AN INVESTIGATION OF THE IMPACT OF TRUST, KNOWLEDGE, AND DEPENDENCE ASYMMETRIES ON RELATIONAL PERFORMANCE IN BUYER-SUPPLIER DYADS

By

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ABSTRACT

AN INVESTIGATION OF THE IMPACT OF TRUST, KNOWLEDGE, AND DEPENDENCE ASYMMETRIES ON RELATIONAL PERFORMANCE IN BUYER-SUPPLIER DYADS

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Asymmetries in buyer-supplier relationships can have major implications on relational performance. This dissertation explores the relationship between three different asymmetries that emerge in relationships. Trust, knowledge, and dependence levels have been shown to have both positive or negative effects in buyer-supplier relationships. In order to explain these paradoxes, the constructs of trust asymmetry, knowledge asymmetry, and relational dependence asymmetry are developed in order to understand how asymmetries in buyer-supplier relationships might lead to conflict and opportunism in buyer-supplier dyads. This dissertation explores the concept of asymmetries in buyer-supplier relationships through a multi-method approach which explores dyadic asymmetries from the perspective of theory-building, simulation modeling and testing, and empirical survey collection and analysis.

A model which explores the dyadic nature of trust and combines the trust models of reciprocal trust, mutual trust, and trust asymmetry is presented and tested. The relationships between trust, knowledge, and dependence asymmetries and the negative relational outcomes of conflict and opportunism are explored via dyadic survey data. The concept of signal loss within trust channels is proposed as a mechanism which leads to trust asymmetry. A simulation is developed which explores the theory of the fraud triangle in the context of buyer-supplier relationships as the mediating pathway through which asymmetries lead to opportunism in relationships. This relationship is developed and tested using a cellular automata simulation. The

findings support the need for dyadic analysis in buyer-supplier relationships and yield additional insights in managing buyer-supplier relationships and relational risk.

This dissertation is dedicated to Dr. Ram Narasimhan in honor of his service to the profession of supply chain management and for his influence on countless PhD students and scholars. Dr. Narasimhan was the finest faculty advisor and mentor one could ask for and I express my deepest appreciation for his service.

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KEY TO ABBREVIATIONS

Transaction Cost Economics (TCE)

Complex Adaptive Systems (CAS)

Outgoing Trust (OT)

Incoming Trust (IT)

Seemingly Unrelated Regression (SUR)

OLS (Ordinary Least Squares)

CHAPTER 1: INTRODUCTION

1. MOTIVATION

Research in supply chain management is focused on understanding how relationships can influence firm performance (Chen & Paulraj, 2004). In order to understand this complicated issue, a number of important relational constructs have been discussed in the literature that focus on how relationships between firms can lead to positive and negative effects on firm performance. One of the key areas that is often explored is the concept of collaboration in buyer supplier relationships. Collaboration within a supply chain is a critical component of successful relationships. Research has generally supported the relationship between collaboration and firm performance (Heide & John, 1990; Holcomb & Hitt, 2007; Cao & Zhang, 2011). However, research has also shown that collaboration can also lead to negative firm performance through various mechanisms (Anderson & Jap, 2005; Rossetti & Choi, 2005; Villena, Revilla, & Choi, 2011).

This dissertation explicates both the positive effects of collaboration and the negative effects of collaboration on firm performance by conceptualizing traditional relational constructs as dyadic measures. Traditional research primarily focuses on relational constructs from the perspective of a single party in a relationship. This limits our understanding of the constructs by ignoring the interactive behavior of the two perspectives within a relationship of the buyer and the supplier.

Central to that focus is the concept of asymmetries in buyer-supplier relationships. This dissertation develops the ideas of relational asymmetries in three key aspects in order to understand unexplained paradoxes in previous literature. These paradoxes generally take the form of conflicting findings in previous research which are not yet understood using only the singular

perspective that is traditionally adopted. Using asymmetries, previous contradictory findings can be explored by models which use dyadic interpretations of relational aspects to explain both positive and negative relational performance.

Three asymmetries will be developed within this dissertation: Trust Asymmetry, Knowledge Asymmetry, and Dependence Asymmetry. Each of these asymmetries represents a key relational construct that is often researched in the context of a single party and which is significantly different when viewed in the context of the dyadic perspective. Asymmetries in buyer-supplier relationships have received limited attention in the literature. Part of the limited volume of research on asymmetries is due to the challenge of dyadic data collection and access to dyadic data sources. However, the richness of the understanding obtainable through the dyadic perspective on relational constructs merits additional research on asymmetries in in buyer-supplier relationships.

2. LITERATURE REVIEW

2.1 Asymmetries in Buyer-Supplier Relationships

Research on asymmetries provides a unique opportunity to explore how different levels of relational constructs between buyers and suppliers can lead to different relational outcomes when considered in conjunction with one another rather than independently. The goal of this dissertation is to develop a more comprehensive understanding of buyer-supplier relational outcomes and relational.

Research using the dyadic perspective can be particularly good at explaining counterintuitive findings or paradoxes in the literature due to the ability it has to explain specific interactions among relational constructs that are not intuitive using the traditional approach of a

singular perspective. Each of the asymmetries developed in this dissertation address a key paradox in the literature by exploring the role of asymmetries in buyer-supplier relationships.

2.2 Conflicting Findings in Research

2.2.1 Trust

Collaboration and cooperation within supply chains has been shown to have mixed effects on firm performance (Rossetti & Choi, 2005; Villena, Revilla & Choi, 2011). Trust is a construct that can bridge the gap between collaboration and performance (Schoenherr, Narayanan, and Narasimhan, 2015) and it can be used to understand how collaboration might be positively or negatively related to performance. In one case study, trust was intentionally developed by a supplier in order to take advantage of the buyer firm (Anderson & Jap, 2005). These findings suggest that trust can have various roles related to relational performance.

In order to explain these findings, trust is explored as a dyadic measure, which captures the role of both perspectives within buyer-supplier relationships. Research on the dyadic perspective on trust has been very limited. It has been shown that trust levels matter between firms and that it is important to take into account the behavior of both parties in order to understand trust completely (Barney and Hansen, 1994). Furthermore, trust levels are sometimes different between buyers and suppliers (Mahapatra, Narasimhan, & Barbieri, 2010). This research demonstrates that trust has a critical role in predicting relationship success and can take a variety of roles in that relationship.

The dyadic perspective taken in this dissertation views asymmetries in trust in a buyer-supplier relationship (when parties have different levels of trust within a relationship) as core to explaining trust's mixed effects in relationships. It expands on previous studies of the influence of trust which have primarily studied trust from the perspective of the buyer.

2.2.2 Dependence

Literature on relational dependence has identified the effect of relational dependence as both a positive and a negative effect. The Kraljic purchasing model that has gained significant attention in the literature suggests the buyers should exploit suppliers when they have higher power over their supplier (Kraljic, 1983). Asymmetric power and dependence in a relationship can lead to supplier squeezing where powerful firms take advantage of weaker suppliers (Bloom & Perry, 2001). This can be advantageous to buyers who are able to capture more of the value from the relationship. Studies have argued that supplier dependence on the buyer will lead to lower levels of opportunistic behavior by suppliers (Provan & Gassenheimer, 1994). Research has also found empirical evidence that suggests power asymmetry can be used to promote supply chain integration and performance (Maloni & Benton, 2000).

Developing relational dependence in partners can have obvious benefits for a firm, but at the same time it can create relational risks which are ignored. Other research has shown that relationships with asymmetric dependence become deficient relationships because of exploitation by the stronger party (Anderson & Weitz, 1989). The asymmetric dependence in the relationship creates long term friction between companies that can lead to reduced relational performance. Power imbalance has also been shown to lead to unproductive relationships (McDonald, 1999). This dissertation seeks to better understand the relationship between dependence and relational performance by exploring how dependence can be beneficial when it is balanced within a relationship and lead to negative consequences within the relationship when dependence is asymmetric.

2.2.3 Knowledge

Different knowledge levels between firms can both be desirable and undesirable depending on the circumstances. Research on credence goods (Darby & Karni, 1973) shows how knowledge asymmetries can lead to opportunistic behavior by suppliers who have a greater level of product knowledge than their buyers. Credence goods are a type of good where the seller has significantly higher knowledge regarding the product than the buyer and can potentially withhold critical information about the product from their buyers in order to serve self-interest. Credence goods have been shown to be prone to opportunistic behavior (Vetter & Karantininis, 2002; Dulleck, Kerschbamer, & Sutter, 2009).

Asymmetries in information levels have also been shown to lead to opportunism in principal-agent problems, where differences in incentives and information levels between exchange partners creates higher levels of opportunistic behavior by the informed party (Eisenhardt, 1989). Sharma (1997) discussed the principal agent problem in the context of principal-professional exchanges where knowledge asymmetry was particularly high and argues that knowledge asymmetry arising from a difference in task-related knowledge would have an even stronger effect on developing opportunism than information asymmetry because the deeper intricacies of knowledge asymmetries allow for more opportunistic behavior.

On the other hand, knowledge asymmetry can be the driving force behind outsourcing decisions as companies that are able to leverage knowledge capabilities in their supplier base are able to convert those capabilities within their supply chain into competitive advantage. This enables innovation as companies seek to gain access to specialized knowledge, resources and innovations through their supplier knowledge capabilities (Quinn & Strategy, 2013). Knowledge

asymmetry has been noted as a positive influence on global innovation (Cooke, 2005), further supporting the link between knowledge asymmetry and innovation performance.

Knowledge asymmetry can both be a driver for innovative success or a driver for relational problems. Research that has looked at knowledge asymmetry finds results for both sides of knowledge asymmetry. Blomqvist, Kyläheiko, and Virolainen (2002) find that asymmetric complementarities such as knowledge and technologies can lead to greater innovation, but some problems might arise from asymmetric information. This lends support for the knowledge asymmetry paradox which will be explored by this dissertation.

3. DISSERTATION OUTLINE

In order to explore the implications of asymmetries on relational performance, this dissertation takes a multi-method approach in order to explore these relationships.

Chapter 1 introduces each of these asymmetries and presents a theoretical background for understanding asymmetries in buyer-supplier relationships. Paradoxes established within the literature in the context of trust, knowledge, and dependence are presented which motivate this dissertation. Chapter 2 develops the concept of trust asymmetry more fully, presenting a theoretical model to capture the complexities of trust measured in buyer-supplier relationships. Three models presented in the trust literature, reciprocal trust, mutual trust, and asymmetric trust are combined into a dyadic trust model which clarifies the distinctions and similarities between each of those models. The concepts of trust asymmetry and signal loss are presented and explored. Chapter 3 is an analysis of empirically collected dyadic survey data on buyer-supplier relationships on trust asymmetry, dependence asymmetry, and knowledge asymmetry that can form in relationships. Chapter 3 extends and tests the findings from Chapter 2 and motivates additional research in

chapter 4 using empirical analysis which examines the relationships that asymmetries have with conflict and opportunism. Chapter 4 explores the complex role of trust asymmetry, knowledge asymmetry, and dependence asymmetry as precursors to opportunistic behavior through the concept of the fraud triangle. The mediating theory of the fraud triangle is presented which discusses how asymmetries can lead to differences in opportunity, pressure, and rationalization to commit opportunistic behavior in a relationship. A simulation is developed and tested to evaluated to test these relationships using Cellular Automata. Chapter 5 is a summary of the primary contributions of this dissertation and presents additional areas of research to be explored by future work.

CHAPTER 2: A DYADIC THEORY ON TRUST

1. INTRODUCTION

1.1 Introduction

Trust asymmetry, dependence asymmetry, and knowledge asymmetry can all have implications on relational outcomes. Of these three asymmetries, trust asymmetry has been relatively unexplored and is one of the most complicated to measure and identify within a dyadic relationship. Because of this, Chapter 2 is focused on developing a theoretical model to understand dyadic trust and trust asymmetry more fully.

One reason that research on trust is particularly interesting is that trust has been shown to have mixed effects in relationships (Zahra, Yavuz & Ucbasaran, 2006). In order to understand these mixed effects, much of the recent research has explored the concept of asymmetric trust. Many recent, excellent reviews of the role of trust in relationships have emphasized the importance of additional research on dyadic trust and trust asymmetry (Tomlinson, Dineen, & Lewicki, 2009; Fulmer & Gelfand, 2012; Korsgaard, Brower, & Lester, 2014). This research is motivated by the pressing need for additional research on trust asymmetry, and to address the clear paradox of when trust leads to positive or negative outcomes in relationships.

Trust is a concept that has been heavily explored by scientific literature because of the major implications that trust has on relationships (Moorman, Zaltman, & Deshpande, 1992; Doney & Cannon, 1997). Research on trust continues to yield valuable insight for understanding relational behavior. A recent paper in the Journal of Management reviewed the current literature on trust and found that trust research could be primarily described within the context of three key

trust models: Reciprocal Trust, Mutual Trust, and Trust Asymmetry (Korsgaard, Brower, & Lester, 2014). The research model presented here builds upon that work, combines each of these three perspectives, and demonstrates how trust can shift between each of these prevailing models through trust asymmetry, trust signals, and signal loss. A more specific model for understanding trust in a dyadic relationship is developed which identifies the multifaceted role of dyadic trust and trust asymmetry and allows a better understanding of reciprocal trust, mutual trust, and trust asymmetry.

1.2 The Role of Trust

Trust has been defined as a social lubricant that enables exchange (Arrow, 1974). Firms engaged in a relationship have at least a minimal expectation that the other firm will follow through with their commitments and will not violate the contractual terms of an agreement. In cases of higher levels of trust, firms might be more willing to collaborate or share information and might use fewer contractual controls to manage the relationships. Trust represents an expectation that another firm will not act opportunistically (Bradach & Eccles, 1989), and it can be defined as the belief in the credibility and benevolence of another firm (Doney & Cannon, 1997).

In addition to acting as the basis for allowing interfirm collaboration, trust can be beneficial for a number of reasons. Trust has been suggested as a low cost and effective governance mechanism which can substitute for more formal governance mechanisms such as contracts (see Williamson, 1985; Gulati, 1995b; Gulati & Nickerson, 2008). Trust can result in positive relational outcomes such as leading to higher levels of cooperation (Mayer, Davis, & Schoorman, 1995) and communication (Zand, 1972; Roberts & O'Reilly, 1974), inducing desirable behavior

(Madhok, 1995), and helping relationships recover from disputes (Ring & Van de Ven, 1994) among other positive effects.

Despite these positive outcomes of trust, trust can also lead to strong negative outcomes in relationships. One central component of trust is risk (Das & Teng, 1998). Firms with very high levels of trust in relationships often times expose themselves to higher levels of opportunistic behavior by their partner. For example, a firm which trusts a supplier might be willing to share intellectual property with that supplier under the expectation that the supplier will not steal and use that information for its own gain. Trust becomes more critical under conditions of vulnerability to the behavior of others (Hosmer, 1995). The connection between trust and risk (particularly that of opportunistic behavior) is identified in many definitions of trust, including that by Bradach and Eccles (1989), who identify trust as an expectation that another party will not act opportunistically. Based on this interpretation, higher levels of trust can directly lead to higher levels of exposure to opportunistic behavior if firms fail to prepare themselves against potential opportunism. In addition, trust has been shown to have negative outcomes in terms of stunting growth (Morck & Yeung, 2004), leading to large financial impacts when expectations are not met (Blois, 2003), and leading to ethically questionable purchasing practices (Saini, 2010). All of this research points to the complex relationship that trust has with relational success, with many positive and negative outcomes.

To demonstrate the potential for positive and negative outcomes of risk, consider the following example from the animal kingdom. In some species of tortoises, mutually beneficial behavior between birds and tortoises transpires where the birds eat parasitic insects living on the turtles. Turtles have parasitic insects removed from hard to reach places and the birds receive an available food supply. This behavior emerges as a tortoise rises up to expose its limbs and neck to

the birds, which then walk under the tortoise to eat the insects. In some cases, tortoises have used this behavior to draw in birds, only to suddenly fall upon them, crushing them and consuming them as a dietary supplement (Bonin, Devaux, & Dupré, 2006). This is an interesting example, as the trust enables a mutually beneficial relationship but can also lead to drastic consequences when one party violates the trust placed in them.

This analogy echoes opportunistic relationships within the supply chain context. Anderson and Jap (2005) present a case study analysis of a buyer and a supplier where the supplier intentionally developed trusting relationships through interfirm parties and gatherings as a precursor to using those relationships to hide opportunistic behavior in future interactions. Firms that are over-reliant on or trusting other firms might find themselves in a situation where they face cases of opportunism. Examples of companies that violate trust are frequent and have major implications for relational outcomes. Severn Trent, a water utilities company, deliberately misreported customer service data being sent to Ofwat (the water and sewage regulatory agency in England and Wales). This opportunistic behavior was exacerbated as Severn Trent failed to reveal incriminating evidence in an audit when a whistleblower reported being instructed to manipulate performance data. This was a major breach of the trust placed in them by Ofwat and led to fines of over £37 Million (Dietz & Gillespie, 2012). Mattel faced opportunism by a supplier which it relied on to source non-lead based paint for use in children's toys. Mattel had built and paid for a testing laboratory to check lead levels and prevent the use of lead-based paints in the manufacturing process. Despite these precautions, their supplier circumvented the process and used lead-based paint to cut costs leading to a major recall when lead paint was found in Mattel's toys (Woo, 2008). Opportunistic behavior can lead to major implications for relational performance when firms violate the trust placed in them.

One critical component for determining whether trust leads to positive or negative outcomes is the behavior of the other party in the relationship. Because of this, research that takes into account the dyadic perspective in trust is particularly critical. A recent article by Korsgaard, Brower and Lester (2014) in the Journal of Management highlighted the need for additional research on dyadic trust, in particular asking for increased studies on asymmetric trust: "One promising direction for moving the trust literature forward is more in-depth examinations of trust asymmetry and the variables and situations surrounding its existence. While the ideal scenario is one in which both dyadic members share a high level of trust in one another, this situation will not always exist. Therefore, it is vital for organizations to gain a better understanding of how to lead in situations where trust perceptions diverge." (Korsgaard, Brower, & Lester, 2014).

This need acts as a strong motivation for this research. Additionally, it is important to understand not only how to manage in the presence of trust asymmetry but also to understand how and why trust perceptions diverge. The dyadic perspective taken in this chapter views asymmetries in trust in a buyer-supplier relationship as core to explaining mixed effects of trust in relationships and presents a model that explains how asymmetric trust is formed in the context of previously established models of trust.

2. TYPES OF TRUST

2.1 Reciprocal Trust, Mutual Trust, Asymmetric Trust

Research regarding trust has been focused on three models of trust, which examine trust from three different perspectives within the relationship. Reciprocal trust exists when the one party's trust influences the trust of another party. Mutual trust exists when there exists a single level of trust that is shared by both parties. Trust asymmetry exists when both parties in a

relationship have different levels of trust. Despite being conceptually different, each of these types of trust have been used by multiple researchers in a variety of settings and evidence exists that supports each of these three trust models (Korsgaard, Brower, & Lester, 2014) as discussed in the sections 2.1.1 – 2.1.3.

2.1.1 Reciprocal Trust

Implicit in the theory of trust reciprocity is that trust levels between parties converges over time or the relationship tends to dissolve (Korsgaard, Brower, & Lester, 2014). Research has shown that trust levels between two parties are positively related (Butler Jr, 1986; Ferrin, Bligh, & Kohles, 2008; Shallcross & Simpson, 2012), but those correlations have been found to be fairly modest in some cases (Butler, 1983, 1991; Brower et al., 2009). Research on trust in interorganizational alliances has shown that one representative's trust in their partner predicts their partner's trust in them (Johnson et al., 1996). Reciprocal trust represents the relationship between the trust exhibited by a party and that felt by a party, suggesting that over time these levels of trust influence one another and lead to a convergent trust level. Thus trust reciprocity is the process through which trust levels are updated over time with regards to the level of trust exhibited and experienced within a single party.

However, research has shown that trust levels can also be divergent. Graebner (2009) finds asymmetric trust at an interorganizational level, and other research on trust asymmetry demonstrates that trust is not always convergent (Stoel & Muhanna, 2012). In fact, in order for reciprocal trust to occur there must exist some difference in the trust levels between parties in order for trust reciprocity to mitigate those differences over repeated interactions.

2.1.2 Mutual Trust

The theory on mutual trust suggests that trust between parties is shared between the organizations as a combined form of trust (Sabel, 1993). While reciprocal trust describes the transient nature of trust evolving over time, mutual trust represents the trust levels between two parties that have reached convergence and are mutually shared. Key to the idea of mutual trust is mutual awareness of the intent and trust of both parties in the relationship (Deutsch, 1958). Support between mutual trust and reciprocal trust is difficult to disentangle, as both mutual trust and reciprocal trust predict that trust levels will become homogenous among firms. Because of this, many of the findings which support the concept of reciprocal trust additionally support mutual trust. Mutual trust is focused on the level of shared trust as either a high or low level of shared trust, rather than on the degree of convergence between the two parties. Research on mutual trust explores the causes and consequences of mutual trust, and treats trust as a measure that is shared among both parties. High levels of mutual trust have been argued to be positively related to relational success as the relationship is able to develop into strong-form trust (Barney and Hansen, 1994) when both parties are highly trusting and trustworthy.

2.1.3 Asymmetric Trust

Trust asymmetry is the opposite of mutual trust as it represents when there is not a shared level of trust between parties. Trust asymmetry studies explore divergent trust levels between parties within a dyad. Although research on the consequences of trust asymmetry is limited (Korsgaard, Brower, & Lester, 2014), research has associated trust asymmetry with negative relational outcomes such as exposure to exploitation or inappropriate behavior in the relationship. (Tomlinson, Dineen, & Lewicki, 2009). Trust levels that are substantially different

between two parties can lead to possible relational friction from trust-based misunderstandings or behavior or lead to opportunistic behavior if one party has a level of trust that is too high. Research that explores how trust asymmetry emerges and when trust asymmetry, reciprocal trust, or mutual trust become relevant can lead to valuable insights for both understanding trust and relational performance.

2.2 Trust, Trustworthiness, and Opportunism

In addition to understanding the primary models for trust in relationships, it is critical to understand the relationships between trust, trustworthiness, and opportunism. Trust is generally conceptualized as an outward facing construct in that it measures the expectation of behavior by another party. Trustworthiness and opportunism act as counterpoints to one another as a trustworthy party would be less likely to engage in opportunism, and opportunistic parties are inherently not trustworthy. Given that trust is related to a belief in benevolence (which is diametrically opposed to opportunism), it is possible that trust reduces the safeguards of firms, exposing them for the potential of opportunistic behavior. Crocker and Reynolds (1993) found that the U.S. Air Force procurement contracts allowed more room for opportunism when previous experience lacked opportunistic behavior, supporting this conjecture. A study by Nair, Narasimhan, and Choi (2009) found that, in an adaptive simulation, firms that survived in the simulation behaved in a risk-prone way by mutually trusting each other, despite the risk of extreme loss. This concept has been developed further by Barney and Hansen (1994) in discussing weak-form, semi-strong form and strong-form trust, in which they argued that strong-form trust (trusting in the presence of vulnerabilities without expensive governance controls) will only be a competitive advantage if every member involved in the exchange is trustworthy.

Trust and opportunism are closely tied to each other as constructs, but the actual mechanism for when trust can lead to opportunism is not made clear in the literature. Specific to the buyer-supplier literature, trust has been identified both as the mechanism that enables opportunism in close relationships (Anderson & Jap, 2005) and as the mediating variable that enables collaboration to lead to positive performance (Schoenherr, Narayanan, & Narasimhan, 2015). Zahra, Yavuz, and Ucbasaran (2006) found that trust can have both positive and negative aspects in relationships. Overall these findings suggest that trust can have both beneficial and detrimental effects.

3. A DYADIC THEORY OF TRUST

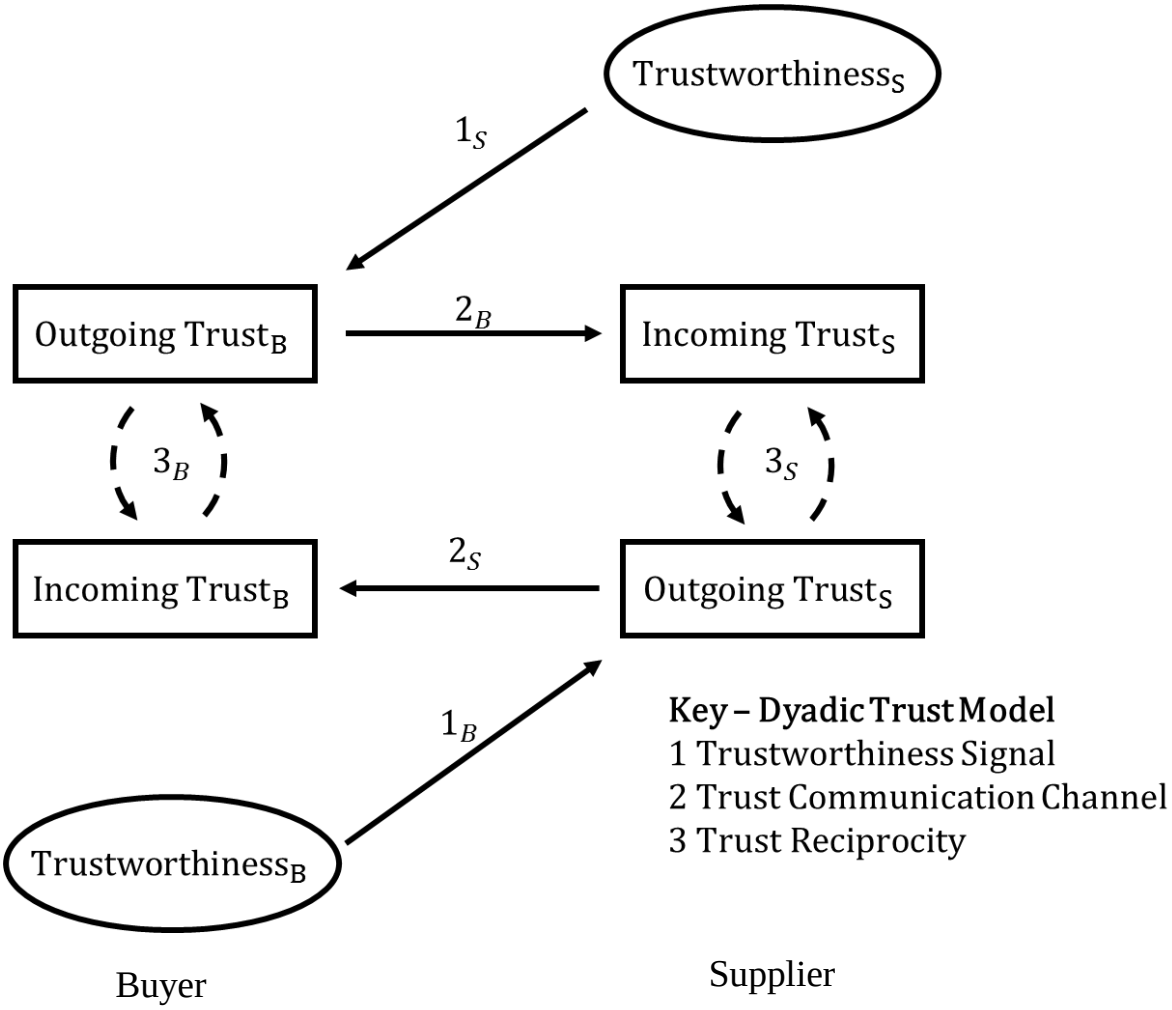
As research on trust asymmetry continues to be explored, it is critical to understand the components of dyadic trust in the context of a dyadic relationship. Three fundamental aspects of trust are developed when viewed as a dyadic construct: trustworthiness, outgoing trust, and incoming trust. Based on the relationships between these three aspects of trust, a model of trust asymmetry gaps is presented which explains how trust diverges within a dyadic pair and how reciprocal trust, mutual trust, and trust asymmetry emerges within a relationship.

3.1 Measures of Relational Trust

Trustworthiness, outgoing trust, and incoming trust are all different perspectives from which trust should be considered when viewing it from the dyadic perspective. It is critical to understand not only how they differ, but also to distinguish between different aspects of trust in future research. Disentangling the concepts of trustworthiness (a firm's future benevolent behavior and reliability), outgoing trust (the trust one party has in another), and incoming trust (the amount of trust one party perceives from another) is a critical endeavor for a topic that is as widely studied

and valuable as trust, especially as the need for additional research on trust asymmetry continues to grow.

Figure 1: Dyadic Trust Model



3.1.1 Trustworthiness

Trustworthiness acts as the primary basis for trust. Barney and Hansen (1994; 176) define trustworthiness as "an exchange partner is trustworthy when it is worthy of the trust of others. An exchange partner worthy of trust is one that will not exploit other's exchange vulnerabilities." However, despite the intuitive understanding of what is trustworthiness, it is a difficult construct

to capture directly. Trustworthiness is based on expected future behavior while other forms of trust are primarily based on past experiences or signals, and trustworthiness can only be captured indirectly as behaviors observed over time. Thus it is included in the dyadic trust model in Figure 1 as an oval, following the structural equation modeling approach for depicting latent constructs that are not measured directly. Although one could attempt to measure trustworthiness directly, it is primarily valuable as a reflective construct that is highly related to one party's behavior and the outgoing trust of other parties. In the unrealistic system of perfect information, trustworthiness would be perfectly related to the trust of others. However, as trustworthiness is not measured directly, parties in a relationship are reliant on perceptions of their partner's trustworthiness which might or might not be accurate. Researchers have found that communicating trustworthiness is a critical component of developing a partner's trust level (Kasper-Fuehrera & Ashkanasy, 2001). This indicates that trustworthiness is communicated in the relationship to the other parties and could be interpreted differently.

3.1.2 Outgoing Trust

Outgoing trust for a party in a relationship is the measure of that party's trust in another. It represents the commonly understood use of the word trust in both research and common usage. Specific to the buyer-supplier relationship, a buyer's outgoing trust reflects the belief held by the buyer that the supplier's behavior will be benevolent and reliable. In this context, it can be seen as the measure of trust that is going outward from one party towards its partner in the relationship. Outgoing trust for a party is based on an evaluation of the trustworthiness of another party and a party's willingness to trust. For example, consider the relationship between a buyer and a supplier. A supplier has a certain trustworthiness that is inherent to the supplier and which cannot be measured directly. However, the buyer has received trustworthiness signals and can

interpret the trustworthiness of the supplier in order to decide how to do business with the supplier in this situation. Thus, the buyer forms a degree of outgoing trust, which reflects the trust that they have that the supplier will behave trustworthily. In a system of perfect information, the outgoing trust would exactly mirror the trustworthiness of the partner, but in many cases communication failures or signal misinterpretation can lead to differences between outgoing trust and trustworthiness. A difference between the trustworthiness of a partner and the outgoing trust of a partner can be problematic as it leads to a misalignment between the ideal trust level and the actual trust level.

