | 0.19 | 0.06 | 0.23 | 0.03 | -0.02 | 0.11 | 0.14 | 0.28 | 1.00 | | | |
| 14. Deal transaction | 0.68 | 0.47 | -0.16 | 0.11 | 0.31 | -0.16 | 0.31 | 0.11 | -0.19 | -0.13 | 0.17 | 0.15 | 0.16 | 0.30 | -0.01 | 1.00 | | |
| 15. Well type | 1.05 | 0.27 | 0.09 | 0.16 | -0.09 | 0.11 | 0.01 | -0.01 | 0.12 | 0.26 | -0.21 | -0.10 | 0.07 | 0.11 | -0.03 | -0.25 | 1.00 | |
| 16. Drilling cost | 26.26 | 34.45 | 0.18 | 0.12 | -0.22 | 0.23 | 0.17 | -0.05 | -0.03 | 0.15 | 0.13 | 0.09 | -0.08 | 0.25 | 0.07 | 0.17 | -0.16 | 1.00 |

n = 1,325. Correlations greater than 0.20 are significant at 0.05, and those greater than 0.17 are significant at 0.1

## Table 3: Results Using OLS regression with Fixed Effects (Hypothesis 1, 2, 3, 4, and 5 Results)

| Unit of Analysis: dyad-year<br>DV: Supplier driller's bargaining power | Model 1<br><br>Hypothesis 1 | Model 2<br><br>Hypothesis 2 | Model 3<br><br>Hypothesis 3 | Model 4<br><br>Hypothesis 4 | Model 5<br><br>Hypothe-sis5 |
|---|---|---|---|---|---|
| *Main Predictors:* | | | | | |
| Focal operator's prominence | -1.218*** | -2.115** | -2.069** | -2.051** | -2.062** |
| | (0.467) | (0.896) | (0.912) | (0.882) | (0.906) |
| Driller's network multilateral competi-tion | | 0.929** | | 0.876* | |
| | | (0.421) | | (0.463) | |
| Focal operator's prominence X | | 1.768** | | 1.698* | |
| Driller's network multilateral competi-tion | | (0.887) | | (0.876) | |
| Driller's diverse learning network | | | 1.011*** | | 1.007* |
| | | | (0.377) | | (0.559) |
| Focal operator's prominence X | | | 1.449*** | | 1.431* |
| Driller's diverse learning network | | | (0.561) | | (0.786) |
| Short term | | | | 2.436 | 2.361 |
| | | | | (1.874) | (1.672) |
| Focal client's prominence X | | | | 0.993 | 0.982 |
| Short term | | | | (0.772) | (0.781) |
| Driller's multilateral competition clients X | | | | 1.025* | |
| | | | | (0.583) | |
| Short term | | | | | |
| Focal client's prominence X | | | | 0.849** | |
| Driller's multilateral competition clients X | | | | (0.457) | |
| Short term | | | | | |
| Driller's diverse learning network X | | | | | 1.025* |
| Short term | | | | | (0.583) |
| Focal client's prominence X | | | | | -0.675** |
| Driller's diverse learning network X | | | | | (0.316) |
| Short term | | | | | |

**Continue on next page**

**Table 3 (continued)**

| | | | | | |
|---|---|---|---|---|---|
| *Controls:* | | | | | |
| Constant | 4.331 | 3.363 | 3.129 | 3.381 | 3.292 |
| | (2.962) | (2.631) | (2.962) | (2.631) | (2.962) |
| Driller's age | 0.612* | 0.522* | 0.564* | 0.558* | 0.612* |
| | (0.351) | (0.273) | (0.312) | (0.289) | (0.301) |
| Operator's age | -0.467 | -0.452 | -0.442 | -0.439 | -0.467 |
| | (0.241) | (0.301) | (0.207) | (0.308) | (0.241) |
| Operator's size | 0.368 | 0.401 | 0.368 | 0.312 | 0.368 |
| | (0.223) | (0.328) | (0.223) | (0.328) | (0.223) |
| Operator's experience | -0.676*** | -0.617** | -0.613** | -0.621* | -0.676** |
| | (0.251) | (0.301) | (0.298) | (0.323) | (0.251) |
| Additional partnership ties | 0.221* | 0.232* | 0.215* | 0.221* | 0.221* |
| | (0.119) | (0.132) | (0.116) | (0.112) | (0.119) |
| Additional partner prominence | -0.531 | -0.502 | -0.515 | -0.502 | -0.521 |
| | (0.325) | (0.268) | (0.386) | (0.268) | (0.323) |
| Cost reimbursement | -0.326 | -0.225 | -0.233 | -0.225 | -0.221 |
| | (0.124) | (0.191) | (0.212) | (0.191) | (0.141) |
| Contractual strictness | 0.658* | 0.643* | 0.639* | 0.643* | 0.648* |
| | (0.361) | (0.312) | (0.304) | (0.322) | (0.351) |
| Deal size | -0.182 | -0.171 | -0.029 | -0.171 | -0.174 |
| | (0.121) | (0.145) | (0.122) | (0.145) | (0.125) |
| Deal transaction | 0.252 | 0.268 | 0.354 | 0.168 | 0.159 |
| | (0.201) | (0.198) | (0.219) | (0.178) | (0.182) |
| Well type | 0.351 | 0.382 | 0.381 | 0.372 | 0.378 |
| | (0.218) | (0.264) | (0.295) | (0.564) | (0.218) |
| Drilling cost | 0.487 | 0.446 | 0.308 | 0.446 | 0.482 |
| | (0.337) | (0.301) | (0.237) | (0.301) | (0.329) |
| Driller Fixed Effect | Yes | Yes | Yes | Yes | Yes |
| Operator Fixed Effect | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,325 | 1,325 | 1,325 | 1,325 | 1,325 |
| R-squared | 0.221 | 0.349 | 0.336 | 0.349 | 0.341 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Table 4. Comparison of the network effects on a new driller's bargaining power in the short run versus the long run periods (additional test for Hypothesis 4 and 5)**

| | Short-run network effect (within initial 3 years) | | | Long-run network effect (after initial 3 years and at least up to 10 years) | | | |
|---|---|---|---|---|---|---|---|
| | Low | High | Change | Low | High | Change | Difference in Changes |
| Moderation effect of driller's network multilateral competition (H2) | 1.27 | 3.21 | 1.94** | 0.97 | 1.52 | 0.55* | -1.39* |
| Moderation effect of driller's diverse learning network (H3) | 0.62 | 1.13 | 0.51 | 2.03 | 4.58 | 2.55** | 2.12** |
| Difference in changes | | | 1.43* | | | -2.00** | -3.51** |

Note: Low is -1 standard deviation; High is +1 standard deviation.
Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

# ESSAY III

## Merger Wave Types and the Effects of Firm Timing on Acquisition Returns

Research summary: In this paper, we examine how entry timing of acquirers in a merger wave (early vs. later mover) affects their potential market returns. We make a distinction between two types of merger waves, *contractionary* versus *expansionary*, based on whether the industry is experiencing a slowdown or an upswing. During contractionary waves, we argue that acquirers prefer to buy targets which are in the same industries. Thus, early acquirers in such waves exhibit greater returns to their acquisitions as they can buy better quality targets without substantially overpaying for them before others jump into the fray. On the other hand, in expansionary waves, we argue that acquirers become more exploratory in nature and tend to acquire more distant targets that are outside their primary industry - In such cases, acquirers face greater information asymmetry about potential targets. Thus, moving somewhat later may benefit the acquirers more as they are able to learn from the experiences of the early acquirers. Furthermore, this later-mover advantage due to learning relative to early movers becomes more pronounced when target information asymmetry is higher. Finally, we examine learning by later movers in more detail by demonstrating that they can learn by observing early moving acquirers and also learning by doing if they had made previous acquisitions. Our analyses of merger waves across ten industries provide support for our arguments.

## INTRODUCTION

Merger waves are periods of intense merger activities when the frequency of these transactions within an industry is substantially higher than the average rate in normal periods. Merger waves take place across major industries and many of the most well-known companies today were formed during these waves (Andrade, Mitchell, and Stafford, 2001). As competition for assets intensifies during a wave, acquirers need to time those acquisitions such that they are able to gain preferential control over essential and relevant targets. Previous work generally shows that acquirers that move early benefit more than later movers in terms of gaining access to better quality targets, and also not paying disproportionately for them (Carow, Heron, and Saxton, 2004; McNamara, Haleblian, and Dykes, 2008). Many practitioners also acknowledge the benefits of being early in buying high-quality assets to maintain their leadership position in the industry (Anthony, 2012).

In this study, we reexamine whether early acquirers always have an advantage over later movers during a merger wave. We are motivated to examine this question because there is competing evidence in economics and strategy research on investment entry timing showing that when information asymmetry is sufficiently high late movers may have a timing advantage, as they can learn from information spillovers from early movers' actions (Hoppe, 2000; Suarez, Grodal, and Gotsopoulos, 2015). Also, several scholars have examined the linkage between timing advantages and the stage of an industry's evolution (e.g., Christensen, Suarez and Utterback, 1998; Markides and Geroski, 2005). We believe that prior merger wave research may overlook possible differences in the nature of merger waves along industry evolution, which in turn might differentially impact the kind of companies that firms acquire in those waves, and consequently the implications of acquisition timing.

To contribute to merger wave research, we argue that there are two different types of merger waves - contractionary versus expansionary - depending on changes in the external or industry environment. In the face of an economic downturn, industries contract in terms of revenues or margins (Anand and Singh, 1997) and can trigger merger waves that we refer to as 'contractionary' waves. During economic upswings, however, industries usually expand as firms seek growth (Uhlenbruck, Hitt, and Semadeni, 2006) and can create merger waves that we refer to as 'expansionary' waves. We believe that acquirers have different objectives, and hence pursue different kinds of targets, across these two types of waves. During periods of industry contraction, when revenues are declining, acquirers prefer acquiring other firms within the same industry for efficiency gains and cost reductions. During periods of industry expansion, when revenues and margins are increasing, acquirers become bolder and more exploratory in nature – and as they pursue new growth opportunities, they may be willing to acquire companies that are outside or distant from their core businesses.

