

## ABSTRACT

Title of dissertation: TWO ESSAYS ON TRUST IN SUPPLY CHAIN  
MANAGEMENT

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In this dissertation, I propose that trust is an important yet under-studied concept in supply chain relationships both upstream in a Business-To-Business (B2B) context and downstream in a Business-To-Consumer (B2C) context. In the first essay, I investigate the evolution of trust in buyer-supplier relationships in a VMI setting. Supply chain management literature is rich in pointing to the benefits generated by collaborative supply chain arrangements, however recently the dark side of these collaborative relationships has been reported as well. To the best of our knowledge, our study is the first to bring in a new dimension – “length of the relationship” to these research models. Using survey data collected from distributors that use VMI, we find that longer relationships are associated with lower levels of distributor trust in the manufacturer. This erosion of trust over time is fully mediated by the distributors’ experience of psychological contract violation. Our findings demonstrate that good inventory performance may not be sufficient to maintain trust in VMI relationships, but regular communication between parties, as well as nonverbal documented agreements, may also be needed to maintain trust.

In the second part of the dissertation, I study the effectiveness of third-party trust seals that have emerged as a prominent mechanism to enhance trust in B2C online markets. Despite their common use by practitioners, systematic research studies of the effectiveness of trust signals are scarce. Exploiting a unique dataset of over a quarter million transactions across 493 online retailers, this study empirically measures the value and effectiveness of trust seals on the likelihood of purchase by shoppers. The dataset is collected from a randomized field experiment by a large trust seal provider, which enables us to infer the causal impacts of the presence of a trust seal. It is found that the presence of the online trust seal increases the odds of completion of purchase. I further find that online trust seals serve as partial substitutes for both shopper experience and seller size, which makes the seal more useful for first time visitors at a web site and also for smaller online retailers. Interestingly, the effect of the number of trust seals is subject to diminishing marginal returns, such that the presence of additional seals does not necessarily increase cart completion rates.

TWO ESSAYS ON TRUST IN SUPPLY CHAIN MANAGEMENT

by

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## **CHAPTER 1: INTRODUCTION**

Confucius, a long time ago, proposed that trust is a fundamental requirement for all social exchanges. Trust plays a key role in personal relationships between individuals in different settings including families, schools, groups and organizations. Supporting this point of view, Blau (1964) views trust as an important ingredient of stable relationships in society. Hirsch (1978) assesses the role of trust in economic exchanges and suggests that trust is a “public good” required for a functioning economic system. Fukuyama (1995) further suggests that the inherent trust level in a society is a major predictor of the economic development of that society. Viewing commerce as a form of social exchange, we can confidently say that an understanding of trust is also essential for businesses.

American society is quite diverse. Globalization, fueled by developments in information technologies, has further pushed this society to interact with people from different cultures, both in the US and across the globe. Practices of establishing trust solely based on personal experience, interpersonal similarities, common social status, trusted third parties and family ties etc., are no longer sufficient in global relationships on the internet. Moreover, Mistrz (1996) suggests that the mechanisms for cooperation and solidarity in the society have weakened significantly and it is essential to find new alternatives. With the emergence and growth of new forms of business cooperation, such as joint ventures, networked firms and supply chain partnerships, businesses need a better comprehension of the trust concept to develop successful relationships both within and across business units.

In this dissertation, I study two problems regarding the role of trust in supply chain management. In the first essay, I examine the evolution of trust in collaborative

supply chain relationships in a business-to-business (B2B) distributor-manufacturer context. Focusing on a particular technology – Vendor Managed Inventory (VMI) – and using survey data, I empirically test the effect of VMI relationship length on distributors’ trust in their manufacturers. In the second essay, I move to a business-to-consumer (B2C) context and shed light on trust transfer along the supply chain through online trust seals. Using a large archival dataset comprising over a quarter million online shopping carts, I provide evidence that online trust seals are valuable technologies in enhancing consumer trust in the e-commerce world.

In the remaining sections of this chapter, I introduce the research settings for my dissertation, namely - Vendor Managed Inventory and Electronic Commerce.

## **1.1 VENDOR MANAGED INVENTORY (VMI)**

### **1.1.1 Automatic Replenishment Programs (ARP)**

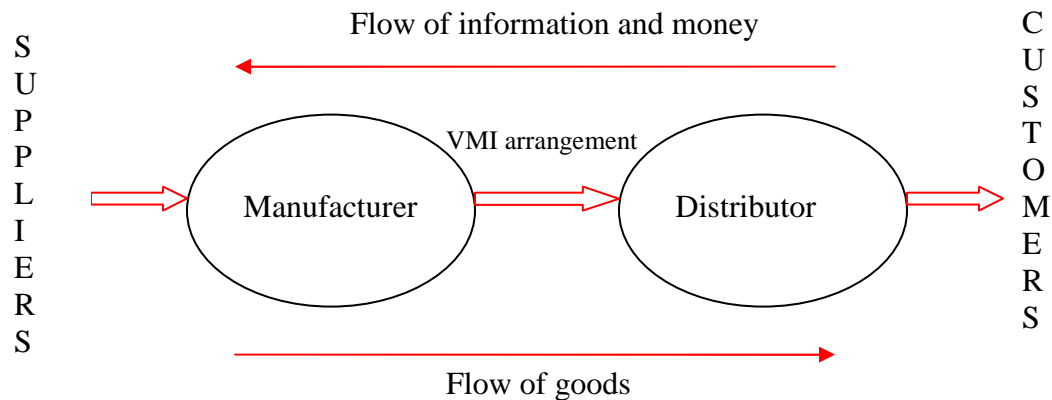
Competition and shorter product cycles have pushed companies to re-evaluate their distribution and inventory management systems (Myers *et al.*, 2001). Viewing inventory as a liability rather than an asset, firms have looked for new ways of managing their inventories. ARPs provide a solution to firms that suffer from high safety stock, low return on assets and obsolete items in warehouses. In this program, sellers use the sales and inventory data provided by the buyer to automatically replenish stock at the buyer’s premises. Daugherty *et al.* (1999, pp. 64) observe that the main benefit of this program comes from “substituting information for inventory.” To enhance effective acquisition and transfer of information, ARP require the presence of underlying components, such as bar-coding, electronic data interchange (EDI) and decision support systems.

Along the supply chain, downstream retailers have frequently utilized ARP to manage their inventories. For example, Procter and Gamble used ARP to manage inventories of their product portfolio at large retailers, such as K-Mart and Wal-Mart (Myers *et al.*, 2000). Different forms of ARP have been used in a variety of industries. Daugherty *et al.* (1999) cite two forms - Efficient Consumer Response (ECR) and Quick Response (QR): ECR is common in the grocery industry, while QR is widely used in the apparel industry. Along the same line, retailers have encouraged the development of Collaborative Planning Forecasting and Replenishment (CPFR) initiatives to add joint planning and forecasting of inventory by the buyer and seller. As VMI is the most commonly used form of ARP, next I present VMI in more details.

### **1.1.2 VMI as a subset of ARP**

As a form of supply chain coordination initiative, Vendor Managed Inventory (VMI) was first used as part of the Efficient Consumer Response program by Wal-Mart and Procter & Gamble (Kurt Salmon Associates Report, 1993). In this type of relationship, the upstream manufacturer manages the inventory of Stock Keeping Units (SKU) at the downstream retailer's premises. While it is always the upstream party managing the inventories at a downstream firm, the titles of these parties may be different. In the auto industry, the downstream firm could be an auto manufacturer having inventories managed by upstream suppliers of auto parts and assemblies. In our study, as depicted in Figure-1, the downstream firms are called *distributors* while the upstream firms are called *manufacturers*. Sticking to our VMI nomenclature, the manufacturer usually gets paid by the downstream distributors only when a sale is realized. In return, the distributor shares sales information with the manufacturer (Cetinkaya & Lee, 2000).

**Figure-1: Our nomenclature of VMI relationships**



It is important to note that VMI programs have resulted in significant changes to the conventional supply chain relationships. For example, transfer of inventory decision-making from the distributor to the manufacturer, coupled with a shift in financial responsibility of inventories, could pose adaptation challenges to the VMI users. Also, VMI requires the distributors to share confidential sales data with the manufacturer. Therefore, as distributors become vulnerable to the actions of the manufacturers, inter-organizational trust becomes operational in VMI relationships.

## **1.2 ELECTRONIC COMMERCE**

### **1.2.1 Information asymmetry**

Online markets are characterized by a significant amount of information asymmetry in comparison to offline settings. Traditional brick and mortar shoppers usually get to “feel and touch” the product before making a purchasing decision and observe product quality directly. Daignault *et al.* (2002) assert that “Trust depends on identity, the condition of being distinguishable from others” and one can not group past experiences into a meaningful history without identity. Verification of the brick and mortar merchants’ identity is relatively easier as factors such as premier location,

investment in the store assortment, and personal communication with customers, often serve to signal quality in traditional settings. As noted by Zaheer *et al.* (1998), while a few of these features are replicable online, others are not. Hence, innovative mechanisms are needed to reduce information asymmetry in electronic markets and bring online markets closer to conventional markets in the eyes of online shoppers.

Two issues that plague online markets are privacy concern of consumers about their personal information and security threats, such as confidence fraud, unauthorized access and attacks to consumer computers from the internet. A large part of the emphasis relating to online security has been targeted at preventing unauthorized access and hackers, as evidenced by the huge growth in the sale of anti-virus and anti-spyware software, spam filters, firewalls, among others. Surprisingly, according to the figures published by the Internet Crime Complaint Center (2007), of the 206,884 complaints received in 2007, almost two thirds were about online retailers not delivering as promised. Credit card and check frauds comprised only 12.3 percent of the total. Increasingly, online retailers are beginning to understand the importance of mechanisms that signal their reliability and quality to potential customers.

### **1.2.2 Sources of retailer information for consumers**

Online shoppers can typically get information regarding merchant reliability and quality from three types of sources before making a purchasing decision (Daignault *et al.* 2002). First-party information is provided directly by the online retailer. The quality of the website design, contact information, existence of a privacy policy, and past performance reports, may all be useful in inducing trust. Two operational variables: Technological capabilities of the web site (Ba & Johansson, 2008) and quality of the

online service (Field *et al.*, 2004) also lead to customer satisfaction. The advantage of direct communication between the shopper and online retailer however, may sometimes be offset by the possible information biases and lack of independent verification of merchant claims. Second-party information about the online retailer can be provided by previous shoppers through reputation systems and rating mechanisms. Some online retailers, such as Amazon.com, enable shoppers to view the feedback provided by previous shoppers. Consumer review websites may host feedbacks regarding both the products and web sites. Finally, third-party mechanisms – the focus of this study – can provide independent verification of a retailer’s trustworthiness. Such independent verification is usually provided by specialized companies such as buySAFE, TRUSTe and VeriSign that investigate the quality claims of the online retailers and allow the approved retailers to display a trust seal on their websites. Alternatively, some agencies such as Better Business Bureaus (BBB) may publish directories of trusted e-merchants. Third party ratings are relatively more important in e-commerce compared to brick and mortar businesses due to the inherent difficulties of establishing identity and conveying trust in the online world.