3.1.3 Incoming Trust

Incoming trust for a party in a relationship is a measure of the trust that a party perceives its partner has towards them. A firm's incoming trust is the perception of the trust levels exhibited by a partner firm. For example, the trustworthiness of a supplier is observed by the buyer who forms a measure of outgoing trust, which represents the buyers trust in the supplier. The outgoing trust of the buyer is then interpreted by the supplier and becomes the measure of incoming trust for the supplier, which represents the supplier's perception of the buyer's trust. Incoming trust for one party is highly related to the outgoing trust of another party, as they both form part of the same trust communication channel between two parties engaged in a relationship. However, it is critical to distinguish between the two as they represent two different perspectives of the same trust channel, and there is the potential for imperfect signaling within the trust channel such as poor communication of trust levels by the buyer or poor interpretation of trust signals by the supplier.

3.1.4 Trust Channels

While it may seem like a simple question to ask how trustworthy a party in a relationship is, there are multiple perspectives from which this could be measured. The problem of understanding trust from multiple perspectives within the dyad can be simplified by viewing trust as a channel within the relationship. Trust channels represent the pathways through which trust evolves as it moves from trustworthiness to outgoing trust to incoming trust between two parties engaged in a relationship (see Figure 1 paths 1 and 2). The trustworthiness of Party A is interpreted by Party B and becomes the measure of outgoing trust for Party B. The outgoing trust measure for party B is then interpreted by Party A and becomes a measure of incoming trust for Party A. Thus, a trust channel acts as the different perspectives within a relationship that one might measure the trustworthiness of a party in the relationship, either measuring a party's trustworthiness directly, measuring it as the outgoing trust of the partner, or measuring it as the incoming trust of that party. Using this conceptualization, it is clear that the same aspect of trust (trustworthiness of party A) could be reflected within the same channel at three different points ($TW_A, OT_B,$ or IT_A). For each relational dyad, two separate trust channels exist which measure the trustworthiness of each party within the relationship from the perspectives of both parties following the approach as described above for trust channels.

3.2 Changes in Trust

One of the key aspects of trust is that trust represents a variable that is in a constant state of revision and that trust can quickly change based on new information such as recent behavior or trust signals. The theory of trust reciprocity is based on the notion that firms are updating their trust on a regular basis to be more aligned with that of their partner in the relationship. Behavior

can also have major implications for trust levels as firms adjust trust levels to match behavior within the relationship. Additionally, as trust changes within a trust channel, there is potential for signal loss to occur due to information loss, misinterpreted trust levels, or poorly communicated trust levels. These effects can then lead to changing trust levels over time as parties make adjustments based on their trust levels and perceptions of trust within in the relationship.

3.2.1 Reciprocal Trust

Reciprocal trust suggests that trust levels tend to converge over time as parties continue to engage in relationships or the relationship will end (Korsgaard, Brower, & Lester, 2014). Within the dyadic model, the impact that reciprocal trust has on trust levels is represented by the connection between incoming trust and outgoing trust within a single party (Figure 1, Path 3). Trust is constantly updating within the relationship as a party in a dyadic relationship adjusts its incoming and outgoing trust to converge over time.

3.3.2 Behavioral Updates

One key aspect for how trust changes over time is through updating trust in response to partner behavior. Trust perceptions will adjust over time as outcomes of trusting behavior add new information (Mayer et al., 1995). Large deviations from expected behavior will have large effects on trust levels as firms update their trust based on the behavior of their partners. The amount of trust placed in a highly trusted firm which engages in opportunistic behavior will degrade accordingly in response to the trust being violated. For example, consider the recent behavior by Volkswagen with regards to the emissions testing scandal where Volkswagen admitted to installing devices to cheat on emissions testing. This led to a huge shift in the trust placed in

Volkswagen (Anderson, 2015), and led to a decrease in the stock value of 30% after the news was released (La Monica, 2015). Trust is constantly updating based on the behavior of partners in a relationship. In this case, the behavior of Volkswagen led to a significant reduction in outgoing trust held by their partners which could be construed to include consumers, dealerships, and the government.

3.3.3 Signal Loss

In a system with perfect information, trustworthiness, outgoing trust, and incoming trust within the same trust channel would be in perfect alignment. Outgoing trust for one party would reflect a perfect belief in the trustworthiness of the partner, and that outgoing trust would also perfectly translate into incoming trust for the other party. However additional noise and variability can exist within each stage of communication and interpretation which creates divergent levels of trust in the relationship. The differences that emerge in trust levels within a channel represent the concept of 'signal loss'. Signal loss can have different effects on trust levels based on how the communication breaks down. Signal loss can occur due to intentional or unintentional causes. Firms can deliberately manipulate trust perceptions in order to gain advantage in future relationships (Kasper-Fuehrera, & Ashkanasy, 2001; Anderson & Jap, 2005). Other factors can influence whether and how trust signals are changed within a trust channel. Attenuation, amplification, and signal noise are considered in the remainder of this section.

Attenuation occurs when the signal being received by one party is much smaller than the level of trust being sent. For example, when one firm has a high level of outgoing trust, but their partner has a low level of incoming trust. This is likely to exist when one party is sending a strong

signal, but it is not being received by the other parties. Cultural differences, poor communication, the receiver's propensity for trust, and many other factors could all lead to signal attenuation.

Amplification occurs when the signal being sent is much smaller than the signal which is received. This could occur when small events are given significant weight in the perception of another party. There are many factors that could lead to an amplification effect such as the halo effect (Nisbett & Wilson, 1997) or availability bias (Tversky & Kahneman, 1973). For example, a single late delivery that is given significant value for future events, or a small demonstration of good will is given high consideration in the future.

Signal noise occurs when the trust level from one party is different than the trust level received by the second party. This can occur because of weak communication channels, lack of collaboration or interaction, or cultural barriers that lead to different perceptions. Signal noise can have a major impact on trust levels, because it prevents effective communication transfer and can create situations where trust levels are significantly different within the trust channel.

3.3.4 The Dynamic Nature of Trust

One of the key complications of understanding trust is recognizing the dynamic nature of trust. Trust is constantly adjusting over time based on reciprocal trust, behavioral updates, or signal loss leading to trust that can vary substantially over time. Over time, relationships can develop trust levels based on the relational history, but trust initially starts out with limited information.

Early in relationships, the information that is used to determined trustworthiness of a partner is fairly limited and might require significant adaptation over time. This is significant because higher levels of information loss within the context of trust in the relationship can lead to signal loss and thus trust asymmetry. Additionally, significantly different trustworthiness levels

(which might be found in new relationships) can also lead to higher levels of trust asymmetry. Over time, as firms in relationships update their trust levels to match that of their partner's trust levels through trust reciprocity and better information sharing trust asymmetry might evolve into mutual trust. Thus, within a single relationship all three models of trust might be applicable as trust asymmetry changes based on reciprocal trust and behavioral updates over time and eventually might lead to mutual trust as trust levels within a relationship eventually converge or the relationship disbands.

4. **DISCUSSION**

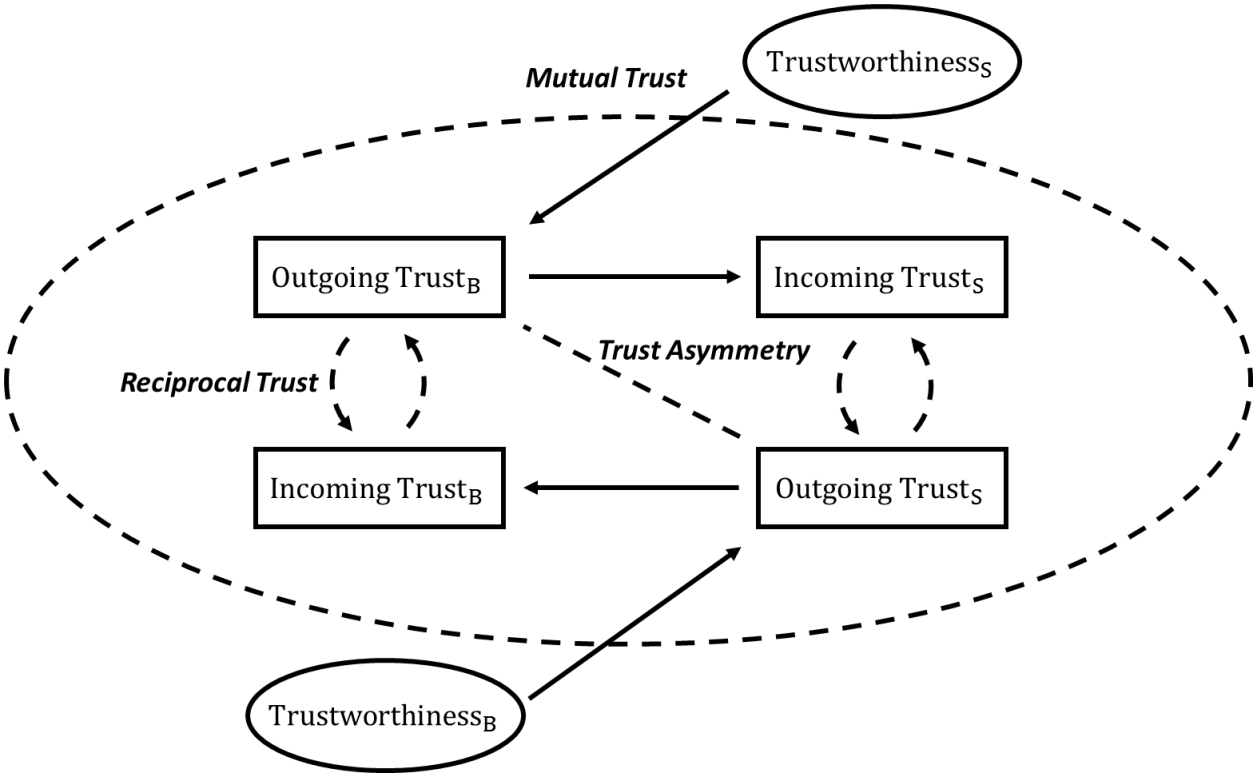
The dyadic trust model provides insight into how to conceptualize trust as a dyadic construct and understand the different ways that trust is communicated within a relationship. Understanding how trust is communicated and updated over time can yield valuable insight for understanding how each of the trust models identified in the literature emerge within relationships and how they are interconnected. In addition, the dyadic perspective provides additional insight regarding how gaps within the trust communication channels emerge, leading to additional insights regarding different types of trust asymmetries.

4.1 Explaining the Multiple Trust Models

The model presented in this chapter provides greater understanding trust in terms of the relationships between the three models discussed in the literature of reciprocal trust, mutual trust, and trust asymmetry. Each of the three models of trust in the literature represents a different aspect of the dyadic trust model in Figure 1. Reciprocal trust reflects the behavioral updates based on perceived trust levels being different which causes a convergence over time between outgoing trust and incoming trust within a single firm. This can lead to similar levels of outgoing and incoming

trust within the same party ($OT_B \cong IT_B$ and $OT_S \cong IT_S$). Mutual trust reflects the overall trust level shared between the two firms, which is only possible when outgoing trust and incoming trust levels for both parties are similar (that is, $OT_B \cong IT_S \cong OT_B \cong IT_S$), providing a single trust score for the relationship. Trust asymmetry emerges within the relationship in various forms, but can be generalized as a difference between the outgoing trust levels of two firms.

Figure 2: Models of Trust



Within the context of the dyadic trust model, one can identify how different trust model behavior might emerge over time. The evidence that trust levels converge over time supports the concept of reciprocal trust. However, this effect does not occur in a vacuum, and there are other factors which act as counter-points to convergence between incoming and outgoing trust for a firm. The trustworthiness of the partner firm will have a direct impact on outgoing trust and the outgoing

trust of the partner firm will have a direct impact on incoming trust. Thus, when these factors are significantly different, they might override the effect of trust reciprocity. Thus, while the effect of reciprocal trust could be constantly in effect, the prediction of trust reciprocity that incoming and outgoing trust for a single company will converge over time need not be valid.

Reciprocal trust will govern trust in the relationship when reciprocity is strong, trustworthiness levels are similar, and signal loss is low. For example, consider a situation where two parties in a relationship have a propensity for adjusting trust levels to be equal to the trust they feel in the relationship, both have a high degree of trustworthiness, and where communication is very effective at sharing trust levels. Even in a situation where initial trust was different for some reason, trust levels will quickly converge as the trustworthiness of each party becomes more known, leading to very similar levels of outgoing trust and incoming trust levels between two parties. As any of these assumptions (tendency to reciprocate, similar trustworthiness levels, and limited signal loss) are relaxed, reciprocal trust is less likely to emerge.

Mutual trust will exist in similar circumstances, as it is very similar to the outcomes of trust reciprocity. However, mutual trust encompasses all four components of observable trust levels and can exist when each of them are similar, thus necessitating even more stringent requirements for signal loss to be low and for trustworthiness levels to be similar. Reciprocal trust can emerge even in the case of signal loss or trustworthiness differences if the tendency to reciprocate trust is particularly high. However, mutual trust can only exist when firms are similarly trustworthy and the communication is effective. Essentially, mutual trust is more likely to emerge in a fully transparent relationship between two equally trustworthy parties where trust levels are clearly communicated. This is reflected in strong-form trust as discussed by Barney and Hansen (1994)

which argues that trust can act as a competitive advantage when both parties in a relationship are trustworthy and exhibit high levels of trust in the relationship.

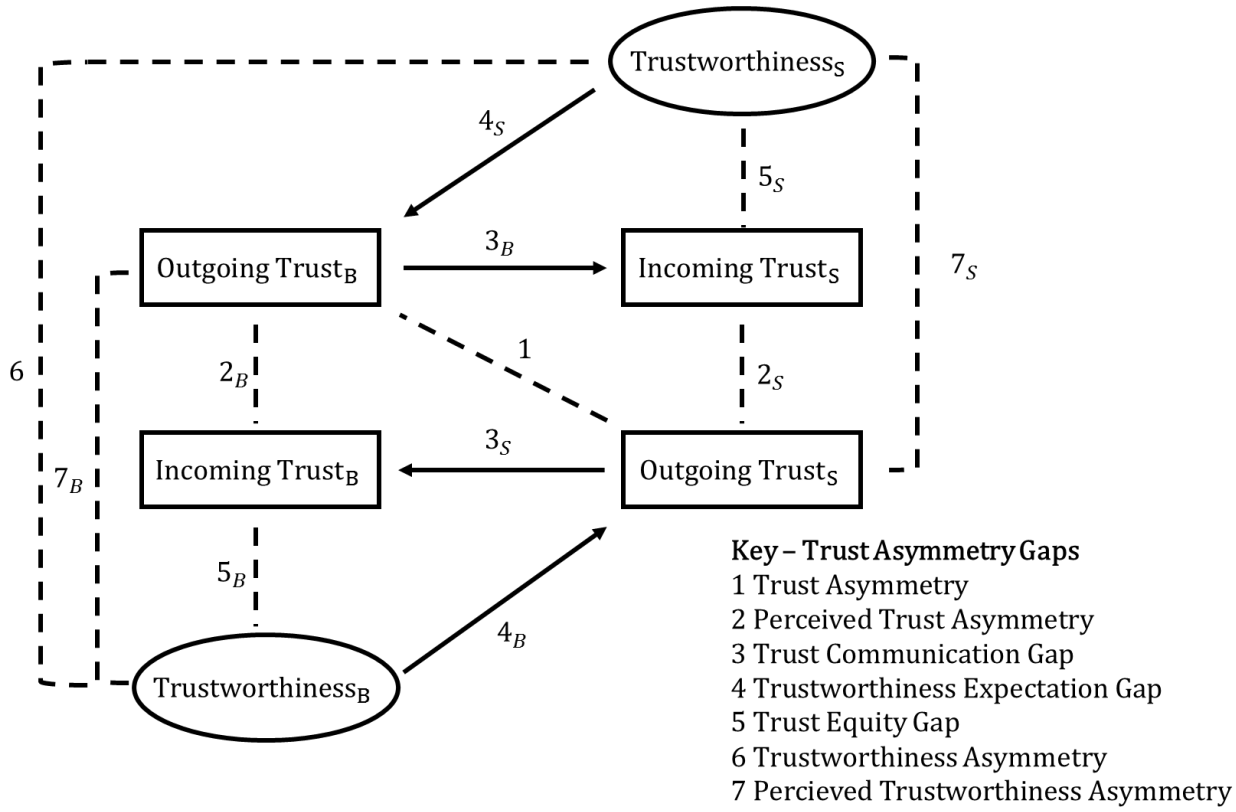
Trust asymmetry is more likely to emerge when trustworthiness levels are significantly different or signal loss occurs in the trust channels. In either of these cases, different levels of trust will emerge within the relationship, either within a channel through signal loss, between channels through differences in trustworthiness levels, or some combination of the two. Trust Asymmetry refers to divergent trust levels within a dyad (Korsgaard, Brower, & Lester, 2014), and taken at the most basic form would represent the difference in outgoing trust between two parties.

Trust asymmetry can occur through two primary mechanisms, signal loss and differences in trustworthiness. In signal loss, the trust levels within a trust channel are different between a sender and a receiver of the signal. This can occur because the signal from the sender introduces noise (sending a signal to a partner that is different than the trust level, sending a weaker signal than the trust level would indicate, or not clearly communicating trust levels) or because the receiver of the signal does not interpret the signal correctly (perceiving a signal at a different level than what is being sent, or not recognizing trust signals that are being sent). Differences in trustworthiness can lead to trust asymmetry in the absence of signal loss as trustworthiness acts as the primary driver of trust levels within a channel. Different trust levels in the different trust channels can create large differences in trust levels between at multiple points within the channel. Trust asymmetry occurs in systems where information is imperfect or firms have significant differences in terms of trustworthiness or signaling behavior. Trust asymmetry is additionally complicated compared to the other trust models as there are multiple locations within the model that trust can diverge as discussed in the following section.

4.2 Trust Gaps

As research on trust asymmetry advances, it will be especially critical that researchers have the ability to clearly communicate what aspect of trust asymmetry they are researching. Although trust asymmetry was primarily discussed as the divergence of outgoing trust levels between two parties in a relationship, trust asymmetry can emerge in different forms within a specific relationship. The dyadic trust model presented in this chapter can be used to identify multiple points of trust asymmetry where trust levels can diverge within a relationship, which are presented in Figure 3.

Figure 3: Trust Asymmetry Gaps



4.2.1 Trust Asymmetry

Trust asymmetry is the difference or misalignment of trust levels between two parties in a relationship. The most basic form of trust asymmetry would be reflected in the difference between outgoing trust levels between two parties in a relationship (See Figure 3, Gap 1). Trust Asymmetry has been suggested as a precursor to poor relational performance (Tomlinson, Dineen, & Lewicki, 2009). Although using this measure of trust asymmetry can be valuable, it is both difficult to capture and includes information which is not fully available to either party in the relationships. Thus, it is equally important to recognize perceived trust asymmetry, which is measured by differences in incoming trust and outgoing trust (Gap 2). This represents the trust asymmetry that is observable by a single party in a relationship. Any decisions or behavioral reactions to trust asymmetry are based on perceived trust asymmetry. Perceptions of high trust asymmetry can lead to perceptions of inequity within the relationship and cause relational friction or lead to opportunistic behavior. This can lead to perceptions of injustice in the relationship similar to injustice in organizational justice which has been shown to lead to higher levels of counter-productive work behaviors and lower levels of good citizenship behavior (Cohen-Charash and Spector, 2001). Additionally, the theory of reciprocity suggests that individuals who receive positive/negative behavior from someone else tend to return the behavior in kind (Gouldner 1960). Thus one can expect that feelings of inadequate trust could emerge, leading to negative behavior in the relationship. Although these theories reflect individual level behaviors, it is reasonable to suppose that they might have organizational level parallels.

4.2.2 Trust Channel Gaps

Within the trust channel, gaps in trust can be identified when trust levels diverge. These are identified in Figure 3 as a communication gap (Gap 3), a trustworthiness expectation gap (Gap 4), and a trust equity gap (Gap 5). These gaps can occur due to signal loss within a trust channel. These diverging values of trust within the relationship can lead to problematic issues such as over-trusting or under-trusting in the relationship.

The communication gap represents a situation where the outgoing trust is not reflected in incoming trust by the other party in the relationship. It exists when the communicated trust levels from one party (the outgoing trust) is perceived as a different level of trust (the incoming trust) by the other party. This can occur when the trust signal that is sent or the signal that is received is different from the level of outgoing trust. Cultural differences and poor communication can be primary causes of a communication gap. For example, individuals from individualist cultures might be more willing to trust than collectivist cultures (Pearce, 1974; Gudykunst et al., 1996; Jarvenpaa and Leidner, 2006). Other causes could lead to problems with communicating trust levels within a relationship, such as language barriers, communication frequency, locational proximity, or relationship history.

The trustworthiness expectation gap represents a difference between the outgoing trust of a party and the trustworthiness of their partner. A difference between the trustworthiness of a partner and the outgoing trust of a partner can be problematic as it leads to a misalignment between the ideal trust level and the actual trust level. A large trustworthiness expectation gap it reflects a poor understanding of the expected behavior and actual behavior, which can lead to a suboptimal level of trust, either by overtrusting and thus exposing oneself to opportunism or exploitative

behaviors or undertrusting a partner leading to unattained relational gains that are possible in a higher trust environment.

The trust equity gap represents the difference between the trustworthiness of a party and the perception of how they are trusted in the relationship. This represents the difference between trustworthiness and incoming trust for one party in the relationship. This can take the form of either "Our firm is trustworthy, but we are not trusted by our partner" or "Our firm is not trustworthy, but our partner is very trusting." Both of these scenarios can lead to negative relational behavior. Parties in a relationship experiencing a large trust equity gap can have perceptions of unfairness and inequitable treatment if they are not trusted as much as they should. In the other direction, parties experiencing a trust equity gap where they perceive themselves as being overly trusted might use that information to take advantage of their partner through opportunistic behaviors.

4.2.3 Trustworthiness Asymmetry

Trustworthiness asymmetry occurs when trustworthiness levels between two companies are significantly different. Different levels of trustworthiness can have major implications on the trust levels within a relationship as it will lead to the other types of trust asymmetries within the relationship. Firms that are significantly different from another in trustworthiness will not be able to achieve strong-form trust, as it will expose the relationship to opportunistic behavior. Similar to trust asymmetry, there is both the direct asymmetry which compares the trustworthiness of two firms (Gap 6), and the perceived trustworthiness asymmetry (Gap 7) which is based on a firm's perceptions of its own trustworthiness compared to its perception of its partner's trustworthiness. As trustworthiness is generally not measurable directly, the perceived trustworthiness asymmetry has more relevance in most situations than the trustworthiness asymmetry gap.

5. **CONCLUSIONS**

5.1 Relational Governance in the Context of Trust Asymmetry

It is important to understand how trust impacts relational governance strategies. Trust has major implications on which types of governance mechanisms might be more effective in different circumstances. Research has found that transactional and relational governance might have complementary effects (Poppo & Zenger, 2002) or act as substitutes for one another (Wuyts & Geyskens, 2005). Other research suggests that both governance mechanisms might be effective, as both transactional and relationship governance mechanisms can reduce opportunistic behavior and the effect is particularly strong when used together (Liu, Luo, & Liu, 2009). Within the context of trust management, the role that transactional and relational governance each has is different in managing the behavioral and relational outcomes and the priorities for which governance mechanism to use will depend on trust levels within the relationship.

Transactional governance, primarily managed through contracting, is one of the primary mechanisms for enforcing good behavior in relationships and limiting opportunistic behavior (Williamson, 1979). While the primary role of transactional governance is not trust management, it acts as an inhibitor for opportunistic behavior, which can arise in relationships with poor trust management. Transactional governance can limit the negative effects of high trust asymmetry by preventing or protecting against certain forms of opportunistic behavior. Relational governance allows management of the trust levels within a relationship as the relationship is developed and managed, leading to potentially higher levels of trust and more effective trust communication. Thus, transactional governance might take the role of limiting the negative outcomes of trust asymmetry, while relational governance can help to reduce trust asymmetry.

While both limiting the cause and the symptoms of trust asymmetry are critical, different governance mechanisms could be more valuable in different circumstances. In cases where high levels of trust asymmetry are likely to emerge regardless of communication and relational management (for example when the trustworthiness levels between two firms are significantly different), transactional governance would be particularly important. In situations where the trustworthiness between two firms are similar, relational governance could take the primary role as the protection to reduce trust asymmetry and create clear understanding of trust levels within the relationship.

5.2 Managing the Degree of Trust

One of the key aspects of trust management is having the *right* level of trust. Much of the literature on trust has found conflicting results with higher levels of trust. This is simple to explain by understanding the dyadic model for trust. Trust levels are interpretations of the trustworthiness of another party, which, when accurate, can provide valuable information regarding the future expected behavior of the other party in the relationship. In cases of low signal loss, outgoing trust is a good indicator of success as it is closely tied to the trustworthiness of the partner. In situations of high signal loss, parties within the relationship could find themselves in situations where their outgoing trust is not reflective of a high trustworthiness level for the other party, leading to disastrous consequences from overtrust. Higher levels of trust are not inherently good, as they are not necessarily the right levels of trust.

Trust asymmetry is a key indicator for when trust can lead to positive or negative outcomes. If trust asymmetry is low, higher levels of trust would be more beneficial for the relationship. However, if increasing trust leads to an increase in trust asymmetry as well, problems are likely to

arise in the relationship. In cases of low trust asymmetry, self-protective measures such as transactional governance could be important in limiting the downside of potential opportunistic behavior, although it might be possible to reduce the trust asymmetry through proper relational governance as well.

One of the key strategies for trust management could be adopted from the signature phrase by Ronald Reagan to "Trust but Verify." While trust can act as a powerful force for leveraging a relationship to be successful, it is critical that the trust is correctly placed and that parties in a trusting relationship are not over-exposing themselves to opportunistic behavior simply for the sake of increasing trust levels. One of the key ways to do this is to verify in addition to trusting. The previously mentioned example of Severn Trent, which falsified consumer reports, would have been a much smaller problem if the trust placed in Severn Trent also included verification of the information being shared through independent consumer report collection rather than relying on Severn Trent to provide accurate and unbiased reports without any verification process or oversight. Understanding the dyadic nature of trust and recognizing when and how to trust in a relationship can be critical to prevent opportunistic behavior within the relationship.

6. CONTRIBUTION AND FUTURE RESEARCH

This research addresses and combines several domains of research. The research lends valuable contributions to the research exploring trust, buyer-supplier relationships, interfirm and governance as well as opening up multiple avenues for future research.

6.1 Trust and Trust Asymmetry

Within the domain of trust and trust asymmetry research, additional calls for trust asymmetry research have been made to increase the understanding of trust. The dyadic trust model developed here addresses that, and additionally presents a model of trust that distinguishes between and combines the theories of trust reciprocity, mutual trust, and trust asymmetry. This effectively enables research which can address each of these types of trust and more fully understand the relationship between trust and critical variables. This approach is used in Chapter 3 in order to explore the relationships between reciprocal trust, mutual trust, and trust asymmetry and conflict and opportunism.

The mechanisms that drive which model becomes prevalent is introduced through the concept of signal loss and trust channels. This creates a better understanding of how to view trust within the dyadic context and allows the findings from multiple streams of research to be combined, explaining how different findings can emerge in each stream of research.

Using the trust model presented here, future research on trust and trust asymmetry can be done with greater precision, by recognizing which aspect of trust is being measured and which asymmetry is being researched, allowing for a far better understanding of a very critical topic. The model provides a tool for identifying which aspect of trust is measured within a dyadic analysis of trust, whether it be the incoming trust, the outgoing trust, trustworthiness, trust asymmetry, or the other gaps identified. This provides greater precision in understanding the concept of dyadic trust, and particularly that of trust asymmetry, which is inherently a multi-faceted construct.

6.2 Buyer-Supplier Relationships.

Trust is an important concept within the buyer-supplier relational context, especially to help better predict relational outcomes. The trust model developed within this chapter has implications for buyer-supplier relationships by providing a greater understanding of the trust paradox established within the literature. It addresses the paradox of when collaboration can lead to positive or negative outcomes in buyer-supplier relationships through recognizing how trust asymmetries can emerge and the implications of trust asymmetries on relational performance. Positive trust performance can emerge in relationships which are characterized by a high level of mutual trust, while relationships which have high degrees of signal loss are likely to have additional problems in the relationship emerge which can lead to higher levels of conflict and opportunism. These results are empirically explored in Chapter 3.

6.3 Governance.

Recognizing the dyadic model of trust yields better understanding of the role that different governance strategies have for protecting against opportunism or reducing the behavioral causes of opportunism through transactional governance or relational governance. The perspective of the trust model provides greater insight for optimal governance strategies in different circumstances, allowing firms to make optimal decisions regarding which governance mechanism to use in each relationship. Understanding how trust and governance mechanisms interact can be critical for determining whether the relationship leads to positive or negative performance. Both having the correct level of trust, and having the appropriate governance tools in place are critical for success. The dyadic trust model can explain much of the difference in the literature regarding the specific effectiveness of different governance mechanisms. These findings are connected to the findings in

Chapter 4 which provide additional insight for the impacts of different relationship management strategies.

6.4 Future Research Directions.

There are many rich avenues of future study that are possible in the area of trust asymmetry. As researchers explore the relationships between trust asymmetry and relational outcomes, there are a number of areas that merit specific inquiry and understanding. Of primary importance is recognizing the fundamental relationship that trust asymmetry has on relational performance through things such as opportunistic behavior or conflict. While these have been suggested as linkages, empirically connecting trust asymmetry with negative relational outcomes is necessary. In addition to understanding the outcomes of trust asymmetry, rich areas of research could be explored in understanding the antecedents to trust asymmetry, especially the factors that amplify, attenuate, or obfuscate trust signals within trust channels leading to higher levels of signal loss. As the mechanisms through which signal loss emerges become more clear and the mechanisms through which trust signals are sent, relationship management strategies can more effectively manage trust and leverage relationships for positive performance. Finally, empirical investigations into relationships between trust reciprocity, trust asymmetry and mutual trust to connect the various trust models presented in prior research can expand our theoretical and practical understanding of trust in relationships.

CHAPTER 3: EMPIRICAL ANALYSIS AND DISCUSSION OF TRUST ASYMMETRY, KNOWLEDGE ASYMMETRY, AND DEPENDENCE

1. HYPOTHESES AND RESEARCH MODELS

The primary research question explored empirically in this chapter is the impact of relational asymmetries on conflict and opportunism. Asymmetries have been shown to be the critical pathway through which asymmetries can lead to negative relational performance or outcomes. Relational performance can suffer when opportunistic behavior or conflict emerge within the relationship, leading to conflicting findings in the literature with regards to relational performance outcomes. These findings are explored through analysis of asymmetric levels of trust, knowledge, or dependence as discussed in Chapter 1. This dissertation argues that asymmetries in these core relational measures are factors that lead to relational problems such as opportunism and conflict within the relationship. Trust asymmetry can lead to situations where a firm has a non-optimal trust level, and which can lead to problems in the relationship. Knowledge asymmetry can lead to conflict within the relationship as firms understand things differently and opportunism as it provides the opportunity to hide or abuse information differences. High levels of dependence asymmetry can lead to opportunistic behavior such as supplier squeezing or quality depreciation. These hypotheses are tested in this chapter using empirically collected survey data.