These differences in merger waves, and the kinds of targets that firms acquire across them, will also impact the returns to those acquisitions based on when firms time those acquisition moves in each kind of waves. We propose that the advantage of acquiring early, as proposed and tested by prior research, is salient in contractionary waves. In expansionary merger waves, however, when firms tend to acquire a broader set of targets that are often outside their primary segments or industries, later acquirers might benefit more due to learning spillovers from earlier acquirers. The value of this learning might mitigate the advantages otherwise enjoyed by early movers in merger waves. We find support for our arguments by collecting and analyzing data on merger waves across ten industries between the periods of 1990 to 2015.

We contribute to the merger wave research in at least three ways. First, unlike prior studies, we argue and show that not all merger waves are the same. We examine their differences by studying how they can be triggered. Depending on the type of waves, firms have different acquisition objectives and they pursue different acquisition targets. Second, we show that entry timing has different performance implications for acquirers across different types of merger waves. Third, we examine the later mover advantage due to learning in the merger wave context in more detail. We demonstrate that later movers enjoy relatively higher market returns when acquiring targets are more distant, or more unrelated to the acquirer – hence learning becomes even more valuable. Finally, we examine how later movers can learn – they can learn by observing such that they pursue more targets in certain industries where early-moving acquirers have found success.

## THEORETICAL BACKGROUND

Most of the extant management literature on merger waves has dedicated its attention on investigating how firms compete during such a wave. Specifically, this work has focused on firm's acquisition timing once a wave arises. Here, the theory and empirical findings generally suggest that firms that move to make early acquisitions during a wave benefit because they obtain access to higher-quality targets suited to their needs (Carow *et al.*, 2004; Haleblian, McNamara, Kolev, and Dykes, 2012; McNamara *et al.*, 2008). In addition, during the early period of a wave these players face less competition for those targets from other firms and hence are less likely to overpay for those targets. On the other hand, later movers fight for the remaining lower-quality targets, and face more competitive pressures for those targets that will likely result in overpaying for them. Consequently, early acquirers in merger waves experience better acquisition performance in terms of abnormal stock returns. This perspective in extant research is broadly referred to as the first-mover advantage (FMA) in merger waves.

As outlined above, the starting point of prior research is to focus on the implications of firm timing in a merger wave. While this aspect is certainly important, the implicit assumption of prior work seems to be that all merger waves are homogenous – in other words, extant research fails to consider the possible difference in the nature of those merger waves.[12] We believe, however, that by overlooking such distinction from the acquirers' perspective, prior research provides only a partial explanation of the outcome of acquiring firms' investment timing in a wave. If waves are indeed different, it is plausible that the implications of who firms acquire, how much information asymmetry they face, and when they time those acquisitions, might also be different. We try to address this research opportunity in our paper.

Prior research shows also that merger waves can arise due to different types of shocks, the most prevalent being macroeconomic factors that can potentially alter firms' incentives and approaches regarding how they compete in the industry (Harford, 2005; Maksimovic, Phillips, and Yang, 2013; Mitchell and Mulherin, 1996). Merger waves can have different natures depending on whether the economic shock is negative (which leads to a decline in sentiments and growth), or is positive (which leads to an upturn in sentiments and growth). On the one hand, industries during an economic downturn often contract in terms of revenues or margins. Under such conditions, the sentiment is quite negative and firms in the industry are under great pressure to find ways to reduce costs to remain competitive and even survive – this triggers merger waves which we refer to as 'contractionary' waves. On the other hand, during economic upswings industries usually expand in terms of revenues and margins. The sentiment in the industry is very positive and firms with surplus resources are full of optimism – this triggers merger waves which we refer to as 'expansionary' waves.

[12] While some scholars have accounted for different industry conditions such as munificence, they have done so for the industries of the investment targets and not for the industry of the acquirers (McNamara et al., 2008).

Given the substantial differences across these two types of situations, firms' objectives regarding why they acquire other firms, and what kind of companies they seek to acquire to create value, would also most likely differ. We believe these differences will also have an impact on the kind of challenges firms face in doing acquisitions in these two types of waves and consequently the benefits or risks of when they time those acquisitions. Therefore, we examine this aspect in much greater detail below.

**I. Acquisition patterns during different types of merger waves**

Firms pursue acquisitions as one of the means of adjusting to changes in the external environment. As we suggest earlier, if merger waves differ in nature based on the kind of economic shock that triggers them, then firms might pursue different kinds of acquisitions as a way of adjusting to those changes.

During an industry downturn, industries often contract in terms of revenues or margins. Under such conditions, firms are under pressure to reduce costs in different possible ways to survive and stabilize these periods. Consequently, firms tend to undertake a series of acquisitions to consolidate their operations with other firms in the industry (Anand and Singh, 1997; Filatotchev and Toms, 2003). Consolidation often entails searching locally for potential targets within the same primary industry as the acquiring firm (Capron, 1999). Acquiring another firm in the same primary industry allows the focal acquirer to reduce costs and gain efficiencies in several ways. First, the merging firms can reduce costs by simply eliminating any unnecessary duplication in similar or overlapping resources/assets across the two concerned entities. Second, by combining similar activities across relevant parts of the value chain (e.g. procurement, manufacturing, etc.), they can also reduce costs through economies of scale. Finally, consolidation through acquisitions in the industry also reduces the number of players and competitors in that industry (Porter,

1979), which in turn may even allow industry players to minimize price competition and thereby better deal with the downward pressure on prices in a contractionary wave.

Following an economic upturn, however, industries often experience an expansion in their revenues and margins. During such times, firms with stronger finances are more likely to pursue acquisitions for new growth opportunities rather than consolidate (Nohria and Gulati, 1996). Flush with cash, and often even inflated stock prices, these companies have more resource slack and risk appetite to make investments with potentially long-term payoffs (Gupta, Smith, and Shalley, 2006). In this scenario, firms can become more expansive in their thinking and be more willing to invest beyond their core businesses. Pursuing targets that are beyond their primary industry might be a way of obtaining complementary assets to exploit new growth opportunities or markets (Capron and Mitchell, 2008; Voss, Sirdeshmukh, and Voss, 2008). By bringing together complementary assets or capabilities that are 'non-overlapping' in nature, the merging firms are able to create a 'more complete set of capabilities' to pursue growth options that might not have been feasible on their own (Anand, 2004). Thus, we believe that acquirer firms are likely to have different business objectives across the two types of merger waves, contractionary and expansionary, and hence more likely to pursue different types of targets in these two waves.

***Hypothesis 1: Firms will be relatively more exploratory by acquiring a greater proportion of targets outside their primary industry during an expansionary merger wave than during a contractionary merger wave.***

## II. Performance Implications of Acquisition Timing during Contractionary Merger Waves

As we suggested above, contractionary waves are triggered when a negative external shock to the industry leads to significant and continuous decline in industry revenues and margins. During such adverse conditions, firms are inclined to make consolidation-related acquisitions (Anand and Singh, 2004) in order to reduce costs and increase efficiencies in multiple

ways. This implies that acquiring firms pursue more targets that are in the same primary industry and can have significant over-lapping resources. For these targets, acquirers will naturally face less investment information asymmetry because they can be quite familiar with their targets' assets and operations. In this scenario, acting quickly on available information can be more valuable to acquirers than the potential benefits of waiting. Early movers have an advantage in terms of preemption by getting preferential access to higher quality assets among the pool of available assets.In addition as noted, during the early period, there is less competition for those assets which minimizes the risk of over-valuation and payment (Saxton and Dollinger, 2004; Sarkar, Cavusgil, and Aulakh, 1999). The prediction in this scenario favors early movers to earn higher returns on their acquisition, which is in line with the FMA view adopted by previous merger wave research.

On the other hand, late acquirers during contractionary waves face several challenges. First, they will have proportionately less access to high quality targets as compared to early movers. Second, even if they find quality targets, the chances of overpaying for those targets is higher because as the merger wave progresses the competition for those same targets from other acquirers who jump into the fray also intensifies. Finally, any learning benefit by waiting is likely to be limited for later movers when operating in an environment where valuable investment targets are familiar and have been mostly identified.

From the market investor's perspective, being an early mover in this context can also signal that the firm is acting quickly on valuable information. Meanwhile, later movers are perceived by the market investors as followers that increasingly exhibiting herding behavior where managers are increasingly imitating their earlier moving peers and not thinking independently (Lieberman and Asaba, 2006).

***Hypothesis 2: During contractionary merger waves, early movers' acquisition returns are greater than later movers' returns.***

**III. Performance Implications of Acquisition Timing during Expansionary Merger Waves**

As discussed earlier, during an expansionary wave that is triggered during an industry upswing, firms are under less pressure to reduce costs. They also share more optimism about future prospects and are generally flush with more cash and other resources to pursue future growth options through acquisitions. In such situations, firms are likely to have greater risk appetite for potentially higher reward investments (Gupta *et al.*, 2006) and become more exploratory in their search for acquisition targets – consequently, as we argued before, they are more likely to acquire companies outside of their primary business or industry in search of new growth.

However, if that is indeed the case, then firms will face greater information asymmetry in acquiring such targets. For acquiring firms, targets outside the focal industry are more difficult to evaluate than those within the acquirer's industry due to having less business overlaps (Hoskisson and Busenitz, 2002). In such a scenario, early mover during the merger wave may face disproportionately more risk and confront significant information deficit. Even if they do not face much bidding competition from other acquirers during the early part of the wave, they are disadvantaged by higher information asymmetry in terms of sufficiently understanding the exact nature and worth of their target's operations and assets – which could often lead to making inferior choices regarding whom they acquire and how much they pay for them (Gal-Or, 1988; Hoppe, 2000; Suarez *et al.*, 2015). As such, acting early in the face of high information asymmetry may be fraught with hazards in the early periods of the wave.