### **1.2.3 Third party online trust seals**

Trust certification authorities, also called “seal providers”, have been classified into three major categories by the *Trust Seal Review* (<http://trustsealreview.com>). The first category includes Privacy Seal Providers, such as “TRUSTe” and “Trust Guard”. These providers ensure that the e-merchant has a privacy policy and treats the private data of shoppers confidentially. The second category includes Security Seal Providers, such as “VeriSign” and “GeoTrust”, which provide digital certificates and secure SSL

connections. The third category of trust seals is called “Business Verification Seals”. In this category, “Better Business Bureau - BBB” investigates the ID of the e-merchant and makes sure that the merchant represents itself truthfully. “buySAFE” provides identity verification for businesses and enables bonded purchases as well. I should here also acknowledge that some seals provide more than a single functionality like “buySAFE”. For example, VeriSign seals also serve for business identity verification and NexTag seals provide price comparison service as well as business identity verification. A sample of trust seal logos is provided in Table-1. This study focuses on online retailers that host, among others, a *trust seal* provided by the focal third-party certification firm.

**Table-1: Some trust seals frequently used in e-commerce**



### 1.2.4 Operations of online trust seal providers

Typically, seal providers first set their minimum privacy and safety requirements expected from online stores. The focal trust-seal provider performs a stringent review of online retailers seeking a “trust certificate/seal” for financial stability, verifiable identity, and a successful business track record. Online retailers satisfying the criteria determined by the trust-seal provider are then certified in return for a fee to be paid by the retailer. The focal seal provider also requires that the certified online retailer allow monitoring of website operations and performance in every transaction following certification. The focal trust-seal logo is then displayed by the online retailer as an endorsement of its



quality claims by an independent verification authority. Shoppers can then verify the seal by clicking on it and seeing the membership status of the online retailer.

Overall, we can say that trust seals are commonly used in e-commerce today. Preferred more by small-to-medium sized online retailers, trust seals could help bridge the confidence gap experienced by online shoppers due to information asymmetry, on the web sites of these retailers.

### **1.3 CONTRIBUTION**

Given the scarcity of empirical trust studies in a business context, this dissertation contributes to the supply chain management body of knowledge in two ways, (i) showing how B2B trust evolves over time in collaborative buyer-supplier relationships, and (ii) how trust transfer through 3<sup>rd</sup> party online trust seals influences decision making in the B2C supply chain contexts. Overall, our findings indicate that supply chain technology solutions could influence the trust among supply chain members in different ways. While, downstream in the supply chain, trust seals could increase the consumers' trust in the online retailer, upstream distributors using the VMI technology could experience trust erosion in their relationship with the manufacturers. Thus, in adopting boundary-spanning supply chain technologies, it is of utmost importance to consider the effects of the technology on relationship parameters, such as trust.

## **CHAPTER-2: THE EVOLUTION OF INTER-ORGANIZATIONAL TRUST IN VMI RELATIONSHIPS**

### **2.1 THE TRUST CONCEPT**

Being trustworthy is fundamentally an ethical and moral duty owed by the trustee to the society in general and to the trustor in particular (Hosmer, 1995). Mayer *et al.* (1995, pp. 712) define trust as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party.” The authors further discuss that being vulnerable shows that the trustor has something important to lose, and that the trustor takes a risk by making him/herself vulnerable. Similarly, McEviliy *et al.* (2003, pp. 99) define trust as “willingness to accept vulnerability based on positive expectations about another’s intentions or behavior.” Zaheer *et al.* (1998, pp. 143) define inter-organizational trust more broadly as “the expectation that an actor 1) can be relied on to fulfill obligations 2) will behave in a predictable manner 3) will act and negotiate fairly when the possibility of opportunism is present.” Lewis & Weigert (1985) focus on risk and interdependence in a relationship and suggest that both are both essential for trust to make a difference. If actions can be completed with no risk (uncertainty) involved, trust will not be needed (i.e., matter). Thus, Rousseau *et al.* (1998, pp. 392) define trust as “willingness to be vulnerable under conditions of risk and uncertainty.” Deutsch (1958) posits that the outcome of a decision must bear some uncertainty and be important for the trusting parties, making them vulnerable (at least to a degree) for trust to be operational. Overall, the initial Mayer *et al.* (1995) definition is the most comprehensive one, applicable at both individual and

organizational levels. In the context of this essay, which comprises VMI relationships between downstream distributors and upstream manufacturers, the distributors using VMI are taking risk by outsourcing their materials management function. Therefore, I will base my work on the Mayer *et al.*'s (1995) definition of trust.

Blois (1999) contrasts the trust and trustworthiness concepts and shows that trustworthiness is a characteristic of the trustee and the trustor additionally considers the contextual factors and its own disposition to trust. He also suggests that trust is seldom offered unconditionally in the form of blanket trust, but that one party trusts the other in some particular areas or issues.

As a complex concept, trust has multiple dimensions. Rousseau *et al.* (1998) propose that there are four different forms of trust. Deterrence-based trust is based on the idea that the other party cannot act opportunistically because societal or institutional sanctions will make it costly to breach the trust. Calculus-based trust stems from the rationality of decision makers where the incentives and governance structures will make it irrational for the other party to breach trust. The third form is relational trust, which develops after successful interactions among parties. The final form of trust is institution-based trust (i.e. legal systems and cultural norms). In a logistics context, we can cite Knemeyer (2000) as an example presenting a model of trust that includes dimensions of trust as well as its determinants and consequences in logistics outsourcing relationships. Next, we discuss the antecedents and outcomes of trust.

### **2.1.1 Antecedents of trust**

In the theoretical trust literature, two main factors have been studied as antecedents of one party's trust in the other, (i) characteristics of the trustee, and (ii) the

trustor's propensity to trust others. Ability, integrity and benevolence of the trustee are the most frequently cited characteristics that lead to trust (Mayer *et al.*, 1995; Butler, 1991). In well established relationships, repeated prior interactions allow the trustor to collect data about ability, integrity and benevolence of the trustee, however in new relationships, the trustor may need to rely on the reputation of the trustee as a source of information (Ganesan, 1994).

Trustor's own propensity-to-trust may be another factor that could partially explain the variability in trust (Mayer *et al.*, 1995). Individuals have their own inherent disposition to trust, while firms may also differ in their willingness to trust other firms as part of their organizational culture. Therefore, in order to understand why one party trusts another, it is important to consider the trustor's general willingness to trust and the characteristics of the trustee as perceived by the trustor.

In a supply chain context, Kwon & Suh (2004) studied the factors affecting the level of trust in buyer-seller relationships and found that relationship specific asset investments and information sharing are positively associated with trust. Morgan & Hunt (1994) provide empirical evidence that shared values and higher levels of communication between supply chain partners are likely to increase trust, while opportunistic behavior is likely to reduce trust. Doney & Cannon (1997) identified two factors: supplier's size and willingness to customize as significant drivers of a buyer's trust in the supplier. Finally, Ganesan (1994) demonstrates that in a buyer-supplier relationship, trustor's satisfaction with the trustee's performance is a major determinant of trust. Briefly, we may say that factors driving trust include characteristics of the trustee, trustor's propensity to trust, and

some relationship parameters such as communication and satisfaction with previous outcomes.

### **2.1.2 Outcomes of trust**

Trust's influence on outcome variables comes in two main ways: direct effects on performance parameters; and trust's facilitating role between drivers of performance and outcome variables. Trust has been shown to reduce transaction costs and increase supply chain performance in exchange relationships (Dyer & Chu, 2003). Absence of trust requires that every contingency be planned in advance and written into a contract; transactions have to be scrutinized against opportunistic behavior, all of which increase transaction costs. Additionally, trust results in "more positive attitudes, higher levels of cooperation and superior levels of performance" for employees in a workplace (Dirks & Ferrin 2001, pp. 450). Interpreting trust as a facilitator, Dirks & Ferrin (2001) demonstrate that presence of trust influences the trustor's interpretation of the current and future behavior of the trustee, thereby reducing contextual uncertainty. This positive interpretation forms the basis of the moderating effects of trust between factors such as motivation, group processes, and organizational change on work attitudes, perceptions and performance outcomes. Finally, Seppänen *et al.* (2007) reviewed 15 empirical trust papers in the 1990 – 2003 period, and observed that trust is a "reciprocal concept" and has been modeled as both a cause and affect in inter-organizational relationships.

### **2.1.3 Approaches of different disciplines to the trust concept**

The trust concept has been approached differently by a variety of disciplines. Rotter (1967, pp.651) for instance, defines interpersonal trust from a psychologist's viewpoint as "an expectation held by individuals or groups that the word, promise, verbal

or written statement of another can be relied on.” Doney & Cannon (1997, pp.46) report that marketing researchers who have examined trust related to suppliers and salespersons suggest that “inter organizational trust operates as a governance mechanism that mitigates opportunism in exchange contexts characterized by uncertainty and dependence.” In a similar vein, Morgan & Hunt (1994) develop the “Key Mediating Model” where they suggest that an agent (downstream channel member) that trusts its principal (supplier) is more likely to cooperate and commit harder for that principal. They also propose that trust reduces uncertainty in the relationship. Economists assume that in exchange relationships, parties are inherently untrustworthy and may act opportunistically if proper governance mechanisms are not in place (Barney & Hansen, 1994). The founder of Transaction Cost Economics theory, Williamson (1979), recommends that the interests of both parties be aligned through idiosyncratic investments to make untrustworthy behavior irrational to the parties. Finally, organizational researchers view trust to be a major attribute of functioning organizations. (Argyris, 1962; McGregor, 1967)

In a supply chain context, two theoretical lenses have commonly been adopted in scholarly research, including the study of trust in organizational relationships. The first is Transaction Cost Economics used by Zaheer *et al.* (1998), Nooteboom *et al.* (1997), and Mollering (2002). Based on this theory, trust is proposed as a substitute for costly control and coordination mechanisms. The second is the Social Capital Theory (Ganesan, 1994; Smith & Barclay, 1997; Young-Ybarra & Wiersama, 1999) which views economic exchanges as based on reciprocity. Any benefit provided to an organization is expected to be reciprocated in the future by that organization based on mutual trust (Blau, 1964; Uzzi, 1997). Thus, trust is viewed as a kind of “relational lubricant” that enhances knowledge

transfer and joint efforts between parties (Inkpen, 2001). Acknowledging that trust has been studied at both personal and organizational levels, next we discuss inter-organizational trust.

#### **2.1.4 Inter-organizational trust**

Although an inherently individual-level psychological state, the trust concept has been researched in inter-organizational relationships as well. Zaheer *et al.* (1998) empirically show that interpersonal and inter-organizational trust are two distinct but strongly correlated constructs. “Boundary spanner” individuals establish relationships among organizations that may / may not share the organization’s orientation towards another firm. However, the authors (Zaheer *et al.*, 1998, pp. 142) provide evidence that “organizations develop a collective view about each other after repeated transactions,” and that organizational culture often shapes the trust orientation of the individuals. Consequently, the authors (Zaheer *et al.*, 1998, pp. 143) propose, “Inter organizational trust describes the extent to which organizational members have a collectively held orientation toward the partner firm,” and find that performance of a buyer-supplier link is strongly related to inter-organizational trust.

At an inter-organizational level, trust has been studied from a buyer-supplier angle (Lane & Backman, 1996; Dyer & Chu, 2003), in joint ventures (Madhok, 1995; Inkpen & Curall, 2004) and with strategic alliances (Ring & Van de Ven, 1992; Das & Teng, 1998). A major benefit of trustful relationships is that trust reduces the need to write complicated contracts between organizations that may be costly to put together and enforce, thereby lowering transaction costs. (Barney & Hansen, 1994; Gulati, 1995). Given the importance of the topic, Seppänen *et al.* (2007) review trust articles in inter-

organizational relationships and conclude that the theory in this field is still developing. In addition, despite the quantity of theoretical trust papers, empirical trust studies are rare (e.g. Ganesan, 1994; Sako & Helper, 1998; Young-Ybarra & Wiersama, 1999; Mollering, 2002) and often inconsistent, as it is difficult to operationalize the trust concept. This essay makes a contribution by bringing inter-organizational trust studies into the supply chain management body of knowledge through a study of VMI programs.