In order to evaluate these relationships, this chapter proposes several hypotheses regarding asymmetries, presents the data collection procedures, evaluates the degree of asymmetries, evaluates the relationship between asymmetries and the performance outcomes of conflict and opportunism, and discusses the importance of these findings.

1.1 Mutual Trust and Trust Asymmetry

One of the challenges of identifying the relationship between trust and opportunism is that the difference between a positive and negative outcome of trust is largely dependent on the behavior of the other party in a relationship. For example, if a buyer has a high level of trust in a supplier, but that trust is not reciprocated, the buyer's high level of trust in a supplier might add little benefit to relational performance. In this case, the high levels of trust exhibited by one party but not the other do not act as an enabler for positive performance. On the other hand, if the high trust levels are reciprocated, the relationship might be a strong positive relationship as suggested by Barney and Hansen (1994) in their discussion of "strong form trust," where trust allows positive collaboration in the presence of key vulnerabilities between two parties only when both parties are trustworthy. In order for strong form trust to be effective, trustworthy behavior of both parties in the relationship is critical. If either party behaves untrustworthily, strong form trust cannot be successful. For example, if a trusted supplier identifies a high level of trust from the buyer they might potentially proceed to take advantage of the buyer's trust. This is very similar to the findings of Anderson and Jap (2005), in which a supplier firm was able to manipulate a buyer's trust in order to engage in opportunistic behavior.

In each of these three prior examples, understanding the perspective of only the buyer is insufficient without understanding the exogenous behavior of supplier. Understanding the relationship from a dyadic perspective can add additional insight to the relationship between trust and opportunism. It is critical to consider the behavior of the partner firm because if a buyer uses trust as a governance mechanism it might expose firms to the potential opportunistic behavior from suppliers. Crocker and Reynolds (1993) found that the U.S. Air Force procurement contracts allowed more room for opportunism when previous experience lacked opportunistic behavior,

supporting this conjecture. In a simulation study of complex adaptive systems, Nair, Narasimhan, and Choi (2009) found that firms that performed the best behaved in a risk-prone way by mutually trusting each other, despite the risk of extreme loss. This concept extends the research on strong-form trust by Barney and Hansen (1994) in discussing weak form, semi-strong form and strong form trust, in which it was argued that strong form trust (trusting in the presence of vulnerabilities without expensive governance controls) will only be of competitive advantage if every member involved in the exchange is trustworthy. As discussed in chapter 2, one key asymmetry that can lead to relational problems is that of a trustworthiness expectation gap, when trust levels do not accurately reflect the trustworthiness of a partner, leading to situations of having the wrong level of trust. Trust levels that are too high can lead to problems with exposing oneself to opportunistic behavior. Trust levels that are too low might lead to relational problems and unrealized gains in the relationship due to low levels of trust.

Trust and opportunism are closely tied to each other as constructs, but the actual mechanism for when trust can lead to opportunism is not clear in the literature. Specific to the buyer-supplier literature, trust has been identified both as the mechanism that enables opportunism in close relationships (Anderson & Jap, 2005) and as the mediating variable through which collaboration can lead to positive performance (Schoenherr, Narayanan, and Narasimhan, 2015). Zahra, Yavuz and Ucbasaran (2006) found trust can have both positive and negative aspects in relationships. Overall these findings suggest trust can have both beneficial and detrimental effects on relational performance.

In an in-depth case study of an Italian OEM that studied five key suppliers in a dyadic relationship, Mahapatra, Narasimhan, and Barbieri (2010) found different levels of trust between the suppliers and the OEM. In three of the cases, they find that the OEM viewed their supplier as

highly trustworthy, while the supplier had concerns about questionable benefit sharing and opportunistic behavior from the OEM. In two other cases, suppliers were not trusted and had substantial concerns about OEM opportunism. While the range of the overall governance effectiveness differed, it is obvious that there is additional complexity that needs to be addressed in trust levels from multiple perspectives in the relationship.

Recognizing the different perspectives of buyers and suppliers is important because of the role that perception can have on the levels of key relational constructs. Anderson and Weitz (1992) found the perceived commitment of the other party in a relationship affected the commitment level of the primary party, suggesting the existence of reciprocal trust levels. Gundlach, Achrol, and Mentzer (1995) found asymmetric commitment in a dyadic relationship can lead to opportunism. Key to all of these issues is that trust must be studied at a dyadic level, as outcomes related to trust are tied directly to the perception of trust between parties and the behavior of the other party in a relationship.

Trust asymmetry, as discussed in Chapter 2 is the difference or misalignment of levels of trust between the buyer and the supplier. The trust model presented in Chapter 2 suggests that trust can be measured at multiple locations. Multiple trust models, including reciprocal trust, mutual trust, and trust asymmetry have been explored in the research. This model is empirically evaluated to explore which trust asymmetries are observed within the sample with the following hypotheses:

Hypothesis 1: Outgoing trust and incoming trust are equivalent within the same organization.

H1a: $OT_B = IT_B$

H1b: $OT_S = IT_S$

Hypothesis 2: Outgoing trust and incoming trust are equivalent within the same trust channel.

H2a: $OT_B = IT_S$

H2b: $OT_S = IT_B$

Mutual trust has been explored in the research as a shared level of trust between a buyer and a supplier that can lead to positive outcomes. Mutual trust exists when the trust level between all parties can be identified as a single shared level of trust. This trust can have implications on the relationship. Although mutual trust exists when trust is shared among parties, the mutual trust in the relationship can range from high trust levels to low trust levels that are shared among two parties. In low levels of mutual trust when the parties do not share a high level of trust with each other, self-protecting measures will limit opportunistic behavior. Such relationships can exist when firms engage in arms-length relationships or have contractual controls to protect themselves from opportunistic behavior or conflict in the relationship.

In high levels of mutual trust, parties might be more likely to engage in mutually beneficial relationships, such as strong-form trust. Firms that are able to achieve a high level of mutual trust in a relationship will likely be characterized by having a lower level of opportunism and conflict within the relationship. Based on this, the following hypothesis is proposed:

Hypothesis 3: Mutual trust will be negatively related to conflict (a) and opportunism (b)

Trust asymmetry can be used to explain how higher levels of trust can have both a positive and negative relationship with relational performance. High trust asymmetry exists in a buyer-supplier relationship where trust levels between parties are dissimilar to one another. Trust asymmetry exists when the levels of trust between two parties are different and can lead to

opportunistic behavior. For example, a supplier that trusts a buyer highly might be willing to invest in assets specific to the buyer, which in turn could lead to opportunism from the buyer (McHugh, Humphreys & McIvor, 2003). A supplier with a low level of trust towards a buyer (low outgoing trust) who perceives high trust from the buyer (high incoming trust) might take advantage of the buyer's high trust levels. The greater the disparity between trust levels, the greater the potential for opportunism is to occur.

Asymmetries in trust levels between a buyer and a supplier can similarly lead to conflict within the relationship. The norm of reciprocity is the expectation that people who receive positive/negative behavior from someone else tend to return the behavior in kind (Gouldner, 1960). In the context of trust, the norm of reciprocity would suggest that firms would react positively to higher levels of comparative trust and react more poorly to lower levels of trust. This effect would be exacerbated when there is a perception of inequitable trust levels. That is, when one party has a high level of trust and their partner has a low level of trust in the relationship this could lead to perceptions of negative behavior from their partner because the trust they are sending out is not reciprocated. This negative behavior then can lead to higher levels of relational conflict and opportunistic behavior as a form of negative behavior in reaction to the lower relative levels of trust received from their partner. In cases where trust levels are mutually low, or mutually high (low trust asymmetry), the trust levels within the relationship are similar and the perception of inequitable trust will not be poignant and will not lead to these types of negative reciprocal behaviors. This would lead to higher levels of opportunism when trust levels are higher for one party than the party feels from their partner in the relationship. Following these arguments, I propose the following hypotheses:

Hypothesis 4: Trust asymmetry will be positively related to conflict (a) and opportunism (b)

1.2 Knowledge Asymmetry

The relational view posits that one of the four key sources of interorganizational competitive advantage is complementary resources/capabilities (Dyer & Singh, 1998). Knowledge asymmetry is often sought by firms seeking complementary relationships with suppliers (Shan & Hamilton, 1991). In the relational view, knowledge asymmetries can increase relational innovation performance because knowledge differences can be complementary resources which generate additional relational rents that can be captured within the supply chain.

TCE and agency theory explain the possible negative effects of knowledge asymmetries. TCE provides an explanation for why knowledge asymmetries might lead instead to opportunistic behavior in order to maximize self-interest, especially in situations where monitoring is difficult or costly. TCE suggests firms are more likely to engage in self-interest seeking with guile in these situations. Agency theory similarly predicts agents will take advantage of principals when principals are unable to monitor their behavior and there exists potential for self-interested behavior (Eisenhardt, 1989; Sharma, 1997).

Knowledge differences between parties can increase the potential to engage in opportunistic behavior. For example, the higher knowledge level of Takata allowed them to take advantage of the buyer's lack of knowledge regarding the use of ammonium nitrate in their airbags, which led to major problems within the distribution channel. Furthermore, Takata was able to hide much of the knowledge from additional tests which could have prevented additional problems had they been willing to share that knowledge with their buyers. Research has found that a person’s probability of receiving surgical interventions is one third higher for individuals who are not physicians or members of a physician’s family (Dulleck & Kerschbamer, 2006). One could argue

the reason a person did not receive a potentially unnecessary intervention is because of the individuals' access to additional knowledge, which prevents the knowledge asymmetry from emerging within the relationship and prevents the individuals from receiving unnecessary surgical procedures. Thus, the following hypothesis is conjectured:

Hypothesis 5: Knowledge asymmetry will be positively related to conflict (a) and opportunism (b)

1.3 Dependence Asymmetry

A typical strategy in managing buyer-supplier relationships is seeking favorable relational dependence or power asymmetries to strengthen one firm's position in the relationship at the expense of a partner. This can lead to better negotiations (Inderst & Wey, 2007) and potential profit squeezing and price cutting that can favor the party with more power in the relationship (Porter, 2008). However, it is important to recognize that dependence can also lead to negative effects. Relationships characterized by dependence asymmetry have been argued to lead to opportunistic behavior in the relationship (Gundlach, Achrol, & Mentzer, 1995; Lonsdale, 2001). Despite the potential for positive outcomes for dependence asymmetry, the negative outcomes of conflict and opportunism might be more likely to occur in relationships that have high levels of asymmetry. Anderson and Weitz (1989) show that relationships with asymmetric dependence lead to higher levels of exploitation. McDonald (1999) suggests that relationships with power imbalances lead to unproductive relationships.

The bilateral dependence theory (Bacharach and Lawler, 1981) argues that dependence levels that are highly asymmetric can lead to higher levels of conflict from *both* parties. Firms that have a dependence advantage in the relationship will take advantage of their position and engage

in opportunistic and exploitative behavior and firms that are less advantageous in the relationship engage in preemptive exploitation or rebellion (Kumar, Scheer, and Steenkamp, 1995). Following the predictions from the theory of bilateral dependence and findings from prior research, the following hypothesis is posited:

Hypothesis 6: Dependence asymmetry will be positively related to conflict (a) and opportunism (b)

2. DATA COLLECTION

2.1 Dyadic Survey

In order to fully explore the research questions that research on asymmetries creates, it is important to capture information that measures both the buyer's perspective and the supplier's perspective in a relationship. In order to do this, a paired dyadic data collection methodology was used. Individuals who were primarily responsible for managing purchasing relationships or would be familiar with a firm's relationship with a supplier were approached via multiple avenues to participate in an online survey. The survey was designed to explore trust asymmetry, knowledge asymmetry, and dependence asymmetry and their relationship with conflict and opportunism. Respondents were asked to provide a link to their supplier to answer a similar survey after completion.

Due to the challenge of dyadic data collection, the survey was designed in such a way that, whenever possible, the primary hypotheses could be tested using only the buyer survey if necessary and the survey responses could be used for confirmatory and difference testing within the relationships. This was a valuable approach for multiple reasons. First, the dyadic perspective on relationships does not necessitate dyadic data collection in all cases, but requires appropriate

survey design to focus on dyadic differences that can emerge within a dyad. For example, perceived trust asymmetry can be observed and measured from the buyer's perspective within the relationship and can capture the behavioral implications of perceived trust asymmetry (which is inherently a dyadic construct) using data from a single source. Second, the challenge of collecting a large sample of dyadic data on a potentially challenging topic to gather significant response rates such as trust or opportunism of suppliers could preclude research on a topic that has significant merit and this approach allows an exploration of asymmetries in buyer-supplier relationships. Third, empirically driven research on asymmetries in buyer supplier dyads is still in an exploratory stage, and this research sets the stage for additional empirical research that takes into account the dyadic perspective for data that is collected from a single perspective as well as dyadic data.

The invitation to participate in the survey was distributed using multiple approaches. The survey was taken through Qualtrics as an online survey. Data collection included placement of an invitation to an online link in an electronic newsletter, a large e-mail campaign, presentations at professional conferences to supply chain industry professionals, individual invitations to participate from multiple academic contacts, and cold-calling purchasers at manufacturing firms to extend invitations to participate. Respondents were asked to select a specific supplier and part to use as a reference point for all questions within the survey. At the end of the survey, they were asked to share a link with their suppliers to take a similar online survey.

At the end of data collection period, a total of 210 individual buyer respondents opened the survey and 70 completed buyer responses were collected. Data collection efforts were successful in gathering 24 responses from the suppliers matched dyadic data. Of the incomplete responses, all but 25 (17.9%) of the 140 responses that did not complete the survey did not answer a single question after opening the survey, and of those that did, only 4 respondents selected a supplier and

component. This limits the likelihood that the failure to complete the survey was due to sensitivity to answering questions related to trust or opportunistic behavior, which is a possible concern as it is potentially sensitive information. While it is impossible to determine the total survey response rate given the multiple approaches, of those that were engaged enough to open the survey, 33.3% of respondents completed the survey and 34.3% of those completed surveys could be paired with a supplier response.

2.1.1 Common Method Bias

Common method bias has received substantial attention in research and multiple approaches have been suggested to manage common method bias. Post-hoc analysis to measure and capture common method biases such as Harman's single factor model or partial correlation procedures such as marker variables or a general factor score have been found to have significant limitations and lead to potentially incorrect findings (Podsakoff et al., 2003; Straub & Burton-Jones, 2007; Yetton, Sharma, & Crawford, 2007; Sharma, Yetton, & Crawford, 2009). Because of this, these approaches for measuring common method biases are not included.

In order to limit common method bias, the survey was designed in such a way as to minimize potential common method bias following suggested guidelines by Podsakoff et al., (2003). Data were collected from both buyers and suppliers in the relationship. Constructs which were conceptually similar, but had different anchors (for example outgoing trust and incoming trust) were placed on separate pages within the study and were split by different questions. Additionally, the placements of dependent and independent variables were chosen carefully to limit common method bias following the suggestions from Podsakoff et al. (2003). Finally, common method bias can be reduced by selection of an appropriate key informant which was done

in survey distribution and verified through survey responses. Despite these efforts, common method bias is a potentially limiting aspect of the empirical data analysis.

2.1.2 Key Constructs

Survey measures were based on previously established measures that had demonstrated reliability whenever possible. Table 1 has a list of the full set of core constructs which were used in the analysis. All of the measures exhibited a reliability score of .70 or higher for Cronbach's alpha with the exception of reported conflict, which was a formative measure of different types of conflict reported during the 12 months prior to taking the survey. Additionally, composite reliability measures were determined by analysis using SEM. While a full measurement model was not possible due to sample size limitations, composite reliability was determined by individual measurement models for each of the primary constructs. All composite reliabilities were found to be .80 or higher except for reported conflict. Measures used for statistical analysis were combined via averaging of the relevant individual measurements for all cases except for reported conflict which was a sum of the different types of reported conflict. These measures were then used to calculate difference scores and asymmetries as discussed in the following sections.

Outgoing trust and incoming trust were measured using four measures which were adopted from Cannon et al., (2010) measures on trust. The measures were modified slightly to specifically account for which aspect of trust was being measured by which party in the relationship. Cronbach's alpha values were calculated to determine measure reliability and were found to be equivalent to those in previous literature. This suggests that the measures are internally consistent for both outgoing trust ($\alpha = .89$ for buyer responses, $\alpha = .93$ for supplier responses) and incoming trust ($\alpha = .89$ for buyer responses, $\alpha = .94$ for supplier responses). Measures for outgoing trust and

incoming trust were captured for both the buyer and the supplier in the relationship. These measures were then averaged to determine measurement for trust to be used in the analyses for outgoing trust and incoming trust for both the buyer and the supplier.

Mutual trust was determined by taking the level of shared trust between a buyer and a supplier as measured by the minimum value of outgoing trust and incoming trust reported by the buyer. This represents the minimum level of trust that exists within the relationship between the buyer and the supplier. This measure was selected to capture the essence of mutual trust, which reflects that a shared level of trust between a buyer and a supplier emerges. While much of the literature on mutual trust assumes that a single measure of trust exists between a buyer and a supplier and thus a single measure is sufficient, this approach does not make that assumption, yet still captures the critical essence of mutual trust that exists within a relationship. In cases where high levels of trust emerge for both incoming and outgoing trust, mutual trust is high. In cases where one or both of the trust measures is low, mutual trust is consequently low.

Trust asymmetry was calculated by taking the absolute value of the difference between outgoing trust and incoming trust for the buyer. Trust asymmetry represents the difference between trust levels without taking into account the direction of the difference between parties.

Dependence was measured using four measures from Jap and Ganesan (2000) and Bode et al., (2011). The measures for dependence demonstrated high levels of reliability ($\alpha = .91$ for buyer responses; $\alpha = .92$ for supplier responses). These measures were then averaged to determine a single measurement for dependence to be used in the analyses. Dependence measures were only collected for the firm which was responding to the questionnaire due to the nature of the measures precluding external observation even within a buyer-supplier relationship. Because of this, buyer

dependence was measured only by the buyer, and supplier dependence was measured only by the supplier. This substantially limited the sample size of dependence asymmetry measures as it requires the full dyadic data to be complete. Dependence asymmetry was calculated by taking the absolute value difference between buyer and supplier dependence levels.

Knowledge was measured using four questions that were adapted from Jap and Ganesan (2000). The buyer was asked about how knowledge levels for their own firm and their supplier compared to the best alternative supplier for the product category of the relationship. Knowledge demonstrated high levels of reliability ($\alpha = .97$ for the buyer's self-reported knowledge, and $\alpha = .98$ for buyer's assessment of supplier's knowledge). These measures were then averaged to determine a single measurement for knowledge to be used in the analyses. Knowledge asymmetry was calculated by taking the absolute value of the difference between the knowledge levels of the buyer and the supplier.

Conflict was measured using two separate measures, perceived conflict and reported conflict. Perceived conflict was measured using three measures of conflict adapted from Jap and Ganesan (2000) which captures relational friction such as tense relationships, working disagreements, or clashes on how to conduct business. Reliability for perceived conflict was sufficient ($\alpha = .92$). The three measures were then averaged prior to any analysis.

Reported conflict was measured by asking respondents to recall a count of the number of instances of issues requiring escalation, disagreements over price adjustments, disagreements over quality specifications, and disagreements over contractual terms. Thus, conflict represented negative forms of conflict, as opposed to potentially beneficial forms of conflict such as cooperative conflict. Respondents selected a categorical response for 0, 1-2, 3-4, or 5+ instances

observed in the last 12 months with that relationship for each of the types of potential conflict. The sum of these values were then used. Reliability for this measure was low ($\alpha = .52$), however given that it is a formative and objective measure rather than reflective this does not pose any concern. Both aspects of conflict were significantly correlated ($r = .4694$, $p < .01$, $n = 62$) with each other. Additionally, buyer responses and supplier responses for conflict were positively correlated to one another for both perceived conflict ($r = .3653$, $p = .11$, $n = 20$) and reported conflict ($r = .6243$, $p < .01$, $n = 20$). This suggests overall large agreement over the conflict levels observed within the buyer firm and between buyer and supplier responses.

Opportunism was measured as a self-reported measure and as a measure of the behavior of the partner in the relationship. Opportunism was measured using 4 questions adapted from Wuyts and Geyskens (2005) and Liu, Luo, Liu (2009). Reliability for opportunism levels indicated that the measures were internally consistent ($\alpha = .78$ for buyer self-reported opportunism; $\alpha = .86$ for buyer reports of supplier opportunism). Opportunism measures were focused on violations of verbal and non-verbal agreements with the other party in order to further their own interests. In order to minimize social desirability or non-response bias, questions were phrased using softer language such as ‘sometimes’ and by using ‘the firm’ as the agent rather than the respondent. Opportunism scores were averaged for all analyses.

2.1.3 Control Variables

Relationship history can have an impact on trust and relational issues. Relational history represents the number of years the respondent has worked with the supplier. The individual level relationship can have implications on the behavior of the partners within the firm. In some cases, this relationship was used in order to enable higher levels of opportunistic behavior (Anderson

and Jap, 2005), while in others it might limit the level of opportunism that occurs as a stronger individual relationship forms.

Product complexity could imply greater potential for conflict in task execution or it could allow asymmetries to be exploited one party or the other. Product complexity can add additional opportunities to engage in negative relational behavior. Research in fraud has identified complex transactions as an indicator of opportunistic behavior (Cohen et al., 2012; Wilks and Zimbelman, 2004) as has recent research in corruption levels in the supply chain literature (Arnold, Neubauer, & Schoenherr, 2012). Product complexity was captured for the product that was being analyzed in the relational dyad using a Likert scale from 1 to 7 (where 1 is a simple product and 7 is a highly complex product).

Prior trust was captured using a single item measure, "Based on past experience, our firm can rely on this supplier to keep promises." Prior trust was captured in order to ascertain whether the effects that were hypothesized and observed were independent of the trust levels of a firm which could be highly related to both conflict and opportunism levels within the relationship.

Table 1: Constructs and Measures List

Construct	Definition	Measures	Source of Measure	Reliability from Literature	Observed Reliability
Buyer (Supplier) Outgoing Trust	The belief held by the buyer that the supplier's behavior will be benevolent and reliable.	We know this supplier is sincere with us This supplier is genuinely concerned that our business succeeds We believe the information that this supplier provides us We trust this supplier	Cannon et al., (2010)	0.88	.89 (.93)
Buyer (Supplier) Incoming Trust	The perception of the trust levels exhibited by a partner in a relationship	Our supplier believes our firm is sincere with them Our supplier believes our firm is genuinely concerned that their business succeeds Our supplier believes the information our firm provides Our supplier trusts our firm	Cannon et al., (2010)	0.88	.89 (.94)
Mutual Trust	The minimum level of trust level shared between two the two parties in the relationship.	$\min(OT_B, IT_B)$			
Trust Asymmetry	The absolute value of the difference between outgoing trust and incoming trust within the same organization	$\lvert OT_B - IT_B \rvert$			
Buyer (Supplier) Relational Dependence	The reliance of a company on the relationship.	If our relationship with this supplier were to be discontinued, we would have difficulties achieving our goals. It would be difficult for us to replace this supplier We are quite dependent on this supplier We do not have a good alternative to this supplier	Bode, Wagner, Peterson, and Ellram (2011); Jap and Ganeson, 2000	.90; .95	.91 (.92)
Relational Dependence Asymmetry	The absolute value of the difference between a buyer's dependence and a supplier's dependence	$\lvert RD_B - RD_S \rvert$			
Buyer (Supplier) Knowledge	The amount of knowledge held by a firm related to the product category in the relationship	Compared to the principal firms in this product's industry, OUR FIRM (OUR SUPPLIER) has: ...A great deal of knowledge about this product category ...A great deal of information about this product category ...A strong understanding of this product category ...A great deal of insight regarding this product category	Brockman and Morgan (2003)	0.95	.97 (.98)
Knowledge Asymmetry	The absolute value of the difference between a buyer's knowledge and a supplier's knowledge	$\lvert K_B - K_S \rvert$			
Perceived Conflict	The perception that one party's interests are being opposed in the relationship.	How does this supplier perform on the following dimensions relative to the best alternative supplier for this product? ...The relationship with this supplier can best be described as tense ...We have significant disagreements in our working relationship with this supplier ...We frequently clash with this supplier on issues relating to how we should conduct our business	Jap and Ganeson (2000)	0.83	.92
Reported Conflict	An objective measure of the number of instances where conflict occurred in the relationship.	How many times has an issue with this supplier required escalation in the last 12 months? How many times was there a disagreement over price adjustment with this supplier in the last 12 months? How many times was there a disagreement over quality specifications with this supplier in the last 12 months? How many times was there a disagreement over contractual terms with this supplier in the last 12 months?			.52
Buyer Opportunism	The amount of opportunism exhibited by the buyer from the buyer's perspective. Opportunistim refers to the incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse another party for your gain.	Our firm sometimes does not fully disclose information to this supplier in order to protect our firm's interest Our firm sometimes fails to deliver on promises to this supplier for our firm's interests Our firm sometimes breaches informal agreements with our supplier to maximize our firm's benefits Our firm sometimes takes advantage of holes in the contract with this supplier to enhance our firm's interests	Wuyts and Geyskens (2005); Liu, Luo, Liu (2009)	0.89	.78
Supplier Opportunism	The amount of opportunism exhibited by the supplier from the buyer's perspective.	This supplier sometimes does not fully disclose information to our firm in order to protect their firm's interests This supplier sometimes fails to deliver on promises to our firm for their firm's interests This supplier sometimes breaches informal agreements with our firm to maximize their firm's benefits This supplier sometimes takes advantage of holes in the contract with our firm to enhance their firm's interests	Wuyts and Geyskens (2005); Liu, Luo, Liu (2009)	0.89	.86

Table 2: Correlation Matrix of Buyer Responses

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	Min	Max
1 Outgoing Trust	5.39	0.86	-									3.50	7.00
2 Incoming Trust	5.39	0.81	0.59*	-								3.00	7.00
3 Dependence	4.55	1.36	0.00	-0.06	-							1.50	7.00
4 Buyer Knowledge	5.88	0.86	0.06	0.00	0.16	-						2.50	7.00
5 Supplier Knowledge	6.06	0.92	0.15	0.10	0.12	0.45*	-					3.50	7.00
6 Perceived Conflict	2.93	1.45	-0.49*	-0.36*	0.21	0.03	-0.18	-				1.00	6.00
7 Reported Conflict	1.8	0.5	-0.50*	-0.58*	0.10	0.06	-0.21	0.46*	-			1.00	3.25
8 Buyer Opportunism	3.63	1.22	-0.31*	-0.36*	0.31*	-0.20	-0.04	0.56*	0.25	-		2.00	6.00
9 Supplier Opportunism	3.96	1.27	-0.43*	-0.31*	0.22	0.03	-0.17	0.68*	0.56*	0.67*	-	1.25	6.00

* indicates significance at the .05 level (two-tailed); Uses listwise deletion; N = 58

Table 3: Correlation Matrix of Supplier Responses

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	Min	Max
1 Outgoing Trust	6.19	0.76	-									4.50	7.00
2 Incoming Trust	6.3	0.73	0.83*	-								4.50	7.00
3 Dependence	5.08	1.25	0.62*	0.64*	-							2.50	7.00
4 Buyer Knowledge	6.33	0.88	0.36	0.16	0.26	-						4.00	7.00
5 Supplier Knowledge	6.5	0.61	0.44	0.63*	0.26	0.34	-					5.00	7.00
6 Perceived Conflict	1.88	0.92	-0.78*	-0.64*	-0.66*	-0.75*	-0.52*	-				1.00	4.00
7 Reported Conflict	1.58	0.51	-0.60*	-0.42	-0.61*	-0.22	0.05	0.60*	-			1.00	2.50
8 Buyer Opportunism	3.19	1.62	-0.51*	-0.57*	-0.61*	0.03	-0.37	0.44	0.35	-		1.00	6.00
9 Supplier Opportunism	3.02	1.87	-0.13	-0.23	-0.26	-0.11	-0.44	0.22	-0.09	0.44	-	1.00	7.00

* indicates significance at the .05 level (two-tailed); Uses listwise deletion; N = 15

2.2 Data Source

Survey data were collected from manufacturing firms located in North America, Europe, and Asia. The survey respondents ranged from purchasing managers to CEOs of firms and when contacting firms, the key respondent was the person most familiar with the relationship with the supplier. Buyers were asked to share the survey with the contact at their supplier who they felt would be the most capable to answer a similar survey.

Two rounds of Q-sort were done with academics in order to determine appropriateness of scale development and survey development for the key constructs of outgoing trust, incoming trust,

conflict, collaboration, and opportunism. The Q-Sort was distributed to two different sets of three academics who were not involved in survey development outside of the Q-Sort. The item placement score in the final round of Q-Sort for perfectly matched responses was 82.88%, and the item placement score for responses which marked the correct response as well as a secondary incorrect response was 87.4%. The average score is well above the desired threshold of .7 for item placement score (Moore and Benbasat, 1991).

Respondent information is included in Tables 4-6 and locations of buyers and suppliers are graphically presented in Figures 4 and 5. The data are representative of a diverse group of buyers and suppliers across many countries and continents. Additionally, firm sizes ranged from small firms with <$5M in annual revenue to firms with revenue >$1B showing that a broad range of firm sizes were included in the data.