Later movers, on the other hand, can benefit in this scenario because the ability to learn from the experience of those moving early becomes valuable when target information asymmetry is higher. Unlike early movers, later movers can benefit under certain circumstance due to the

possible “introduction of new information” (Gort and Klepper, 1982: 632). Firms that wait will have more opportunities to understand their potential distant outside-industry targets and also build the capacity to manage those firms more effectively during the post-acquisition integration phase – which, in turn, increases their chances of post-merger success (Lichtenthaler, 2009). Later movers also have the benefit to learn from the mistakes of their predecessors (Hoppe, 2000; Schwab, 2007). Scholars have generally described these processes as ‘learning by observing’ instead of ‘learning by experience’ (Huber, 1991). As early movers are at a greater risk of making suboptimal acquisition decisions, acquiring firms that wait can update their information sets and revise their decisions accordingly. Thus when information deficit cost is significant, then later movers can gain the upper hand over early movers (Gort and Klepper, 1982).

That said, the benefits that later movers can derive from waiting and learning from early movers are also likely to depreciate over time. Modern learning curve models demonstrate that knowledge acquired through learning reduces over time (Argote and Epple, 1990), such that the marginal returns decline and even reach an inflection point. At some point in the merger waves, the later movers would have gained sufficient knowledge to learn about acquisition targets outside of their own line of business. Also, as the merger waves continues to progress, at some point the ‘demand’ for those remaining good targets amongst competing potential acquirers might outstrip the ‘supply’ of those targets – then the risk of overpaying for those targets might exceed any incremental benefits of waiting and learning about those targets. Thus, even in an expansionary wave, the later mover advantage is not uniform; initial later movers might benefit more from waiting and learning as compared those firms who wait too long in the wave to make their acquisitions.

From the market investors' perspective, they are likely to perceive firm timing signaling differently during an expansionary wave as information asymmetry about valuable targets are higher. In this context, as the set of investment targets are broader and not quickly evaluated, learning becomes more valuable. In this context, being later movers do not necessary sends a negative signal to market investors because waiting can signal that the firm has more opportunities to learn, especially by observing the mistakes of their earlier-moving peers. According to research on information cascade (Bikhchandiani, Hirshleifer and Welch, 1998), firms may not only follow others' actions resulting in herding behavior (Bauer,and Wieserman, 2012), but can also learn as new information is revealed and actions are adjusted accordingly (Xu, 2017).

***Hypothesis 3: During the expansionary merger wave, later movers' acquisition returns are greater than the early movers' returns. This advantage subsequently declines, whereby overall we predict an inverted U-shaped relationship between acquisition timing (early vs. late movers) and acquisition returns.***

We have argued that later movers are more advantageous during expansionary waves when target information asymmetry is significant due to having more opportunities to learn. If investment information asymmetry is greater, then we would then expect that the learning opportunities for later movers will be even more valuable relative to early movers. For the acquirer, more 'distant' targets can be more difficult to evaluate and integrate (Christensen, Suarez, and Utterback, 1998; Vermeulen and Barkema, 2001) because their knowledge and asset base are less familiar to the acquiring firm (Hoskisson and Busenitz, 2002). Here in this section, we argue that the target 'distance' moderates the relationship between firm timing and acquisition returns – differences in target 'distance' can change the level of information asymmetry faced by firms and the value of learning opportunities for firms that time their acquisitions at the early, middle, and latest stages of a merger wave.

When firms time their acquisitions at the middle stage of an expansionary wave, these later movers as we have argued in the above hypothesis are more advantageous because they have more opportunities to learn about their outside-industry targets and can make better acquisition decisions compared to early movers. In the case, when target 'distance' is high – or target information asymmetry is higher than average – this later-mover advantage relative to early movers will be more pronounced because learning will be even more valuable. However in the case, when target 'distance' is low – or target information asymmetry is lower than average – this later-mover advantage will be less pronounced as learning will be less valuable.

When firms time their acquisitions at the early stage of an expansionary wave, these early movers can face significant target information asymmetry when pursuing outside-industry targets. In the case when target 'distance' is high, early movers – relative to later movers – will face even higher information asymmetry about their targets and consequently risk making poorer acquisitions decisions than later movers. In the case when target 'distance' is low – or lower than average during an expansionary wave, early movers face lower information deficit, and as a result, the early mover's acquisition performance disparity with later movers will not be as great.

When firms time their acquisitions at the latest stage of an expansionary wave, these 'latest' movers moving towards the tail end of an expansionary wave will experience lower acquisition returns than acquirers before them. These 'latest' movers will face decreasing returns to learning, and at the same time increased competitive bidding pressures on the remaining quality targets. In the case when target 'distance' is high, however, there is likely to be remaining target information asymmetry as acquirers can still be familiarizing with potential targets – this will allow for some remaining benefits to learning; and furthermore competitive bidding pressures on targets will not be as intense compared to the case of average target distance. In the case when

target ‘distance’ is low, then decreasing returns to learning will be faster, and competitive bidding pressures will be more intense compared to the case of average target distance during an expansionary wave.

***Hypothesis 4: Target distance moderates the curvilinear relationship between firm timing and acquisition return: the inverted U-shaped pattern is amplified when target distance is high and is neutralized when target distance is low.***

## METHODS

### Data Source

Our primary data comes from the Securities Data Corporation (SDC) M&A database to gather deal-specific information on acquisitions. We used COMPUSTAT to collect financial information on the transacting firms. We used the Center for Research in Securities Pricing (CRSP) database for information on stock market returns. We used the National Bureau of Economics Research (NBER) for industry-level business cycles data, which include employment and production, to identify periods of industry contraction and expansion. NBER however covers only 20 major industries based on two-digit SIC code, which limits the industries we can examine.

*Identifying merger waves:*

An industry experiences a merger wave when merger activities significantly increase from the average rate of acquisition in previous periods (Carow *et al.*, 2004; Mitchell and Mulherin, 1996). We follow Carow et al., (2004) and manually identify and characterize a merger wave occurring in a given industry. First, we identify for each industry the peak year of acquisition activity over the sample period – we use acquisition frequency per year (or the number deals per year), and determine the peak year based on taking the top 10 percentile of acquisition frequency per year in the industry between 1990 and 2015. Second, after identifying a wave peak

year, we identify the start year of that merger wave by: moving backwards from that peak year until we identify the year when the acquisition frequency falls below one third of the peak deals value; and the start year of that merger wave is defined as the following year. Third, we define the end-year of that merger wave in a similar method by: moving forward from the peak year until we find the year that acquisition frequency falls below one third of the peak deals value; and the end year of that wave is defined as the preceding year. Furthermore, we took additional steps to ensure that we have identified a merger wave: 1) The peak acquisition frequency be at least 100 percent greater than acquisition frequency values at the start and end wave tails; 2) we check each wave to ensure that the frequency of merger activity during our defined wave follows a bell-shaped curve that represents a wave peak with its start- and end-tails; 3) acquisitions that are considered part of the wave all must be 50% greater than the pre-wave baseline rate during normal periods, which we estimate as the average acquisition frequency per year during a two-year window pre-wave.

*Identifying industry 'contractionary' and 'expansionary' cycle periods:*

Periods of industry contraction and expansion are determined by periods between the 'peaks' and 'troughs' in economic activities in that industry based on employment and production levels. According to NBER, the industry is categorized as experiencing contraction during the period between the economic cycle peak and trough; while the industry is categorized as experiencing expansion during the period between the economic cycle trough and peak. Similar to Maksimovic and Phillips (2001), we identify economic cycle 'peaks' and 'troughs' the following way based on NBER criteria: Taking a 12-month moving average in the industry sample, economic cycle 'peaks' are identified as industry employment and production levels above the 15$^{th}$ percentile of the sample observations; while economic cycle 'troughs' are identified as industry

employment and production levels below the 15th percentile of the sample observation. For periods in the industry that NBER categorizes as a contraction phase, merger waves that occur during this phase would be characterized as a 'contractionary'. For periods in the industry that NBER categorizes as an expansion phase, merger waves that occur during this phase would be characterized as 'expansionary'.

*Sample:*

From our analysis using SDC and NBER data, we identify 18 major merger waves across 10 industries between the years of 1990 to 2015, and that these waves occurred only during either periods of industry 'contraction' or 'expansion'. The industries in our sample that have experienced both 'contractionary' and 'expansionary' waves include the following: two waves in the oil-gas production (SIC 13), two waves in chemicals (SIC 28), two waves in rubber-plastics (SIC 30), lumber-wood products (SIC 24), two waves in textile-apparel (SIC 22), two waves in publishing (SIC 27), two waves in metals production (SIC 33), and two waves in industrial equipment (SIC 35). The industries that we identified as experiencing only 'contractionary' waves are the following: one wave in mining (SIC 21), one wave in paper (SIC 26). We excluded merger waves that did not fall in either of these periods – there were two. As Table 1 in the analysis and results section shows, the final sample comprises 12,798 mergers; with 5,348 observations in the sample for the contractionary waves and 7,450 observations in the sample for the expansionary waves. In addition, Table 2 shows a breakdown of merger waves by industries, the average acquisition frequency per year, and the total number of acquisitions during every wave period in the industry. Furthermore, Table 2 demonstrates the magnitude of every merger wave by comparing average acquisition frequency per year during the wave period with the average acquisition frequency per year during the two-year period prior to the start of that wave.

**Dependent Variables**

*Outside-industry acquisition* is our first outcome variable, which measures as acquisitions made by firms outside their primary industry. We created a binary variable based on two-digit SIC classification- A value of 0 means targets are in the acquirer's industry; while a value of 1 refers targets that are outside the acquirer's industry.

*Cumulative abnormal return (CAR)* for the acquiring firm is our outcome measure for acquisition return that we derived using event studies analysis to quantify the market reaction to the release of new information, which is the firm's security price change to an acquisition announcement (McWilliams and Siegel, 1997). We used the estimation period of 250 days, ranging from 295 days before each event to 45 days before it (Dewenter, 1995). We used the -1 and 1-day event window around the event.[13]

**Independent Variables**

For hypothesis 1, our main explanatory variable when we run the full sample is acquirers in *wave2*, which we categorize as equal to 1 if acquiring firms operate in the 'expansionary' wave, and as equal to 0 if acquiring firms operate in the 'contractionary' wave.