### **2.1.5 Evolution of trust**

The level of trust between individuals, groups or parties evolves as parties interact with each other. Rousseau *et al.* (1998, pp. 402) suggest that societal control and institutional mechanisms may “serve as a springboard in creating trust,” while some forms of trust, such as calculative trust, may be more effective early in a relationship, and could develop into relational trust over time. In a case study, Ratnasingam (2005) studies the evolution of trust in e-commerce relationships between Cisco and Compaq, and observes that technological trust develops over time in stages into relational trust in this dyadic relationship. In their experimental study of trust erosion, Elangovan *et al.* (2007) observed that in some circumstances, trustors could forgive up to two violations before erosion hits and suggest that trustee’s inability to perform obligations causes less trust erosion than trustee’s unwillingness to perform. It is important to note that studies in “evolution of trust” are rare in the empirical trust literature due to the data requirements to test the research models. Having introduced the trust concept, next, I discuss the psychological contract violation, which is an important determinant of trust.



## **2.2 PSYCHOLOGICAL CONTRACT VIOLATION**

Complementing formal contracts, psychological contracts are also important aspects of relationships. Usually, parties have some ideas and expectations about the reciprocal obligations in a relationship, which is called “psychological contract”. (Robinson, 1996) It is called a psychological contract because an understanding of the perceived obligations by one party may not be shared by the other party. Building on these differing perceptions, one party may observe that the other has not fulfilled a promise; hence resulting in feelings of injustice, resentment, and betrayal; which is called psychological contract violation (Robinson, 1996). Briefly, we can say that experiencing psychological contract violations does not only depend on what the other party does, but also how those actions are perceived.

There are two main conditions that result in the experience of psychological contract violation: Reneging and Incongruence. Next, we discuss them in more details.

### **2.2.1 Reneging and Incongruence**

One party’s unwillingness or inability to fulfill a promise is called reneging and it is agreed by both parties that there is an obligation not being fulfilled by one party. Environmental turbulence, between the time of promise and fulfillment, may cause a party to break a promise, or sometimes the more powerful party may intentionally renege as well. (Morrison & Robinson, 1997) The second condition is incongruence between perceptions, where, parties have different understanding of the reciprocal obligations. This incongruence may produce cases where one party believes a promise was completely fulfilled, while the other party perceives that there are unfulfilled promises, and consequently experiences psychological contract violation. Klatzky (1980) illustrates

that promises could get distorted in human memory which could generate incongruence between perceptions over time.

Robinson (1996) asserts that there are three main factors that could produce incongruence. The first factor is divergent schemata. Parties in a relationship may have different schemata that they use to make sense of events happening around them. Also viewed as cognitive frameworks, organizations may have different schemata due to differences in previous experiences and organizational cultures. The second factor is the complexity and ambiguity of the tasks commonly performed by the parties. Given bounded cognitive capacity and bounded rationality of human beings, it is highly probable that each party could approach a complex task from a different angle, thus producing an idiosyncratic simplification and understating of the task complexity. Also, the parties may interpret and bridge the ambiguities in different ways based on their unique experiences, which produces incongruence in understanding a task and assigning mutual responsibilities. Finally, the third factor is lack of communication between parties. In the rapidly changing business environment of today, absence of regular multi-lateral communication between organizations may result in incongruence in perceptions. Overall, one can say that promises could be forgotten or distorted in memory over time, which generates incongruence, if not resolved, could cause the experience of psychological contract violation.

Trust and Psychological Contract Violation (PCV) are strongly related but two distinct concepts (Robinson, 1996). The literature is rich in pointing out to the important role of trust in psychological contracts (Rousseau, 1989; Morrison & Robinson, 1997). Both concepts are fundamentally measured at the individual level and they are boundary

spanning concepts where a second party is always involved. As both variables are used in our research model, it is important to mention the distinctiveness of them. Trust is willingness to take risk based on positive expectations about the future actions of the trustee, regardless of the ability of the trustor to control the actions of the trustee. Psychological contract violation is about feelings of anger and resentment, when the other party fails to fulfill obligations. First of all, psychological contract violation requires the presence of a psychological contract about mutual obligations in a relationship which may not be the case in deciding to trust another party. While violation of a psychological contract is experienced only based on an account of past interactions with the other party, trusting another party is about willingness to take risks in the future. Also, should we mention that reciprocity of obligations is the key for psychological contract violation, but not for trusting beliefs. Unidirectional perceptions of ability, integrity and benevolence are the determinants of trust (Mayer *et al.*, 1995). For example, in a buyer-seller relationship, the seller's repeated failures to deliver shipments on time will hurt the buyer's trust in the seller and may also cause the buyer to experience psychological contract violation. But if the buyer also defaulted previously (i.e. not paid on time), seller's failures may not cause a violation of the psychological contract as the buyer considers its own failures and view a zero balance in the psychological contract. Having reviewed the inter-organizational trust and psychological contract literatures, I now turn to Vendor Managed Inventory (VMI).

### **2.3 VENDOR MANAGED INVENTORY (VMI)**

Chapter-1 introduced the VMI concept and laid the research context. In this section, I will discuss the characteristics of VMI that relates to inter-organizational trust.

VMI has been found to reduce information distortion along the supply chain (Chen *et al.*, 2000), and increase inventory turnover and reduce stock-outs in the manufacturer-retailer channel. The manufacturer benefits from synchronization of inventory and transportation decisions through long term retailer commitment, and from increased purchase quantities, while the retailer enjoys savings in holding costs, fewer stock-outs and cash flow benefits (Dong & Xu, 2002). Similarly, Kulp *et al.* (2004) examine the impact of VMI on manufacturers' profitability and find that VMI increases manufacturers' profit margins. Cachon & Fisher (1997) also report that VMI increases inventory performance, but attribute these improvements to information sharing through EDI, which is a technological requirement for VMI implementation.

On the other hand, the literature points to some drawbacks of VMI as well. For example, Nannery (1994) observed that VMI causes significant changes in traditional buyer-seller relationships. Downstream VMI users (distributors) have to transfer their control on the materials management function to the upstream partner (manufacturers), which could cause loss of critical purchasing and inventory management skills. Moreover, in VMI relationships distributors often have to share their proprietary data with the manufacturers, which is risky. Williams (2000) observed that after starting to use VMI, buyers become more dependent on their suppliers. A survey of VMI users by Roberts (2004) found that while buyers (distributors) make significant gains by VMI adoption, suppliers' (manufacturers) main reason to accept VMI is to retain customers. Lee (2004, pp. 9) reported, "In fact some VMI systems have generated friction, because buyers have refused to share costs with the suppliers." This unequal sharing of costs and benefits could be a point of conflict among VMI users.

Overall, with all its pros and cons, VMI is a type of partnership between a buyer and a supplier, or between a distributor and a manufacturer in our nomenclature. As in any other business partnership, a degree of trust is essential (Pohlen & Goldsby, 2003). While power and dependence are also important, adoption of VMI requires the distributor to trust that the manufacturer could manage its inventory more efficiently than if it was self-managed by the distributor. Therefore, maintenance and development of trust between VMI partners is of utmost importance and in this essay, we investigate the role of VMI relationship length on the distributor's trust in its manufacturer.

## **2.4 RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT**

The literature in evolution of trust in buyer-seller relationships is quite mixed in terms of the direction of evolution (upwards or downwards). Social Exchange Theory posits that longer relationships bear higher trust as positive results over time increases the partners' trust in each other (Blau, 1964; Dwyer *et al.*, 1987). Gulati & Singh (1998) even use the prior history of ties as a proxy for inter-organizational trust. However, Moorman *et al.* (1992) and Young-Ybarra & Wiersama (1999) found no link between the length of a relationship and inter-organizational trust. On the contrary, Grayson & Ambler (1999) find empirical evidence that longevity in advertising service relationships is negatively related to the buyer's trust in the service provider. Therefore, looking at the supply chain management literature, it is difficult to see a clear direction on evolution of trust in buyer-supplier relationships.

Having some idiosyncratic attributes, participating in a VMI relationship could have a negative influence on trust in buyer – seller relationships. First, VMI is a unique collaborative process that requires a distributor to transfer inventory decision- making to

the manufacturer. Evanko (2010) suggests that VMI results in the loss of two core competencies: purchasing and inventory management for the distributors. Perceived lack of control and flexibility in these core competencies, coupled with vulnerabilities brought by sharing confidential data with the manufacturer - such as sales, inventory, price and promotion - may generate hard feelings on the distributor side. Overall, Williams (2000) observed that after starting to use VMI, buyers become more dependent on their suppliers. Trust is best bred in mutual dependencies (Emerson, 1962) and distributors' increased dependence on their VMI manufacturers carries the potential to make the relationships unstable and to reduce the distributors' trust in their manufacturers.

On the manufacturer side, the literature points out to the asymmetry in sharing VMI benefits between manufacturers and retailers. Roberts (2004) and Lee (2004) both wrote that it is the distributors that get the larger share of supply chain benefits produced by adopting VMI. This unequal sharing of costs and benefits could cause the manufacturer to renege and seek fairness by limiting performance, which could be perceived as a breach of the psychological contract by the distributors.

Finally, rapid staff turnover and the informal nature of VMI agreements could have a negative effect on distributors' trust in their manufacturers. Mentzer *et al.* (2000) observed that VMI relationships take quite a long time to establish (2 years average), and given the high rate of employee turnover in many industries, it is not unusual that key staff who started the VMI transition are different from those who completed it. As most of the VMI implementation process is executed by informal agreements, frequent changes in key personnel are likely to cause loss of accumulated information and consensus, which could increase the extent of conflicts in the relationship resulting in

perceived breach of the psychological contract. Mentzer *et al.* (2000) demonstrate that quite a significant portion of enablers and inhibitors in VMI relationships are people-related soft factors rather than technological factors. Therefore, all else equal, the unique attributes of VMI relationships carry the seeds to allow distributors to experience psychological contract violations as the relationship ages. Hence, we hypothesize:

**H1: A distributor's length of VMI relationship with a particular manufacturer is positively related to the degree of distributor's psychological contract violation experienced with that manufacturer.**

Violation of a psychological contract is often associated with broken promises which erode the perceived benevolence and integrity of the violator. In an organizational context, Robinson (1996) demonstrated that an employee's feelings of psychological contract violation will lead to loss of trust towards his/her employer. In a buyer-seller context, Hill *et al.* (2009) investigated the link between experience of psychological contract violation and two dimensions of trust: dependability and benevolence. According to the authors, suppliers, that experience psychological contract violation in their relationship with buyers, tend to evaluate the dependability and benevolence of those buyers negatively; therefore eroding the perceived trustworthiness of the buyers. Similarly, in a VMI context, we also expect that feelings of psychological contract violation will lead to loss of trust. Therefore, we hypothesize:

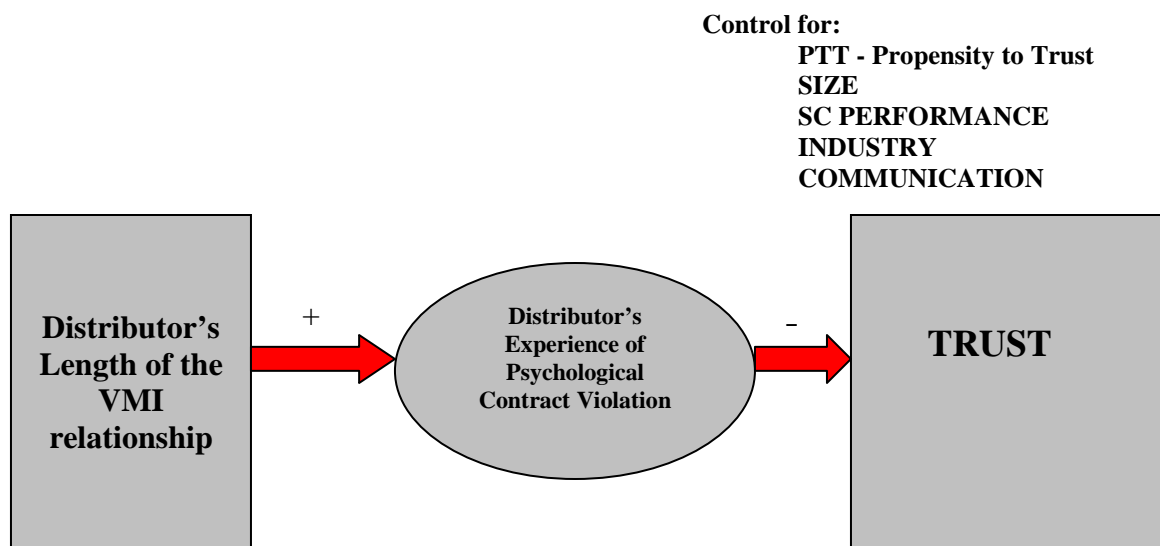
**H2: A distributor's experience of psychological contract violation with a manufacturer is negatively related to the level of distributor's trust in that manufacturer.**

Erosion of trust in a buyer-seller relationship does not necessarily happen instantly. Distributors, observing that the manufacturer does not fulfill obligations, may (i) forgive the manufacturer by acknowledging its own limited effort in the relationship, (ii) forgive the manufacturer by considering the hostile environmental factors that could have prevented the manufacturer from fulfilling an obligation, or (iii) give signals of frustration, anger and disappointment to the manufacturer (Elangovan *et al.*, 2007). If the manufacturer does not address the distributor's perception of psychological contract violation, then the distributor adjusts the level of trust put into that manufacturer downwards. We believe that length of a relationship has no direct effect on perceived trustworthiness of a supply chain partner and expect that psychological contract violation is the mechanism linking both. Therefore, we hypothesize:

**H3: The relationship between length of a VMI relationship and trust is mediated by psychological contract violation.**

Figure-2 plots our research model.

**Figure-2: The research model for Essay-1**





## **2.5 RESEARCH METHODOLOGY**

### **2.5.1. Research Design**

In this study, we use a commercial online survey tool – SurveyMonkey, to collect cross-sectional data from distributors which are having their inventories managed partially/fully by manufacturers through a VMI arrangement. The unit of analysis was the firm and key informants are executives/senior managers overseeing the VMI relationship with manufacturers. Similar to Dyer & Chu (2003) who treated vulnerable suppliers in the auto industry as trustors and the powerful auto manufacturers as trustees, I consider distributors as trustors and manufacturers as trustees due to the fact that by accepting VMI, the distributors are made vulnerable to the actions of the manufacturer. Each key informant is associated with a different distributor. The questionnaire was designed to tap into each distributor's relationship parameters with its largest manufacturer with which the distributor has a VMI agreement.

The sampling frame consists of distributors who have their inventories managed by manufacturers. In this VMI arrangement, the communication infrastructure is established through the Electronic Data Interchange (EDI) technology. A third party information services provider facilitates the EDI/VMI arrangement between the distributor and the manufacturer. Despite its critical role, the information services provider does not intervene in the VMI adoption decision of the parties, but only provides its expertise to allow both parties to have a well functioning VMI arrangement. Moreover, the information services provider holds annual conferences to bring its manufacturer and distributor customers together and facilitate sharing of best practices. The distributors share item level point of sales (POS) data and inventory levels with the

manufacturers daily using the Product Activity Data document (EDI 852). The manufacturer replenishes the distributor inventories based on this set of data. The distributors are not subsidiaries of the manufacturers but they are independent entities and the distributors also own the inventories at their premises. Finally, all distributors in our sample operate in North America with 96 percent being US firms and 4 percent are Canadian.

The third party information services provider agreed to sponsor our research by sharing the contact information of all of their distributor customers (200 of them) with us. The distributors mainly came from the Electrical Supplies, Auto Parts and Supplies, Plumbing, Consumer Goods and Industrial Products sectors.

The survey was pre-tested by both researchers and industry professionals. An early draft was reviewed by three logistics and supply chain researchers for content, clarity, flow and coherence. Then, the survey was sent to two industry professionals and it was pre-tested, resulting in further improvements. Finally, in order to encourage participation, we promised to donate \$2 to the National Wildlife Federation for each completed survey.

As shown in Appendix A, our sponsor sent a pre-notification letter to its distributors before we launched the survey in order to encourage their participation. A week after the pre-notification letter, a link to the survey was emailed to each distributor. This first wave was followed by two subsequent waves separated by a week, generating a total of 57 responses. (Please see Appendices B, C and D for the invitation emails sent at each wave.) To increase the response rate, the invitation emails were always sent on Tuesdays (to avoid busy Mondays after the weekend) at 10:00 AM (after the early

morning email traffic). The first wave produced 38 responses, the second wave produced 17 responses, and third wave produced 2 responses. The questionnaire was designed primarily by using the tested measures from previous studies in the literature, but also some new measures were used as detailed in Section 2.5.3. The items measuring a single construct were grouped together in the questionnaire and each section started with a brief description of its content. The survey had a total of 32 questions (listed in Appendix E), which is well below 125 - the upper threshold suggested by Dillman (1978) to achieve a good response rate.

Finally, we did some research about different regression techniques to estimate our model, such as OLS (Ordinary Least Squares), SEM (Structural Equation Modeling) and PLS (Partial Least Squares). Nasser & Wisenbaker (2003) recommend that for any covariance based SEM, a minimum of 100 observations are required to obtain reliable fit statistics, while Marsh *et al.* (1998) suggest a minimum sample size of 200. Therefore, covariance based SEM was not a good choice in estimating our model. We also considered PLS analysis which estimates model parameters by maximizing the dependent variables' variance that could be explained by the independent variables. PLS does not make distributional assumptions about variables and is applicable to smaller sample sizes as few as 50 observations (Haenlein & Kaplan, 2004; Chin & Newstead, 1999). Barclay *et al.* (1995) recommend that a sample in PLS analysis should have a minimum size of 10 times the number of items in the most complex construct in the research model. This corresponds to a sample of 60 observations (10 x 6), as our most complex construct – TRUST is measured by 6 items.

Given the relatively high sample size requirements of SEM and PLS, we preferred OLS regression to analyze the collected survey data, like two recent similar studies by Hill *et al.* (2009) and Villena *et al.* (2011). Although network models using latent variables can more accurately be analyzed by SEM, our limited sample size makes OLS a more reliable option. However, our sample size of 57 observations is very close to the minimum of 60 as suggested by Barclay *et al.* (1995) and we will do the robustness check of our main OLS results by estimating our model on PLS as well.

### 2.5.2 Profile of the distributors and key informants

Following the recommendation of Kumar *et al.* (1993), we requested our sponsor (third party information services provider) to identify a senior manager / executive for each distributor as our key informant, who is in charge of overseeing the day-to-day VMI relationship with the manufacturer. The profiles of the key informants to our survey are illustrated in Table-2. Forty percent of the respondents held positions at the director or higher levels such as Director of Purchasing, Vice President of Operations, and Director of Supply Chain Management. Forty-three percent occupied managerial roles such as Procurement Manager, Alliance Manager and IT Manager. Remaining 17 percent of the respondents were comprised of specialists such as IT Analysts and EDI Administrators.

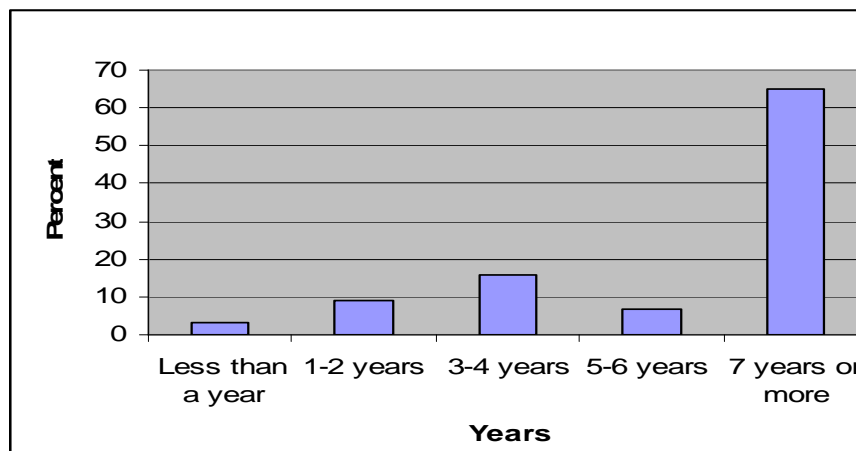
**Table-2: Profile of key informants**

<b>Position held in the distributor firm</b>	<b>Percent</b>
Director / CEO / President / Vice President	40 %
Manager / Department Head	43 %
Analyst / Specialist	17 %

We also asked our key informants the length of their personal involvement in their firm's relationship with the VMI manufacturer and found out that the key

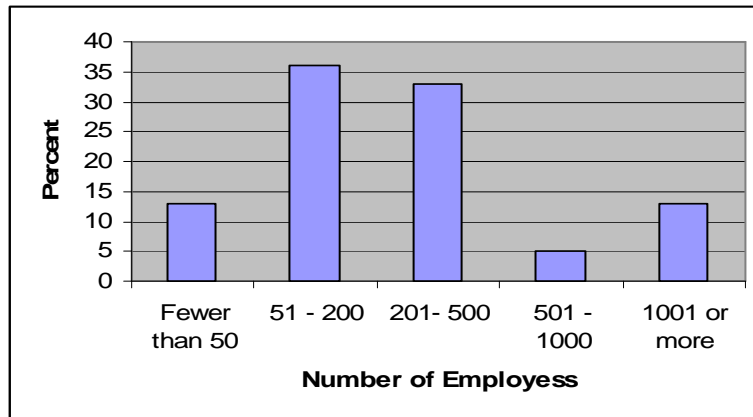
informants who completed our survey are very familiar with the particular VMI relationship we ask them to respond. As shown in Figure-3, 65 percent of our key informants have been personally involved for 7 years or more with the manufacturer, 7 percent have been personally involved for 5-6 years, 16 percent have been personally involved for 3-4 years and 9 percent have been personally involved for 1-2 years. Only 3 percent of our respondents reported that they have been involved with the manufacturer for less than a year. Thus, based on the profiles of our key-respondents and the length of their involvement with the manufacturers, we are confident that our key-respondents are competent and knowledgeable to complete our survey.

**Figure-3: Key informant’s personal involvement in the VMI relationship**



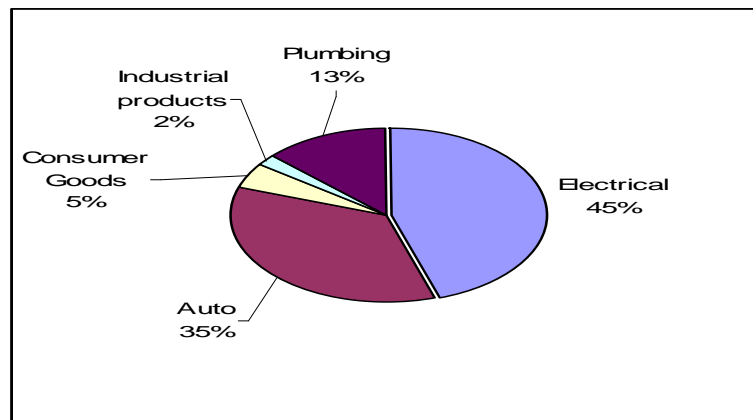
Finally, we provide some information about the profiles of distributors in our sample. Figure-4 shows that majority of the distributors that participated in our study are small to medium sized enterprises. Seventy percent of these distributors have between 50 and 500 employees and 13 percent of our responses came from relatively larger firms employing more than 1,000 employees.