Table 4: Respondent Location

Firm Location	Buyer Responses	Supplier Responses
USA	18	9
India	18	7
South Korea	13	0
Denmark	10	0
Switzerland	1	0
Italy	1	0
Thailand	1	1
Ireland	0	1
Sweden	0	1
Missing Data	8	3
Totals	70	22

Table 5: Firm Annual Revenue

Firm Annual Revenue	Buyer Responses	Supplier Responses
< $5M	10	6
$5M-$9M	11	4
$10M-$99M	10	1
$100M-$499M	2	2
$500M-$1B	20	7
Greater than $1B	16	0
Missing Data	1	2
Totals	70	22

Table 6: Firm Size

Number of Firm Employees	Buyer Responses	Supplier Responses
< 249	11	10
250-499	6	1
500-999	7	2
1,000-4,999	1	0
5,000-9,999	17	6
More than 10,000	28	0
Missing Data	0	3
Totals	70	22

Figure 4: Distribution of Survey Respondents for Buyers

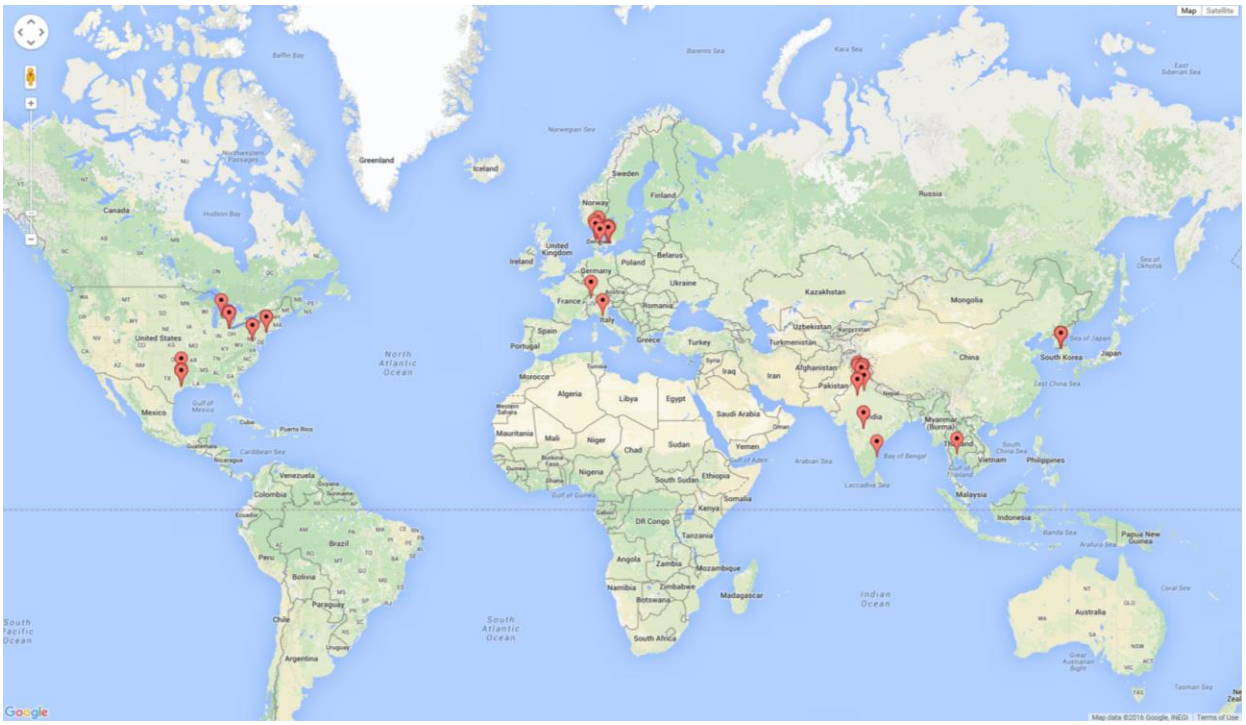
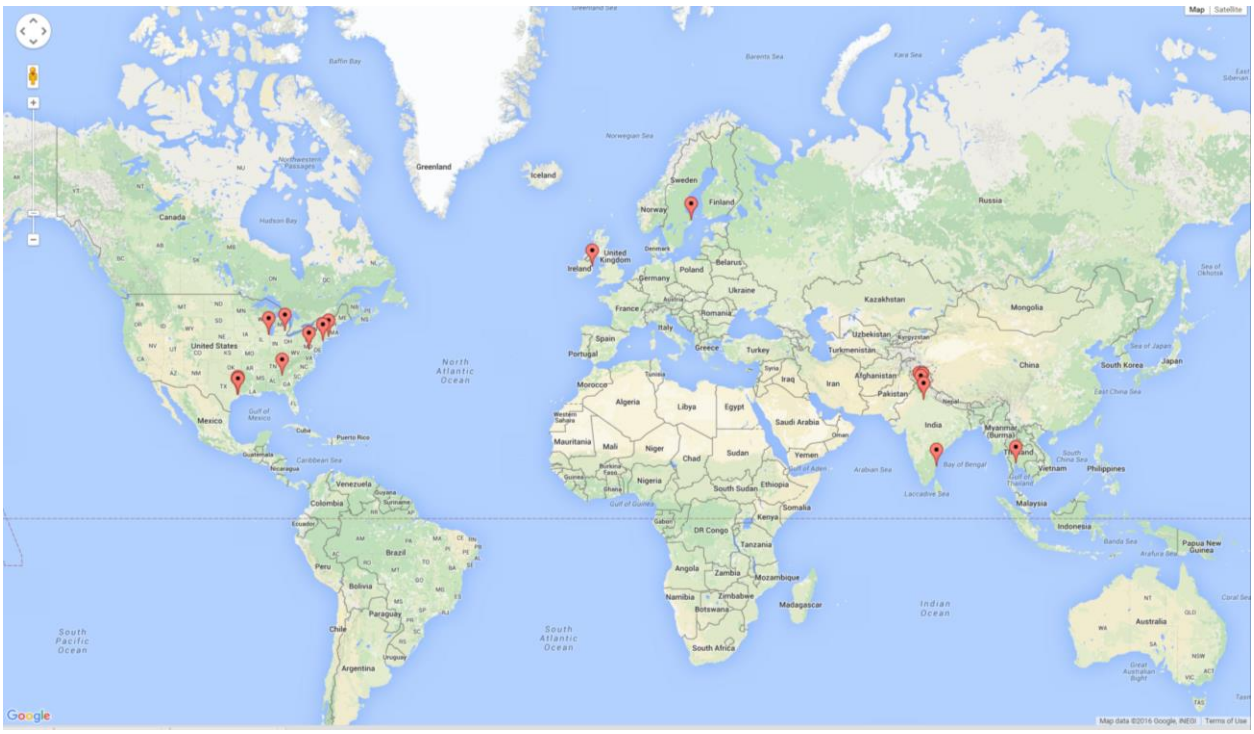


Figure 5: Distribution of Survey Respondents for Suppliers



3. ANALYSIS OF DYADIC DATA

The follows sections test the degree of asymmetry observed within the relationships between buyers and suppliers. Data was collected from both buyers and suppliers, but for testing purposes data analysis was done using the buyer responses for measures of mutual trust, trust asymmetry, and knowledge asymmetry. Given the difficulty of respondents accurately identifying the dependence levels of their partner firms in the relationship, both the buyer and supplier responses were required for analysis of dependence asymmetry. Because of this limitation sample sizes differ largely between the analyses on trust and knowledge and the analyses on dependence.

3.1 Existence of Relational Asymmetries

In order to establish whether asymmetries emerged within the relationship, descriptive statistics and confidence intervals are provided for each of the three types of asymmetries and the difference scores for the observed data. Analysis of the 95% confidence intervals indicates that asymmetries emerged in responses of buyers and supplier for trust, knowledge, and dependence levels. The direction of asymmetry for all three difference scores included zero, suggesting that although asymmetries emerge, there was no systematic difference in mean levels that is observed at a significance level of .05. These results are included in Table 7. The existence of asymmetries in the collected data allows further analysis of the variables in the remainder of this chapter.

Table 7: Descriptive Statistics for Asymmetry Variables

Variable	Calculation	N	Mean	Min	Max	95% Confidence Interval
Trust Difference	Outgoing Trust - Incoming Trust	65	0.04	-2.00	3.00	(-.15, .23)
Knowledge Difference	Buyer Knowledge - Supplier Knowledge	66	-0.25	-5.75	2.50	(-.53, .03)
Dependence Difference	Buyer Dependence - Supplier Dependence	21	-0.77	-5.00	2.75	(-1.71, .17)
Trust Asymmetry	|Outgoing Trust - Incoming Trust|	65	0.48	0.00	3.00	(.34, .63)
Knowledge Asymmetry	|Buyer Knowledge - Supplier Knowledge|	66	0.66	0.00	5.75	(.43, .89)
Dependence Asymmetry	|Buyer Dependence - Supplier Dependence|	21	1.68	0.00	5.00	(1.05, 2.31)

3.2 Analysis of the Dyadic Trust Model

In order to test Hypothesis 1 which states that incoming trust and outgoing trust are equivalent within the same organization, a two-sided paired t test was performed to compare the mean levels of outgoing trust for the buyer and incoming trust for the buyer. The results indicate no significant difference ($t = .406$, $p > .1$) between a buyer's incoming trust and a buyer's outgoing trust. Similarly, no significant difference ($t = 1.000$, $p>.1$) emerges in a two-sided paired t test for the supplier mean levels of outgoing trust and incoming trust. The results from this test indicate support for the concept of trust reciprocity, and the results indicate that in this case, trust measurements of both incoming and outgoing trust within an organization are not significantly dissimilar to one another.

In order to test Hypothesis 2, which states that outgoing trust is equal to incoming trust within the same trust channel, the outgoing trust of one party was compared with the incoming trust of the other party in the relationship. The buyer's outgoing trust and the supplier's incoming trust were found to be statistically different ($t = -1.865$, $p < .1$). Additionally, the supplier's outgoing trust and the buyer's incoming trust was found to be significant ($t = 2.239$, $p < .05$). The results from Hypothesis 2 testing provide evidence that there exists a degree of signal loss that

occurs in communicating trust signals between buyers and suppliers in trust channels, lending support for the concept of signal loss presented in chapter 2. These tests and the descriptive statistics for the relevant variables are provided in Table 8 and Figure 6.

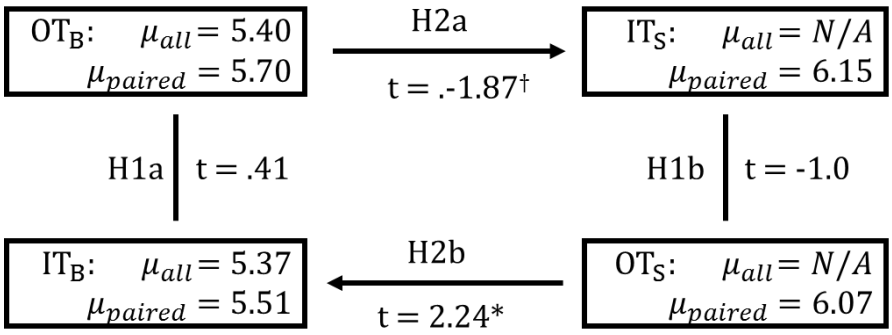
Table 8: Two-tailed Paired *t* Test of Trust

Two-tailed Paired *t* Test

Paired Comparison		N	Mean OT	Mean IT	*t*	p	Null Hypothesis
OT_B	IT_B	65	5.40	5.37	0.4056	0.686	H1a: Supported
OT_S	IT_S	21	6.07	6.15	-1.000	0.329	H1b: Supported
OT_B	IT_S	21	5.70	6.15	-1.865†	0.077	H2a: Rejected
OT_S	IT_B	21	6.07	5.51	2.239*	0.037	H2b: Rejected

OT = Outgoing Trust; Subscript B = buyer, subscript S = supplier
* indicates signicance at the .05 level; † indicates significance at the .10 level

Figure 6: Mean Observed Trust Levels and Paired *t* Test Results



4. REGRESSION ANALYSIS

Hypotheses 3-6 were tested using OLS regression analysis. Deletion of cases with missing responses was done for each regression independently. This led to a minimum sample size of N = 60 for regressions including only the buyer's perspective (analyses exploring trust and knowledge levels) and N = 20 for regressions including both buyer and supplier responses (analyses exploring

dependence levels). Because dependence measurements require both buyer and supplier responses, dependence models have a much smaller sample size in all analyses. VIF scores for all regressions were well below the suggested limits of 10 (Hair et al., 2006), 5 (Rogerson, 2001) or 4 (Pan & Jackson, 2008). Additionally, observation of the distributions of the variables and the distribution of the error terms for the regression did not indicate violations of the assumptions of regression.

4.1 Controls

Relational history had positive and significant relationship ($p < .10$) with reported conflict in two of the four significant models. Similarly, relational history had a positive and significant relationship ($p < .10$) relationship with supplier opportunism in two of the four significant models. This is an interesting finding. Although the argument might be made that a stronger personal relationship is beneficial for a relationship, the evidence suggests a possible connection in the opposite direction. This finding suggests that a connection might exist between the length of a personal relationship between a buyer and a supplier with negative relational outcomes, as it could increase the amount of relational conflict observed and the supplier opportunism levels. This finding suggests that additional research should identify how opportunistic behavior and conflict might emerge over time within a relationship. This finding merits additional exploration with a more robust sample size, but the finding does indicate some support for the idea that longer relationships between an individual and a supplier can lead to higher levels of opportunistic behavior by the supplier. Prior literature has found support for stronger personal relationships being used as the mechanism through which opportunistic behavior was enabled (Anderson and Jap, 2005). It is possible that the stronger personal connections between individual employees and supplier can be used for opportunistic behavior at the expense of the buyer. This finding merits additional exploration, as it might be more optimal for companies to rotate individuals responsible

for managing a supplier relationship periodically to avoid developing ties which can enable opportunistic behavior. This is counter-intuitive to the current understanding which would suggest that the expertise and relationship built with having the same employee responsible for the relationship over a long period of time is beneficial.

Product complexity was expected to be positively related to both conflict and opportunistic behavior. This relationship was found to be insignificant in all tested models. This is an interesting observation because of the theoretical justification and support for complexity leading to problems within the relationship. Complexity can act as one of the mechanisms or means through which opportunistic behavior can be hidden and high levels of complexity provide additional points of friction through which conflict can emerge in a relationship. It is therefore interesting that this relationship did not emerge within the observed data. It is possible that the relationship between complexity and opportunism and conflict is more complex than that presented within this paper, with other factors playing a key role in that relationship.

Prior trust acted as a very strong predictor for conflict and opportunism levels. Prior trust, which was measured by capturing the degree to which suppliers were able to keep previous promises had a significant negative relationship ($p < .10$ in all models) with perceived conflict, reported conflict, and supplier opportunism in all models which were significant. This finding is expected, as prior trust levels should be strongly related to the outcome measures of interest. One interesting distinction might be that neither prior trust or outgoing trust predicted the buyer opportunism levels, indicating that the decision to engage in opportunism as a firm is not driven by how trustworthy a firm perceives its partner to be.

One of the limitations of the country codes that were used is that data collection samples might differ by region, as multiple data collection efforts in different regions were undertaken using different methods (for example e-mailed invitations versus personal contacts). Because different methods were obtained in each region, observable effects might be due to sampling bias, as opposed to country level biases and so care should be used in interpreting these results. As country effects and sampling effects are not distinguishable, country level differences might be due to sampling differences. Despite this limitation, the results did indicate some interesting differences between the regions. Europe, was selected as the base dummy variable for analysis. Given that point of reference, the country codes demonstrated significant differences in the following ways. Sampled firms from South Korea had a significantly higher relationship with perceived conflict observed within the sample. Sampled firms from India had a significantly stronger relationship with supplier opportunism levels. Sample firms which were from the USA had a significantly higher relationship with buyer opportunism levels. On all other accounts, there was no statistically different findings for any other relationship. While there are some interesting insights that could be explored because of these differences, this exploration is not done here due to the inability to distinguish between sampling methodologies and country effects such as culture or the legal environment. However, these distinguishing features are recognized and controlled for in the analysis.

4.2 Trust

A series of regression analyses were run to determine the relationship between trust and the outcome variables of conflict and opportunism. For each of the outcome variables, three models for trust are evaluated in addition to the base model. The relationship that trust has with conflict and opportunism was evaluated through outgoing trust, incoming trust, mutual trust, and

trust asymmetry. Mutual trust represents the shared degree of trust within a relationship and is operationalized as the minimum value of outgoing and incoming trust for the buyer. Trust asymmetry represents how differently the firms trust one another in the relationship and is operationalized as the absolute value of the difference between outgoing trust and incoming trust as reported by the buyer. The base model captured the relationship between the control variables and each of the outcome variables. The effect of both incoming and outgoing trust is captured in the reciprocal trust model which identifies the trust that a buyer has in a supplier and their perception of their supplier's trust in them. captured the regression with outgoing and incoming trust added to the control variables. The effect of mutual trust is captured in the mutual trust model which uses mutual trust as the primary trust indicator, replacing outgoing and incoming trust. Including mutual trust in addition to outgoing and incoming trust lead to problems of multicollinearity due to strong relationship between mutual trust and either incoming or outgoing trust levels. The effect of trust asymmetry was captured in the trust asymmetry model which added trust asymmetry to the reciprocal trust model. The predictive utilities of the subsequent models of the reciprocal trust model, the mutual trust model, and the trust asymmetry model were captured through the f test to compare nested models. Hypotheses and findings are discussed in the following sections. All results are included in table form in tables 9-12.

4.2.1 Trust and Conflict

Two different measures were collected to capture conflict within the relationship. Perceived conflict represents the degree of conflict experienced within the relationship, while reported conflict represents the recorded number of instances of specific types of conflict over the last 12 months in the relationship. The hypotheses are evaluated in terms of both perceived conflict and reported conflict. Eight models were evaluated for each of perceived conflict and reported

conflict which examine the influence that the control variables, trust, knowledge, and dependence have on the conflict levels in the relationship.

Outgoing trust, which is reflective of the traditional measure of trust in relationships (i.e., the trust one firm places in another) was not significantly related to either perceived or reported conflict although the relationship was in the direction that was expected. A higher level of outgoing trust is expected to be related to a lower level of perceived conflict. Although no significant relationship is observed, it is possible that the lack of a significant finding is due to relatively small sample size.

Incoming trust was not found to be significantly to perceived conflict, but was significantly related to reported conflict. This finding is interesting, in particular with regards to the absence of a strong relationship between outgoing trust and conflict. Incoming trust, which represents the perception of trust from a partner was strongly associated with the number of conflict incidents reported within the relationship, although this relationship did not persist to the higher levels of perceived conflict. This finding yields two interesting insights, outgoing trust and incoming trust have different predictive power, and demonstrate significant relationships with different outcome variables. This finding is substantiated in section 4.2.2 as well. There is significant merit in exploring the differentiation of trust to consider both incoming and outgoing measures in future research on trust within relationships. This supports the exploration of trust using the dyadic model presented in Chapter 2 and the further exploration of trust asymmetry.

Introducing mutual trust into the base trust improved the predictive power of the model for both types of conflict observed in the relationship. Results from the regression show that mutual trust was a significant predictor of conflict for both perceived conflict ($\beta = -.246$, $p < .10$) and

reported conflict ($\beta = -.450$, $p < .01$). Higher levels of mutually shared trust led to lower levels of conflict, supporting H3a which predicted that mutual trust would be negatively related to conflict. This finding substantiates prior literature on trust which has found that trust has a generally positive outcome on relational performance. Higher levels of shared trust led to lower levels of both perceived and observed conflict. These findings suggest support for H3a.

Introducing trust asymmetry into the Base Trust Model improved the predictive power of the model on perceived conflict significantly ($F = 5.71$, $p < .05$), but did not improve the model significantly for reported conflict. Although both incoming trust and outgoing trust were non-significant in the relationship predicting perceived conflict, trust asymmetry had a significant and positive relationship to perceived conflict ($\beta = .215$, $p < .01$). Trust asymmetry was not significantly related to reported conflict. This finding is interesting because the relationship between trust asymmetry and conflict is dependent on the type of conflict, whether captured as a perceptual measure or an objective measure. While trust asymmetry did not change the objective amount of conflict observed within the relationship, there was a higher level of perceived conflict, suggesting that there is some relational impact from trust asymmetry which impacts the degree of conflict felt within the relationship by the respondents. These combined findings provide mixed support for H4a.

These findings on trust and conflict overall suggest that trust might have different implications on conflict within a relationship when considered from the perceptual or objective point of view. This indicates that additional research is necessary to explore the impact of trust which consider both subjective and objective measures as well as recognizing the complexities of incoming trust, outgoing trust, mutual trust, and trust asymmetry. While previous research has addressed mutual trust, trust asymmetry, and outgoing trust – to my knowledge no research has

endeavored to look at trust from each of the perspectives of reciprocal trust (capturing incoming and outgoing trust simultaneously), mutual trust, and trust asymmetry simultaneously. Yet the results indicate a differentiation in results when trust is divided into separate effects. This is a key contribution which future research should recognize in research on trust.

It is equally important to recognize that future research which explores trust should take into account possibly mixed effects on perceptions in the relationship as compared to objective effects within the relationship. Research on conflict must therefore differentiate between different components of conflict within the relationship in order for a complete understanding of conflict within the relationship.

4.2.2 Trust and Opportunism

Outgoing Trust was found to be negatively related to supplier opportunism ($\beta = -.283$, $p < .01$) and unrelated to buyer opportunism. Buyer firms who reported lower levels of trust in their supplier firms also reported higher levels of opportunistic behavior by those firms. This finding is non-surprising as the relationship between outgoing trust and supplier opportunism is expected to be significant.

The opposite relationship emerged for incoming trust, which found incoming trust was negatively related to buyer opportunism ($\beta = -.314$, $p < .01$), but was not related to supplier opportunism. Firms that perceived higher levels of incoming trust from their partners had lower levels of opportunism within those relationships. While this finding is very similar to the finding of outgoing trust, it is important to recognize that previous research has not looked at the concept of incoming trust as a predictor for firm behavior. Thus, finding that incoming trust might act as motivation for opportunistic behavior suggests that an important antecedent to opportunistic

behavior has not been explored and merits additional research. While this is an interesting finding which indicates an interesting relationship which needs additional research, it is important to recognize that causality has not been tested. It is possible that the observed relationship is in the opposite direction, and that buyer firms which are more opportunistic tend to perceive lower levels of incoming trust rather than the direction suggested by the regression analysis.

Mutual trust was found to have a significant negative relationship with both supplier opportunism ($\beta = -.382$, $p < .01$) and buyer opportunism ($\beta = -.384$, $p < .01$). Mutual trust levels were find to be strong predictors of relational wellbeing, limiting both conflict and opportunistic behavior within the relationship. This supports prior literature on mutual trust which has found positive outcomes of mutual trust in relationships and shows strong support for Hypothesis 3.

This finding provides positive support for the use of mutual trust in research that uses trust to evaluate performance outcomes within relationship. Mutual trust was a strong predictor of conflict and opportunism in relationships and merits exploration in addition the understanding the effects of both outgoing and incoming trust levels.

No support was found for a significant relationship between trust asymmetry and opportunism. No support for H4b was found in the observed data. Trust asymmetry was not found to predict either buyer or supplier opportunistic behavior. It is interesting to note that trust asymmetry observed by the buyer in this data analysis only impacted the perceived level of conflict within the relationship. Thus, while trust asymmetry might be positively related to perceptions of conflict, it does not necessarily transcend to more practical negative relational outcomes such as observed conflict or higher levels of opportunism.

Table 9: Regression Results on Perceived Conflict by Buyer

Regression results on Perceived Conflict

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.246†					
Trust Asymmetry				.215*				
Outgoing Trust		-.225	See Note 1	-.221				
Incoming Trust		.034	See Note 1	.096				
Knowledge Variables								
Knowledge Asymmetry						-.103		
Buyer Knowledge					.029	-.055		
Supplier Knowledge					.089	.092		
Dependence Variables								
Dependence Asymmetry								.129
Buyer Dependence							.042	.136
Supplier Dependence							-.342	-.364
Controls								
Relational History	.078	.050	.095	.063	.083	.090	.150	.168
Product Complexity	.090	.132	.105	.118	.098	.100	.226	.196
Prior Trust	-.312*	-.240†	-.266*	-.218†	-.344*	-.345*	.072	.106
Observed Conflict	.333**	.270*	.218†	.288*	.345*	.348*	.509*	.557*
USA	-.021	-.009	-.038	-.053	-.053	-.062	.124	.092
India	-.021	.025	.028	.038	-.006	-.026	.203	.155
South Korea	.345**	.343**	.317**	.328**	.360**	.345**	See Note 3	See Note 3
N	61	61	61	61	60	60	21	21
RMSE	1.044	1.035	1.015	1.002	1.061	1.068	1.111	1.154
R^2	0.518	0.544	0.552	0.581	0.527	0.531	0.569	0.574
ΔR^2	-	0.026	0.034	0.037	0.008	0.004	0.073	0.005
F test of incremental model	11.41**	1.21	3.97†	5.71*	.65	.51	.74	.17

Variables were standardized prior to performing the regression. Reported coefficients are standardized betas.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 10: Regression Results on Reported Conflict by Buyer

Regression results on Reported Conflict

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.450**					
Trust Asymmetry				-.053				
Outgoing Trust		-.138	See Note 1	-.138				
Incoming Trust		-.404**	See Note 1	-.418**				
Knowledge Variables								
Knowledge Asymmetry						.042		
Buyer Knowledge					.179†	.212		
Supplier Knowledge					-.279†	-.281†		
Dependence Variables								
Dependence Asymmetry								-.486
Buyer Dependence							.041	-.319
Supplier Dependence							-.132	-.025
Controls								
Relational History	.183	.187†	.175†	.183†	.181	.178	.166	.068
Product Complexity	.189	.156	.177	.159	.193	.192	.183	.260
Prior Trust	-.531**	-.344**	-.335**	-.348**	-.483**	-.482**	-.594**	-.616**
USA	.107	.067	.053	.077	.123	.126	.294	.364
India	-.083	.021	.025	.018	-.154	-.146	.275	.405
South Korea	-.176	-.187	-.191	-.182	-.251	-.245	See Note 3	See Note 3
N	61	61	61	61	60	60	21	21
RMSE	0.429	0.371	0.385	0.374	0.420	0.424	0.369	0.348
R^2	0.306	0.499	0.452	0.502	0.368	0.368	0.538	0.620
ΔR^2	-	0.194	0.146	0.002	0.063	0.001	0.013	0.082
F test of incremental model	7.09**	7.44**	14.39**	.24	3.29*	.07	.36	1.88

Variables were standardized prior to performing the regression. Reported coefficients are standardized betas.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 11: Regression Results on Supplier Opportunism Reported by Buyer

Regression results on Supplier Opportunism

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.382**					
Trust Asymmetry				.061				
Outgoing Trust		-.283*	See Note 1	-.274*				
Incoming Trust		-.148	See Note 1	-.139				
Knowledge Variables								
Knowledge Asymmetry						-.042		
Buyer Knowledge					.029	.003		
Supplier Knowledge					-.050	-.052		
Dependence Variables								
Dependence Asymmetry								-.288
Buyer Dependence							.390*	.177
Supplier Dependence							-.097	-.034
Controls								
Relational History	.159	.132	.166†	.140	.161	.164	.429†	.371
Product Complexity	.107	.117	.095	.112	.113	.112	-.184	-.138
Prior Trust	-.488**	-.300**	-.324**	-.298**	-.483**	-.485**	-.327†	-.340†
USA	.074	.085	.035	.066	.076	.080	.360	.402†
India	.274*	.379**	.358**	.376**	.268†	.263†	.527*	.604**
South Korea	.044	.056	.025	.045	.034	.032	See Note 3	See Note 3
N	62	62	62	62	61	61	21	21
RMSE	1.085	1.010	1.004	1.017	1.114	1.124	1.009	1.010
R^2	0.333	0.442	0.439	0.445	0.326	0.327	0.615	0.644
ΔR^2	-	0.110	0.107	0.003	0.001	0.001	0.144	0.029
F test of incremental model	6.83**	5.48**	10.07**	.70	.08	.11	3.11†	1.11

Variables were standardized prior to performing the regression. Reported coefficients are standardized betas.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 12: Regression Results on Buyer Opportunism Reported by Buyer

Regression results on Buyer Opportunism

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.384**					
Trust Asymmetry				.013				
Outgoing Trust		-.121	See Note 1	-.121				
Incoming Trust		-.314**	See Note 1	-.311*				
Knowledge Variables								
Knowledge Asymmetry						-.112		
Buyer Knowledge					-.174	-.265		
Supplier Knowledge					.054	.067		
Dependence Variables								
Dependence Asymmetry								-.351
Buyer Dependence							.597*	.382
Supplier Dependence							-.246	-.202
Controls								
Relational History	.085	.082	.072	.083	.087	.097	.297	.203
Product Complexity	-.137	-.185	-.174	-.186	-.138	-.133	-.379	-.401
Prior Trust	-.154	.000	.014	.001	-.132	-.135	.361	.345
USA	.284*	.293*	.276*	.290*	.301*	.296*	.704*	.820**
India	-.012	.095	.098	.095	.015	.004	.225	.282
South Korea	.118	.141	.134	.140	.142	.134	See Note 3	See Note 3
N	62	62	62	62	61	61	20	20
RMSE	1.149	1.085	1.087	1.096	1.158	1.166	1.053	1.052
R^2	0.110	0.235	0.218	0.235	0.143	0.149	0.445	0.492
ΔR^2	-	0.125	0.108	0.000	0.025	0.005	0.277	0.047
F test of incremental model	1.65	5.71**	7.73**	.02	1.07	.60	3.12†	1.45

Variables were standardized prior to performing the regression. Reported coefficients are standardized betas.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

4.3 Knowledge

Buyer knowledge was found to be positively related to observed conflict within the relationship at a .10 significance level. The higher degree of knowledge regarding a product the higher the level of conflict observed within the relationship over the prior 12 months. This relationship is inverse for the supplier levels of knowledge. Supplier knowledge was found to be negatively related to observed conflict at the .10 level. Suppliers with higher levels of knowledge tended to decrease the level of observed conflict. Thus, the literature which suggests that seeking suppliers with higher levels of knowledge can provide sources of interorganizational competitive advantage as knowledge can be considered complementary resources/capabilities (Dyer & Singh, 1998) is supported in this finding. and supplier knowledge levels were found to be significantly related to reported conflict at the .10 level. Suppliers who were considered to have higher understanding regarding the product were positively related to lower levels of reported conflict within the relationship. There were no other effects of knowledge that were found to be significant for buyer or supplier knowledge on conflict or opportunism.

Knowledge asymmetry was not found to be significantly related to any of the four outcome variables. Thus no support is found for Hypothesis 5a or 5b. While knowledge levels did have some impact on observed conflict, absolute differences of knowledge levels between two firms did not tend to predict negative relational outcomes within the relationship. This finding is surprising given the prior literature support which makes strong claims for how knowledge asymmetry can lead to problems, especially in terms of opportunism. It is possible that the positive impact which might be due to knowledge asymmetry is mitigated due to other factors which are not captured within the relationship. Thus, the relationship between knowledge asymmetry and opportunism that might occur as predicted by agency theory and TCE is not observed. This could

include having appropriate governance mechanisms in place to monitor the relationship and thus limit opportunism within the relationship.

4.4 Dependence

Dependence Asymmetry was only testable using results from both the buyer and the supplier survey and so was tested using a much smaller sample size. This led to limited analysis of dependence and dependence asymmetry. While dependence asymmetry was not found to have a significant effect, buyer dependence was positively related to both supplier and buyer opportunism at the .10 level. This finding indicates that buyers who are highly dependent are more likely to both experience and engage I opportunism levels within a relationship. While the former is expected, the finding that buyer firms that are highly dependent tend to have higher levels of opportunism is surprising and should be analyzed using a larger sample size. It is possible that this effect is due to the feeling of dependence in the relationship leading to desperation in the relationship. Dependence asymmetry was not found to be significantly related to any of the four outcome variables and no support was found for Hypothesis 6a or 6b.

4.5 Additional Findings

One of the interesting findings from this analysis was that the observed asymmetries were not strongly associated with higher levels of opportunism in the observed data. Out of the multiple asymmetries that were observed, only trust asymmetry and perceived conflict were found to be significantly related. Although efforts were made to capture the key variables which would be related to possible buyer or supplier opportunism, many of the regressions were insignificant and insufficient in explaining opportunism levels. This suggests that many of the driving factors behind both buyer and supplier opportunism are not yet identified. Despite the theoretical linkages

existing between asymmetries and opportunistic behavior, the linkage might either be indirect or overstated. It might also be due to the limitations of the sample size in this research, or might only emerge in the case of extreme levels of asymmetries. Thus, additional exploration of the empirical factors that drive opportunistic behavior should be undertaken which considers these alternatives.