For hypothesis 2 and 3, we measure the variable for *firm timing* in a merger wave by taking the ordinal rankings of the acquiring firms within a merger wave. We follow McNamara *et al.* (2008) by quantifying an acquiring firm's relative timing within a wave by finding the ratio of its ordinal position over the total number of acquisitions in the wave, with values greater than 0 up to 1. For example, we consider a firm with an ordinal value close to 0 as an earlier mover, while we consider a firm with an ordinal value closer to 1 as the latest mover. Squaring this

[13] We repeated the analysis using other common event windows to check the robustness of our results: The results for windows of (-3, 3) and (-5, 5) were similar and also statically significant.

measure created the additional variable for firm timing we needed in order to run our polynomial regression and test Hypothesis 3.

For hypothesis 4, our variable of interest is acquirer's *target distance* to test whether the later-mover advantage in expansionary waves is stronger as information asymmetry between the acquirer and target increases. Even though outside-industry targets have different SIC codes from the acquirer, their 'distance' to the acquirer can vary in their degree of un-relatedness. Based on the continuous un-relatedness measure between target-acquirer pairs developed by Hoberg and Phillips (2010), we measure the degree of information asymmetry between acquirer and target by looking at product dissimilarities between pairs of firms by comparing the same words in their 10-K product descriptions - a lower dissimilarity measure means that the target's product description uses more same words, while a higher dissimilarity measure means that the target's product description uses less same words (ranging from 0 to 1). According to Hoberg and Phillips (2010), targets that share less product overlaps than others involve less complementary assets in terms of expertise and technology to produce, and less overlaps in shared suppliers and customer.

**Control Variables**

Prior research has shown that the characteristics of the acquirer and target can affect acquisition returns. We control for *acquirer total assets* (King, Dalton, Daily, and Covin, 2004). We control for *acquirer slack*, calculated as the ratio of debt to equity, because more slack can allow the firm avoid costly debt financing (Hitt, Harrison, and Ireland, 2001). We also control for *acquisitions of past similar targets*, which we measure as the number of acquisitions the firm made in a five-year period in the same industry as the focal target prior to the current acquisition of interest (Haleblian and Finkelstein, 1999; Hitt *et al.*, 2001).

We control for both *acquirer and target firm performance*, estimated as the firm's ROA subtracted by the median industry ROA value at the end of the fiscal quarter prior to the acquisition announcement (Morck *et al.*, 1990; Bruton, Oviatt, and White, 1994). We control for *prior joint venturing*, coded as a dummy variable, given the learning opportunities that can impact target selection and acquisition performance. We control for *diversification*, based on the entropy measure using sales attributed to each product segment of the firm, because diversification can affect acquisition strategy (Wan, *et al*., 2011). We control for *outside directors* as a proportion measure by counting the number of independent directors divided by board size (Hoskisson, Hitt, Johnson, and Grossman, 2002) because the firm with more outside directors serving on the board can impact objective decision making (Baysinger and Hoskisson, 1990). We lagged the above control variables by one year (Haunschild, 1994).

Beyond firm-level factors, we also control for transactional and environmental factors. We controlled for *merger relatedness*, such that acquirer and target are considered related if they shared the same four-digit SIC code (Morck et al., 1990). We controlled for *deal attitude*, which we coded with a categorical variable with 1 if the acquisition was considered friendly, 2 if the acquisition was considered neutral, and 3 if the acquisition was considered hostile (Brickley, Coles, and Terry, 1994). We control for whether the transaction is mostly in cash or stocks because such payment type can signal to the market how much the acquirer undervalues or overvalues the target, respectively (King *et al.*, 2004). The control variable *stock payment type* is measured as the percentage of the acquisition price paid in the firm's common stocks (McNamara *et al.*, 2008). We also control for *acquisition premium*, which is measured as percentage difference between the final purchase price for the target and the trading price of the target's stock during normal periods prior to the takeover (Hayward and Hambrick, 1997).

Finally, we consider the macroeconomic conditions that can impact acquisition market returns. We control for *environmental dynamism*, which is measured by regressing industry sales for a period of three years prior the focal acquisition on a year-counter variable and then dividing the standard error of the regression coefficient by the mean value of the industry sales (Dess and Beard, 1984; Schilke, 2014).

## RESULTS

The descriptive statistic and the correlation matrix of the final dataset are provided in Table 1. Examining the correlation matrix, the variables are not significantly correlated. The variance inflation scores for explanatory variables are below three, for which the conventional threshold for concern is five. This suggests that multicollinearity does not seem to be a concern.

[Insert Tables 1 and 2 about here]

For hypothesis 1, we predicted that acquiring firms in the 'expansionary' waves are more likely to pursue outside-industry targets than acquiring firms in the 'contractionary' wave. In so far that the decision for the firm to invest in an expansionary wave is a function of observable firm characteristics, we first use the propensity score matching technique to calculate the probability estimates (or propensity scores) that acquiring firms in the full sample (of both waves) 'select into' the expansionary wave. Estimating the propensity scores helps generate one-to-one matched samples based on relevant observed firm characteristics in the data in order to create a control group that is more comparable to the treatment group. We matched companies using stratification matching based on firm assets, slack, performance, leverage, market value, and geographic headquarters due to agglomeration effects. Using the probit model to estimate the

propensity scores for our variables, we find that firm assets, slack, leverage, and relative performance have positive and significant effects ($p<0.05$) in explaining whether the firm received the treatment (being in the expansionary wave).

The final sample included 12,798 observations: there are 5,348 firms in the treatment group (expansionary wave group) and 7,450 in the control group (contractionary wave group). The test for multivariate balance suggests that the matched variables are balanced, as we failed to reject that the null hypothesis of the difference in variable effects between the waves are zero. The average treatment effect before matching for acquirers in the treatment group of expansionary waves pursue on average 46% of their targets in outside industries; while firms in the control group of contractionary waves pursue on average 25% of their targets in outside industries. After matching, the average treatment effect on the treated results in firms in the treated group of expansionary waves pursuing on average 41% of their targets in outside industries; while firms in the counterfactual control group of contractionary waves based on propensity matching pursue on average 22% of their targets in outside industries. The difference in the treatment and control groups after matching is 19% and is significant (difference in mean = 0.19, Standard Error = 0.027, t-statistic = 3.19, p-value<0.01) (see Table 3a). Therefore, the estimates for the averaged treatment effect using matched samples provide initial support for hypothesis 1. In fact, comparing the results before matching and after matching suggests that the two groups are not too different.

We then modeled the process of the acquirers choosing outside-industry targets as a multinomial logit regression using acquirer and target industry fixed effects. As Table 3b shows, the coefficient results for the explanatory variable provide support ($b=1.621$, $se=0.772$, $p<0.05$). This

means that acquiring firms in the 'expansionary' wave group compared to acquirers in the 'contractionary' wave group are more likely to acquire outside-industry targets. More specifically, a one unit change in the 'expansionary' dummy results in a 1.621 unit change in the log odds of being in a higher level of acquisition distance (outside the acquirer's primary industry), given that other variables are held constant. In other words, acquiring outside the market in the expansionary waves are about 1.5 times more likely to pursue outside-industry targets than acquiring firms in the contractionary waves. Thus, Hypothesis 1 is supported.

[Insert Tables 3a and 3b about here]

Hypothesis 2 states that during contractionary merger waves, acquisition market returns for early movers are higher than those for later movers. Most studies on firm investment timing do not consider endogeneity (Eggers, Grajek, and Kretschmer, 2016). Yet some recent studies consider the possibility that firm investment timing may be contingent on the firm's inherent quality – for example, firms that are early movers are those that may be more capable and higher quality and thus are able to gain a first-mover advantage (Hawk, Pacheco-de-Almeida, and Yeung, 2013; Franco et al., 2009). According to Eggers et al. (2016), accounting for the firm's unobserved factor of "high quality" is challenging to measure and also "difficult to interpret" (Eggers et al., 2016: 15) – a common measure used is the firm's pre-entry experience, but such experience is 'difficult to interpret' in part because it must be specific relevant experience such as prior investments in the same product market to matter for the focal investment outcome. On the other hand, the firm's general pre-entry experience that is unrelated to the focal investment will not materially make much difference in being rewarded by the market, but may positively associated with the firm's ability to be an early mover in the new market (Dutta, 2006).

To test Hypothesis 2, we ran a two-stage least squares fixed-effects model. When applied to the context of acquisition investments during a merger wave, a firm's pre-entry 'merger wave' experience that affects its timing - but not associated with its unobserved "quality" when investing in the focal merger wave - can be its prior acquisitions of targets in unrelated industries, which must be both outside the acquirer's industry and also outside the industries of their targets pursued during the merger wave. The instrument we therefore use is prior unrelated acquisition. Specifically, we measure 1) the number of acquisitions made by the focal firm that is outside focal industry, and 2) more importantly, acquisitions made in industries different from the focal target's industry in the same year up to the month when the current acquisition is made. Testing the instrument validity provides support: the correlation between our instrument and the possible endogenous variable of timing for the wave 1 sample is sufficiently high (wave 1 partial R-squared = 0.6136), and the estimated the F-statistics for the instrument is significantly above of the critical value to reject the null hypothesis that our instrument is weak (wave 1 F-statistic = 31.6405 with p-value <0.01).

Hypothesis 2 will be supported if the variable for firm timing is negative and significant, meaning that as acquiring firms are positioned later in the wave (as their value representing firm timing increases), they are associated with lower CARs. In other words, acquiring firms positioned earlier in the wave (when their firm timing value is low) are associated with higher CARs. The results testing hypothesis 2 are reported in Table 4 Model 2. The coefficient for the variable of firm timing derived in the second stage using 2SLS model is negative and significant (b = -0.819, se = 0.188, p<0.01). We then analyzed the full sample with both types of waves using

fixed effects estimation. As reported in Table 4 Model 7, the coefficient for firm timing in contractionary waves is negative and significant = -1.218, se = 0.602, $p<0.1$). Thus, Hypothesis 2 is supported.

[Insert Table 4 about here]

Hypothesis 3 states that during an expansionary merger wave, market returns for later movers are initially higher than those for early movers, but then the later mover advantage will decline in subsequent periods. We also test the effect of firm timing on acquisition returns by running the two-stage least squares fixed-effects model using the instrumental variable of prior unrelated acquisition experience. Testing the instrument validity for the wave 2 sample provides support: the correlation between our instrument and the possible endogenous variable of timing for the wave 2 sample is sufficiently high (wave 2 partial R-squared = 0.7089), and the estimated the F-statistics for the instrument is significantly above of the critical value to reject the null hypothesis that our instrument is weak (wave 2 F-statistic = 46.7467 with p-value<0.01).