**Figure-4: Distributors' number of employees**



Regarding the industry sectors, we see that 45 percent of the distributors in our sample come from the Electrical Supplies industry, while 35 percent are in the Auto Parts and Supplies industry. Consumer Goods, Plumbing and Industrial Products industry sectors are also represented in our sample as illustrated in Figure-5.

**Figure-5: Distributors industry sector**



### 2.5.3 Measurement of variables

Most of the measures were adapted from the extant trust and supply chain literatures. In order to increase clarity, minor adjustments were made in a few items based on feedback from industry professionals. We preferred to use five-point Likert scale (0: Strongly disagree; 4: Strongly agree).

Our dependent variable Trust intends to capture a distributor's trust in its largest VMI manufacturer by using 6 items. Benevolence, integrity, ability and fairness dimensions of the trust concept were represented by separate items. Two items measuring the perceived benevolence of the manufacturer were adapted from Dyer & Chu (2000) and Doney & Cannon (1997) papers. Perceived integrity of the manufacturer was measured by an item adapted from Zaheer *et al.* (1998) paper. Distributor's perceived fairness of the VMI manufacturer was measured by an item adapted from Dyer & Chu (2000). As ability could be context specific, we developed an item to measure the perceived ability of the manufacturer in a VMI context. Finally, to perform a reliability check on the Trust construct as suggested by Dyer & Chu (2000), we added the following item, "This supplier has a reputation for trustworthiness in the business world."

The independent variable in our model is Length of VMI Relationship which is measured by a direct item in the questionnaire, "How long has your firm been using VMI with this supplier? (Round to the nearest year)" Five choices include "Less than a year", "1-2 years", "3-4 years", "5-6 years" and "7 years or more".

The mediating variable in our model is Psychological Contract Violation (PCV). This variable intends to capture the degree of psychological contract violation experienced by a distributor in its VMI relationship with the manufacturer. Four out of the five items used to measure the PCV variable were adapted from the work of Hill *et al.* (2009) while one item was developed by us.

We have included five very important control variables to make sure that our results are reliable. Propensity-to-Trust (PTT) variable was added as a control variable for two reasons; (i) to make sure that the key informant's inherent trust propensity does

not confound our results (ii) to control for any potential common method bias created by the key informant's affective states. Two items of the PTT construct were adapted from Mayer *et al.* (1995) and one item was self developed. Size of the distributor was added to the model to control for unobservable distributor heterogeneity. Measuring the Size variable, two self developed items probed the number of employees and total revenue of the distributor in year 2010. As performance is a significant predictor of trust, supply chain performance variable was included in our model as a control variable. Three self-developed items probed (i) the reduction in inventory levels, (ii) increase in inventory turnover and, (iii) reduction in safety stocks due to VMI use. Communication is a single item variable and it was self developed to capture the change in distributor's communication with the manufacturer after adoption of VMI. Finally, the distributor's industry was included to control for unobservable industry effects.

#### **2.5.4 Summary statistics**

We provide the descriptive statistics of the key variables in Table-3. The Trust construct has a mean score of 3.07. Considering that the item scores range from lowest trust: 0 to highest trust: 4, on a 5 point Likert scale, we can say that the average trust among distributors is quite high. Similarly the Psychological Contract Violation (PCV) construct has a mean of 0.69 showing that perceived psychological contract violation among distributors is low, but the standard deviation of 0.60 indicates that there is a significant amount of variation in PCV among distributors. The Propensity to Trust (PTT) variable has a mean of 2.16 which means the key informant's inherent disposition to trust is moderate. In other words, our key informants neither extend blind unconditional trust to the external business world nor suspect every action of their



partners. The Performance variable has a mean of 2.62 out of 4.00 which points to above average performance improvement after adoption of VMI. Finally, the two industry dummies show that 45 percent of the respondent distributors came from the electrical supplies industry while 35 percent came from the automotive parts and supplies industry, and the remaining 20 percent make up the base category (Consumer Goods, Plumbing, Industrial Products and Utility) for these two dummies.

**Table-3: Descriptive statistics**

<b>Latent Variable: Linear combination of the items</b>	<b>Mean</b>	<b>SD</b>
TRUST	3.07	0.49
PCV	0.69	0.60
PTT	2.16	0.54
PERFORMANCE	2.62	0.71
Industry Auto	0.35	0.48
Industry Electrical	0.45	0.50

## **2.6 VALIDITY AND RELIABILITY CHECKS**

### **2.6.1 Non-response bias test**

Out of the 200 respondents we contacted, 5 respondents had previously opted out of any survey invitation from the online survey tool - SurveyMonkey, therefore our invitation email was not sent by SurveyMonkey to these distributors. Four respondents mentioned that their firms did not use VMI. Twenty-nine email addresses had problems resulting in our e-mails bouncing back. We did manage to reach 162 distributors, and 57 of them completed the survey resulting in a response rate of 35.19 percent. Although the high response rate could alleviate some concerns, we still tested for non-response bias using two different methods as suggested by Lambert & Harrington (1990).

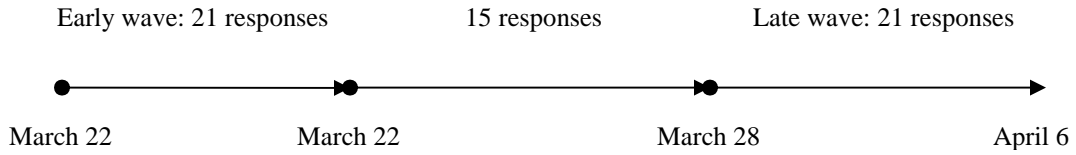
First, we compared the non-respondents and respondents across two demographics: distributor’s industry and key informant’s gender. As we had the names of the key informants as well as distributor web addresses, we managed to collect the gender and industry information. As illustrated in Table-4, among respondents, 82 percent of the key informants were male, while among non-respondents, 83 percent of key informants were male. Comparing the industries that the distributors operated in, we see that electrical supplies, plumbing and consumer goods industries were represented very closely among both respondents and non-respondents. Although, the automotive industry had a slightly smaller representation among non-respondents (29 to 35 percent), overall we see that our set of respondents is very close to the group of non-respondents in terms of key informant gender and industry.

**Table-4: Non-response bias test using demographics**

<b>Variable</b>	<b>Percent among</b>	
	<b>respondents</b>	<b>non-respondents</b>
Gender of the key informant: Male	82 %	83 %
Industry – Electrical supplies	45 %	43 %
Industry Automotive	35 %	29 %
Industry Plumbing	13 %	10 %
Industry Consumer Goods	5 %	4 %

Our second non-response bias test compared early and late waves of the completed questionnaires based on the suggestion of Armstrong & Overton (1977) that late responses proxy for non-respondents. Twenty-one distributors completed the survey on the day it was emailed out and this set was tagged the “*early wave*”. An additional set of 21 distributors, at the bottom of our respondents as sorted by date of response, were tagged the “*late wave*” as illustrated in Figure-6.

**Figure-6: Depiction of early vs. late respondents**



We compared the early and late waves across three variables: distributor’s trust in the manufacturer, distributor’s length of the VMI relationship with the manufacturer and distributor’s number of employees. Our t-test, as summarized in Table-5, failed to find any statistically significant difference between early and late respondents, thus lending support to the absence of non-response bias in our survey.

**Table-5: Non-response bias test results using early vs. late respondents**

Variable	t-value
Trust	-0.44
Length VMI	-0.69
No. of Employees	0.66

### 2.6.2 Common Method Bias Tests

Common method bias is a potential problem in behavioral sciences when the same person provides the items measuring the dependent and independent variables (Bogozzi *et al.*, 1991). In our study, only one person from each distributor firm completed the entire survey, therefore we took the common method bias issue seriously both during the design of survey and throughout the statistical analysis.

In designing the survey, we included the propensity-to-trust (PTT) variable in the models to control for method biases. Podsakoff *et al.* (2003) discuss the partial correlation procedure as a way to control for the impact of method variance and suggest that the main idea of this procedure is to “use a measure of the assumed source of the

method variance as a covariate in the statistical analysis.” The authors further cite two factors, both related to the individual differences of key informants, as causes of the common method variance (i) key informants’ affective states and, (ii) their tendency to respond in a socially desirable manner. Watson & Clark (1984) view affectivity as the “mood dispositional dimension” of an individual. In the same line, we have measured the dispositional trust attitude of our key informants through the propensity-to-trust (PTT) variable and included it in our models, to control for the common method variance caused by affective states.

Another procedural remedy we took in design of the survey against common method bias is to include reverse-coded items. Hinkin (1995) suggests that use of negatively worded items can partially alleviate the negative effects of response pattern biases. In order to prevent the survey completion from turning into a monotonic task and encourage a more controlled attitude, we have utilized reverse-coded items in the survey. For example, Trust, PCV and PTT constructs included at least one reverse-coded item for this purpose.

In addition to the precautions in the survey design phase, we also examined the common method bias during the statistical analysis phase as well. Using Herman’s single-factor test, we conducted an exploratory factor analysis by using all items in our study (Aulakh & Gencturk, 2000) and analyzed the unrotated factor solution to identify the distinct factors that could explain the majority of the variance in the variables. We found that four different factors emerged with eigenvalues greater than one and these four factors together accounted for 78.11 percent of the variance. Neither a single factor emerged from the exploratory factor analysis, nor a single variable accounted for

majority of the covariance among items, thus we can conclude that common method variance is not a significant issue for our study (Podsakoff & Organ, 1986).

### 2.6.3 Discriminant Validity

Next we provide the inter-factor correlations for analyzing discriminant validity in Table-6. All inter-factor correlations are below the 0.85 threshold (Brown, 2006); therefore we can confirm that the constructs are distinct from one another.

**Table-6: Discriminant validity**

	<b>Trust</b>	<b>Length_VMI</b>	<b>Performance</b>	<b>PCV</b>	<b>PTT</b>	<b>Size</b>
<b>Trust</b>	1					
<b>Length_VMI</b>	0.19	1				
<b>Performance</b>	0.23	0.17	1			
<b>PCV</b>	-0.63	0.30	-0.36	1		
<b>PTT</b>	0.46	-0.04	0.06	-0.31	1	
<b>Size</b>	0.30	0.19	0.43	-0.25	0.25	1

### 2.6.4 Confirmatory Factor Analysis

Finally, we conducted Confirmatory Factor Analysis (CFA) to check the internal consistency of the factors. Although model fit statistics are very sensitive to sample size (Gerbing & Anderson, 1985) and given our small sample of 57 observations, we see that our model reasonably fits the survey data: Chi-Square = 232.12, d.f. = 142, P = 0.01, CFI = 0.90, RMSEA = 0.10. (Bagozzi & Yi, 1988; Hu & Bentler, 1999) In addition, as shown in Table-7, all item loadings onto the respective constructs are highly significant and they are above the 0.6 threshold (Nunnally, 1978), except for the second item of the Trust construct that had a 0.59 coefficient. As this particular item was previously tested in the seminal work of Dyer & Chu (2003), we decided to keep it although it loaded slightly below 0.6 in the model.