One possible explanation for why trust asymmetry did not lead to a significant relationship with opportunism is that the trust asymmetry observed of the difference between outgoing and incoming trust within the same party (perceived trust asymmetry; gap 2 in Figure 3 in Chapter 2) can emerge in a system where trustworthiness levels are significantly different between two firms (trustworthiness asymmetry, gap 6 in Figure 3 in Chapter 2). In the case where trustworthiness levels between two firms are dissimilar and there is limited signal loss, a perceived trust asymmetry gap can emerge which is an accurate reflection of differences in trustworthiness. In this case, the existence of trust asymmetry is not representative of improper levels of trust, but having the *right* levels of trust which can prevent opportunistic behavior by not over-trusting or under-trusting in the relationship.

Asymmetries alone might be weak or insufficient predictors of opportunism. Given that the sample size is largely exploratory, there is the possibility of the effect not being large enough to observe within the sample. Additionally, the connection between asymmetries and opportunism could be a rare-event which occurs infrequently, yet with still large consequences as many of the case studies addressing opportunistic behavior demonstrate.

5. SUR EXTENSION

The analysis using OLS was extended by using SUR which allowed for correlation between the error terms for each of the regressions of perceived conflict, reported conflict, supplier

opportunism and buyer opportunism. Four separate SUR models were ran, one for each of mutual trust, trust asymmetry, knowledge asymmetry, and dependence asymmetry. This analysis is included in tables 13-16. The findings were largely similar to the findings from the OLS regressions, although significant and interesting differences are discussed in the following sections.

5.1 Mutual Trust

Mutual trust demonstrated largely the same effect when evaluated using SUR, although the level of significance was higher in most cases. Mutual Trust had a significant negative relationship with each of the outcome variables at the .05 level, suggesting that higher levels of mutual trust in a relationship is significantly related to a decrease in negative relational outcomes in the observed data.

Table 13: SUR Results for Mutual Trust

SUR Results for Mutual Trust

Dependent Variable	Perceived Conflict	Reported Conflict	Supplier Opportunism	Buyer Opportunism
Trust Variables				
Mutual Trust	-.585** (.171)	-.268** (.063)	-.537** (.163)	-.470* (.183)
Trust Asymmetry				
Outgoing Trust				
Incoming Trust				
Knowledge Variables				
Knowledge Asymmetry				
Buyer Knowledge				
Supplier Knowledge				
Dependence Variables				
Dependence Asymmetry				
Buyer Dependence				
Supplier Dependence				
Controls				
Relational History	.153 (.103)	.068† (.038)	.163† (.098)	.056 (.110)
Product Complexity	.144 (.089)	.059† (.033)	.10 (.085)	-.128 (.095)
Prior Trust	-.422** (.133)	-.148** (.049)	-.340** (.127)	.014 (.143)
USA	-.216 (.377)	-.008 (.139)	.157 (.359)	.771† (.404)
India	.051 (.375)	-.011 (.138)	1.085** (.357)	.311 (.402)
South Korea	.906* (.427)	-.290† (.157)	.156 (.406)	.477 (.457)
Intercept	6.953** (1.043)	3.558** (.383)	7.152** (.991)	5.869** (1.116)
N	58	58	58	58
RMSE	0.977	0.359	0.929	1.045
R^2	0.529	0.475	0.442	0.216
Chi^2	65.17**	52.44**	46.0**	15.98*

Reported coefficients are non-standardized. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

5.2 Trust Asymmetry

Trust asymmetry was found to only have a significant positive relationship with perceived conflict when using SUR. This relationship was significant at the .01 level, while all other relationships remained insignificant. This finding was similar to the prior analysis. Trust asymmetry's relationship with negative relational outcomes appears to be bounded to perceptions

of conflict within the relationship, but those relationships did not translate to higher levels of reported conflict, or opportunism levels in the relationship.

Table 14: SUR Results for Trust Asymmetry

SUR Results for Trust Asymmetry

Dependent Variable	Perceived Conflict	Reported Conflict	Supplier Opportunism	Buyer Opportunism
Trust Variables				
Mutual Trust				
Trust Asymmetry	.556* (.241)	.001 (.086)	.126 (.231)	-.023 (.259)
Outgoing Trust	-.356 (.222)	-.043 (.079)	-.441* (.213)	-.398† (.229)
Incoming Trust	-.104 (.213)	-.284** (.076)	-.175 (.204)	-.195 (.239)
Knowledge Variables				
Knowledge Asymmetry				
Buyer Knowledge				
Supplier Knowledge				
Dependence Variables				
Dependence Asymmetry				
Buyer Dependence				
Supplier Dependence				
Controls				
Relational History	.150 (.107)	.079* (.038)	.131 (.102)	.055 (.115)
Product Complexity	.153† (.091)	.048 (.032)	.119 (.087)	-.134 (.097)
Prior Trust	-.416** (.139)	-.163** (.049)	-.30* (.133)	.012 (.149)
USA	-.272 (.386)	.002 (.137)	.253 (.370)	.833* (.415)
India	.053 (.377)	-.032 (.134)	1.155** (.361)	.317 (.405)
South Korea	.875* (.429)	-.291† (.153)	.234 (.411)	.514 (.461)
Intercept	6.106** (1.213)	4.042** (.431)	7.40** (1.161)	6.673** (1.303)
N	58	58	58	58
RMSE	0.962	0.342	0.921	1.033
R^2	0.543	0.522	0.451	0.234
Chi^2	68.96**	63.43**	47.71**	17.72*

Reported coefficients are non-standardized. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

5.3 Knowledge Asymmetry

Knowledge asymmetry remained insignificant in all models. There is no significant relationship between knowledge asymmetry and any of the negative relational outcomes observed

within the data. Buyer knowledge levels was no longer a significant predictor of supplier opportunism, while supplier knowledge was significant at the .05 level. Higher levels of supplier knowledge did tend to decrease the reported conflict in the relationship, suggesting some potential benefit from working with suppliers with a higher knowledge level.

Table 15: SUR Results for Knowledge Asymmetry

SUR Results for Knowledge Asymmetry

Dependent Variable	Perceived Conflict	Reported Conflict	Supplier Opportunism	Buyer Opportunism
Trust Variables				
Mutual Trust				
Trust Asymmetry				
Outgoing Trust				
Incoming Trust				
Knowledge Variables				
Knowledge Asymmetry	-.146 (.272)	-.001 (.101)	.016 (.260)	-.125 (.279)
Buyer Knowledge	.025 (.251)	.116 (.093)	.126 (.239)	-.229 (.257)
Supplier Knowledge	-.018 (.201)	-.166* (.075)	-.038 (.192)	.064 (.207)
Dependence Variables				
Dependence Asymmetry				
Buyer Dependence				
Supplier Dependence				
Controls				
Relational History	.170 (.120)	.063 (.045)	.156 (.115)	.056 (.123)
Product Complexity	.158 (.119)	.052 (.044)	.086 (.113)	-.147 (.122)
Prior Trust	-.641** (.141)	-.210** (.052)	-.517** (.135)	-.113 (.145)
USA	-.052 (.471)	.176 (.175)	.405 (.449)	.961* (.483)
India	-.222 (.416)	-.159 (.154)	.879* (.397)	.090 (.427)
South Korea	.946† (.490)	-.296 (.182)	.265 (.468)	.548 (.503)
Intercept	5.127** (1.801)	2.905** (.668)	4.933** (1.717)	5.326** (1.847)
N	57	57	57	57
RMSE	1.067	0.396	1.017	1.094
R^2	0.444	0.369	0.332	0.155
Chi^2	45.56**	33.30**	28.37**	10.47

Reported coefficients are non-standardized. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

5.4 Dependence Asymmetry

Dependence asymmetry had a significant negative relationship with reported conflict at the .01 level. Relationships which had a higher level of relational dependence asymmetry exhibited lower levels of reported conflict. Dependence asymmetry was also negatively related to supplier opportunism at the .10 level. This supports some of the previous findings that suggest dependence asymmetry can lead to superior relationships in some ways when one party has significantly more control over the supply network. It is important to recognize these findings in light of the small sample size in the dependence models due to needing both buyer and supplier responses for the model. Although the SUR results allow some interpretation of the dependence asymmetry models, it is important to not attribute either the existence of or lack of a significant relationship as conclusive.

Table 16: SUR Results for Dependence Asymmetry

SUR Results for Dependence Asymmetry

Dependent Variable	Perceived Conflict	Reported Conflict	Supplier Opportunism	Buyer Opportunism
Trust Variables				
Mutual Trust				
Trust Asymmetry				
Outgoing Trust				
Incoming Trust				
Knowledge Variables				
Knowledge Asymmetry				
Buyer Knowledge				
Supplier Knowledge				
Dependence Variables				
Dependence Asymmetry	-.136 (.302)	-.252** (.071)	-.412† (.236)	-.331 (.244)
Buyer Dependence	-.041 (.275)	-.098 (.065)	.188 (.214)	.336 (.222)
Supplier Dependence	-.357† (.215)	-.030 (.050)	-.064 (.167)	-.171 (.173)
Controls				
Relational History	.217 (.204)	-.012 (.048)	.343* (.159)	.183 (.165)
Product Complexity	.262 (.190)	.008 (.045)	-.191 (.148)	-.263† (.153)
Prior Trust	-.255 (.222)	-.223** (.052)	-.368* (.173)	.318† (.179)
USA	.761 (.894)	.508* (.210)	1.307† (.697)	1.803* (.721)
India	1.001 (.817)	.283 (.192)	1.487* (.637)	.647 (.659)
South Korea	See Note 3	See Note 3	See Note 3	See Note 3
Intercept	3.347 (2.114)	3.613** (.497)	4.601** (1.649)	1.152 (1.705)
N	20	20	20	20
RMSE	0.967	0.227	0.755	0.780
R^2	0.448	0.730	0.666	0.492
Chi^2	16.26*	54.08**	39.92**	19.33*

Reported coefficients are non-standardized. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

5.5 Controls

Additional evidence emerged for two key control variables that had mixed findings in section 4.1 Relational history (the length of time that the buyer respondent was involved with the specific supplier company) was positively related to supplier opportunism levels at a significant level in two of the four models. This supports the argument that personal relationships developed

between the buyers and the suppliers might lead to opportunism following similar mechanisms to the case study analysis by Anderson and Jap (2005) which found that the supplier used personal relationships to enable opportunistic behavior.

6. DISCUSSION

6.1 Limitations

The analysis taken in this section represents one of the key limitations of research that explores sensitive data such as opportunistic behavior and research that explores dyadic data. One of the key challenges in data collection was getting a sample size significant enough to do fully rigorous analysis. Because of sample size limitations, it is possible that some relationships that are significant were not found.

The requirement of dyadic data for the analysis led to additional methodological limitations. Dependence asymmetry was particularly hampered through a small sample size as it required both buyer and supplier responses to be tested. While these limitations were alleviated through survey design to incorporate buyer's perceptions of supplier trust and supplier knowledge levels, these also lead to a limitation that some of the findings in this methodology are dependent on data collected from the buyer's perspective, and could have potential single response biases, despite efforts to mitigate this through both subjective and objective measures, as well as survey design.

This methodological approach primarily focuses on a single aspect of asymmetry as measured from the buyer's perception. Asymmetries can emerge between perspectives as well as demonstrated in Chapter 2. Trust asymmetry was only measured from the perceived trust asymmetry measurement, which suggest that there are additional aspects of trust asymmetry that can be explored.

Exploration of causality is also not done through the dyadic data collection. Although the hypothesis development was on causal relationships, the data collected cannot be used as a test for causality. Due to the complicated relationships and the possible recursion that can occur within the relationships over time no claims of causality are made by this positive association as it is very possible that observed effects on relational outcomes have a reverse causal or a reciprocated relationship. For example, it is possible that low levels of incoming trust lead to higher levels of reported conflict. It is also possible that higher levels of reported conflict lead to lower levels of incoming trust. This potential direction of causality is not explored in this chapter. Because of this limitation, the research should be understood as exploratory which develops the associations between key constructs. Additional empirical research is needed to determine causal relationships.

6.2 Key Findings

The empirical results from this chapter demonstrate many new and interesting findings which lend additional support to Chapter 2, explores the relationships between trust asymmetry, knowledge asymmetry, and dependence asymmetry more fully, and motivates additional research in Chapter 4. The results from the analysis suggest that asymmetries emerge for each of trust, knowledge, and dependence levels between buyers and suppliers, lending motivation for additional

research in asymmetries in buyer-supplier relationships and additional focus on the dyadic perspective in relationships. The conceptualizations of trust as a dyadic model is substantiated and has predictive validity for key relational performance constructs.

The results from empirical testing suggest that there is strong empirical support for dyadic trust model presented in Chapter 2. Evidence supporting the existence of reciprocal trust within the research models was found. This finding supports prior literature on trust, and lends justification for the dyadic trust model presented in chapter 2. In addition to the concept of reciprocal trust which is demonstrated via the different effects of incoming and outgoing trust, mutual trust was shown to be a consistently significant predictor of relational outcomes within the regressions. Thus, the value of having a model which can capture reciprocal trust, mutual trust, and trust asymmetry together is demonstrated to be of relevance and value to the literature on trust. Additionally, there was some support found for the existence of trust asymmetry occurring between outgoing and incoming trust levels. These results support the existence of signal loss occurring in the communication channels between a buyer and a supplier. These findings in aggregate indicate strong support for the hypothesized model in Chapter 2 for dyadic trust.

The difference in findings regarding perceived conflict and reported conflict is an interesting and unexpected finding. This finding suggests an interesting dynamic between conflict in terms of subjective levels of perceived conflict and objective measures of observed conflict within the relationship. It is likely that these two forms of conflict emerge through different mechanisms.

One other key finding regarding trust demonstrated that the relationships that trust had both in terms of conflict and in terms of opportunism were different for incoming and outgoing trust.

This is an interesting finding, because it validates the dyadic perspective on trust, and provides additional insights which are not obtainable with the traditional approach of measuring trust. Additionally, incoming trust, which has received little to no attention in the literature was one of the few significant predictors of buyer opportunism, suggesting that low levels of incoming trust might act as a rationalization for opportunistic behavior in a relationship. To the best of my knowledge, no other research has explored this relationship.

Overall, the findings on trust suggest that depending on the trust that is being measured, different significant relationships are observed. This finding is a critical finding for research on trust. The concept of reciprocal trust which prior research has explored is substantiated both in terms of similar levels of trust between incoming and outgoing trust, but in the predictive power of incoming trust and outgoing trust having differentiable effects on relational risk. The positive effect of mutual trust is observed in all four outcome variables, demonstrating strong validity for research which explores mutual trust. Lastly, trust asymmetry was additionally shown to be of additional explanatory value. Thus, research on trust should explore all three of the trust models and conceptualize trust in a more dyadic fashion to get a full understanding of the true relationships between trust and key relational outcomes. Research that only takes into account a single of these three perspectives is insufficient and will not be able to disentangle the complex effects of trust on behavior.

One interesting and critical finding from this research is the absence of relationships in some cases between asymmetries and conflict or opportunism. This is notable because of literary support which suggests these relationships should occur. There are multiple reasons why this might occur. Lack of findings regarding supplier opportunism might occur due to limitations of sample size, overall scarcity in the levels of supplier opportunism, limited effect size, complex or dynamic relationships that are not observable using regression analysis which observes a single point in time. Because of this, additional research on asymmetries in buyer supplier relationships which takes into account the dynamic effects and changing relationships over time is done in Chapter 4.

One unexpected finding in this research is that of the potentially positive relationship between relationship history and observed conflict and supplier opportunism. The idea that the length of the relationship between the individual respondent and the supplier led to higher levels of supplier opportunism explains a possible mechanism for opportunistic behavior which is very interesting and merits additional exploration. This finding supports the increasingly important are of research on Social Exchange Theory, which explains how relational aspects are critical in addition to observing business exchanges (Narasimhan, Narayanan, and Schoenherr, 2013). Relationship history reflects the social and relational aspects of supplier management in one sense, and has a demonstrable effect on opportunism and conflict levels within the firm.

Many of the findings regarding conflict differed depending on whether the conflict being measured was perceptual or objective. This suggests that many aspects of conflict in a relationship are driven by perceptions of the supplier in the relationship, rather than objective differences. This lends additional support for exploring the concept of incoming trust, outgoing trust, and signal loss as differences in order to explore the impact of how differing perceptions that emerge within the relationship can impact relational outcomes.

Lastly, evidence for a strong relationship between buyer and supplier opportunism levels was observed. The strong relationship between buyer and supplier opportunism levels within the relationship lend additional motivation to exploring the concepts of opportunism through a complex adaptive system which can take into account the dynamic relationships among buyers and suppliers over time. This relationship is explored in Chapter 4.

This methodological analysis in this chapter, while certainly not exhaustive due to data limitations, lends strong support for the conclusions made in Chapter 2, provides additional clarification on the relationships between asymmetries and relational performance, and motivates additional research on exploring the complex interactions of asymmetries with relational behavior which is explored in Chapter 4.

APPENDIX

Table 17: Non-Standardized Regression Results on Perceived Conflict

Regression results on Perceived Conflict

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.394† (.198)					
Trust Asymmetry				.502* (.210)				
Outgoing Trust		.059 (.201)	See Note 1	-.362 (.241)				
Incoming Trust		3.874* (1.472)	See Note 1	.169 (.191)				
Knowledge Variables								
Knowledge Asymmetry						-.148 (.208)		
Buyer Knowledge					.039 (.093)	-.074 (.207)		
Supplier Knowledge					.137 (.170)	.142 (.172)		
Dependence Variables								
Dependence Asymmetry								.122 (.300)
Buyer Dependence							.042 (.141)	.136 (.308)
Supplier Dependence							-.322 (.264)	-.343 (.281)
Controls								
Relational History	.086 (.110)	.055 (.107)	.104 (.108)	.069 (.105)	.092 (.120)	.100 (.119)	.159 (.219)	.178 (.226)
Product Complexity	.081 (.097)	.119 (.097)	.094 (.087)	.106 (.090)	.092 (.114)	.093 (.115)	.175 (.207)	.152 (.203)
Prior Trust	-.390* (.155)	-.299† (.160)	-.332* (.145)	-.272† (.148)	-.433* (.163)	-.434* (.165)	.077 (.374)	.114 (.399)
Observed Conflict	.964** (.331)	.780* (.359)	.631† (.375)	.832* (.319)	.999* (.389)	1.005* (.391)	1.527* (.668)	1.669* (.650)
USA	-.066 (.319)	-.028 (.318)	-.120 (.287)	-.165 (.315)	-.167 (.343)	-.197 (.361)	.319 (.642)	.235 (.664)
India	-.066 (.329)	.076 (.333)	.086 (.338)	.117 (.343)	-.018 (.362)	-.081 (.348)	.535 (.355)	.409 (.456)
South Korea	1.258** (.356)	1.251** (.357)	1.155** (.369)	1.196** (.339)	1.312** (.380)	1.255** (.403)	See Note 3	See Note 3
Intercept	2.474† (1.389)	-.369 (.241)	4.633** (1.511)	2.776* (1.304)	1.519 (1.869)	2.242 (2.159)	-.974 (3.310)	-1.786 (3.595)
N	61	61	61	61	60	60	21	21
RMSE	1.044	1.035	1.015	1.002	1.061	1.068	1.111	1.154
R^2	0.518	0.544	0.552	0.581	0.527	0.531	0.569	0.574
ΔR^2	-	0.026	0.034	0.037	0.008	0.004	0.073	0.005
F test of incremental model	11.41**	1.21	3.97†	5.71*	.65	.51	.74	.17

Reported coefficients are non-standardized coefficients. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 18: Non-Standardized Regression Results on Reported Conflict

Regression results on Reported Conflict

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.250** (.066)					
Trust Asymmetry				-.042 (.087)				
Outgoing Trust		-.078 (.073)	See Note 1	-.078 (.072)				
Incoming Trust		-.245** (.073)	See Note 1	-.253** (.082)				
Knowledge Variables								
Knowledge Asymmetry						.021 (.079)		
Buyer Knowledge					.084† (.044)	.099 (.086)		
Supplier Knowledge					-.149† (.074)	-.149† (.074)		
Dependence Variables								
Dependence Asymmetry								-.153 (.112)
Buyer Dependence			`				.013 (.060)	-.106 (.115)
Supplier Dependence							-.041 (.061)	-.008 (.054)
Controls								
Relational History	.069 (.046)	.071† (.038)	.066† (.038)	.069† (.038)	.070 (.044)	.069 (.044)	.059 (.085)	.024 (.083)
Product Complexity	.059 (.035)	.048 (.034)	.055 (.036)	.049 (.034)	.062 (.038)	.062 (.039)	.047 (.066)	.067 (.064)
Prior Trust	-.229** (.039)	-.148** (.040)	-.145** (.036)	-.150** (.039)	-.210** (.045)	-.210** (.046)	-.213** (.065)	-.221** (.040)
USA	.116 (.183)	.072 (.158)	.057 (.160)	.083 (.166)	.135 (.187)	.139 (.192)	.252 (.337)	.311 (.264)
India	-.088 (.160)	.022 (.169)	.027 (.158)	.019 (.170)	-.164 (.151)	-.155 (.155)	.241 (.331)	.356 (.272)
South Korea	-.222 (.182)	-.235 (.160)	-.241 (.162)	-.230 (.160)	-.316 (.190)	-.308 (.195)	See Note 3	See Note 3
Intercept	2.620** (.292)	3.917** (.415)	3.435** (.336)	3.992** (.511)	2.942** (.509)	2.838** (.704)	2.489** (.596)	3.064** (.639)
N	61	61	61	61	60	60	21	21
RMSE	0.429	0.371	0.385	0.374	0.420	0.424	0.369	0.348
R^2	0.306	0.499	0.452	0.502	0.368	0.368	0.538	0.620
ΔR^2	-	0.194	0.146	0.002	0.063	0.001	0.013	0.082
F test of incremental model	7.09**	7.44**	14.39**	.24	3.29*	.07	.36	1.88

Reported coefficients are non-standardized coefficients. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 19: Non-Standardized Regression Results on Supplier Opportunism

Regression results on Supplier Opportunism

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.548** (.173)					
Trust Asymmetry				.133 (.160)				
Outgoing Trust		-.417* (.170)	See Note 1	-.403* (.171)				
Incoming Trust		-.234 (.158)	See Note 1	-.220 (.164)				
Knowledge Variables								
Knowledge Asymmetry						-.073 (.216)		
Buyer Knowledge					.040 (.228)	.005 (.222)		
Supplier Knowledge					-.066 (.161)	-.069 (.165)		
Dependence Variables								
Dependence Asymmetry								-.271 (.258)
Buyer Dependence			`				.388* (.175)	.176 (.287)
Supplier Dependence							-.091 (.176)	-.032 (.205)
Controls								
Relational History	.153 (.096)	.127 (.087)	.159† (.082)	.135 (.087)	.157 (.106)	.159 (.107)	.455† (.227)	.393 (.236)
Product Complexity	.085 (.085)	.092 (.088)	.075 (.083)	.089 (.089)	.092 (.115)	.091 (.116)	-.142 (.139)	-.107 (.140)
Prior Trust	-.548** (.120)	-.337** (.116)	-.364** (.108)	-.334** (.116)	-.544** (.132)	-.546** (.134)	-.351† (.190)	-.365† (.190)
USA	.204 (.378)	.233 (.330)	.095 (.316)	.182 (.348)	.213 (.438)	.224 (.438)	.923 (.559)	1.029† (.479)
India	.754* (.372)	1.044** (.363)	.986** (.346)	1.037** (.364)	.737† (.378)	.723† (.393)	1.387* (.526)	1.590** (.485)
South Korea	.144 (.417)	.183 (.414)	.083 (.413)	.147 (.432)	.112 (.453)	.104 (.460)	See Note 3	See Note 3
Intercept	5.759** (.871)	8.032** (1.006)	7.526** (.846)	7.817** (1.000)	5.858** (1.173)	6.134** (1.427)	2.803† (1.495)	3.823* (1.576)
N	62	62	62	62	61	61	21	21
RMSE	1.085	1.010	1.004	1.017	1.114	1.124	1.009	1.010
R^2	0.333	0.442	0.439	0.445	0.326	0.327	0.615	0.644
ΔR^2	-	0.110	0.107	0.003	0.001	0.001	0.144	0.029
F test of incremental model	6.83**	5.48**	10.07**	.70	.08	.11	3.11†	1.11

Reported coefficients are non-standardized coefficients. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

Table 20: Non-Standardized Regression Results on Buyer Opportunism

Regression results on Buyer Opportunism

		Trust Models			Knowledge Models		Dependence Models	
Model	Base Model	Reciprocal Trust	Mutual Trust[2]	Trust Asymmetry	Knowledge	Knowledge Asymmetry	Dependence	Dependence Asymmetry
Trust Variables								
Mutual Trust			-.488** (.175)					
Trust Asymmetry				.024 (.188)				
Outgoing Trust		-.155 (.175)	See Note 1	-.154 (.177)				
Incoming Trust		-.440** (.161)	See Note 1	-.436* (.165)				
Knowledge Variables								
Knowledge Asymmetry						-.134 (.173)		
Buyer Knowledge					-.191 (.139)	-.290 (.189)		
Supplier Knowledge					.066 (.114)	.082 (.118)		
Dependence Variables								
Dependence Asymmetry								-.331 (.274)
Buyer Dependence			`				.526* (.229)	.336 (.290)
Supplier Dependence							-.208 (.185)	-.171 (.213)
Controls								
Relational History	.075 (.099)	.072 (.089)	.064 (.090)	.073 (.091)	.078 (.106)	.088 (.111)	.269 (.220)	.183 (.225)
Product Complexity	-.098 (.084)	-.132 (.082)	-.124 (.077)	-.133 (.085)	-.103 (.094)	-.099 (.096)	-.248 (.199)	-.263 (.177)
Prior Trust	-.161 (.173)	.000 (.173)	.015 (.168)	.001 (.176)	-.139 (.176)	-.143 (.179)	.333 (.211)	.318 (.225)
USA	.731* (.360)	.752* (.311)	.711* (.298)	.746* (.316)	.789* (.378)	.778* (.382)	1.548* (.691)	1.803** (.565)
India	-.031 (.372)	.244 (.363)	.252 (.352)	.245 (.366)	.038 (.375)	.010 (.374)	.517 (.669)	.647 (.521)
South Korea	.354 (.493)	.425 (.500)	.402 (.486)	.421 (.509)	.428 (.513)	.402 (.515)	See Note 3	See Note 3
Intercept	4.416** (1.221)	6.739** (1.031)	5.981** (.968)	6.699** (1.049)	4.969** (1.093)	5.519** (1.210)	-.232 (1.838)	1.152 (1.730)
N	62	62	62	62	61	61	20	20
RMSE	1.149	1.085	1.087	1.096	1.158	1.166	1.053	1.052
R^2	0.110	0.235	0.218	0.235	0.143	0.149	0.445	0.492
ΔR^2	-	0.125	0.108	0.000	0.025	0.005	0.277	0.047
F test of incremental model	1.65	5.71**	7.73**	.02	1.07	.60	3.12†	1.45

Reported coefficients are non-standardized coefficients. Standard errors are reported in parentheses.

** p <.01, * p <.05, † p<.10

Note 1 - Not included due to multicollinearity from the very strong association between mutual trust and both incoming and outgoing trust levels

Note 2 - Because Mutual Trust is not an extension of the Base Trust Model, it is compared to the Base Model

Note 3 - South Korea not included due to having no supplier responses used to calculate dependence asymmetry

CHAPTER 4: EXPLORING THE MEDIATING MECHANISM OF THE FRAUD TRIANGLE ON OPPORTUNISTIC BEHAVIOR

1. INTRODUCTION

Opportunistic behavior in buyer-supplier relationships in supply chains is a critical impediment to success in business exchanges. As firms engage in multiple interactions over time, opportunistic behavior for short term gains can increase the total-cost of the exchange relationship, undermining trust and leading to ineffective relationships (Ketchen & Hult, 2007). Despite the negative ramifications of opportunistic behavior in relationships, opportunism continues to be a problem in buyer-supplier relationships. Research that explores the determinants and deterrents of opportunistic behavior is limited and needs additional exploration (Wang et al., 2013).

This paper investigates the role of asymmetries in buyer-supplier relationships to develop a better understanding of how opportunistic behavior arises in business exchanges. In particular, how dependence asymmetry, knowledge asymmetry, and trust asymmetry can induce opportunistic behavior and the pathways through which relational asymmetries lead to opportunistic behavior at both the dyadic level and the network level are explicated. In doing this, we contribute to a better understanding of opportunism in buyer-supplier relationships and how opportunism, an aspect of relational risk, can be ameliorated.

1.1 Opportunism

Opportunism has been defined by Williamson (1985) as "self-interest seeking with guile" and represents actions that firms engage in exchange relationships that grant them some advantage, generally at the expense of their exchange partners. Opportunism has been defined as various behaviors including, misrepresentations about capacity (Wathne & Heide, 2004), needs (John,

1984), information about competitive bids (Kelly and Kerwin, 1992), skills and resources (Walton 1997), and contract opportunism (Klein, 1980).

Practical examples of opportunisms in buyer-supplier relationships are quite varied. They can have a major impact on firm performance. The recent recall of Takata airbags, which affected over 34 million vehicles, was the largest auto recall in history (Ivory & Tabuchi, 2015). Although Takata blamed the defect on a variety of factors, including poor processes, quality control, and manufacturing errors, evidence that came after the recall suggests that test data indicating a major problem was covered up by the company in 2004 (Tabuchi, 2015). In this instance, Takata had superior product and process knowledge compared to the buyer, and was opportunistic in the relationship with its buyers by hiding potential problems with the airbag manufacturing process. The problem with the defective airbags has had a major financial impact for the OEMs and it has raised public safety concerns.

Examples of opportunistic behavior are common in buyer-supplier relationships. Chipotle has faced quality issues with its primary supplier of "carnitas" meat after it was discovered that the product it was buying as 'antibiotic free meat' was found to contain antibiotics and that its primary supplier was not compliant with Chipotle's requirements for humane treatment of animals. This led to Chipotle halting pork sales at one-third of its restaurants in the U.S (Zacks Equity Research, 2015). Walmart has faced numerous accusations from its suppliers for price-squeezing and aggressive negotiating tactics (Fishman, 2003). Supreme Foodservice, an army food contractor, agreed in 2014 to pay a total of $434 Million to the US government after it was accused of fraudulent behavior by raising prices for food and water delivered to US soldiers, overcharging $757 Million over the course of the contract from 2005 to 2014 (Jahner, 2014). Evidence of

opportunistic behavior in relationships is plentiful, and the impact that it can have on firm performance is very large.

Opportunistic behavior can also occur as a result of unforeseen events which force companies to breach some contracts or favor certain companies without being intentionally opportunistic. Consider, for example, how dependence asymmetry can impact business relationships. Qualcomm was a principal supplier for Apple and Samsung in early 2012. Apple and Samsung are competitors in the same industry who were dependent on Qualcomm's production capacity at that time. Qualcomm was facing chip shortages for their 28nm chipsets and had to decide how to manage excess demand and limited supply for its chipsets. Qualcomm was forced to decide which contracts to fulfill for Apple and Samsung, directly impacting both firms' performance and target release dates (BBC News, 2012; Donnelly, 2012).