Hypothesis 3 will be supported if the polynomial regression using 2SLS estimation shows that the coefficient on the variable for firm timing is positive and significant, while the coefficient on the squared measure of firm timing is negative and significant. This means that as acquiring firms are positioned later in the wave (their ordinal value increases), their associated CARs initially increase, but that advantage decreases in return over time. The results testing hypothesis 3 are reported in Table 4 Model 4. The coefficient for firm timing is positive and significant (b=2.396, se=0.942, $p<0.05$), while the coefficient for squared firm timing is negative and significant (b= -1.987, se=0.769, $p<0.01$). We then ran the full sample. As reported in Table 4 Model 7, the coefficient for the interaction of firm timing and dummy for expansionary waves is positive and significant (b = 2.351, se = 0.924, $p<0.05$). Thus, we find support for Hypothesis 3

that the acquisition returns for later movers exhibits an inverted U-shaped relationship. These results add further confirmation.

Hypothesis 4 predicts that if the later-mover advantage during an 'expansionary' wave is due to learning, then that advantage will be stronger when target information asymmetry is greater, and hence the opportunity for learning is more valuable. Specifically, we examine whether later-mover advantage in expansionary waves is stronger when the acquirer-target 'distance' is greater. Testing the hypothesis requires examining the effect that the interaction terms of firm timing and acquirer's target distance has on acquisition market returns. If we run the sample of acquisitions during expansionary waves, the hypothesis will be supported when the coefficient of the interaction term of firm timing and target distance is positive, while the coefficient of the interaction term of firm timing squared and target distance is negative – this will show that the inverse curvilinear effect becomes positively moderated. In Table 4 Model 5, the coefficient for the interaction of firm timing and target distance is positive and significant ($b=0.3351$, $se = 0.157$, $p<0.05$), and the coefficient for the interaction of firm timing squared and target distance is negative and significant ($b= -1.582$, $se=0.663$, $p<0.05$).

If we run the full sample with both types of waves, then the hypothesis will be supported if the coefficient for the triple interaction term of firm timing, target distance, and expansionary wave is positive, while the coefficient for the triple interaction term of firm timing squared, target distance, and expansionary wave is negative. In Table 4 Model 8 using the full sample, the coefficient for the interaction of firm timing, target distance, and wave2 is also positive and significant ($b=1.569$, $se=0.607$, $p<0.05$), and the coefficient for the triple interaction term of firm timing squared, target distance, and expansionary wave is negative and significant ($b= -0.772$, $se=0.312$, $p<0.05$).

[Insert Figures 1 and 2 about here]

## SUPPLEMENTARY ANALYSES

*Learning by later movers: learning by observing and learning by doing*

In our main analysis, we argue that later movers are more advantageous during 'expansionary' waves because target information asymmetry is greater and the need for learning is more important. If later-movers benefit by learning, then it is natural to then ask how they learn. What has been implied so far – yet not tested - is that later-movers 'learn by observing' the actions of other firms and thereby make more prudent target selections – later-movers can learn from their earlier-moving rivals in the same industry (also known as "peers") as well as earlier-moving firms in other industries (also known as "non-peers") that have made acquisitions into that target industry. Research on "observational learning" shows that corporate actions by similar firms can offer valuable information (Bikhchandani et al., 1998); and the perceived outcome of other acquisitions can affect the firm's own acquisition choices (Delong and Deyoung, 2007).

We predict that if later-movers do learn from their earlier-moving rivals then previous successful merger performance in a target industry positively affects the frequency of follow-up acquisitions in the same target industry. As we have explained, acquirers during 'expansionary' waves pursue more outside-industry targets, but also face higher information asymmetry about those potential targets. Successful deals can deliver positive information about investment opportunities in the target industry's M&A market, and thereby encourage such follow-up deals by later-moving acquirers also looking to capitalize. In contrast, unsuccessful preceding deals in a target industry can discourage subsequent acquisition activity in that target industry.

Furthermore, later movers can also 'learn by doing' as well. We consider a sub-sample of later-movers that had made previous acquisitions as early movers during the wave. We examine

whether these later movers learn from their earlier pursuits in successful and unsuccessful target industries. Similar to the above logic, earlier successful deals can deliver positive information about investment opportunities in the target industry's M&A market, and thereby encourage such follow-up deals by the firm. On the other hand, unsuccessful previous deals in a target industry can discourage the acquiring firm in subsequently pursuing targets in that industry.

To test our predictions, we use a time-series (by quarter) Poisson regression with fixed effects on acquirer industry, target industry, and year. We use Poisson estimation due to non-negative count variable. The unit of observation is target industry – quarter. Our dependent variable is defined as the number of outside-industry acquisitions by acquirers in the focal industry going into a certain target industry, for a given quarter in year y. Our first main explanatory variable is peer CAR, which we measure as the average cumulative abnormal announcement return of such cross-industry mergers undertaken by others - in the same industry as the focal acquirer - going into the target industry in the previous quarters. Our second main explanatory variable is non-peer CAR, which we measure as the average cumulative abnormal announcement return of cross-industry mergers made by the firm's non-peers - in other industries - going into the target industry in the previous quarters. These two independent variables allow us to distinguish different types of learning: general learning associated with information transmitted from non-peers and learning more specific to the industry (i.e. learning from peers). Finally, our third explanatory variable in the sub-sample of later movers that also made previous acquisitions as the acquirer's own CAR, which we measure as the average in the target industry in the previous quarters.

In Table 5 Model 2, results show that both peer firms and non-peer firms' prior acquisition experiences have a positive effect on a firm's cross-industry acquisition decision – The coefficient for peer CAR is positive and significant ($b=0.051$, $p<0.05$), and the coefficient for non-peer CAR is positive and significant ($0.032$, $p<0.05$). These results suggest that later movers engage in learning by observing that is both general and industry-specific. In Table 5 Model 3, firms that have made previous acquisitions seem to learn from their previous experiences – The coefficient for own CAR is positive and significant ($b=0.026$, $p<0.01$).

[Insert Table 5 about here]

## DISCUSSION AND CONCLUSION

In this study, we reexamine whether early acquirers always have an advantage over later movers during merger waves. First, we make a distinction between two types of merger waves - contractionary vs expansionary - based upon the underlying economic conditions in the industry. We find that acquiring firms in the expansionary wave, compared to those in the contractionary wave, are more exploratory, as reflected in their propensity to pursue a greater proportion of acquisition targets outside their primary industry. Given these different acquisition patterns, we then find that timing advantages vary. The early-mover advantage observed in previous merger wave research seems to hold only for firms in contractionary waves but not for firms in expansionary waves. Our results show that in expansionary waves when investment information asymmetry is higher, then acquisition returns for later movers are greater because learning becomes more valuable, but this later-mover advantage tends to decline over time. We also show that the later-mover advantage during expansionary waves is stronger when acquisition targets are more 'distant', or when investment information asymmetry is greater. Furthermore, we demonstrate in our supplementary analysis that later movers learn by observing early movers –they pursue more

targets in certain industries where earlier-moving peers and non-peers have found acquisition success.

Our paper makes several important contributions. First, we seek to contribute to merger wave research by examining different types of merger waves that arise due to different underlying economic conditions. More understanding is needed about how firms adjust their acquisition strategies to industry downturns compared to upswings (Anand and Singh, 1997; Haleblian et al., 2009; Lieberman, Lee, and Folta, 2016). We show that during each type of wave acquiring firms prioritize different targets.

Second, we contribute to merger wave research by examining whether the early-mover advantage during a merger wave, as traditionally emphasized in prior work, still holds as the economic environment varies. We consider conditions when being a later mover might be more beneficial. Specifically, we examine in more detail the later-mover advantage due to learning. We also show when this learning by later movers becomes the most valuable – when targets are more distant. In addition, we demonstrate how later movers can learn - by observing actions by earlier movers. To the best of our knowledge, management research on merger waves is largely silent on the late-mover phenomenon and its learning advantage, with only a small number of recent studies suggesting that firms moving at the tail end of a wave might recover from a later mover disadvantage (Haleblian *et al.*, 2012; Duchin *et al.*, 2013).

In fact, our paper seeks to clarify some confusion as to how acquiring firms during a merger wave can learn. According to merger wave scholars explaining the early mover advantage, early movers can identify quality assets due their informational advantage, or what is termed as "foresight" (McNamara et al., 2007). This "foresight" becomes especially valuable in environ-

ments characterized by higher uncertainty, as later movers are believed to be punished more because they act on herding behavior (McNamara et al., 2007; Baurer et al, 2012). Such beliefs contradict investment-timing models - such as based on Gort and Klepper (1982) - that show information access working against early movers, rather than in their favor. According to investment timing research, such investment information asymmetry faced by early movers are especially significant in high-uncertainty environments, which should punish early movers due to facing higher information deficit and benefit later movers (not the other way around).

Finally, we seek to contribute to investment timing research in general. The decision for the firm to be an early mover or later mover must weigh the tradeoff between preemption cost and information deficit cost. According to investment timing scholars, this cost tradeoff is the following: Early movers face lower preemption cost, but higher information deficit cost; while later movers face lower information deficit cost but higher preemption cost (Gort and Klepper, 1982). According to our study, which timing option is more optimal depends on the environmental demands. In our case of industry growth, we demonstrate that firms entering into uncertain market environments must confront significant investment information asymmetry, which becomes more pronounced in more uncertain environments – therefore information deficit cost will be significantly high, while preemption cost will be less significant. In this scenario, such cost tradeoff favors later movers over early movers.

Our study has several managerial implications. There continues to be confusion among executives managers about when to strategically time their acquisitions. Executives often make mistakes either jumping into investments too early or too late. For example in the oil industry as one of our covered industries, executives at Exxon, primarily an oil company, came to later regret rushing to acquire natural gas company XTO Energy before sufficiently understanding the

business (Irwin, 2013). On the other hand, executives at Energy Transfer ultimately reached a better deal to merge with Williams after waiting several months (Sider, 2015). As the oil industry has recently experienced another merger wave, industry executives as well as their hired consultants were once again weighing recommendations such as taking a leader or follower strategy in capturing the emerging investment opportunities (Bertocco, Keuer, and Milisavljevic, 2015). Our research helps answer these questions. Though we advocate waiting in some cases, there are caveats as well. Exhibiting strategic patience can be a valuable investment strategy, but waiting too long could be detrimental - we advocate acquiring firms facing high target information asymmetry to time their investments after early movers to learn from them, but not too long so as to miss out on valuable opportunities.