**Table-7: Item loadings on the factors**

Responses are on a 5 point Likert Scale: 0 = Strongly disagree, 2= Not sure, 4 = Strongly agree	Standardized loading	Standard error	t-Value
<b>TRUST</b>			
We receive fair treatment from this supplier.	0.79	0.05	15.94
If given a chance, this supplier could take unfair advantage in our business relationship. (R)	-0.59	0.09	6.11
When making important decisions, this supplier considers our firm's welfare as well as its own.	0.69	0.09	6.97
Based on past experience, we can rely on this supplier to keep promises made to our firm.	0.87	0.03	26.07
This supplier is competent and capable of providing us with required products according to our specifications in a timely fashion.	0.61	0.14	4.50
This supplier has a reputation for trustworthiness in the business world.	0.80	0.05	16.23
<b>PERFORMANCE</b>			
Use of VMI has improved our fill rate to our customers	0.87	0.05	17.67
Use of VMI has allowed us to reduce our inventory related costs	0.91	0.03	34.64
Use of VMI has increased our inventory turnover	0.91	0.03	32.67
<b>PCV:</b>			
When I think about what our firm contributed to the relationship with this supplier and what we received in return, I feel			
pleased (R)	-0.89	0.03	35.43
angry	0.88	0.05	18.77
frustrated	0.92	0.01	99.81
satisfied (R)	-0.80	0.04	20.59
cheated	0.79	0.03	26.91
<b>PROPENSITY TO TRUST (PTT)</b>			
Most business partners can be counted on to do what they say they will do.	0.62	0.16	3.79
These days, our business should be alert; otherwise some other firms are likely to take advantage of us. (R)	-0.66	0.16	3.99
In dealing with our suppliers and customers, each and every aspect of the relationship should be written in a contract to prevent opportunistic behavior. (R)	-0.68	0.15	4.64

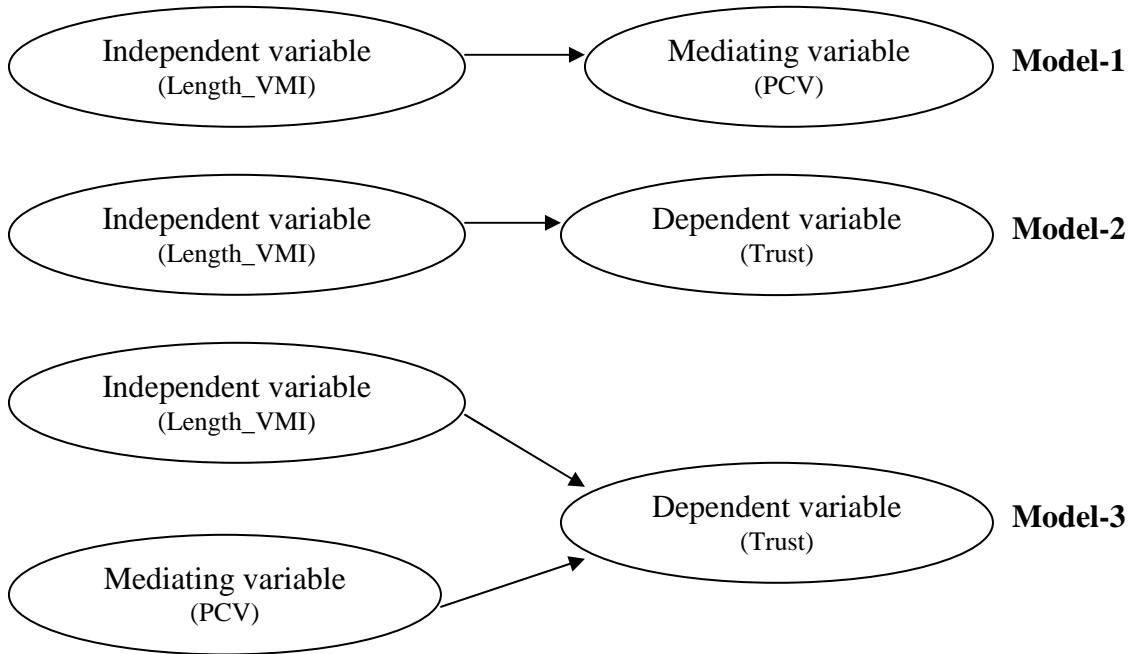
\* Items marked (R) are reverse coded

## 2.7 ANALYSIS AND RESULTS

As we hypothesized that PCV variable mediates the relationship between Length of VMI Relationship and Trust, we used Baron & Kenny's (1986) three step approach to test for mediation, as depicted in Figure-7. In Model-1, the mediating variable - PCV is regressed on the independent variable – Length of VMI Relationship. In Model-2, the dependent variable -Trust is regressed on the independent variable. Finally in Model-3,

Trust is regressed on both the independent variable - Length of VMI Relationship and the mediating variable - PCV.

**Figure-7: Baron & Kenny's (1985) three step mediation model**



Looking at the results in Table-8, we see that, in Model-1, the independent variable - Length of VMI Relationship is significant and positively correlated with PCV, providing support to our Hypothesis-1. In Model-2, Length of VMI Relationship has a negative and significant coefficient demonstrating that longer VMI relationships are associated with lower levels of distributor trust. However, when we add PCV as an independent variable (Model-3), we see that the Length of VMI Relationship turns insignificant. The PCV variable is negative and significant in Model-3 indicating that higher levels of PCV are related to lower levels of Trust extending support to Hypothesis-2. In addition, the explanatory power -  $R^2$  increases from 40.24 percent to 54.24 percent when we add the PCV to Model-2. Therefore, we can say that the PCV variable fully

mediates the relationship between Length of VMI Relationship and Trust, hence providing support to our third hypothesis.

**Table-8: OLS Results**

	Dependent Variable		
	Psychological Contract Violation (Model-1)	TRUST (Model-2)	TRUST (Model-3)
Length of VMI Relationship	0.46***	-0.42**	-0.19
Size of the distributor	0.02	0.52*	0.45
Supply chain performance	-0.41*	0.06	-0.11
Communication	-0.80*	1.23**	0.79*
Propensity to Trust	-0.47*	0.51**	0.39*
Industry Auto	1.16	1.72	1.65
Industry Electrical	0.90	-0.16	0.11
Psychological Contract Violation		-	-0.46***
R <sup>2</sup>	40.18 %	40.24 %	54.24 %
Adjusted R <sup>2</sup>	29.45 %	30.27 %	44.61 %

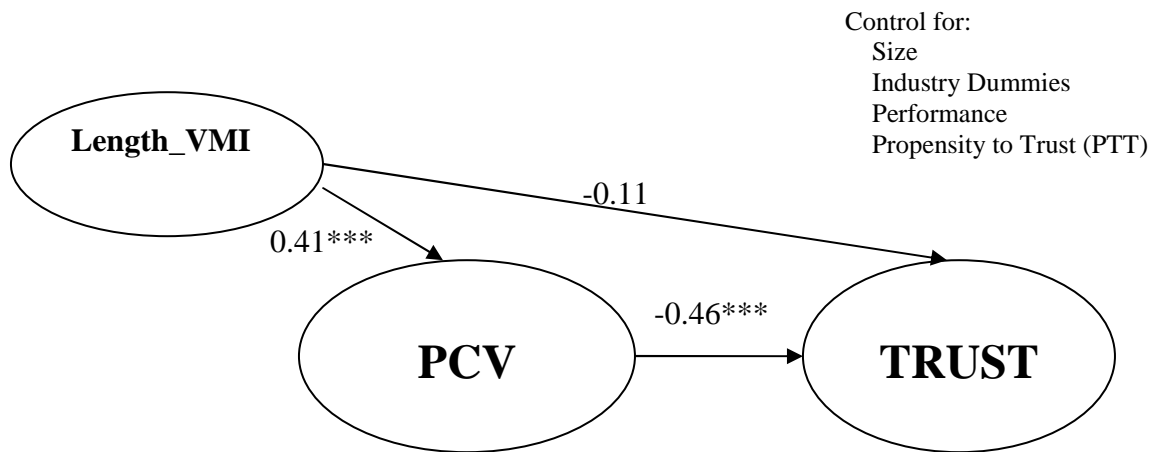
**Significance levels:** \* p < 10 %, \*\* p < 5 %, \*\*\* p < 1 %

Taking a look at the control variables, we see in Model-1 that higher propensity-to-trust (PTT), higher supply chain performance and better communication leads to lower levels of PCV, and that the industry dummies have no effect on PCV. In Model-2, Propensity to Trust (PTT) has a positive and significant association with Trust which could be expected. Size of Distributor is also positively related to trust which may be related to low power asymmetry in the distributor-manufacturer relationship when the distributor is larger. Finally, while Communication is significant in all three models, its coefficient is smaller in magnitude in Model-3 (1.23 vs. 0.79). Again, referring the Baron and Kenny (1986) paper, we can conclude that PCV *partially* mediates the effect of Communication on Trust.



Given the network model of our research, we conducted a partial least squares (PLS) analysis by using the Smart PLS software (Ringle, Wende & Will, 2005), to test the robustness of our previous OLS findings. The PLS results in Figure-8 demonstrate that Length\_VMI variable is positively associated with the PCV variable, which in turn, is negatively associated with TRUST. The coefficient of the direct path from Length\_VMI to the TRUST variable is insignificant, pointing to the fully mediating role of the PCV variable. Therefore, lending additional support to our previous findings, PLS results also provide empirical evidence that length of a distributor’s VMI relationship with its manufacturer has a negative effect on distributor’s trust in the manufacturer. As hypothesized, this effect is indirect and mediated by the distributor’s experience of psychological contract violation.

**Figure-8: PLS Results**



\*\*\*  $p < 0.01$

## 2.8 DISCUSSION AND IMPLICATIONS

Our findings show that longer VMI relationships are associated with lower levels of distributor trust in the manufacturer after controlling for the effects of (i) VMI performance, (ii) distributor size, (iii) industry effects, and (iv) the key informant’s

inherent propensity to trust. Digging deeper to identify the mechanism governing this relationship, we present empirical evidence that in longer relationships, distributors experience higher levels of psychological contract violation, which in turn causes trust erosion on the distributor side.

The bad news to manufacturers using VMI to manage their distributors' inventory is that an average distributor's trust is subject to erosion over time after adopting VMI. However, the good news is that distributors give indications of their disappointment and frustration that leads to trust erosion. As trust erosion is caused mainly by the distributors' experience of psychological contract violation, which comes with feelings of anger, resentment, injustice and even betrayal on the distributor side, manufacturers that meet regularly with the distributors at multilateral levels could see these signals of frustration and act to prevent the relationship from sinking into a deeper crisis. Elangovan *et al.* (2007) suggest that "post-violation analysis" could reduce the extent of the damage, therefore listening to the distributor and jointly bridging the gaps in understanding the reciprocal obligations could help. In addition, Elangovan *et al.* (2007) show that the extent of trust erosion is higher if the distributor believes that manufacturer is not willing to perform duties (rather than believing that the manufacturer is willing but not able to perform). Manufacturers should clarify the reasons if they cannot meet the expectations of the distributors and underline the external disturbances preventing them from fulfilling their duties, if possible.

Contacting some industry professionals, we observed that most VMI relationships are not governed by formal contracts, but by verbal and informal agreements. This creates plenty of room for psychological contracts to rule the relationship. Coupled with

the idiosyncratic attributes of VMI relationships, such as loss of distributor competencies and flexibility, increased distributor dependence, and unequal sharing of costs; we believe that our findings have significant relevance to VMI users. To the best of our knowledge, this is the first paper to investigate the evolution of inter-organizational trust erosion in VMI relationships. Moreover, we can say that our study is one of the rare efforts investigating cognitive and psychological aspects of buyer-supplier relationships.