Opportunism can be viewed as an aspect of risk when viewed in light of the effect that it can have on relational performance as these examples from industry show. Risk between firms has been shown to be increasingly important, and industry trends continue to increase the relevance of relationships for supply chain management (Narasimhan & Talluri, 2009). Despite the strong emphasis placed in the literature on understanding traditional risks in a supply chain, such as disruptions from natural disasters or supplier failures (Hendricks & Singhal, 2003; Sodhi, Son, & Tang 2012), relatively little emphasis has been placed on understanding the role that relational risks, such as opportunistic behavior, have on firm performance. S

1.2 Asymmetries in Buyer-Supplier Relationships

Because of the detrimental effect that opportunism can have on relational performance and the different ways in which it can manifest in a buyer supplier relationship, it is useful and

important to understand the factors that drive opportunistic behavior and the mechanisms through which it occurs in buyer-supplier relationships.

Buyer-Supplier relationships have been studied primarily from understanding the role of the buyer within a relationship with limited attention given to the supplier's perspective. Research involving multiple stakeholders can reach different conclusions when only a single perspective is used rather than a dyadic perspective (Roh, Whipple, & Boyer 2013). In addition, informants' reports on perceptions of relational measures have been shown not to have convergent or discriminant validity (John and Reve, 1982). It is necessary to focus on the perspectives of both the buyer and the supplier in a relational context to understand behaviors within the relationship.

Asymmetries have been shown to have both positive and negative effects on relational outcomes. Dependence asymmetry can have both positive and negative effects in a relationship such as being used to promote supply chain integration (Maloni & Benton, 2000), increasing exposure to opportunistic behavior in a relationship (Anderson & Weitz, 1992; Gundlach, Achrol, & Mentzer, 1995), or leading to additional levels of dependence on suppliers and higher levels of opportunistic behavior (Lonsdale, 2001). Knowledge asymmetry can be beneficial as firms gain access to additional knowledge (Shan & Hamilton, 1991), and yet it can also lead to opportunism (Sharma, 1997). Trust asymmetry has complicated effects on relational behavior, with evidence suggesting that trust can lead to both positive and negative effects such as being used as a form of competitive advantage (Barney & Hansen, 1994) or being tightly connected to opportunistic behavior (Lado, Dant, & Tekleab, 2008). Current literature is lacking in investigations of asymmetries in buyer-supplier relationships and their influence on relational risks such as opportunism. Developing a more complete understanding of opportunism in buyer-supplier

relationships could help explain the inconsistent findings alluded to above. This is the principal objective we pursue in this paper.

This research focuses on understanding how asymmetries lead to negative relational performance through opportunistic behavior. By delineating the pathways through which opportunism arises in buyer-supplier relationships, we seek to develop a theoretical understanding of a key element of relational risk. In addition, by incorporating the notion of "Fraud Triangle," we identify means by which relational risk and opportunistic behavior (in the presence of asymmetries) can be better managed.

1.3 Fraud Triangle

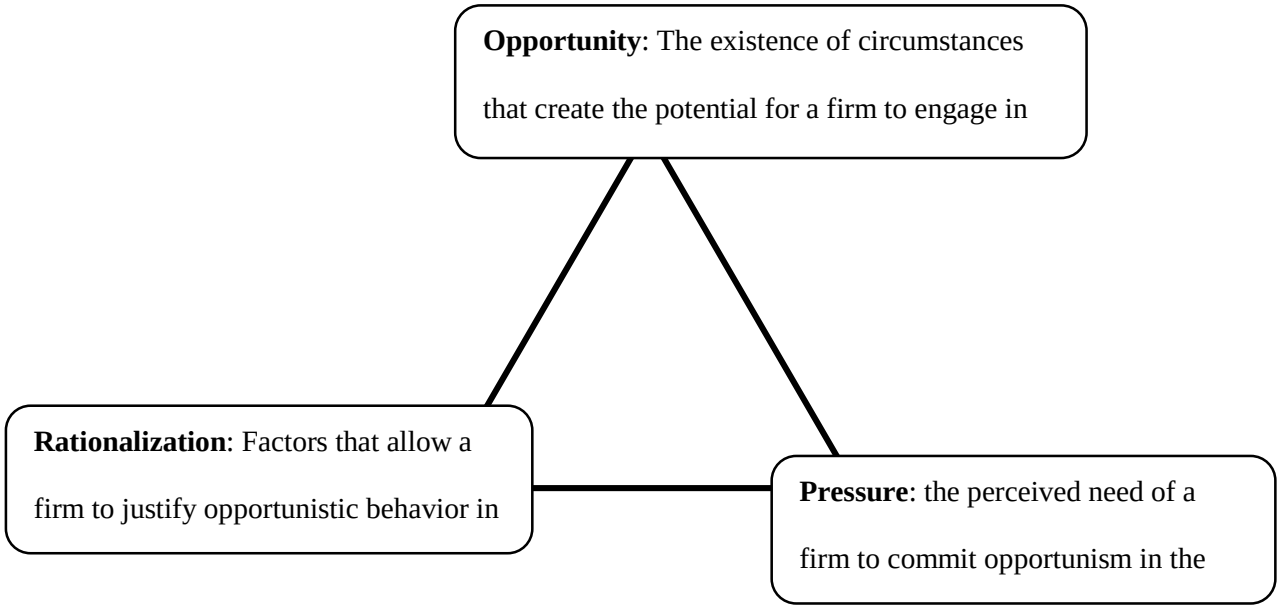
Despite evidence suggesting that opportunistic behavior can arise from asymmetries, the mechanisms through which asymmetries lead to opportunism are not well understood. Gundlach, Achrol and Mentzer (1995) found that asymmetric commitment in a dyadic relationship can lead to opportunism, although a specific mechanism was not identified by the authors. To fill this void in current understanding, we introduce and apply the theory of the fraud triangle as the mediating mechanism for opportunistic behavior.

The fraud triangle, first posited by Cressey (1950) to explain criminal behavior within firms, identifies the elements that are required for fraudulent criminal behavior to occur. The fraud triangle, shown in Figure 7, consists of three elements that must exist for fraud to occur: *opportunity, pressure and rationalization*. Opportunity represents the existence of circumstances that enables the perpetrator to engage in fraudulent behavior. Pressure represents the perceived need of the perpetrator to engage in fraudulent behavior. Rationalization represents the ability of the perpetrator to justify the act of fraud. The fraud triangle is a useful theoretical lens for

explaining opportunistic behavior in relationships. It can be used to understand the complex dynamics of inter-firm relationships and motivations to engage in opportunistic behavior.

The fraud triangle has received considerable attention in the accounting literature. It has become so ubiquitous in the auditing world that it is included in the Statement of Accounting Standards (SAS No. 99), which mandates the use of the fraud triangle in risk assessments made by auditors. The fraud triangle is also used by researchers in the accounting literature to develop theoretical explanations of fraudulent behavior within the firm (Trompeter et al., 2013). The fraud triangle, however, has received little exposure in the supply chain literature, with two notable exceptions. Arnold, Neubauer, and Schoenherr (2012) used the fraud triangle to explain the inclination towards corruption and Katz (2012) discussed the role of the fraud triangle for identifying supply chain fraud.

Figure 7: Components of the Fraud Triangle for Opportunistic Behavior



We explore how asymmetries in buyer-supplier relationships lead to opportunistic behavior by introducing the fraud triangle as a theoretical lens for exploring these pathways. We hypothesize

that it is through the generative interactions of opportunity, rationalization, and pressure that asymmetries lead to opportunistic behavior, thus contributing to a fuller understanding of opportunistic behavior in buyer-supplier relationships.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Theoretical Anchors

2.1.1 Complex Adaptive Systems

One of the challenges of understanding the role of asymmetries in buyer-supplier relationships is that the relationships between firms are driven by *complex interactions that occur over time at a dyadic level and within a larger supply network of firms*. In order to understand opportunism, it is critical to understand the dynamics that occur both at a dyadic level and at the network level. Complex adaptive systems theory provides a powerful approach to capture this duality.

Complex adaptive systems theory focuses on the interplay of a system and its environment and the co-evolution of the system with the environment (Choi, Dooley, & Rungtusanatham, 2001). Under the complex adaptive system perspective, behavior within a system begins as a set of localized decisions that follow a small set of rules, which then have complex interactions and behavior at a network level that is different (Nair, Narasimhan, & Choi, 2009). The interaction between the systematic and localized firm behavior in a complex adaptive system allows for additional insight on complex issues that emerge from simple behaviors of individual firms in the network.

We invoke concepts from transaction cost economics, agency theory and resource dependence theory in order to explicate and evaluate the complex interactions that occur in a supply network.

2.1.2 Transaction Cost Economics

Transaction cost economics (TCE) emphasizes minimizing costs associated with transactions between firms (Williamson, 1981; 1985). Opportunistic behavior, defined as "self-interest seeking with guile" by Williamson (1985) is a key driver of transaction costs. TCE prescribes appropriate structuring of contracts that stipulate performance requirements, monitoring and control of the business exchanges as safeguards against opportunism.

Trust has been discussed often in the transaction cost literature as a possible governance mechanism to reduce transaction costs associated with monitoring and opportunism. Williamson (1993) discusses trust as consisting of calculated self-interest used to determine risk exposure in relationships and suggests that trust exceeding that amount would be inefficient and undesired. Gulati (1995a) argues that trust is the primary governance mechanism in relationships over time. Dyer and Singh (1998) view trust as an informal safeguard which acts as a self-enforcing governance mechanism that is more effective at minimizing transaction costs and maximizing value creation. Gulati and Nickerson (2008) view trust as an antecedent for more formal and informal governance mechanisms, while Malhotra and Lumineau (2011) view trust as an outcome of contract structure. Accordingly, in this research we focus on trust asymmetry in buyer-supplier relationships and its influence on opportunistic behavior.

2.1.3 Agency Theory

Agency theory pertains to the principal-agent relationship in business exchanges. It applies when one party makes decisions that will impact another party but they are working with different sets of information and motivations (Jensen & Meckling, 1976; Eisenhardt, 1989). Agents will often make decisions that favor their own interest, sometimes at the expense of the principal. As long as the principal is unaware of the self-interested behavior, the agent might engage in opportunistic behavior at the expense of the principal.

This applies well to the supply chain setting where suppliers often act as agents for principals, but have different information and different incentives, leading to possible opportunistic behaviors (Sharma, 1997). As such, agency theory lends a valuable perspective to understand the behavior of parties with different incentives and the decision to engage in opportunistic behavior. Opportunistic behavior under agency theory can be active opportunism, or engaging in behavior with a higher level of moral hazard, exposing the buying firm to a higher level of risk based on inferior quality levels and engaging in riskier behavior. The example of Takata airbags is a good example of this, as the risk associated with the use of their airbags due to safety and quality concerns were, in a large part, transferred to their buyers who trusted Takata to act in their best interests. Relational norms, especially trust formation, in a buyer-supplier relationship can be useful in guarding against opportunism (Dyer & Singh, 1998), but it can also expose firms to opportunistic behavior (Crocker & Reynolds, 1993).

2.1.4 Resource Dependence Theory

Resource dependence theory (RDT) suggests that firms access value creating resources through their relationships with other firms (Emerson, 1962). The behavior of firms that access

external resources is determined by *power* and *dependence* between the firm and its suppliers (Pfeffer & Salancik, 2003; Davis & Cobb, 2010). The resource dependence view provides a perspective on why power imbalances might exist between firms based on their resource endowments and how relationships are formed in order to gain access to resources. Power and dependence imbalances in buyer-supplier relationships can create an environment in which opportunism might occur where the more dependent firm might be taken advantage of by the less dependent firm. The dependence between the transacting partners might be due to volume of transactions, specific assets or unique technologies possessed by the supplier (Heide, 1994; Söllner, 1999). Accordingly, we investigate dependence asymmetry in this study as an antecedent of opportunism.

2.2 Asymmetries in Relationships

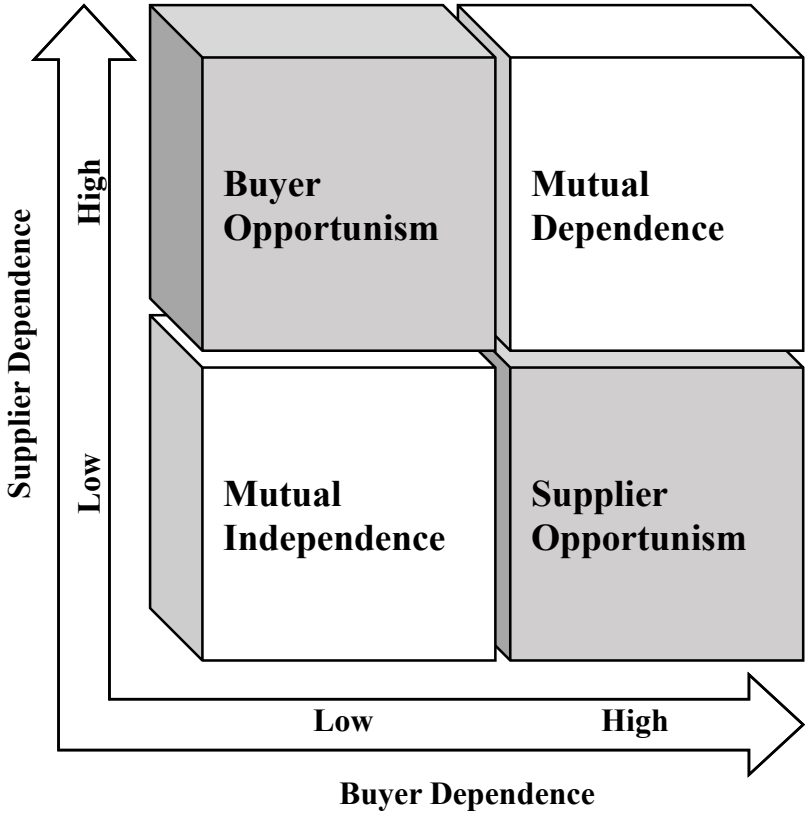
We posit that asymmetries are critical to understanding the behavior of firms engaged in business relationships. Relational asymmetries arise when the buyer and supplier have different levels of trust, dependence and knowledge compared to their exchange partner. The existence of asymmetries is hypothesized as a key condition under which opportunism is more likely to occur. Next, we discuss the three types of asymmetries in relationships with which this paper is concerned.

2.2.1 Dependence Asymmetry

Dependence asymmetry exists in relationships when one firm in the relationship has a higher level of dependence than the partner firm. Relationships that have a high degree of asymmetric dependence lead to high levels of relational risk, as the potential for opportunistic behavior is increased. Capacity allocation decisions made by Qualcomm, discussed previously,

illustrate this. Current literature suggests that there can be a positive relationship between dependence and relational performance as well as a negative relationship between dependence and performance. Gulati and Sytch (2007) suggested that interdependence and relational embeddedness can be factors that lead to relational success. Provan and Gassenheimer (1994) concluded that supplier dependence can reduce opportunistic behavior. Maloni and Benton (2000) found empirical evidence that suggests dependence asymmetry can be used to promote supply chain integration and performance. In contrast, studies have also shown that different levels of dependence in buyer-supplier relationships can lead to opportunistic behavior (see Gundlach, Achrol, and Mentzer, 1995; Lonsdale, 2001). Asymmetric power and dependence in a relationship channel can lead to supplier squeezing where powerful firms take advantage of weaker suppliers (Bloom and Perry, 2001). Other studies have shown that relationships with asymmetric dependence become deficient relationships because of exploitation by the stronger party (Anderson and Weitz, 1989). Power imbalance has been shown to lead to unproductive relationships (McDonald, 1999).

Figure 8: Dependence Asymmetry Matrix



In order to recognize how dependence can be both good and bad in a relationship, it is important to recognize how dependence between partners in a relationship can be symmetric or asymmetric (see Figure 8). High levels of dependence for both the buyer and the supplier lead to mutual dependence which can be beneficial in a relationship because it can drive relational investment and achievement of mutually beneficial goals. Relationships in which both firms have a low level of dependence lead to mutually symmetric relationships where both parties are mutually independent from one another. In these relationships, there is limited exposure to opportunistic behavior. However, when the dependence of a firm is significantly higher than that of their partner, it creates an asymmetry where one firm is exposed to opportunism from the other. Under these circumstances the less dependent firm has the opportunity to take advantage of its partner in the exchange relationship. As mentioned previously, both Samsung and Apple were

highly dependent on Qualcomm for capacity. When capacity constraints arose, Qualcomm was able to exploit the dependence asymmetry to its advantage. Accordingly, we can expect a positive association between dependence asymmetry and opportunistic behavior both at the dyadic level and at the network level. We formalize this in the following hypotheses.

Hypothesis 1a: Dependence asymmetry will have a positive relationship to opportunism at the dyadic level.

Hypothesis 1b: Dependence asymmetry within a (supply) network will be positively associated with opportunism.

2.2.2 Knowledge Asymmetry

The relational view posits that one of the four key sources of inter-organizational competitive advantage is complementary resources and capabilities (Dyer and Singh, 1998). Knowledge asymmetry is often sought by firms seeking complementary relationships with suppliers (Shan and Hamilton, 1991). In the relational view, knowledge asymmetries can increase relational innovation performance and utilization of complementary resources can generate additional relational rents that can be captured by the transacting partners.

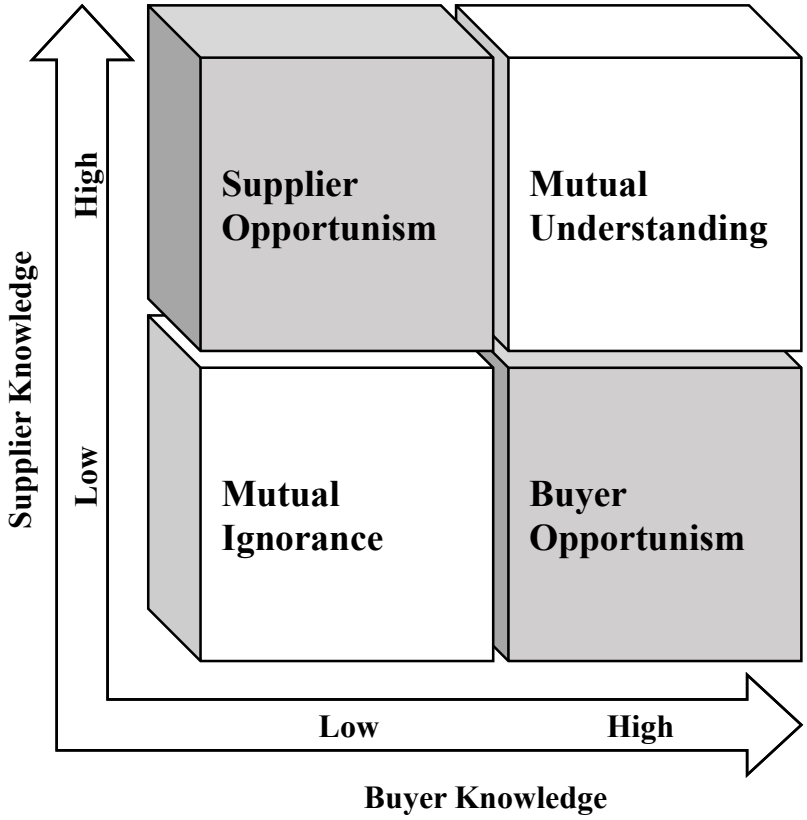
TCE and agency theory explain the opposite effects of knowledge asymmetries. TCE provides an explanation for why knowledge asymmetries might lead to opportunistic behavior in order to maximize self-interest, especially in situations where monitoring is difficult or costly. TCE suggests firms are more likely to engage in opportunism in these situations. Agency theory similarly predicts agents will take advantage of principals when principals are unable to monitor their behavior and there exists potential for self-interested behavior.

The ability to properly manage knowledge in relationships can lead to superior relational success. Toyota was able to achieve greater relational performance, measured by fewer defects, through its superior ability to transfer knowledge from its suppliers than its American counterparts who had a relationship with the same suppliers (Dyer and Hatch, 2006). This suggests the ability to manage knowledge in a relationship will influence a firm's ability to convert knowledge differences into positive relational performance.

Asymmetric levels of knowledge within a relationship can also enable opportunistic behavior. Research has found that a person's probability of receiving surgical interventions is one third higher for individuals who are not physicians or members of a physician's family (Dulleck and Kerschbamer, 2006), suggesting a strong link between relative knowledge levels and opportunistic behavior.

Similarly, asymmetries in information levels have been shown to lead to opportunism in principal-agent problems, where differences in incentives and information levels between exchange partners creates higher levels of opportunistic behavior by the informed party (Eisenhardt, 1989). Sharma (1997) discussed the principal agent problem in the context of principal-professional exchanges where knowledge asymmetry was particularly high and argues that knowledge asymmetry arising from a difference in task-related knowledge would have an even stronger effect on opportunism than information asymmetry because the deeper intricacies of knowledge asymmetries allow for more opportunistic behavior to manifest.

Figure 9: Knowledge Asymmetry Matrix



It is important to understand that knowledge, as it relates to opportunistic behavior, is best understood as an asymmetric measure (see Figure 9). This is because the influence of knowledge on opportunistic behavior is through *knowledge advantage* in the relationship (i.e. a firm having more knowledge than its partner). Two parties with either mutual ignorance, or same level of understanding (knowledge) about a specific product or process would face limited exposure to opportunistic behavior. However, when one party has a knowledge advantage over the other, it can act as an incentive to engage in opportunistic behavior for the party with the knowledge advantage.

For example, consider the case of the Takata airbag recall. One of the primary causes of the Takata recall was reliance on ammonium nitrate as the primary compound in the inflator, a

compound that is sensitive to different levels of humidity. Takata was the only airbag manufacturer using ammonium nitrate (BloombergBusiness, 2014), and there are reports from engineers from Takata expressing major concern about the compound (Tabuchi, 2015). In the case of Takata and their primary suppliers, Takata had a significant advantage of knowledge regarding the product, and specifically the safety levels of the various compounds. If Takata's customers had as high a level of knowledge regarding the risk of ammonium nitrate as did Takata at that time, they would have likely pushed for Takata to use a safer chemical compound. This knowledge advantage regarding ammonium nitrate in the airbag was partly what enabled the opportunistic behavior by Takata to continue using a more dangerous compound in production to achieve higher performance results (i.e. profit margins) despite evidence of safety related concerns.

Research on credence goods (Darby & Karni, 1973) shows how knowledge asymmetries can lead to opportunistic behavior by suppliers who have a greater level of product knowledge than their buyers. Credence goods are a type of good where the seller has significantly higher knowledge regarding the product than the buyer and can potentially withhold critical information about the product from their buyers in order to serve self-interest. Credence goods have been shown to be prone to opportunistic behavior (Vetter & Karantininis, 2002; Dulleck, Kerschbamer, & Sutter, 2009).

Based on this discussion, we formally state the following hypotheses.

Hypothesis 2a: Knowledge Asymmetry will have a positive association with opportunism at the dyadic level.

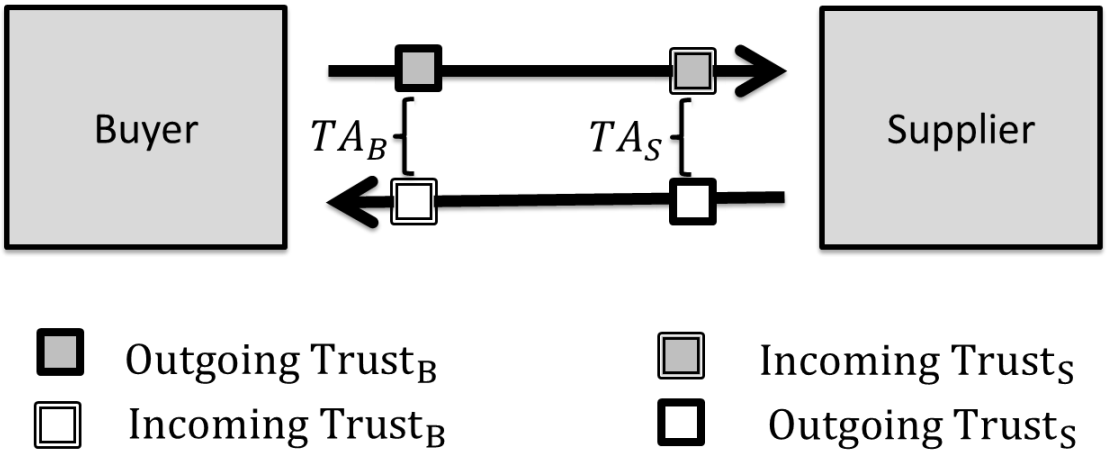
Hypothesis 2b: Knowledge asymmetry within a network will have a positive association with opportunism.

2.2.3 Trust Asymmetry

Trust has a complex role in relational behavior. Trust can be measured from the perspective of both the buyer and the supplier in a relationship; it acts as a communication channel for both firms to signal relational cues about the expectations of behavior. Anderson and Jap (2005) reveal an interesting case study of a firm which actively engaged in trust building exercises with its buyer in order to use the relationships between employees at both firms to disguise quality failures and enable its opportunistic behavior. Trust is interesting in that high levels of trust can act either as a precursor to opportunistic behavior, or a governance mechanism to reduce the transaction costs associated with monitoring and opportunism (Williamson, 1985; Gulati, 1995b; Dyer & Singh, 1998; Gulati & Nickerson, 2008; Malhotra & Lumineau, 2011).

Crocker and Reynolds (1993) found that the U.S. Air Force procurement contracts experienced more exposure to supplier opportunism when previous experience did not indicate opportunistic behavior leading to higher trust levels, supporting the conjecture that trust asymmetries are related to opportunism. In a simulation study of complex adaptive systems, Nair, Narasimhan, and Choi (2009) found that firms that performed well in the simulation behaved in a risk-prone way by mutually trusting each other, despite the risk of extreme loss.

Figure 10: Trust Channels between Buyer and Supplier



It is important to recognize the difference between the trust levels that a firm exhibits towards its partner, which we define as *outgoing trust* and the trust level that a firm perceives from its partner, which we define as *incoming trust* (see Figure 10). Research on the dyadic perspective on trust has been very limited. It has been shown that trust levels matter between firms and that it is important to take into account the behavior of both parties in order to understand trust completely (Barney & Hansen, 1994).

A recent article in the Journal of Management highlighted the need for additional research on dyadic trust, in particular asking for increased studies on asymmetric trust:

> "One promising direction for moving the trust literature forward is more in-depth examinations of trust asymmetry and the variables and situations surrounding its existence." (Korsgaard, Brower, & Lester, 2014)

In order to understand trust, we view trust both as incoming and outgoing trust for both the buyer and the supplier in a relationship and trust asymmetry as the difference in trust levels between the outgoing trust and incoming trust for a specific firm.

Hypothesis 3a: Trust asymmetry will have a positive association with opportunism at the dyadic level.

Hypothesis 3b: Trust asymmetry within a network will have a positive effect on opportunism at the network level.

2.3 Fraud Triangle

In order to understand how asymmetric behaviors impact opportunism in relationships, we apply the theory of the fraud triangle as the mechanism through which relational asymmetries impact opportunism. The fraud triangle can help explain how opportunistic behavior arises in relational exchanges.

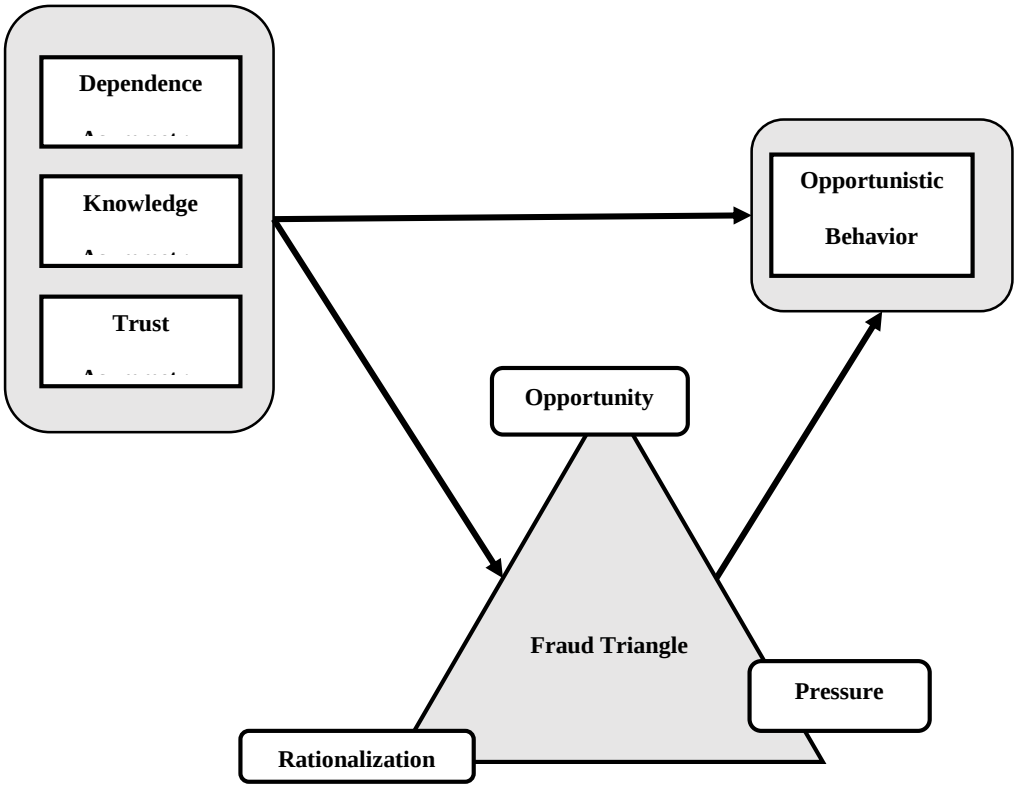
The premise of the fraud triangle is that in order for fraud to occur, all three elements of the fraud triangle – opportunity, pressure and rationalization - must be present. We modify this perspective in studying opportunism in buyer-supplier relationships by recognizing that the critical pathway for opportunism to occur is through the opportunity to engage in opportunism. Even in high levels of pressure or rationalization, if there are no opportunities to engage in opportunism, it can be argued that firms cannot engage in opportunistic behavior. However, in the case where opportunity exists to engage in opportunism, a firm that is facing significant enough pressure or is able to easily rationalize its opportunistic behavior might do so, suggesting that the critical pathway through which opportunism occurs is when opportunity is present.

Although there is evidence to support that dependence, knowledge and trust asymmetries can have a positive impact on opportunism levels, there is lack of clarity about the mechanisms through which they lead to opportunistic behavior. We posit the linkages from relational asymmetries to opportunistic behavior via the constituent dimensions of the fraud triangle.

Hypothesis 4a: The positive effect of asymmetries on opportunism will be mediated by the fraud triangle at the dyadic level.

Hypothesis 4b: The positive effect of asymmetries on opportunism will be mediated by the fraud triangle at the network level.

Figure 11: Mediating Role of the Fraud Triangle



3. SIMULATION MODEL

3.1 Modeling Approach

Research investigating opportunistic behavior in relationships faces many methodological challenges. Data collection via surveys will have issues with various biases in data collection due to the reluctance of individuals to disclose opportunistic behavior; both as agents or recipients of

opportunism. This creates both non-response bias and social desirability bias in primary data collection methodologies. In addition, there are very limited objective measures of opportunism and such examples tend to be found only at a case study level and can suffer from issues of generalizability in addition to the difficulty of developing enough trust with respondents to provide honest answers.