We see several opportunities for future research. In this paper, we study acquisition patterns to make the case that firms pursuing a greater proportion of targets outside their primary industry face higher information asymmetry. Future research can compare acquisition premiums to determine how much the acquiring firm overpays for its target, which can reflect the degree of difficulty for acquiring firms to accurately evaluate and integrate targets (Haunschild, 1994; Hayward and Hambrick, 1997). Another interesting question is whether there are triggers separating firms between being early movers and late movers. In the case of an ‘expansionary’ wave for instance, though we advocate for an optimal midpoint in timing, a challenge for acquiring firms is knowing what market signs to follow that signal needed action. Future scholars can examine this question - for instance determining any ‘hurdle rates’ during a wave to know how long to wait before jumping in.

In summary, merger waves are a common phenomenon across industries, yet there is still much to learn about them. Our findings show that merger waves are not homogenous as implied

in past research, and they can have different natures depending on their underlying economic conditions. By distinguishing different merger waves, we then examine the unique dynamics within these waves. In our paper, we show that firms are more exploratory and enjoy later mover advantage during expansionary waves than during contractionary waves.

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## Table 1: Correlation Tables for 'Contractionary' Waves (top table) and 'Expansion' Wave (bottom table)

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Outside-Industry Acquisition | 0.30 | 0.25 | 1.00 | | | | | | | | | | | | | | | | | |
| 2. CAR | 0.01 | 0.10 | -0.18 | 1.00 | | | | | | | | | | | | | | | | |
| 3. Acq total asset | 4434.74 | 2532.48 | 0.20 | 0.02 | 1.00 | | | | | | | | | | | | | | | |
| 4. Acq slack | 5.68 | 62.36 | 0.23 | 0.18 | 0.25 | 1.00 | | | | | | | | | | | | | | |
| 5. Acquiring past similar targets | 12.92 | 13.55 | 0.17 | 0.09 | 0.18 | 0.15 | 1.00 | | | | | | | | | | | | | |
| 6. Acq performance | 0.06 | 0.26 | 0.15 | 0.22 | 0.02 | 0.21 | 0.15 | 1.00 | | | | | | | | | | | | |
| 7. Target Performance | 0.07 | 0.29 | -0.06 | 0.27 | -0.03 | -0.04 | -0.18 | -0.36 | 1.00 | | | | | | | | | | | |
| 8. Acq num of acquisitions in wave | 8.89 | 7.57 | 0.09 | 0.18 | 0.16 | 0.21 | 0.09 | 0.18 | 0.16 | 1.00 | | | | | | | | | | |
| 9. Prior Joint Venturing | 0.01 | 0.32 | -0.03 | 0.18 | 0.16 | 0.03 | 0.19 | 0.24 | 0.23 | 0.07 | 1.00 | | | | | | | | | |
| 10. Diversification | 0.56 | 0.32 | -0.27 | 0.21 | 0.31 | 0.23 | -0.12 | 0.31 | 0.01 | 0.09 | 0.03 | 1.00 | | | | | | | | |
| 11. Outside Directors | 0.41 | 0.16 | -0.05 | 0.08 | 0.21 | 0.06 | 0.11 | 0.23 | 0.03 | 0.02 | -0.02 | 0.11 | 1.00 | | | | | | | |
| 12. Merger relatedness | 0.68 | 0.47 | -0.16 | 0.31 | -0.16 | 0.11 | 0.17 | -0.19 | -0.13 | 0.15 | 0.17 | 0.15 | -0.01 | 1.00 | | | | | | |
| 13. Deal Attitude | 1.05 | 0.27 | 0.09 | -0.09 | 0.11 | -0.01 | 0.05 | 0.12 | 0.26 | 0.13 | -0.21 | -0.10 | -0.03 | -0.25 | 1.00 | | | | | |
| 14. Stock Payment type | 26.26 | 34.45 | 0.18 | -0.22 | 0.23 | -0.05 | 0.07 | -0.03 | 0.15 | 0.08 | 0.13 | 0.09 | 0.07 | 0.17 | -0.16 | 1.00 | | | | |
| 15. Acquisition Premium | 53.68 | 40.68 | 0.21 | -0.28 | 0.17 | 0.22 | -0.17 | 0.18 | 0.27 | -0.15 | -0.25 | 0.12 | -0.19 | -0.26 | 0.15 | 0.35 | 1.00 | | | |
| 16. Environmental Dynamism | 3.22 | 1.01 | 0.26 | -0.11 | 0.01 | -0.05 | 0.15 | -0.26 | -0.25 | 0.00 | 0.00 | 0.02 | 0.00 | 0.18 | -0.07 | -0.11 | 0.11 | 1.00 | | |
| 17. Target Distance | 17.57 | 3.641 | -0.17 | -0.15 | -0.03 | 0.18 | -0.02 | 0.18 | 0.29 | 0.09 | 0.00 | 0.00 | 0.00 | -0.12 | 0.04 | 0.15 | 0.15 | 0.21 | 1.00 | |
| 18. Firm Timing | 0.50 | 0.29 | 0.19 | -0.26 | 0.14 | -0.16 | -0.24 | 0.13 | -0.20 | 0.19 | -0.13 | 0.21 | -0.01 | -0.19 | 0.23 | -0.15 | -0.22 | 0.19 | 0.08 | 1.00 |

n = 5,348. Correlations greater than 0.20 are significant at 0.05, and those greater than 0.17 are significant at 0.10.

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Outside-Industry Acquisition | 1.30 | 0.60 | 1.00 | | | | | | | | | | | | | | | | | |
| 2. CAR | 0.03 | 0.14 | 0.25 | 1.00 | | | | | | | | | | | | | | | | |
| 3. Acq total asset | 1119.70 | 3688.20 | 0.29 | 0.09 | 1.00 | | | | | | | | | | | | | | | |
| 4. Acq slack | 0.30 | 28.64 | 0.33 | 0.18 | 0.27 | 1.00 | | | | | | | | | | | | | | |
| 5. Acquiring past similar targets | 18.51 | 16.16 | 0.15 | 0.04 | -0.03 | -0.08 | 1.00 | | | | | | | | | | | | | |
| 6. Acq performance | 0.23 | 0.31 | 0.16 | 0.15 | 0.04 | 0.21 | 0.15 | 1.00 | | | | | | | | | | | | |
| 7. Target Performance | 0.21 | 0.29 | -0.08 | 0.06 | 0.03 | 0.19 | -0.06 | 0.31 | 1.00 | | | | | | | | | | | |
| 8. Acq num of acquisitions in wave | 9.42 | 6.81 | 0.07 | 0.17 | 0.14 | 0.20 | 0.11 | 0.17 | 0.15 | 1.00 | | | | | | | | | | |
| 9. Prior Joint Venturing | 0.01 | 0.29 | -0.06 | 0.19 | 0.12 | 0.14 | 0.01 | 0.18 | 0.34 | 0.06 | 1.00 | | | | | | | | | |
| 10. Diversification | 0.52 | 0.29 | -0.18 | -0.26 | 0.36 | 0.25 | 0.19 | 0.25 | 0.01 | 0.08 | -0.11 | 1.00 | | | | | | | | |
| 11. Outside Directors | 0.46 | 0.21 | -0.09 | 0.15 | 0.17 | 0.03 | 0.01 | 0.11 | 0.03 | 0.04 | -0.03 | 0.10 | 1.00 | | | | | | | |
| 12. Merger relatedness | 0.76 | 0.43 | -0.15 | -0.28 | -0.06 | -0.17 | -0.19 | -0.18 | 0.11 | 0.16 | -0.16 | -0.09 | -0.02 | 1.00 | | | | | | |
| 13. Deal Attitude | 1.03 | 0.17 | 0.05 | -0.05 | 0.07 | -0.06 | 0.12 | 0.15 | 0.21 | 0.10 | -0.20 | -0.09 | -0.05 | 0.23 | 1.00 | | | | | |
| 14. Stock Payment type | 38.91 | 27.83 | 0.22 | -0.27 | 0.21 | 0.14 | 0.08 | 0.17 | 0.25 | 0.07 | 0.03 | 0.07 | 0.08 | 0.16 | -0.17 | 1.00 | | | | |
| 15. Acquisition Premium | 61.30 | 32.18 | 0.27 | -0.29 | 0.26 | 0.21 | -0.13 | 0.26 | 0.31 | -0.13 | -0.18 | 0.13 | -0.24 | -0.24 | 0.20 | 0.39 | 1.00 | | | |
| 16. Environmental Dynamism | 3.93 | 1.15 | 0.19 | -0.17 | 0.01 | -0.07 | 0.12 | -0.21 | -0.25 | 0.00 | 0.00 | 0.01 | 0.00 | 0.17 | -0.06 | -0.15 | 0.12 | 1.00 | | |
| 17. Target Distance | 75.41 | 20.97 | -0.20 | 0.21 | -0.06 | 0.23 | -0.16 | 0.15 | -0.06 | 0.08 | 0.01 | 0.00 | 0.00 | -0.15 | 0.07 | 0.19 | 0.16 | 0.29 | 1.00 | |
| 18. Firm Timing | 0.64 | 0.21 | 0.18 | 0.29 | 0.11 | -0.22 | -0.16 | 0.28 | -0.21 | 0.17 | -0.16 | 0.12 | 0.01 | -0.05 | -0.19 | -0.16 | -0.18 | 0.09 | 0.35 | 1.00 |

n = 7,450. Correlations greater than 0.20 are significant at 0.05, and those greater than 0.17 are significant at 0.10.