Our finding that VMI relationships are subject to trust erosion over time, which happens mainly through violation of the psychological contract between business partners, has other implications to the VMI users. First, manufacturers should not let VMI reduce the amount of communication with their distributors. As Robinson (1996) points out, lack of communication is an important factor in generating incongruence between perceptions of the supply chain partners. Therefore, in addition to the regular meetings with distributors, industry-wide VMI conferences could also be helpful in this sense. Manufacturers should not assume that distributors only care for performance. While good supply chain performance is essential for a successful relationship, our findings show that it is not sufficient to maintain trust. Finally, we recommend that VMI partners rely more on legal contracts in governing the relationship and limit the area ruled by psychological contracts. The 3<sup>rd</sup> party VMI technology providers could be instrumental here by encouraging the VMI partners to have their agreements in written contracts rather than in verbal or informal forms.

## **CHAPTER 3: THE VALUE OF TRUST SEALS IN ONLINE**

### **RETAILING – AN EMPIRICAL ASSESSMENT**

Online trust issues have frequently been cited as the main reason why people hesitate to shop on the internet. According to the results of a US survey by Gemalto (2008), forty percent of Americans said that they would buy online more if they felt confident shopping on the internet. Although the share of e-commerce in total US retail sales has steadily increased from 0.7 percent to 3.6 percent between 2000 and 2008 (U.S. Census Bureau, 2008), e-merchants are yet to fully reap the benefits of online commerce due to the risks perceived by online shoppers. However, existing issues with online trust have led to the emergence of several mechanisms that seek to signal the quality of the products as well as merchants. For instance, third-party reviews, and reputation mechanisms, among others, seek to reduce the information asymmetry that buyers face in online markets. However, one of the most prevalent, but least studied, mechanisms is the presence of *trust seals* provided by third parties. My study is among the first to empirically examine the value of one important form of third party certification – online trust seals in a Business to Consumer (B2C) setting. In particular, I am interested in understanding the impact of trust seals on the likelihood of consumers completing their purchase with an online retailer. Using extensive data on over a quarter million shopping carts created by shoppers at 493 online retail websites, this study examines the impact of online trust seals on their completion rate. I find that while the presence of trust seals through trust transfer from a third party has a significant and positive impact on the completion rate of online purchases, the influence of trust seals on purchase outcomes is non-monotonic. In fact, I show that while increasing the number of trust seals at a

retailer's site increases the consumers' likelihood of purchase, beyond a limit, the impact is negative.

This study makes a number of important contributions to research as well as practice. First, I use a unique dataset comprising of shopping carts created by consumers in real B2C environments. Most importantly, the data originates from a randomized field experiment via a third-party certification firm conducting trials by turning the seal ON and OFF randomly to investigate the impact of the presence of its trust seal on completion of shopping carts by customers. While my research measures the impact of trust seals using real shoppers voting with real money, previous research efforts in quantifying the value of online trust seals were methodologically limited to surveys and lab experiments with student subjects and simulated purchase decisions. Second, my investigation sheds light on some important operational issues for online retailers. The findings provide insights into where and under what circumstances trust seals may be effective. Finally, I empirically show that "more is not always better" with trust seals and online retailers with just a few trust seals perform better than those with a large number of trust seals.

The rest of the chapter is structured as follows. I first provide an overview of the related research. This is followed by the development of my research hypotheses. Then I describe the data and explain the statistical methodology used to test my hypotheses. I conclude by discussing the findings, open research questions and the managerial impact of this work.

### 3.1 LITERATURE REVIEW

There is a substantial body of research on issues relating to trust spanning multiple disciplines with each providing a slightly different perspective. Rotter (1967) for instance, defines interpersonal trust from a psychologist's viewpoint, "an expectation held by individuals or groups that the word, promise, verbal or written statement of another can be relied on." Flores & Solomon (1998) argue that trust cannot be completely defined economically but it is more of an ethical concept. Other researchers (for instance see, Wang & Emurian, 2005) highlight the confusion surrounding the definition of trust, and observe that credibility, confidence, and reliability are sometimes used to replace the abstract concept of trust. More recently, researchers have begun to focus on issues of trust in online environments. Brynjolfsson & Smith (2000) for instance assert that trust is an important antecedent of e-commerce.

Usually found to be a less trustworthy environment by shoppers, online markets show some typical characteristics of Akerlof (1970)'s "lemons<sup>1</sup> market." The lack of a central control authority on the internet and low cost of entry exacerbate information asymmetry problems in online settings. While government regulation of online commerce is thought to be infeasible (Tang *et al.*, 2008), it is also feared that the lack of regulation will eventually drive out good merchants. Self-regulation through second-party feedback and third-party rating mechanisms have risen to fill the need for reliable quality and trust signaling mechanisms online.

The role of online second-party feedback mechanisms in building trust among consumers, and signaling quality of products and sellers in markets such as eBay and

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<sup>1</sup> "Lemon" is a slang term in the US for low quality - clunker cars.

Amazon, has attracted a lot of attention from researchers (for instance, see Pavlou & Gefen, 2004; Walden, 2000). I refer readers to Grabner-Kräuter & Kaluscha (2003) and Urban *et al.* (2009) for a critical review of the literature relating to online trust. While second-party feedback is usually from anonymous reviewers, third party rating mechanisms, however, are based on the notion of trust transfer. The literature on trust provides evidence that trust can be transferred from an individual to an individual (Strub & Priest, 1976) or from a location to an individual (Henslin, 1968), or from a physical to a virtual store (Stewart, 2003). More recently, a few researchers have begun to examine the role of third-party certification in online environments. For instance, Jin & Kato (2007) find that online certification attracts risk-averse customers to the market, decreases transaction costs for buyers, and helps sellers charge a premium for being certified - findings that are also supported by Baye & Morgan (2003).

As far as prior research on online trust seals, most of the existing research relies on surveys and self-reported measures or simulated lab experiments rather than field experiments as is the case in my study. In one of the earliest studies in this context, Kimery & McCord (2002) used controlled lab experiments, simulated retail web sites, and online questionnaires to examine the value of different online trust mechanisms. Based on 622 subject responses, they found that among the four manipulations (TRUSTe, BBB, and VeriSign and a privacy policy statement), only viewing TRUSTe was found to have a positive effect on consumer trust. McKnight *et al.* (2004) used a similar controlled setting, but observed that privacy seal and industry seals have no significant effect on consumer trust. Head & Hassanein (2002) developed a conceptual model for online trust and conducted a survey with 223 Canadian subjects to test the impact of online trust seals

on consumers' purchasing behavior. Contrary to their expectations, no significant relationship was observed between the presence of trust seals and consumers' purchasing behavior. In a related study, Hu *et al.* (2003) surveyed 120 undergraduate business students to investigate the impact of five different trust seals (TRUSTe, VeriSign, BizRate, BBB, AOL) on shoppers' purchasing behavior. Participating subjects were asked to imagine purchasing online from an unknown store's website four types of products: a textbook, a printer a pair of shoes and a leather sofa. The subjects were then asked to make their purchasing decision first in the absence, then in the presence of a trust-promoting seal. The researchers found empirical evidence that some seals increased the conversion rates of online shoppers and the seal's effect does not depend on product category.

Extending the behavioral studies discussed above, to a real world setting, Nikitov (2006) examines observational data from 847 consumer-electronics and computer auctions on eBay and finds a significant and positive association between the presence of three trust seals (Square Trade, Power Seller and Mask) and shoppers purchasing behavior. However, as noted by the author, these findings are difficult to generalize outside eBay, as eBay buyers, being more risk-prone and IT sophisticated, do not represent an average online shopper. Limited sample size, using eBay specific trust seals, and a focus on just two product categories further limit the generalizability of these findings. In addition, since the data are of observational nature only, it is hard to argue that, in contrast to experimental data, all external factors have been controlled for. In a more recent study, Benjamin (2009) investigated the trustworthiness of some shopping websites certified by two seal providers: TRUSTe and BBB. He found some evidence of



adverse selection where less trustworthy websites prefer to use the trust seals. While these studies provide some useful insights, the conflicting findings of earlier studies, and the dearth of findings based on real-world data, highlight the need for a large-scale field study that provides a systematic analysis of the impact of trust seals on outcomes of interest to retailers as well as customers. My study seeks to fill this gap.

This study adds to the above mentioned literature on trust and the value of online trust seals by analyzing data from a large-scale randomized field experiment conducted in conjunction with one of the major trust-seal providers. I call this seal used in the experimentation “the focal trust-seal” to distinguish it from other trust seals that could have been displayed at e-merchant web sites. This study uses actual data comprising 288,169 observations of shopping carts created by shoppers that made real purchasing decisions across 493 retailers online. My study not only examines the impact of the focal trust-seal on consumers’ purchase completion but also investigates the impact of multiple seals on purchase outcomes. In addition, I also examine the role of shopper experience, and merchant-size on the relationship between the presence of trust seals and purchase completion rates. Additionally, rather than focusing on a single category, my study differs from previous work by examining twenty five product categories, significantly increasing the generalizability of my results. To the best of my knowledge, this is the first study that uses data collected by the “seal provider” across many e-merchants. Finally, this work is novel in that it is based on data generated from randomized “A/B seal test” conducted by the focal trust-seal provider. Trust seals on certified online retailers’ web sites were turned on and off randomly by the seal provider to observe the seal’s impact on

shopper behavior, enabling me to, for the first time in the literature, infer the *causal relationship* between the presence of trust seals and purchase completion rates.

### **3.2 RESEARCH HYPOTHESES**

Although many online shoppers create carts and add merchandise into them, only a small fraction of these carts ever get completed. Some inherent characteristics of the online world, such as its impersonal nature, make it difficult for shoppers to verify merchant ID and judge product quality before purchase. Various trust inducing mechanisms have been developed to reduce the information asymmetry problem of e-commerce. As discussed earlier, studies by Bernardo *et al.* (1999) and Hu *et al.* (2003) suggest that the presence of trust seals can reduce the trust gap perceived by online shoppers, and have a positive impact on consumers' propensity to complete their purchases in an online store. However, it is important to note that other studies (for instance, see McKnight *et al.*, 2004 and Head & Hassanein, 2002) find no value of displaying trust seals at online stores. While the popularity of trust-seals among online retailers suggest that such trust-seals might be valuable, whether online trust seals have a significant and positive impact on purchase outcome remains an empirical question. Thus, weighing all evidence together, I hypothesize as follows:

***H1. Presence of the focal online trust seal at a retailer's website increases the propensity of completion of shopping carts created by online shoppers.***

Interestingly, many online retailers display more than a single trust seal, some displaying as many as eight of them as shown in the snapshot from an e-merchant web site in Figure-9.