Because of these limitations and challenges of studying opportunism, a simulation approach was chosen to explore how relational asymmetries lead to opportunistic behavior. In order to capture the relevant aspects of opportunism at the dyadic relationship level and at the network level, a combination of system dynamics modeling and cellular automata (CA) principles were used in developing the simulation model. In the CA, firms are embedded within a cellular automata network and have relationships with neighboring firms. Relational history of firms within the network is dynamically updated over time based on the decision of each firm to cooperate or be opportunistic in its relationships, in each time period. We use the fraud triangle concepts to model decisions made by firms at the dyadic level. This approach allowed us to characterize the dynamics of relationships between firms and capture key relational constructs at the dyadic level and at the network level to analyze how asymmetries in relationships lead to opportunistic behavior in a complex adaptive system.

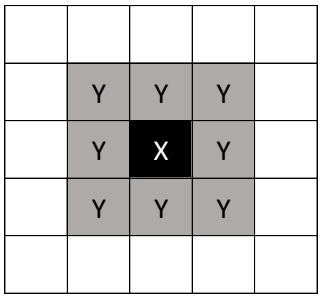
3.2 Model Development

To investigate the relationship that asymmetries have on opportunistic behavior, we developed a simulation model utilizing the principles of CA and system dynamics modeling. Cellular automata models allow agents to interact with a localized network using a simple set of interaction rules over a number of time periods to investigate self-organization within a network.

For a more complete discussion of cellular automata, see Wolfram (1984, 1986). This framework allowed us to model the complexities of dyadic interactions as well as the complex adaptive nature of firm behaviors within a network.

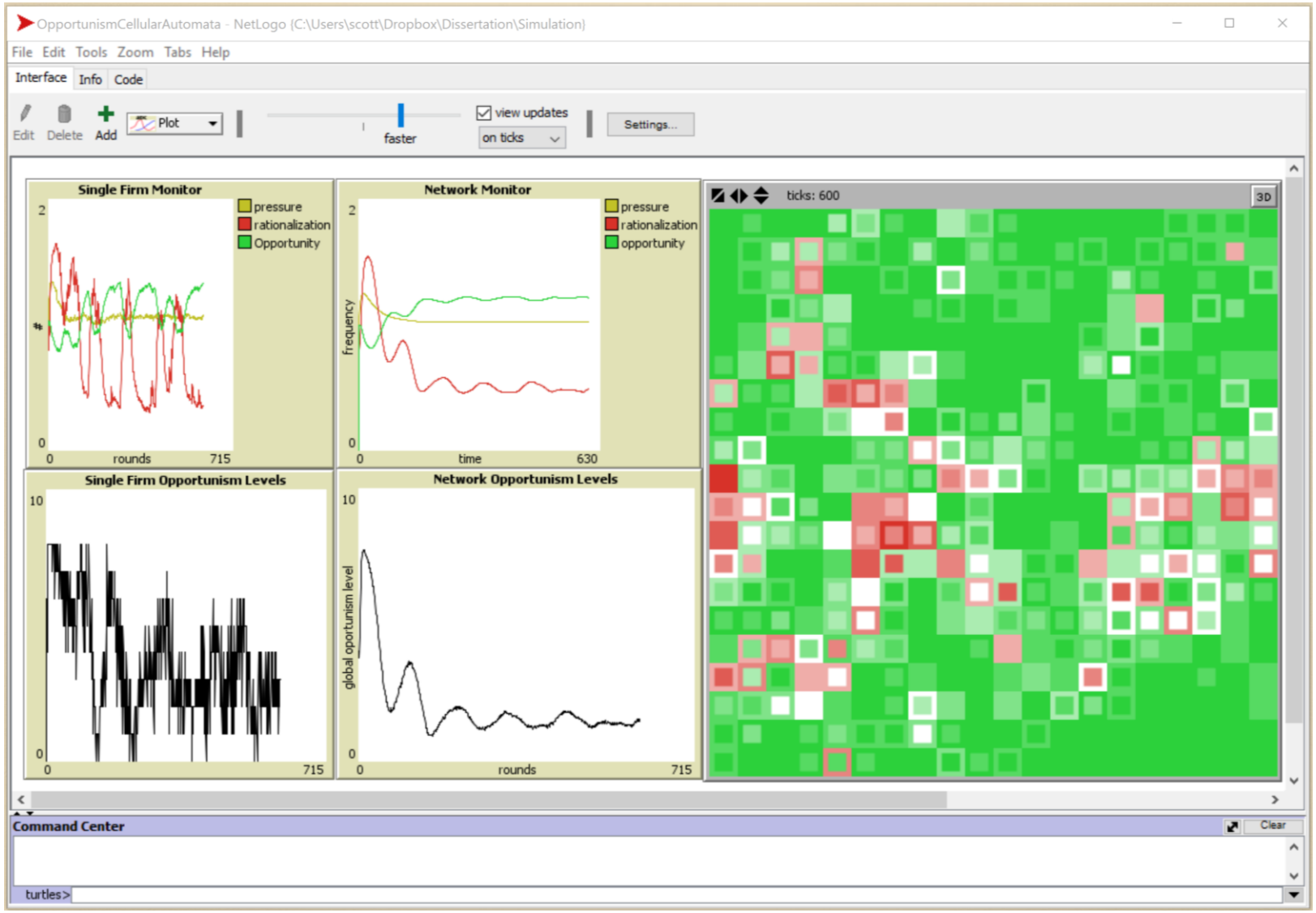
The model used is an adaptation of the N-person iterated prisoner's dilemma which has been explored to explain complexities in "cooperate or defect" behavior of agents within a network (Nowak & Sigmund, 1993; Albin & Foley, 2001; Nair, Narasimhan, and Choi, 2009). The simulation was programmed using NetLogo, an agent-based modeling program developed at Northwestern University to simulate complex phenomena (Tisue & Wilensky, 2004). A set of firms were established within a 2-dimensional *toroidal lattice* and were assigned relationships with neighboring firms based on their Moore neighborhood (shown in Figure 12) which comprises the eight neighboring firms (cells Y in Figure 12) surrounding a single firm within a network lattice structure (cell X in Figure 12). Each of the firms within the simulated network decides to engage in opportunistic behavior or cooperate with each of its neighboring firms in each time period. Edges of the 2 dimensional lattice wrap around following a torus structure so that firms located at the edges connect to firms at the opposite edge of the lattice. Decisions are evaluated for each firm by considering specific relationships that each firm has with its eight surrounding partners.

Figure 12: Moore Neighborhood



We emphasize an important distinction from the traditional approach in prisoner's dilemma, which uses a predefined strategy (such as tit-for-tat or reciprocated behavior) to determine cooperation and defect behavior based on the behavior of neighboring agents. Rather, we develop a model where the decision to cooperate or defect is based on the *state of the relationship* between two firms, which takes into account the complex interactions of the firm with its neighbors in each time period, for each paired relationship within the network. These relationships and the mathematical equations underpinning the dynamic model are discussed in the following section and included in Appendices A and B.

Figure 13: Simulation Model Screenshot



Firms decide to be opportunistic in the relationship when the incentive for opportunistic behavior exceeds an opportunism threshold which is stochastically set for each relationship in each time period by adjusting the mean opportunism level for the simulation. Figure 13 illustrates the decision to defect (engage in opportunism) or cooperate (not engage in opportunism) graphically at the end of a simulation run, for the entire network of firms in the right most graphic. For each time period, firms (a single cell in the CA) decide to engage in opportunism in each of their relationships within the Moore neighborhood and are assigned an integer value in the range of [0, 8] in each time period. These values for each firm in the network are depicted in Figure 13 color-coded for the level of opportunism. A filled-in square represents opportunistic behavior by the firm, while a square border represents the opportunistic behavior experienced in that time period by a firm in each of their 8 relationships. Dark red indicates high level of opportunistic behavior, dark green represents high level of cooperative behavior, and white represents an equal amount of opportunistic behavior and cooperative behavior in that time period.

In the simulation, data are collected that relate to the relational state for every dyad in the network as well as the decision to cooperate or defect in each time period. This was captured at a dyadic level and then aggregated at the network level to capture network level behavior. The three graphs displayed in Figure 13 are time series plots of the network level opportunism, the average fraud triangle scores of the network, and the fraud triangle scores of a selected individual firm within the network.

3.3 Relational Model

We briefly discuss the mathematical model included in the appendix. Opportunism Score (A.1) is determined based on the values for opportunity, pressure and rationalization. As

previously discussed, opportunity is a necessary condition for firms choose to engage in opportunism with both pressure and rationalization as positive modifiers.

Opportunity levels (A.2) are determined in the model by a weighted score of the degree of knowledge asymmetry, dependence asymmetry, and incoming trust. As knowledge asymmetry, dependence asymmetry, and incoming trust levels increase, the opportunity to engage in fraudulent behavior is higher. Firms with less relative relational dependence on their partners, firms that have a higher relative level of knowledge, and firms that are highly trusted by their partners have a higher degree of opportunity to engage in opportunistic behavior.

Rationalization levels (A.3) are determined by network behavior and the relational state of the dyad. In the simulation model, previous opportunistic behavior of firms in the Moore neighborhood and previous opportunistic behavior by the dyadic partner increases the rationalization score for a firm. Firms that observe higher levels of opportunistic behavior in their Moore neighborhood will have more justification to engage in opportunistic behavior. Additionally, the level of rationalization is driven by dependence asymmetry, incoming trust, and outgoing trust levels. Firms will be able to rationalize opportunistic behavior when their partner is more dependent on the relationship. Finally, trust levels will impact a firm's ability to rationalize opportunistic behavior. Both the norm of reciprocity (Gouldner, 1960; Fehr and Gächter, 2000) and expectancy theory (Vroom, 1964) suggest that firms will behave according to the behavior and the expected behavior of their partner firms. Firms that have a low degree of trust in their partner (i.e. *outgoing trust*) will be able to justify opportunistic behavior in anticipation of being taken advantage of in the future. Firms that have a low degree of *incoming trust* will be able to justify opportunism as a reciprocation of the low trust their partner has in them.

Pressure (A.4) levels are determined by performance levels for a firm. Firms that capture a smaller portion of the gains available in the relationship, both at a network level and at a dyadic level, will face higher levels of pressure to increase performance, which in turn increases the pressure to commit opportunistic behavior in the relationship. This pressure will build or decrease over time based on how much profit a firm is able to capture from its relationships. Firms also have a base level of pressure to engage in opportunistic behavior which is stochastically assigned based on a mean level of pressure and standard deviation, which are the same for all firms in the simulated network.

Trust (A.5) in the model is updated every time period based on the difference between expected behavior (represented by outgoing trust) and observed partner behavior. Outgoing trust exhibited by a firm increases (decreases) in time periods in which a firm's partner cooperates (defects). The magnitude of the change in trust is dependent on the previous levels of trust. The consequence of opportunistic behavior in terms of lost trust is relatively minor when the other firm already demonstrates a lack of trust, though very high in cases where a firm is opportunistic towards a firm that exhibits a high level of trust in the relationship. The rate of change is determined by "trust elasticity" within the model. In cases of high levels of trust elasticity, rate of change in trust will be higher based on partner behavior, while it will take longer for trust levels to adjust to a change in partner behavior when trust elasticity is low.

Trust is also updated each time period by a reciprocity measure which adjusts a firm's outgoing trust towards the incoming trust levels of the partner firm. The magnitude of this adjustment is determined by the level of trust reciprocity. A firm that perceives a difference in outgoing trust and incoming trust will adjust its outgoing trust over time to the incoming trust level. A firm with a very low level of trust, which perceives a high level of incoming trust will

increase its outgoing trust as reciprocity for good behavior. Network Behavior and Partner Behavior similarly capture the level of opportunism in the relationship with an exponential smoothing approach to capture historical behavior.

Knowledge levels (A.6) are updated each time period based on firms gaining access to additional knowledge and recognizing old knowledge becomes obsolete over time. Knowledge increases by a fixed rate of knowledge gain each time period for every firm as well as based on the relationships that a firm has within its Moore neighborhood. Firms in networks that have a high level of knowledge will capture a portion of the knowledge deficit they have with their neighbors each time period. In each time period, a percentage of the prior knowledge level becomes obsolete based on the knowledge obsolescence rate which is assumed to be the same for all firms.

Dependence (A.7) is a function of knowledge dependence, investment dependence (i.e. asset specificity induced dependence), and a fixed relational dependence amount established for every relationship. Firms have a higher dependence when their partner firms have a higher level of knowledge, as it will be more difficult to replace the knowledge deficit. Firms are dependent on access to resources through relationships with other firms (Emerson, 1962; Pfeffer & Salancik, 2003; Davis & Cobb, 2010). Firms are also dependent on each other based on investments specific to the relationship. The more a firm invests in a relationship, the higher the dependence it has on its partner. The investment level in a relationship is determined by a firm investing or divesting in the relationship according to trust levels and rates of investment and divestment. Lastly, each firm has a predetermined level of dependence with respect to each specific relationship that it is in, which remains fixed over time.

3.4 Validity Analysis

In order to establish confidence in the simulation model, we followed suggestions from Forrester and Senge (1980) and Kleijnen (1995). Validation and verification of the simulation model is done both in the development of the simulation model and through post-hoc analyses to confirm validity. Model structure was tested by following the suggestions by Forrester and Senge (1980) including tests on structure-verification, parameter-verification, extreme-conditions, and dimensional-consistency.

3.4.1 Simulation Model Development

The simulation model was developed in accordance with the suggestions by Kleijnen (1995): modular programming, verification of intermediate simulation output, comparison to real-data, and animation to confirm that the simulation was developed correctly. The individual modules include establishing the initial network structure and firm (i.e. a cell in the CA) properties, making decisions for each firm in each time period, analyzing paired decision outcomes for each time period for each dyad, and updating historical data for each firm within the network. The results from sample simulation runs were analyzed multiple times during each simulation to verify that the behavior of the simulation model was as expected and that firm decisions, decision outcomes, and historical information were being correctly processed and updated. The behavioral results from each simulation were displayed for both individual firms and for the entire network of firms to aid in this analysis through an animated graphical display (shown in Figure 13). Additionally, unexpected results from the simulation were compared to available secondary data sources to verify that the simulation results comported well with real-world observations, as discussed in section 4.4.

3.4.2 Simulation Validation

Following the guidelines of Forrester and Senge (1980), we evaluated the structural validity of the model using the following procedures.

3.4.2.1 Structure-verification

The model equations represent dynamic relationships among the constructs. The hypotheses embedded in the relationships can be expected to hold *ceteris paribus*. Care was taken to ensure that each relationship within the model was one that has significant face validity and is an accurate representation of behavior. In order to establish behavioral and structural validity, multiple simulations with varying starting values were carried out to identify potential problems with the model and problematic behaviors such as simulation instabilities or irrational firm behavior. Various simulations with different starting values were run to ensure that the modeled behaviors in the simulation runs were reasonable and that they accurately reflect expected firm behavior in the real world.

3.4.2.2 Parameter-verification

Parameter values used in the model were determined to have appropriate relationships within the model. The inter-relationships among the parameter values in the model were deemed to be consistent. Parameter validity (for each relationship) was analyzed by observing the impact of varying the parameter values and observing the behavior of the system and decisions. The effects were consistent with expectations, which demonstrated face validity. The network level tests were done on data collected by allowing stochastic variation of key parameters, creating a variety of different simulations, and dyadic data were collected by holding parameters at their mean values in the simulation runs.

3.4.2.3 Extreme-conditions

The relational model that was developed for the simulations was tested using various extreme-case scenarios during the development of the model to ensure that the model would react appropriately to extreme-conditions and extreme values for different variables. The goal of the extreme-conditions testing was to show that under extreme-conditions or scenarios, the model behaved reasonably without unexplainable or unrealistic behavior. The tests for extreme-conditions were done throughout model development to assess structural validity by manipulating each of the parameters in the model from their theoretical maximum to minimum values to observe the effect that each parameter had on the decisions of individual firms and the effect on the network. This was done to ensure that decisions of individual firms were not entirely dependent on the specific value of parameters and that the behavior of the simulation model adjusted to parameter changes as expected (for example, when knowledge transfer between firms was higher, knowledge asymmetry within the network was lower as expected but overall behavior remained similar). Additionally, the simulation model was tested by applying a sudden 'shock' to the system during simulation runs by increasing or decreasing the threshold required for a firm to engage in opportunistic behavior to make sure that the behavior of the simulation model adjusted to the new threshold for opportunistic behavior and that network behavior was able to adapt to a new steady-state even in extreme-conditions.

3.4.2.4 Dimensional Consistency

Care was taken in the selection and use of constructs within the decision framework to represent real-world constructs that impact a firm's decisions in relationships. However, many of the constructs that were used do not have a meaningful unit (for example, trust, dependence,

rationalization, pressure etc.). Scale-free variables for each firm were bounded to a range of two units, either from 0 to 2 or from -1 to 1. Additionally, calculations done within the simulation model were designed as weighted scores of inputs with minimum and maximum values of zero and two respectively, which ensured consistency between variables. For more details on the specific calculations, see Appendices A and B. The values within the simulation were consistent with one another, and the functional relationships between relationships were dimensionally consistent.

4. RESULTS

The hypotheses were tested using two data sets generated from the simulation. The first data set was generated by analyzing the decision framework for a network of 400 individual firms. The relationships that exist between asymmetries, the fraud triangle scores for pressure, rationalization, and opportunity, and opportunism scores were captured for a single time period at the end of a standardized simulation run. The second data set was a generated by running 400 different simulation runs with different parameter values to modify dependence, knowledge, and trust asymmetries in the simulation. Results from the second data set are network level results over a period of time that capture the average level of opportunistic behavior and the average fraud triangle scores over time.

The simulation model was run for 500 time periods to generate historical data for firms and to ensure steady state. This length of initialization period was deemed adequate based on three approaches: visual analysis of network level graphs, a mean-based stabilization test, and a variance-based stabilization test. For visual analysis, steady state was determined by an approximation of the time period which represented stable behavior based on the network level

averages for opportunism, pressure, rationalization, and opportunity. Mean stability was determined by calculating the mean values for 100 time periods for average network opportunism levels and comparing them to subsequent blocks of 100 time periods. The simulation model was deemed stable if the mean levels did not differ significantly across the time blocks.

4.1 Dyadic Hypotheses

Dyadic data were collected with all parameters set to their mean values. The simulation was allowed to run for 500 time periods. Following the initialization period, relational and behavioral data were collected for a single time period for every firm in the simulation. Due to the assumption that observations are independent from one another, data were only collected for a single dyad for each firm. Analyzing all eight potential dyads for every firm would be problematic as each dyad has a reflected dyad that would have perfect negative correlations on each of the asymmetry measures as well as potential correlation with the other variables, complicating subsequent statistical analyses we did. Similarly, observing relational data on multiple dyads for each firm violates the assumption of independence of the observations due to the nested data structure. To eliminate these issues, we captured the data for the relationship that each firm has in the dyad with the northwest cell in the Moore neighborhood.

In order to test the hypotheses, the data were analyzed using Seemingly Unrelated Regression (SUR). SUR was selected over Ordinary Least Squares (OLS) because it is a more efficient estimator for multiple equations when the error terms among multiple equations exhibit covariance (Moon & Perron, 2006). Four separate SUR models were tested to evaluate the direct effects of dependence asymmetry, knowledge asymmetry, and trust asymmetry on opportunism and the mediation effects of the components of the fraud triangle (see Table 1). Model 1 was used

to test hypotheses 1-3a. Model 2 was used to test the mediation relationship of the fraud triangle for H4b following the suggestions of Preacher and Hayes (2008) for multiple mediation testing. Models 3 and 4 were used to test the network level hypotheses in the same manner. The results of the statistical analyses are shown in Tables 21 and 22.

Table 21: Dyadic Level SUR Results

	Model 1	**Model 2**			
Dependent Variable	Opportunism	Opportunity	Rationalization	Pressure	Opportunism
Independent Variables					
Intercept	2.132**	1.251**	0.700**	1.019**	-1.695**
Dependence Asymmetry	.075**	.046**	0.022**	-0.023**	0.011**
Knowledge Asymmetry	.053**	.113**	-0.024**	-0.089**	0.015**
Trust Asymmetry	.064**	-.032**	0.043**	0.047**	0.011**
Opportunity					1.497**
Rationalization					1.030**
Pressure					1.211**
RMSE	0.131	0.077	0.081	0.110	0.025
R^2	0.634	0.739	0.225	0.342	0.987
Chi^2	691.8	1130.0	115.8	207.9	30436.9

Asymettries were standardized prior to performing the regression.
** p <.01, * p <.05
N = 400

H1a was supported in model 1. Dependence Asymmetry had a significant positive effect on opportunism score in model 1 (B = .075, p < .01). Firms that had a dependence advantage over their neighbor had a higher likelihood of engaging in opportunistic behavior in that time period. H2a was supported by the results in model 1 (B = .053, p < .01). Knowledge asymmetry had a positive association with opportunistic behavior at the dyadic level. H3a was supported in Model 1 (B = .064, p <.01). Trust Asymmetry was positively associated with opportunistic behavior at the dyadic level.

Table 22: Dyadic Level Specific Mediation Tests and Total Indirect Effects

Indirect Effect on Opportunism

Mediating Pathway	Asymmetries	Observed Coefficient	95% CI*	Effect
Opportunity	Dependence Asymmetry	0.069	(.050, .088)	+
	Knowledge Asymmetry	0.169	(.149, .190)	+
	Trust Asymmetry	-0.048	(-.068, -.028)	-
Rationalization	Dependence Asymmetry	0.023	(.008, .037)	+
	Knowledge Asymmetry	-0.024	(-.037, -.011)	-
	Trust Asymmetry	0.045	(.031, .058)	+
Pressure	Dependence Asymmetry	-0.028	(-.051, -.006)	-
	Knowledge Asymmetry	-0.107	(-.131, -.084)	-
	Trust Asymmetry	0.057	(.036, .077)	+
Total Indirect Effects	Dependence Asymmetry	0.063	(.040, .087)	+
	Knowledge Asymmetry	0.038	(.013, .062)	+
	Trust Asymmetry	0.053	(.035, .071)	+

*Confidence intervals were percentile based confidence intervals calculated using 1,000 bootstrapped observations

H4a was evaluated by using a bootstrapping approach to estimate each individual mediated pathway and the total effects of dependence asymmetry, knowledge asymmetry and trust asymmetry on opportunism through the mediating effects of the fraud triangle components. Bootstrapping was used to test mediation because it does not require the assumption of multivariate normal distribution for estimating path coefficients, nor that the sampling distributions of the total or specific indirect effects be normal (Preacher & Hayes, 2008). Following the suggestion from Preacher and Hayes (2008), 1,000 bootstrapped samples were run using the observed data from the simulation to determine correct specification of coefficients and to determine a percentile based confidence interval which allows for potentially skewed distributions. Path coefficients for each of the nine mediated pathways and for the combined total effects of dependence asymmetry, knowledge asymmetry, and trust asymmetry were analyzed. The results from the bootstrap test are

shown in Table 22. Although specific pathways through the fraud triangle had mixed positive and negative mediation effects on opportunism, the overall mediation effect for each of dependence asymmetry, knowledge asymmetry, and trust asymmetry was positive, lending support for H4a.

4.2 Network-level Hypotheses

In order to test the hypotheses at the network level, 400 simulations were run using stochastic assignment of starting parameters to test the network level effect of asymmetries on opportunism. Parameter values for each of the simulations were modified between simulations based on a mean and standard deviation, which determined possible values for dependence (D_{jk}), knowledge gain (KG_j), and trust reciprocity (TR_j), each having an effect on dependence asymmetry, knowledge asymmetry, and trust asymmetry values in the full network simulation. Each simulation was allowed to run for 500 time periods to establish equilibrium and generate a relationship history for each firm. This provides a sample size of 400 simulations across a variety of starting conditions in the model, providing a robust set of results under a variety of conditions. After the initial 500 time periods, network level opportunism levels, average network asymmetry levels, and average network fraud triangle scores of opportunity, rationalization, and pressure were captured for the entire network over 100 time periods. Because of the possibility of auto-correlation for opportunism levels, relatively large batch sizes of 100 were used for the network-level estimations to ensure consistency (Damerdji, 1994). Within each simulation, 400 (20x20), firms were allowed to interact over the course of the simulation, meaning that the observed data account for calculations pertaining to 128,000,000 dyadic decisions (400 simulations * 400 firms * 8 decisions/time period * 100 time periods).

The average number of opportunism over the 400 simulations was 1.62 opportunistic decisions per firm per time period (20.25% of the total decisions) and ranged from 0.73 opportunistic decisions/firm/time period (9.125% of the total decisions) to 3.20 opportunistic decisions/firm/time period (40.0% of the total decisions).

Network level measures for asymmetries were captured within the network by summing the absolute value of asymmetry observed within each relational dyad over the testing period. The absolute value was used because the full network included the relationship from both perspectives, in which case a "directional asymmetry" would cancel out to zero within the network. Fraud triangle scores were measured by summing the scores for each of opportunity, rationalization, and pressure for each of the dyadic relationships in the network over the testing period. Opportunism was captured by the total number of opportunistic decisions made in the network over the observation period for each simulation. In order to test the hypotheses, the data were tested using SUR following the same approach as that for the dyadic tests presented in section 4.1.

Table 23: Network Level SUR Results

Dependent Variable	Model 3	Model 4			
	Network Opportunism	Network Opportunity	Network Rationalization	Network Pressure	Network Opportunism
Independent Variables					
Intercept	1.104**	1.24**	0.421**	1.011**	-23.495**
Network Dependence Asymmetry	2.75**	-.225**	0.546**	0.008	-0.019
Network Knowledge Asymmetry	-.347*	.03*	-0.071*	-0.003	-0.008*
Network Trust Asymmetry	2.139**	-.183**	0.431**	0.036**	0.046**
Network Opportunity					15.847**
Network Rationalization					11.578**
Network Pressure					0.074
RMSE	0.213	0.017	0.042	0.006	0.005
R^2	0.194	0.200	0.197	0.036	1.000
Chi^2	96.5	100.1	98.4	15.0	876989.7

Asymmetries were standardized prior to performing the regression.
** p <.01, * p <.05
N = 400

Table 24: Network Level Specific Mediation Tests and Total Indirect Effects

Indirect Effect on Network Opportunism

Mediating Pathway	Network Asymmetries	Observed Coefficient	95% CI*	Sig. Effect
Network Opportunity	Dependence Asymmetry	-3.558	(-4.891, -2.317)	-
	Knowledge Asymmetry	0.482	(.020, .912)	+
	Trust Asymmetry	-2.905	(-4.065, -2.003)	-
Network Rationalization	Dependence Asymmetry	6.327	(4.137, 8.676)	+
	Knowledge Asymmetry	-0.821	(-1.579, .007)	
	Trust Asymmetry	4.996	(3.371, 6.997)	+
Network Pressure	Dependence Asymmetry	0.001	(-.003, .005)	
	Knowledge Asymmetry	0.000	(-.002, .001)	
	Trust Asymmetry	0.003	(-.003, .009)	
Total Indirect Effects	Dependence Asymmetry	2.769	(1.831, 3.795)	+
	Knowledge Asymmetry	-0.339	(-.677, .022)	
	Trust Asymmetry	2.093	(1.367, 2.952)	+

*Confidence intervals were percentile based confidence intervals calculated using 1,000 bootstrapped observations

H1b, which posited a higher degree of opportunism in a network with high dependence asymmetry, was supported in Model 3. Networks with high levels of dependence asymmetry were found to have higher levels of opportunism in the full network ($B = 2.75$, $p < .01$). H2b, which posited a higher degree of opportunism in a network of high knowledge asymmetry was not supported. Higher average levels of knowledge asymmetry within the network of firms did not tend to lead to a higher level of opportunistic behavior. H3b, which posited a higher degree of opportunism in a network with higher levels of trust asymmetry, was supported ($B=2.139$, $p < .01$).

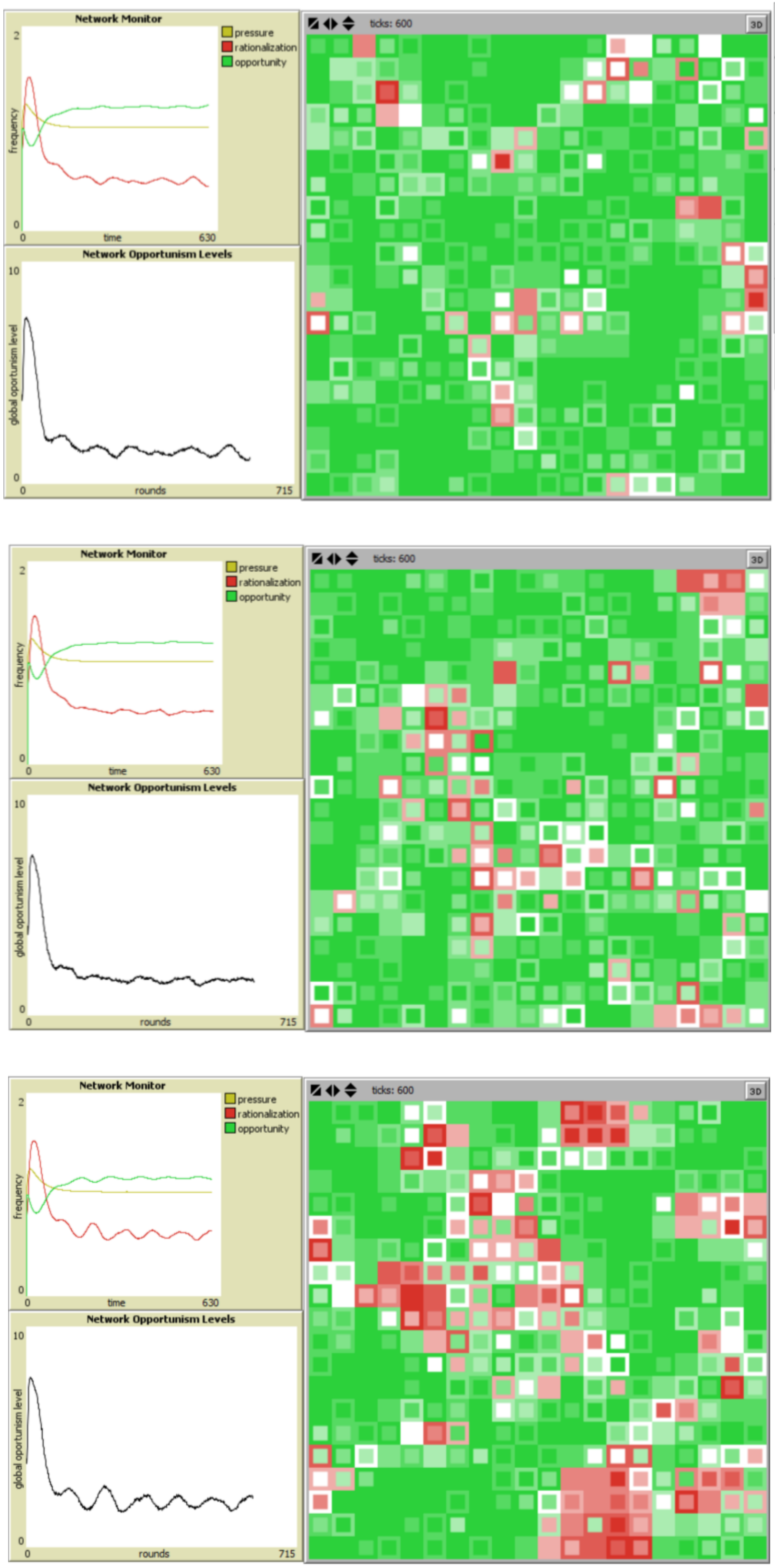
Hypothesis 4b was tested using the same bootstrapping procedure as for the dyadic models. The data support a mediation effect for both Dependence Asymmetry and Trust Asymmetry for the total indirect effects, but *not* for Knowledge Asymmetry. The specific mediation pathways had mixed effects with three significant positive pathways, two significant negative pathways, and 4 non-significant results. This suggests mixed support for H4b.