## Table 2: Mergers waves by industries

This table presents the merger waves in 10 industries. The sample covers for each industry between the periods of 1990 to 2015. Each row represents the industry. First column (1) is when each merger wave in the industry occurred, which we identify by its peak year. The second column (2) is the total number of acquisitions that took place during that wave. The third column (3) is the average number of acquisitions made per year in the industry during the wave period. The fourth column (4) is the average number of acquisitions made per year in the industry during the two years prior to the wave start – this column compared to third column will show difference in acquisition frequency between the pre-merger wave period and the merger wave period. The fifth column (5) is whether that merger wave took place when the industry was in a contraction or expansion period we based this on whether the wave overlapped with periods of industry contraction or expansion according to NBER classification. The sixth column (6) is the total number of acquisitions inside the industry, and the seventh column (7) is the total number of acquisitions outside the industry according to SIC code.

| Industries (by SIC) | (1) Merger waves period (acquisition frequency peak year) | (2) Total number of acquisitions during wave | (3) Average acquisition frequency per year during wave | (4) Average acquisition frequency per year in two-year prior to | (5) Period of industry contraction (C) or expansion (E) | (6) Total Number of Inside Industry Targets | (7) Total Number of Outside Industry Targets |
|---|---|---|---|---|---|---|---|
| Oil-gas production (13) | 1997-1999 (1998) | 2214 | 738 | 122 | C | 1662 | 552 |
| | 2003-2007 (2003) | 4781 | 956 | 211 | E | 1234 | 3547 |
| Chemicals (28) | 2001-2004 (2002) | 3531 | 883 | 183 | C | 1892 | 1639 |
| | 2006-2009 (2007) | 2972 | 743 | 166 | E | 1018 | 1954 |
| Rubber-plastic (30) | 1997-2000 (1998) | 721 | 180 | 52 | E | 299 | 422 |
| | 2004-2007 (2006) | 415 | 104 | 46 | C | 256 | 159 |
| Lumber-wood products (24) | 1993-1996 (1995) | 778 | 195 | 65 | E | 387 | 391 |
| | 2004-2007 (2005) | 1102 | 276 | 84 | C | 633 | 469 |
| Textile-apparel (22) | 2006-2008 (2007) | 622 | 207 | 77 | C | 364 | 258 |
| Publishing (27) | 2007-2009 (2008) | 2126 | 709 | 203 | C | 1482 | 644 |
| Metals production (33) | 1995-1998 (1997) | 1246 | 312 | 96 | E | 521 | 725 |
| | 2005-2008 (2007) | 751 | 188 | 41 | C | 428 | 323 |
| Industrial equipment (35) | 1995-1998 (1997) | 4351 | 1088 | 335 | E | 1684 | 2667 |
| | 2006-2009 (2008) | 3668 | 917 | 256 | C | 2041 | 1627 |
| Mining (21) | 1995-1999 (1997) | 5116 | 1023 | 412 | E | 1902 | 3214 |
| | 2005-2008 (2006) | 3258 | 815 | 303 | C | 1841 | 1417 |
| Paper (26) | 1996-1999 (1997) | 722 | 181 | 52 | C | 426 | 296 |

## Table 3a: Propensity Score Matching - Comparing acquisition patterns for firms in each type of wave (Hypothesis 1)[a]

This table compares the mean percent of outside-industry targets (measured as the proportion of the total number of outside-industry targets over the total number of acquisitions in the wave) for firms in the expansionary wave versus those in contractionary wave. The treatment group includes all acquiring firms in expansionary waves. The control group is all acquiring firms in contractionary waves. Targets are considered outside industry by having different four-digit SIC code from the acquirer. We matched firms based on the observable characteristics of assets, slack, leverage and performance that significantly explained the propensity for acquiring firms to select into the expansionary merger waves (the treatment group). Model 1 is the average treatment effect (ATE) before matching between the treatment and control groups. Model 2 is the average treatment effect on the treated (ATET) after matching between the treatment group and the counter-factual control group.

Average Treatment Effect on the Treated: mean percent of outside-industry targets

| | Model 1 (ATE before matching) | Model 1 (ATET after matching) |
|---|---|---|
| Firms in expansionary waves (treatment) | 0.46 | 0.41 |
| Firms in contractionary waves (control) | 0.25 | 0.22 |
| Difference in mean | 0.2 | 0.19 |
| % Explained by matching | 0 | 0.31 |
| # of Treatment | 5348 | 4215 |
| # of Control | 7450 | 5193 |
| Standard Error (bootstrap) | 0.0395 | 0.0271 |
| T-stat (bootstrap) | 1.65 | 3.39 |

[a] The treatment model uses probit estimation. The t-statistic of 1.65 converts to the p-value of 0.1, and the t-statistic of 3.39 converts to the p-value of 0.0008.

**Table 3b: Multinomial Logit Results with Fixed Effects (Hypothesis 1) [a, b,]**

| Variables | Outside-Industry Acquisitions | Outside-Industry Acquisitions |
|---|---|---|
| *Controls:* | | |
| Acquirer total asset | 0.031* | 0.019** |
| | (0.018) | (0.009) |
| Acquirer slack | 0.275* | 0.232* |
| | (0.148) | (0.137) |
| Acq past similar targets | 0.017 | 0.015 |
| | (0.015) | (0.011) |
| Acquirer performance | 0.867 | 1.795 |
| | (0.980) | (1.392) |
| Target performance | -0.502 | -0.486 |
| | (0.441) | (0.805) |
| Prior joint venture | -0.022 | -0.013 |
| | (0.035) | (0.032) |
| Diversification | -0.148* | -0.132* |
| | (0.086) | (0.069) |
| Outside directors | -0.007 | -0.004 |
| | (0.009) | (0.005) |
| Merger relatedness | -1.731* | -1.229 |
| | (0.988) | (0.783) |
| Environmental dynamism | 0.836 | 0.797* |
| | (0.519) | (0.466) |
| *Predictor:* | | |
| Expansion wave dummy | | 1.621** |
| | | (0.772) |
| Acquirer Industry Fixed Effects | Yes | Yes |
| Target Industry Fixed Effects | Yes | Yes |
| Year Fixed Effects | Yes | Yes |
| Intercept 1 | 2.882 | 4.129 |
| | (1.660) | (0.745) |
| Intercept 2 | 3.829 | 5.099 |
| | 2.050) | (0.861) |
| *Pseudo R-squared* | 0.136 | 0.157 |
| *N* | 12,798 | 12,798 |

[a] Logit function parameter estimates with coefficients measured as log odds. Standard coefficients are reported. Standard errors are in parentheses. We use ***, **, * to denote significance at the 1%, 5%, and 10% levels, respectively.

[b] The dependent variable of outside-Industry acquisition is coded as: same industry = 0, outside industry = 1.

## Table 4: Regression Results using 2SLS Fixed-Effects Estimation to Predict Acquisition Returns

| | Contractionary Wave (Hypothesis 2) | | Expansionary Wave (Hypothesis 3 & 4) | | | Full Sample | | |
|---|---|---|---|---|---|---|---|---|
| Variables | (Model 1) Firm timing | (Model 2) CAR[-1.1] | (Model 3) Firm timing | (Model 4) CAR[-1.1] | (Model 5) CAR[-1,1] | Model 6 Firm timing | Model 7 CAR[-1.1] | Model 8 CAR[-1.1] |
| *Controls:* | | | | | | | | |
| Constant | 0.031 | 0.116 | 0.042 | 0.152 | 0.041 | 0.115 | 0.117 | 0.111 |
| | (0.022) | (0.133) | (0.052) | (0.098) | (0.054) | (0.132) | (0.131) | (0.137) |
| Acquirer total assets | 0.005 | 0.007 | 0.004 | 0.008 | 0.004 | 0.007 | 0.008 | 0.005 |
| | (0.009) | (0.012) | (0.003) | (0.005) | (0.003) | (0.012) | (0.011) | (0.011) |
| Acquirer slack | -0.004** | 0.004** | -0.002** | 0.005* | -0.002* | 0.003 | 0.004** | 0.005 |
| | (0.002) | (0.002) | (0.001) | (0.003) | (0.001) | (0.002) | (0.002) | (0.003) |
| Acq past similar targets | -0.036** | 0.035 | -0.031** | 0.015 | -0.031** | 0.032 | 0.031 | 0.035 |
| | (0.015) | (0.026) | (0.012) | (0.026) | (0.012) | (0.024) | (0.025) | (0.026) |
| Acq number of acquisitions in wave | -0.03** | 0.861* | -0.12** | 0.512* | 0.510* | 0.22* | 0.742* | 0.742* |
| | (0.011) | (0.431) | (0.022) | (0.223) | (0.224) | (0.101) | (0.356) | (0.355) |
| Acquirer performance | 0.0762 | 0.151*** | 0.029 | 0.045 | 0.029 | 0.151*** | 0.155** | 0.153** |
| | (0.069) | (0.053) | (0.018) | (0.029) | (0.018) | (0.053) | (0.071) | (0.073) |
| Target Performance | -0.128** | 0.083*** | 0.150** | 0.012 | 0.150** | 0.085 | 0.083* | 0.082** |
| | (0.062) | (0.031) | (0.062) | (0.035) | (0.062) | (0.033) | (0.041) | (0.039) |
| Prior Joint Venturing | -0.286 | 0.128* | -0.211 | 0.153** | -0.198 | 0.126 | 0.127 | 0.128 |
| | (0.175) | (0.077) | (0.168) | (0.082) | (0.162) | (0.075) | (0.076) | (0.077) |
| Diversification | 0.371** | 1.520** | 0.032 | -1.371** | 0.032 | 1.521*** | 1.521*** | 1.519*** |
| | (0.155) | (0.227) | (0.021) | (0.645) | (0.022) | (0.226) | (0.227) | (0.331) |
| Outside Directors | -0.022 | 0.136 | 0.005 | 0.258 | 0.004 | 0.134 | 0.136 | 0.135 |
| | (0.053) | (0.087) | (0.013) | (0.163) | (0.013) | (0.086) | (0.087) | (0.086) |
| Merger relatedness | -0.261** | 0.107*** | -0.007 | -0.041** | -0.008 | 0.107** | 0.111* | 0.107*** |
| | (0.129) | (0.032) | (0.006) | (0.018) | (0.006) | (0.048) | (0.054) | (0.032) |
| Deal attitude | 0.210 | -0.143 | -0.035* | -0.003 | -0.033 | -0.142 | -0.143 | -0.143 |
| | (0.173) | (0.099) | (0.019) | (0.006) | (0.021) | (0.101) | (0.099) | (0.098) |
| Stock Payment Type | -0.086 | -1.821*** | -0.021 | -1.067** | -0.019 | -1.822*** | -1.823** | -1.819*** |
| | (0.099) | (0.697) | (0.015) | (0.473) | (0.016) | (0.698) | (0.897) | (0.695) |
| Acquisition Premium | 0.421** | -0.403*** | -0.023** | -0.237** | -0.025** | -0.402** | -0.403*** | -0.401** |
| | (0.205) | (0.152) | (0.011) | (0.095) | (0.012) | (0.193) | (0.152) | (0.191) |
| Environment Dynamism | 0.028** | -0.327 | 0.151 | -0.232** | 0.152 | -0.326 | -0.325 | -0.329 |
| | (0.012) | (0.283) | (0.112) | (0.112) | (0.112) | (0.283) | (0.281) | (0.284) |
| Unrelated Acq Experience | -0.054*** | | 0.015*** | | | -0.032** | | |
| | (0.010) | | (0.002) | | | (0.016) | | |
| *Predictors:* | | | | | | | | |
| firm timing | | -0.819*** | | 2.396** | 2.371** | | | |
| | | (0.188) | | (0.942) | (0.933) | | | |
| Firm timing squared | | | | -1.987*** | -1.853** | | | |
| | | | | (0.769) | (0.822) | | | |
| Target Distance | | | | | -0.827 | | | |
| | | | | | (0.511) | | | |
| Target Distance x Firm Timing | | | | | 0.335** | | | |
| | | | | | (0.157) | | | |
| Target Distance x Firm Timing Squared | | | | | -1.582** | | | |
| | | | | | (0.663) | | | |