There were two key results that were interesting. First, the mediation behavior of the fraud triangle was very different at the network level compared to the dyadic level. This suggests that additional understanding of network behavior is needed to fully understand how opportunism behaviors arise in a network or that the fraud triangle theory is only applicable at the dyadic level. Second, rationalization and opportunity behaved in the specific mediation pathways as opposites, suggesting a complex relationship that merits additional exploration. The evidence from the simulation suggests that factors that increase opportunism through increasing opportunity might decrease opportunism through rationalization when viewed within a network over time. This interesting finding might help explain how governance mechanisms (i.e. trust or contractual

controls) can have varying influences on opportunism levels within a network depending on the fraud triangle measures.

These two findings can be explained by the theory of complex adaptive systems which posits complex behaviors arising from simple rules of engagement at the individual firm level. In the CA based simulation model of a supply network, simple relational rules for individual firms led to interesting and unexpected results in the supply network over time. Additionally, these two findings in conjunction can help explain situations where asymmetries might lead to positive relational performance such as when interdependence and relational embeddedness can increase relational success (Gulati & Sytch, 2007), supplier dependence sometimes reduces opportunistic behavior (Provan & Gassenheimer, 1994), and how power asymmetry might be used to promote supply chain performance (Maloni & Benton, 2000).

Figure 14: Sample Simulation Runs



4.3 Discussion

The CA simulation yielded two interesting results that were not anticipated. The first was that zones of opportunistic and cooperative behavior tended to emerge in the network over time. This was interesting because in a fully connected network there is potential for very different behavioral outcomes based on certain regions within the network. In many cases these zones or hot-spots of opportunism or cooperation could be observed as outcomes from a single firm with a high propensity for opportunistic behavior which impacted the neighboring region. In other cases, it was a conglomeration of a set of firms that all operated in conjunction with one another. These hotspots tended to emerge within the simulation and can be observed in Figure 14 as clusters of similar colored firms where the local behavior tended to converge to either opportunism or cooperation. Hotspots tended to have a strong central point where the firms were entirely opportunistic (dark red in Figure 14) or entirely cooperative (dark green in Figure 14) and then slowly decrease in intensity (observable by light red/light green/white firms) in regions further away from the hot spot.

The second interesting finding that emerged was that simulations tended to enter into two different steady states after an initialization period. For some simulations, opportunism levels within the network tended to converge to a relatively stable value (see for example the Network Opportunism Levels graph in the second simulation run depicted in Figure 14). However, in other simulation runs (see the Network Opportunism Levels graph in the third simulation run depicted in Figure 14), tended to exhibit an oscillatory behavior after the initialization period with levels of opportunism shifting from high to low. The oscillatory behavior can be understood by examining the relationship that rationalization and opportunity have with each other and with opportunism over time. One contention proposed in this research is that opportunity alone is not sufficient to

create opportunistic behavior, but it is through the combined presence of opportunity, rationalization and pressure that opportunism emerges. Analysis of the graphs from the simulation runs suggest that rationalization plays a key role in driving opportunism levels in the network, with shifting rationalization levels leading to a shift in the opportunism level for the network (See the third figure in Figure 14). The oscillatory behavior of opportunism at the network level was unanticipated. We suggest that this is a case of "emergent behavior" in complex adaptive systems.

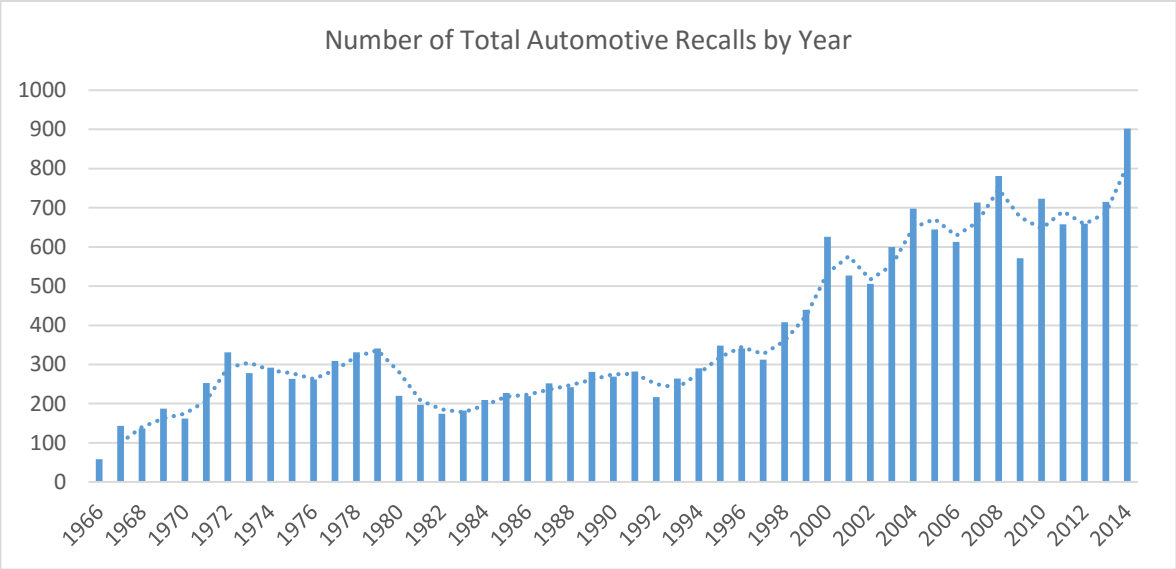
In order to further examine the oscillatory behavior at the network level, secondary data on automotive recalls was collected. The automotive industry was selected for three reasons. First, many of the examples of opportunistic behavior in buyer-supplier relationships have arisen in the automotive sector and they have led to recalls. Second, the automotive industry has placed significant value on supplier relationships and is a tightly connected network with relationships that remain over a long period of time. Third, the data on automotive recalls is publicly available and has a relatively large sample size.

We do not make the claim, nor intend to, that automotive recalls are the best representation of opportunistic behavior. However, there are several examples where opportunistic behavior by a supplier has led to product recalls. For example, consider the case of the Aston Martin recall which included over 17,000 cars (approximately 75% of the cars produced from 2007 – 2012) due to a sub-supplier using counterfeit plastic material in the accelerator arms (Klayman, 2014). The recall is directly related to opportunistic behavior by the supplier and lends support to viewing recall data as a surrogate measure of opportunism in the automotive industry.

In examining the number of automotive recalls (see Figures 15 and 16), there is an interesting pattern of behavior that emerges beginning in the year 2000 which is highly indicative

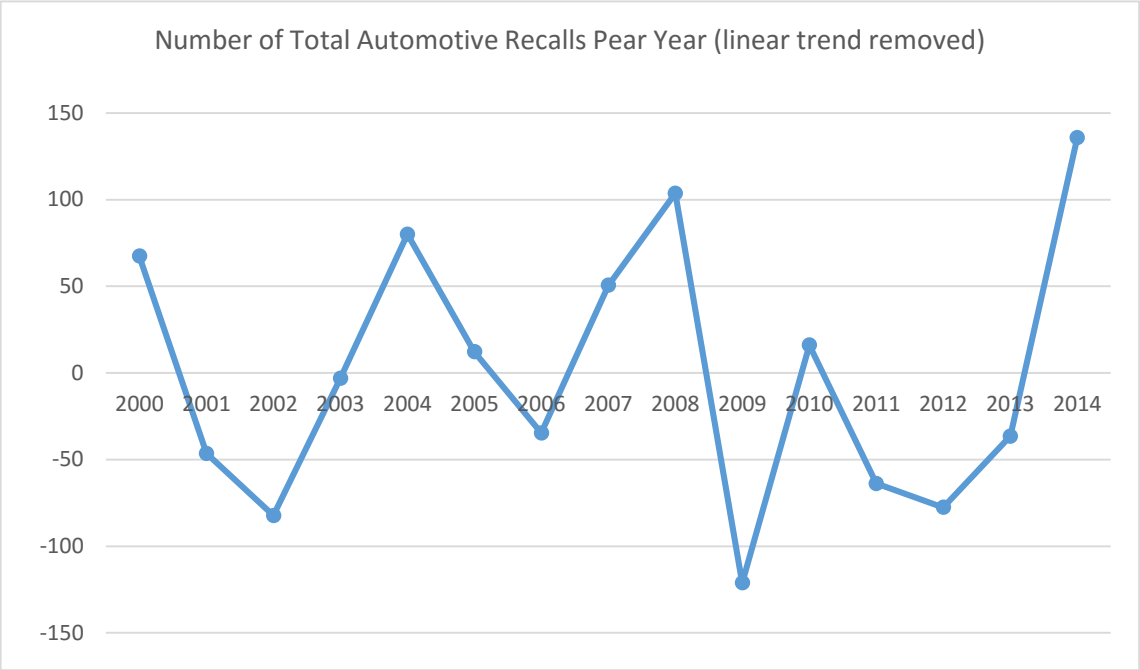
of a cyclical process with respect to recalls. This cyclical pattern suggests that there is some evidence of cyclical network behavior and there is potential value in exploring oscillatory behavior at a network level for issues related to relational risk and opportunism as suggested by the CA based simulation model.

Figure 15: Number of Total Automotive Recalls by Year



*Dotted line represents a two year moving average.

Figure 16: Number of Total Automotive Recalls by Year (trend removed)



5. CONCLUSION

The use of the fraud triangle to explain the mechanism through which asymmetries lead to opportunistic behavior yields interesting and valuable insights. The application of the theory of the fraud triangle to the supply chain context to explain behavior within dyadic relationships and to better understand network-level behaviors is a fruitful area of exploration.

5.1 Practical Application

Understanding the role of the fraud triangle as a mechanism through which asymmetries in relationships lead to opportunistic behavior allows for multiple approaches to minimizing a firm's exposure to relational risk if high degrees of asymmetry exist in relationships. As it might not be possible to control the asymmetries directly, understanding and limiting the mechanism through which asymmetry leads to opportunism can help protect firms against relational risk.

There are several strategies that have been discussed in the literature to govern relationships that will have a different effect on the components of the fraud triangle. One of the most common is using trust to govern the relationship rather than relying on contractual governance. There are a number of advantages discussed in the literature regarding the benefit of using trust as a governance mechanism (Gulati & Nickerson, 2008; Puranam & Vanneste, 2009). However, trust can also lead to higher exposure to opportunistic behavior. Trust has an important role in predicting partner behavior and avoiding exposure in a relationship to opportunistic behavior and using trust as a management tool can have complex implications on behavior in a relationship. However, it might be possible to send a high outgoing trust signal, and still avoid exposing oneself to opportunistic behavior, which might lead to a more positive relationship with the supplier without increasing the relational risk associated with increasing opportunity in the fraud triangle.

Both formal contracting and relational contracting can be used in a relationship to protect against opportunistic behavior (Carson, Madhok, & Wu, 2006). Contracting controls are effective in limiting specific types of opportunistic behavior by providing penalties and controls to limit the opportunity to engage in opportunistic behavior. However, contracts can never completely identify all of the possible scenarios and firms often face court litigations because of incomplete contracts (Hart & Moore, 1988).

Recent studies have explored the role of justice in dyadic relationships (Liu et al., 2012; Katok & Pavlov, 2013; Narasimhan, Narayanan, & Srinivasan, 2013). Unfair dealings with suppliers can lead to opportunistic behavior in relationships (Rossetti & Choi, 2005; Narasimhan, Narayanan, & Srinivasan, 2013). Luo et al. (2015) found that opportunistic behavior was related to the types of justice practices firms were engaged in. Justice practices can reduce rationalization in partner firms by establishing rules of engagement that firms are expected to follow. Poor justice

management in relationships can lead to increased levels of rationalization leading to higher levels of opportunistic behavior in the relationship.

Contract duration and profit sharing can reduce pressure that firms face to commit opportunistic behavior. Recognizing the competitiveness of a supplier's industry can also allow firms to better understand the relational risk that they take in engaging with a supplier. These pressures might be alleviated by longer term contracts with suppliers to reduce pressure with that specific supplier. Reducing partner pressure through favorable price adjustments can also reduce pressure in the relationship. This can help explain the interesting finding by Narasimhan et al. (2009), which found the counter-intuitive finding that in certain lock-in situations the optimal strategy for the supplier with an advantageous position in the relationship is to lower prices for the buyer.

Table 25: Potential Effects of Governance Tools on the Fraud Triangle

Governance Tool	Fraud Triangle Effects		
	Opportunity	Rationalization	Pressure
Trust	+	-	
Contracting Controls	-	+	
Contract Duration	+		-
Favorable Contracts			-
Justice Practices		-	
Industry Norms		-	
Increased Oversight/Inspections	-	+	

In many cases it might be impossible to control one aspect of the fraud triangle. For example, high degrees of asymmetry might be impossible to reduce, leading to a high level of opportunity that cannot be reduced. High degrees of competitive pressures might exist within the industry and be impossible to control directly. The supply chain might be in an industry where

opportunistic behavior is common and expected. In those situations, it would be especially critical to limit the other two components of the fraud triangle in order to reduce opportunistic behavior.

However, care must be taken in managing relational risk to avoid increasing one aspect of the fraud triangle while decreasing another. For example, increasing contractual length to reduce supplier pressure can have an adverse effect by creating a lock-in situation where opportunity is increased. Concerted efforts to reduce opportunity might be seen unfavorably by a supplier and lead to higher levels of rationalization. Recognizing how different strategies for managing the components of the fraud triangle interact with each of the constructs is important.

5.2 Conclusions

The fraud triangle provides a useful framework for understanding the mechanism through which asymmetries can lead to opportunistic behavior in relationships. Understanding the role of the fraud triangle and the complex interactions that relational management strategies have with the opportunism triangle can provide useful tools for actively managing and preventing opportunism levels within a dyadic relationship and within a larger network of firms.

The complex adaptive system that developed within the simulation yields some interesting and unexpected results that need further exploration, lending support to the theory of complex adaptive systems and the nature of supply chains as complex structures that need to be explored by recognizing the interdependent nature of relational constructs. The interdependent nature of asymmetries, the fraud triangle, and the evolution of behavior over time is a fruitful direction for future research, as understanding how these tendencies can evolve over time is a practically useful and interesting avenue of research. In particular, the relationship between opportunity levels within a network with opportunistic behavior and rationalization can be further explored.

APPENDICES

APPENDIX A

Simulation Model Variables

Var Type	Variable Name	Variable Definition	Symbol	Boundaries
	Focal firm	firm currently making decision	$Subscript\ j$	$\{0, 1, 2, \ldots N\}$
	Partner firm	Partner of focal firm for decision	$Subscript\ k$	$\{0, 1, 2, \ldots 8\}$
DV	Cooperation	$\begin{cases} -1\ if\ OS_{jk}^{t}\ k\ is > OL_{jk}^{t} \\ 1\ if\ OS_{jk}^{t} is \leq OL_{jk}^{t} \end{cases}$	C_{jk}^{t}	-1 or 1
DV	Partner Cooperation	$= \begin{cases} -1\ if\ OS_{kj}^{t}\ k\ is > OL_{kj}^{t} \\ 1\ if\ OS_{kj}^{t} is \leq OL_{kj}^{t} \end{cases}$	PC_{jk}^{t}	-1 or 1
P	Divestment Rate	The % rate that firms divest in a single time period towards the desired investment level based on trust levels	DR	$[0, 1]$
P	Firm Pressure	The amount of pressure within firm j to succeed	P_j	$[0, 1]$
P	Investment Rate	The % rate that firms invest in a single time period towards the desired investment level based on trust levels	IR	$[0, 1]$
P	Knowledge Gain	The rate of knowledge gain for firm j. This is bounded by KER in order to keep K_j^t bounded to [0,1]	KG_j	$[0, KOR]$
P	Knowledge Obsolescence Rate	The % based loss in total knowledge for every firm in each time period	KOR	$[0, 1]$
P	Knowledge Transfer Rate	The % of knowledge that is available to be transferred from firms with higher knowledge towards firms with lower knowledge	KTR	$[0, 1]$
P	Opportunism Limit	The limit at which firm j will engage in opportunism in a	OL_{jk}^{t}	$[0, 8]$

		relationship with partner k during time period t		
P	Trust Elasticity	The rate at which firm j adjusts trust based on partner behavior	TE_j	$[0, 1]$
P	Trust Reciprocity	The rate at which firm j adjusts trust based on asymmetric trust levels	TR_j	$[0, 1]$
SV	Dependence	The dependence of the focal firm on partner firm k in time period t	D_{jk}^t	$[0, 1]$
SV	Dependence Asymmetry	$D_{jk}^t - D_{kj}^t$	DA_{jk}^t	$[-1, 1]$
SV	Divestment	The decrease to investment by focal firm j with regards to the relationship with partner k in time period t	D_{jk}^t	$[0, 2]$
SV	Dyadic Performance	$\left(\frac{RS_{jk}^t}{RS_{kj}^t + RS_{jk}^t}\right)$	DP_{jk}^t	$[0, 1]$
SV	Firm Gain	Score derived from prisoner's dilemma model based on cooperation/defection of focal firm j and partner k	FG_{jk}^t	$[0, 2]$
SV	Firm Pressure	Pressure faced by firm j to perform	FP_j	$[0, 1]$
SV	Incoming Trust	The trust signal that focal firm j receives from partner k	IT_{jk}^t	$[-1, 1]$
SV	Independent Performance	$\frac{\sum_{k=1}^{8} RS_{jk}^t}{8}$	IP_{jk}^t	$[0, 2]$
SV	Investment	The increase to investment by focal firm j with regards to the relationship with partner k in time period t	I_{jk}^t	$[0, 2]$
SV	Knowledge Advantage	The knowledge that a focal firm j has above that of their partner firm k	KA_{jk}^t	$[0, 1]$

SV	Knowledge Deficit	The shortage of knowledge that a focal firm has below partner firm k	KD_{jk}^{t}	$[0, 1]$
SV	Knowledge	The level of knowledge for firm j in time period t	K_{j}^{t}	$[0, 1]$
SV	Partner Cooperative Behavior	The degree of cooperative behavior observed by focal firm j in time period t with respect to partner j's behavior	PCB_{jk}^{t}	$[-1, 1]$
SV	Network Opportunistic Behavior	The degree of opportunistic behavior observed by focal firm j in time period t in their local network	NOB_{j}^{t}	$[0, 2]$
SV	Network Performance	$\left(\frac{\sum_{k=1}^{8} FG_{jk}^{t}}{\sum_{k=1}^{8} RS_{kj}^{t} + \sum_{k=1}^{8} RS_{jk}^{t}}\right)$	NP_{j}^{t}	$[0, 1]$
SV	Opportunism Score	Utility value for opportunistic behavior based on the fraud triangle.	FTS_{jk}^{t}	$[0, 8\ ]$
SV	Opportunity	The degree of opportunity to engage in opportunistic behaviors	O_{jk}^{t}	$[0, 2]$
SV	Outgoing Trust	The trust that focal firm j has in firm k	OT_{jk}^{t}	$[-1, 1]$
SV	Pressure	The degree of pressure to commit opportunistic behaviors	P_{jk}^{t}	$[0, 2]$
SV	Rationalization	The degree of rationalization to justify opportunistic behaviors	R_{jk}^{t}	$[0, 2]$
SV	Relational Investment	The current investment level in the relationship by focal firm j with respect to the relationship with partner k	RI_{jk}^{t}	$[0, 2]$

DV = Decision Variable, P = Parameter, and SV = State Variable

APPENDIX B

Simulation Model Equations

$$Opportunism\ Score_{jk}^{t} = f\left(O_{jk}^{t}, P_{jk}^{t}, R_{jk}^{t}\right) = \zeta_1 * \left(O_{jk}^{t}\right) * \left(\zeta_{\ 2} * R_{jk}^{t} + \ \zeta_3 * P_{jk}^{t}\ \right) \quad (1)$$

$$Opportunity_{jk}^{t} = f\left(DA_{jk}^{t}, KA_{jk}^{t}, IT_{jk}^{t}\right) \quad (2)$$

$$= \sum_{n=0}^{N} \alpha_n Y_n \ where\ \alpha\ is\ a\ vector\ of\ weights\ associated\ with\ the\ vector\ of\ input\ variables\ Y$$

$$Y = \begin{bmatrix} DA_{jk}^{t} + 1 \\ KA_{jk}^{t} + 1 \\ IT_{jk}^{t} + 1 \end{bmatrix}$$

$$Rationalization_{jk}^{t} = f\left(DA_{jk}^{t}, IT_{jk}^{t}, OT_{jk}^{t}, NOB_{j}^{t}, PCB_{jk}^{t}\right) \quad (3)$$

$$= \sum_{\mathrm{n=0}}^{\mathrm{N}} \beta_n V_n \ \ where\ \beta\ is\ a\ vector\ of\ weights\ associated\ with\ the\ vector\ of\ input\ variables\ V$$

$$V = \begin{bmatrix} DA_{jk}^{t} + 1 \\ 1 - IT_{jk}^{t} \\ 1 - OT_{jk}^{t} \\ NOB_{j}^{t-1} \\ 1 - \ PCB_{jk}^{t-1} \end{bmatrix}$$

$$Pressure_{jk}^{t} = f\left(NP_{j}^{t}, DP_{jk}^{t}, FP_{j}\right) = \ \sum_{n=0}^{N} \gamma_n * \quad (4)$$

$$W_n\ where\ \gamma\ is\ a\ vector\ of\ weights\ associated\ with\ the\ vector\ of\ input\ variables\ W$$

$$W = \begin{bmatrix} 2 * NP_{j}^{t} \\ 2 * DP_{jk}^{t} \\ 2 * FP_{j} \end{bmatrix}$$

$$OutgoingTrust_{jk}^{t} = OT_{jk}^{t-1} + TE_j\left(PC_{jk}^{t-1} - OT_{jk}^{t}\right) + TR_j(IT_{jk}^{t-1} - OT_{jk}^{t-1}) \quad (5)$$

$$IncomingTrust_{jk}^{t} = OT_{kj}^{t-1}$$

$$Network\ Opportunistic\ Behavior_j^t = NOB_j^{t-1} + BE_j\left(\sum_{k=1}^{8}\frac{-PCB_{jk}^t+1}{8} - NOB_j^{t-1}\right)$$

$$Partner\ Cooperative\ Behavior_{jk}^t = PCB_{jk}^{t-1} + BE_j\left(PCB_{jk}^t - PCB_{jk}^{t-1}\right)$$

$$Knowledge_j^t = (1-KOR) * K_j^{t-1} + AC_j * \left(KTR * \sum_{k=1}^{8} KD_{jk}^{t-1}\right) + KG_j \quad (6)$$

$$Knowledge\ Advantage_{jk}^t = \begin{cases} K_j^t - K_k^t & if\ K_j^t > K_k^t \\ 0 & if\ K_j^t \le K_k^t \end{cases}$$

$$Knowledge\ Deficit_{jk}^t = \begin{cases} 0 & if\ K_j^t > K_k^t \\ K_k^t - K_j^t & if\ K_j^t \le K_k^t \end{cases}$$

$$Relational\ Dependence_{jk}^t = \tau_1\left(D_{jk}\right) + \tau_2\left(KD_{jk}^t\right) + \tau_3 RI_{jk}^t \quad (7)$$

$$Dependence\ Asymmetry_{jk}^t = RD_{kj}^t - RD_{jk}^t$$

$$Relational\ Investment_{jk}^t = RI_{jk}^{t-1} + I_{jk}^t - D_{jk}^t$$

$$Round\ Investment_{jk}^t = \begin{cases} IR\left(\left(OT_{jk}^t + 1\right) - Inv_{jk}^t\right) & if\ OT_{jk}^t + 1 > Inv_{jk}^t \\ 0 & if\ OT_{jk}^t + 1 \le Inv_{jk}^t \end{cases}$$

$$Round\ Divestment_{jk}^t = \begin{cases} 0 & if\ OT_{jk}^t + 1 > Inv_{jk}^t \\ DR\left(\left(OT_{jk}^t + 1\right) - Inv_{jk}^t\right) & if\ OT_{jk}^t + 1 \le Inv_{jk}^t \end{cases}$$

CHAPTER 5: CONCLUSIONS AND FUTURE RESEARCH

1. CONTRIBUTION

This dissertation explores the concept of asymmetries in buyer-supplier relationships. Specifically, it explores the concepts of trust asymmetry, knowledge asymmetry, and dependence asymmetry and their relationship with negative relational outcomes. The three primary contributions of this dissertation are a theoretical model for exploring dyadic trust, the development and testing of the use of the fraud triangle for exploring the mechanism through which asymmetries can lead to opportunistic events, and exploration of empirical evidence which explores the relationship between asymmetries and negative relational outcomes.

These major contributions have implications in a variety of domains that are of interest to the field of supply chain management. Specifically, this dissertation expands on the key topic areas of trust, buyer-supplier relationships, relational risk, and relational governance. This dissertation addresses paradoxes and competing theories established by the literature in the exploration of the dyadic perspective on buyer supplier relational constructs.

The approach taken within the dissertation is a multi-method triangulation approach that explores dyadic asymmetries from the perspective of theory-building, simulation modeling and testing, and empirical survey collection and analysis in order to expand on the research. Additionally, the dissertation provides methodological contributions in presenting different approaches for evaluating relational measures in the dyadic context, in particular providing a much more refined model for measuring and addressing trust within a dyadic relationship.

2. SUMMARY OF FINDINGS

Although many specific findings are discussed in prior chapters, there are some overall findings developed within this research that should be acknowledged. This dissertation explores the presence and impact of asymmetries in buyer supplier relationships and uses the dyadic perspective to explain how relational problems emerge in relationships.

The dyadic trust model presented in Chapter 2 yields additional understanding of trust in relationships. The model captures the concepts of trust reciprocity, mutual trust, and trust asymmetry in a single model and explores the mechanisms through how mutual trust, reciprocal trust, and trust asymmetry emerge in relationships. A dyadic model for understanding trust is presented and the concept of trust asymmetry is explored in the dyadic context. This is a key extension of prior literature which has motivated additional research on trust asymmetry.

Evidence which supports the dyadic trust model is found through empirical investigation in Chapter 3. The data indicate support for reciprocal trust emerging within the observed relationships and demonstrate strong predictive power of mutual trust in reducing relational conflict and opportunism. Additionally, the conceptualization of trust as outgoing and incoming trust yielded additional insight from the empirical analysis done in Chapter 3. Reciprocal trust, mutual trust, and trust asymmetry had significant and independent relationships with the outcome variables of conflict and opportunism. This suggests that analysis of trust should be done with the perspective presented in Chapter 2 which captures the dyadic nature of trust in order to fully explain these and other effects. Overall these findings provide strong support for the dyadic trust model presented in Chapter 2.

Evidence of the emergence of asymmetries in the relationship exists for trust asymmetry, knowledge asymmetry, and dependence asymmetry. Trust asymmetry was found to be related to higher levels of perceived conflict within the relationship. Knowledge asymmetry and dependence asymmetry were found to have no significant relationship with any of the negative outcomes, despite theoretical support for the relationship to exist. This suggests that alternative mechanisms either limit the relationship between knowledge and dependence asymmetries and negative relational outcomes, the sample size was insufficient to observe the effects, or the relationships suggested by theory are not as strong as hypothesized. The research has interesting outcome in that it found support of prior literature such as the findings on mutual trust, improves prior literature such as the findings on reciprocal trust, and conflicts with expected theoretical relationships, such as those explored in trust, knowledge, and dependence asymmetries.

The relationship between asymmetries and opportunism was further explored in Chapter 4 given the complex results from Chapter 3. The concept of the Fraud Triangle is presented which acts as the behavioral motivation for how asymmetries can lead to opportunistic behavior. Based on prior accounting literature which explores the concept of fraud triangle in organizational fraud the perspective of the fraud triangle is adapted to the supply chain context and used to explain why firms are more likely to engage in opportunistic behavior. The findings suggest that different asymmetries might have different mediated pathways to influence opportunistic behavior. In particular, the aspects of rationalization and opportunity tended to act as opposite mediation pathways through which mixed performance effects might be possible. Additionally, overall total indirect effects were found for trust and dependence asymmetry, supporting and augmenting findings from Chapter 3.

Additionally, Chapter 4 led to some interesting and unexpected complex dynamic system behavior which lends support to the finding that "rugged landscapes" emerged within supply chain management following the simple rules of engagement established in Chapter 4. These rugged landscapes are those represented both by the regional densities of opportunism and cooperative behavior as well as the interesting dynamic of oscillatory behavior in opportunism that has been discovered and found within the automotive industry as well. These rugged landscapes and behaviors are predicted by complex adaptive systems (Choi, Dooley, and Rungtusanatham, 2001), but rarely are supported via both simulation results and observable empirical data.

Some key unexpected findings were found within this dissertation that provide interesting areas of future research. Key relational differences emerged for constructs that were similar to one another. For example, perceived and reported conflict demonstrated different relationships with the observed data, despite being conceptually similar and having high degrees of similarity. This suggests that there is a perceptual component to many of the relational variables that should be measured and addressed in future research. It is possible that objective and subjective measures yield different insights in empirical research on asymmetries. Specific to the literature on conflict, it is critical to explore the mixed role of conflict. Despite evidence that perceived and observed conflict were highly related to one another, the relationships that emerged with the constructs observed within this research were independent from one another, suggesting that objective and subjective measures of conflict might be differentiable constructs with different practical relationships.

3. ADDITIONAL AREAS OF RESEARCH

There are a number of areas that have been highlighted for additional areas of research in prior chapters. One of the key limitations of the findings is determining true causality relationships. Many of the findings in this dissertation cannot distinguish between causal directions in the relationship. Because of this, additional research methodologies which can address this concern can be of significant value and interest.

Although trust asymmetry, knowledge asymmetry, and dependence asymmetry have formed largely independent streams of research, there is much potential for these asymmetries to interact with one another or with different aspects of the fraud triangle. Understanding and developing theoretical models which account for interaction among asymmetries will provide additional opportunities for relevant research.

Lastly, the research done in this dissertation should be expanded in terms of both sample size and methodology. Limited sample sizes can miss significant results and lead to misstated conclusions. Additionally, exploration of the behavior of asymmetries over time can yield additional insights. While this was addressed in the simulation model in Chapter 4, empirical confirmation of the cyclical nature of opportunism would be a valuable contribution for understanding opportunistic behavior over time at a system level.

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