**Continue on next page**

| **Table 4 (continued)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wave2 (0/1) | | | | | | | 0.842* | 0.841* |
| | | | | | | | (0.411) | (0.409) |
| Firm Timing | | | | | | | -1.218* | -1.216 |
| | | | | | | | (0.602) | (0.730) |
| Wave2 X Firm Timing | | | | | | | 2.351** | 2.350** |
| | | | | | | | (0.924) | (0.922) |
| Target Distance | | | | | | | | -0.825 |
| | | | | | | | | (0.509) |
| Target Distance X Firm Timing | | | | | | | | 0.553 |
| | | | | | | | | (0.362) |
| Target Distance X Wave2 | | | | | | | | -0.826 |
| | | | | | | | | (0.512) |
| Target Distance X Firm Timing X Wave2 | | | | | | | | 1.569** |
| | | | | | | | | (0.607) |
| Target Distance X FirmTiming2 X Wave2 | | | | | | | | -0.772** |
| | | | | | | | | (0.312) |
| Acquirer Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Target Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 5,348 | 5,348 | 7,450 | 7,450 | 7,450 | 12,798 | 12,798 | 12,798 |
| Adjusted R-squared | 0.158 | 0.162 | 0.131 | 0.120 | 0.135 | 0.147 | 0.151 | 0.162 |

Standard coefficients are reported. Standard errors are in parentheses. We use ***, **, * to denote significance at the 1%, 5%, and 10% levels, respectively.

Model 1: This column reports results for the first stage probit regression for the *contractionary wave sample*. Instrumented: firm timing. Instrument: unrelated acquisition experience outside industry of focal target.
Model 2: This column reports results in the second stage of the 2SLS model using robust standard errors for the *contractionary wave sample* (hypothesis 2).
Model 3: This column reports results for the first stage probit regression for the *expansionary wave sample*. Instrumented: firm timing. Instrument: unrelated acquisition experience outside industry of focal target.
Model 4: This column reports results in the second stage of the 2SLS model using robust standard errors for the *expansionary wave sample* (hypothesis 3).
Model 5: This column reports hypothesis 4 results that estimates the interaction effects with target distance for the *expansionary wave sample* (hypothesis 4).
Model 6: This column reports results for the first stage probit regression for the *full wave sample*. Instrumented: firm timing. Instrument: unrelated acquisition experience outside industry of focal target.
Model 7: This column reports acquisition market performance for firm timing (earlier vs. later moving acquirers) across both types of waves for the *full sample*. The variable Wave2 is a dummy for whether or not the acquirer is in an expansionary wave. The model tests the effect that firm timing on the dependent variable. The interaction term of firm timing and wave2 (dummy for expansionary waves) tests whether timing varies by the type of wave (hypotheses 2 and 3).
Model 8: This column tests the effect that acquirer's target distance has on the above main effect using the full sample (hypothesis 4).

## Table 5: Learning by Later-movers (learning by observing earlier mover, and learning by doing previous own acquisitions)

This table reports estimates from Poisson regression with acquirer industry, target industry and year fixed effects. The dependent variable is the number of M&As from a given acquirer's SIC industry to the target's SIC industry. In model 2, we examine how later movers learn by observing success and failures of early movers' acquisitions. The explanatory variables are as follows: *Peer CAR (t-1)* is the average CAR of the cross-industry M&As undertaken by the same SIC industry acquirers in the same target industry in the previous quarter prior to the deal of interest. *Non-peer CAR (t-1)* is the average CAR of cross-industry M&As undertaken by firms from all other industries into the same target industry in the previous quarter prior to the deal of interest. In model 3, we examine the sub-sample of later movers that made previous acquisitions as early movers in the wave in order to determine how later movers can learn by doing based on their previous own acquisitions. The explanatory variable *Own CAR (t-1)* is the average CAR of cross-industry M&A undertaken by the firm in the same target industry in the previous quarter prior to its current deal of interest.

| DV: number of M&As in a given industry per year | Model 1 (Controls Variables) | Model 2 (Learning by Observing) | Model 3 (Learning by Doing) |
|---|---|---|---|
| *Controls:* | | | |
| Constant | 0.027 | 0.022 | 0.022 |
| | (0.015) | (0.016) | (0.016) |
| Acquirer Industry Growth | 0.041 | 0.038* | 0.038* |
| | (0.22) | (0.17) | (0.17) |
| Target Industry Growth | 1.559** | 1.543** | 1.543** |
| | (0.728) | (0.711) | (0.711) |
| Environment Dynamism | 0.589* | 0.581* | 0.581* |
| | (0.262) | (0.256) | (0.256) |
| Wave2 | 0.847** | 0.841** | 0.841** |
| | (0.412) | (0.406) | (0.406) |
| *Predicted:* | | | |
| Peer CAR (t-1) | | 0.051** | |
| | | (0.02) | |
| Non-peer CAR (t-1) | | 0.032** | |
| | | (0.015) | |
| Own CAR(t-1) | | | 0.026*** |
| | | | (0.011) |
| Acquirer Industry Fixed Effects | Yes | Yes | Yes |
| Target Industry Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |
| Observations (acquirer-target-year) | 12,581 | 12,317 | 1,317 |
| R-squared | 0.021 | 0.022 | 0.018 |

Standard coefficients are reported. Standard errors are in parentheses. We use ***, **, * to denote significance at the 1%, 5%, and 10% levels, respectively.

**Figure 1. Relationship between Timing Position in Contractionary Wave and Acquistion Returns**

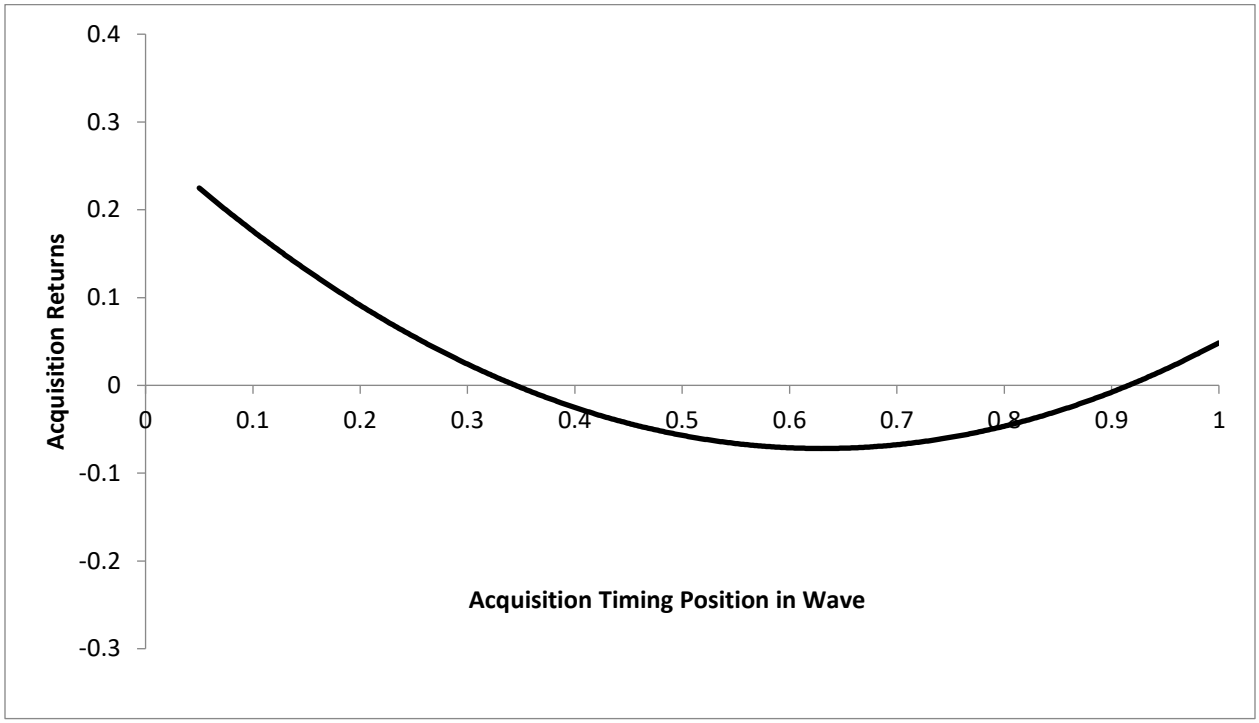


**Figure 2. Relationship between Timing Position in Expansionary Wave and Acquistion Returns**