Figure-9: A snapshot from “http://www.techforless.com”



While I hypothesize trust seals to be valuable and have a positive impact on purchase completion, the law of diminishing returns could also apply to the context of trust seals. In other words, I expect the marginal impact of each additional trust seal on the purchase completion rate to be lower. Hence I hypothesize that:

*H2. As the number of trust seals at an online store increases, the marginal impact of an additional trust seal on the completion likelihood of shopping carts diminishes.*

Differing product values are likely to justify different levels of consumer search costs. It is reasonable for a rational consumer to drive to a few shops before buying expensive furniture, but not for a gallon of standard milk if it is available at the convenience store round the corner. As is well known, shoppers are more likely to be risk-averse when it comes to higher value purchases, while ignoring the risk of low value purchases. Swan and Nolan (1985) posit that trust is essential to complete transactions that contain a high degree of risk and information asymmetry. Daignault *et al.* (2002) view trust to be based on information and they suggest that risky purchases that involve

higher prices require more information to be completed. Given that trust-seals can serve as reliable quality signals in online settings, I posit that,

***H3. The online trust seal is more effective towards completion of higher value shopping carts than lower value shopping carts.***

Most online shoppers feel more comfortable shopping at well known online retailers' web sites Gemalto (2008). Big players in the e-commerce world, such as "Amazon.com", have established reputation over years of business through millions of satisfied consumers and they have significant vested interests as well (i.e. brand, capacity investments) larger than any incentive to cheat (Ippolito 1990). Smith & Brynjolfsson (2001) also find empirically that a merchant's reputation and brand serve as proxies for the merchant's credibility. However, most small online retailers do not have well-known brand names, nor do they have large sunk investments to add credibility. In this study, I proxy the business volume of the e-merchant for its reputation and trustworthiness, and test the following hypothesis:

***H4. E-merchants with smaller business volume benefit more from the presence of the online trust seal through increased sales than larger e-merchants***

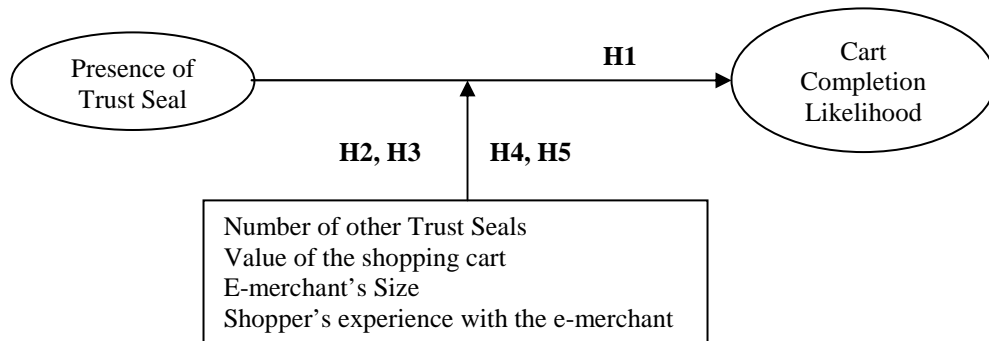
Previous shopping experience with a merchant is likely to play an important role on purchasing behavior as one would expect a satisfied customer to return for repeat purchases. As noted by Hosmer (1995), trust develops over time as a result of repeated transactions. Gefen *et al.* (2008), supporting Hosmer (1995)'s assertion, suggest that trust has a longitudinal dimension and the importance of trust diminishes over time. As business partners get more experienced with each other over time, both parties start to focus on the value of the transaction rather than initial reputation. Fazio & Zanna (1981),

who developed the theory of attitude-behavior consistency, posit that for repeat customers, satisfaction with a merchant is a more important determinant of trust building than reputation and structural assurance. Hee-Woong *et al.* (2004) also distinguish between new and repeat customers and propose that customer satisfaction is the strongest antecedent of trust building for repeat customers. Consequently, having previously purchased from an e-merchant a few times, a repeat shopper probably needs less assurances about that e-merchant for his/her next purchase. The narrowed trust gap between the e-merchant and shoppers, after repeated transactions, is likely to reduce the need for a trusted third party's involvement in the form of a trust seal. Thus I expect that:

***H5. The value of the online trust seal diminishes as shoppers purchase more frequently and become repeat customers at a retailer's website.***

Integrating the five hypotheses discussed above, Figure-10 illustrates my model.

**Figure-10: Theoretical framework of Essay-2**



## **3.3 DATA AND MEASURES**

### **3.3.1 Data**

The dataset was obtained from a well-known trust-seal provider. It contains over a quarter million shopping carts, all created in the period January 1, 2007 through October 18, 2007, by online shoppers at the 493 e-merchant websites all served by the focal provider's trust seal.

The process of certification starts by online retailers applying to the seal provider to be certified. The seal provider vets the applicants by verifying the credentials and places a piece of HTML code at the approved retailers' web sites. The code serves three purposes: to display the seal of trust, to provide some services required such as security encryption or purchase bonding demanded by the shopper and to transfer the transaction details at the merchant's website into the seal provider's own database, out of which the dataset was extracted. Each observation in this dataset contains a rich set of data about the shopping cart, such as the status of the cart (abandoned or completed), the value of the cart (in US dollars), merchant ID, shopper ID, seal status (ON or OFF), cart start date, cart end date, type of experiment (seal test or other tests), and product category, in addition to other variables.

A key aspect of this dataset that enhances its empirical value is the presence of random seal tests. The seal provider, in agreement with the e-merchants, conducts "A/B Test" during specified periods to measure the impact of the focal trust seal on key site metrics. In this test, the participating e-merchants allow the seal provider to display the seal with 50 percent of the visitors to their web sites – so called A's, while not displaying the seal with the other 50 percent – called B's. The visitors were selected randomly to be

either an A or B, ensuring that it is only the presence of the seal that varies systematically between the two sets of visitors. Thus, these “A/B tests” allow me to establish causality and identify the impact of the presence of the trust seal on shoppers’ completion likelihood.

The unit of analysis is an online shopping cart in a retailer’s website which either displayed the seal or not. The data was collected by the seal provider from 493 different e-merchant web sites in the January 2007 – October 2007 period. The dataset required some cleaning to remove inconsistencies inherent in many archival datasets. For example, carts with blank values were deleted. Having sorted cart values, I observed the highest value among completed carts was \$76,241. Hence I treat \$100K as a threshold, and classified the carts with values over \$100K as outliers and deleted them from the dataset as well. The final data set comprised of 288,169 observations.

Table-9 provides some descriptive statistics about the seal tests. It can be observed that the records pertaining to “seal ON” are not significantly different from “seal OFF” thus providing evidence that shopping carts in both categories are distributed very similarly, except for the status of the seal. For example, the seal was displayed with 49.5 percent of the carts which points to the success of the “A/B seal test” to be discussed in the methodology section. The average cart value was \$257 with the Seal ON while it was \$255 when the seal was turned OFF. Similarly, comparing the two subsets, no significant difference is seen in terms of total number of other displayed seals and the percent share of each category. Thus, I can conclude that the distribution of carts is very similar except for the status of the seal, which provides evidence that the experiment

successfully eliminates external factors and thus allows us to infer about the causality of a cart's completion probability.

**Table-9: Descriptive summary statistics of the dataset**

	<b>SEAL ON</b>	<b>SEAL OFF</b>
<b>Number of carts</b>	142,497	145,672
<b>Percent of total</b>	49.5 %	50.5 %
<b>Number of all carts completed</b>	35,704	33,940
<b>% of all carts completed</b>	25.1 %	23.3 %
<b>Mean cart value, SD</b>	\$257, \$1,134	\$255, \$1,203
<b>Total number of other seals (mean, SD)</b>	0.43, 0.81	0.45, 0.82
<b>% of all carts in Furniture category</b>	16.1 %	15.3 %
<b>% of all carts in Books category</b>	7.5 %	7.5 %

The shopping carts in the dataset include a variety of product categories. The seal provider categorized the products offered by the e-merchants into 25 different categories. The top 5 categories, their average cart values, and completion rates are shown in Table-10. Surprisingly, furniture and sporting goods were the most frequently shopped categories, while books, comprising a low-risk and low price category, had the highest completion rate among all categories as expected.

**Table-10: Top five product categories according to the count of carts in the dataset**

<b>Category</b>	<b>Average cart value</b>	<b>Percent of completed carts in this category</b>
<b>Sporting goods</b>	\$309	20.8
<b>Furniture</b>	\$436	36.8
<b>Movies</b>	\$81	29.3
<b>Books</b>	\$85	40.0
<b>Toys</b>	\$106	26.5

### 3.3.2 Measures

The descriptive statistics of the five different variables used in the comprehensive model are provided below in Table-11.



**Table-11: Descriptive statistics of the measures**

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
<b>Completed</b>	0.24		0	1
<b>Seal_ON</b>	0.49		0	1
<b>Merchant volume</b>	\$1.48 million	\$1.73 million	0	\$4.21 million
<b>Cart value</b>	\$256	\$1,169	\$0.1	\$93K
<b>Number of other seals</b>	0.45	0.82	0	4

The dependent variable “Completed” is binary and takes the value of “1” if the cart is completed, “0” otherwise. My dataset is comprised of shopping carts and provides no information regarding the behavior of shoppers who left before creating a cart. Therefore, “Completion rate” is the percentage of the checked-out (paid and purchased) carts among all created carts. The average completion rate of all carts in the dataset is 24 percent.

The independent variable “Seal\_ON” is binary and takes the value of “1” when the seal is displayed and “0” otherwise. As the dataset consists of the carts that went through the seal experiment, roughly half of the carts had the seal ON while the other half did not observe the seal for experimental purposes.

“Cart Value” is the final dollar value of the cart when the shopper checked out, or abandoned the cart. The cart value has a sample mean of \$256 and ranges from \$0.1 to \$93,000.

“Merchant Volume” variable is a measure of e-merchant size. It was computed by summing up the dollar value of all completed carts for each e-merchant in the dataset. Average merchant volume turned out to be \$1.48 million with a SD of \$1.73 million and range of \$0 up to \$ 4.21 million (A few online stores had opened carts but none completed). Most of the online retailers in the dataset are small to medium sized

merchants that do not have established brand names as well as any brick and mortar sales presence.

In addition to the seal, the seal provider also kept track of the presence of 14 other trust seals in the retailers' web sites. It is observed that 69 percent of the e-merchants displayed no other trust seal, 22 percent displayed one other seal, 6 percent displayed two other seals, and 3 percent displayed three or more other seals. Excluding the seal provider's own seal, on average 0.45 other trust seals were displayed by the merchants, statistically ranging between 0 and 4. A total of 15 trust seals (including the focal seal) were considered in my analysis which includes the following: BBB, BizRate, Geotrust, Google-Checkout, NexTag, PayPal, VeriSign, buySAFE, Truste, PriceRunner, Comodo, ControlScan, RapidSSL, ScanAlert and Thawte. Treating each of the other seals equally, I have counted the number of other seals in each retailer's web site and called this "Total Number of Other Seals". To test for the diminishing marginal returns of additional seals, I have log-transformed this variable in the regression model.

I use a limited version (137,162 observations) of the comprehensive dataset to test my hypothesis relating to shopper experience because clustering a shopper's multiple carts into a shopping experience variable requires a unique identifier of that shopper. I used the e-mail addresses of shoppers for this purpose and not all shoppers progressed far enough in the shopping process to enter their email addresses. This filtering process resulted in a subset of shoppers who were closer to completion than those in the comprehensive dataset. Hence, it is observed that the percentage of completed carts in the limited model is 68 percent, much higher than the equivalent 24 percent of comprehensive dataset, as presented in Table-12. The seal was "ON" for slightly over 50

percent of carts as expected. Next I take a closer look at the key variable, “Shopper Experience”.

**Table-12: Some descriptive statistics for the experience dataset**

Variable	Mean	SD	Min	Max
<b>Completed</b>	0.68	0.47	0	1
<b>Seal_ON</b>	0.52	0.50	0	1
<b>Shopper Experience per Merchant</b>	2.12	17.98	0	343

“*Shopper Experience*” variable indicates the number of repeat purchases (excluding the first visit) that a shopper made at an e-merchant’s website. It is interesting to see that shoppers in the dataset were usually loyal customers of a single store rather than shopping across the 490 different e-merchants. Shopper experience per merchant and total shopper experience across all merchants are almost identical with almost a perfect correlation of 0.99. An average shopper in the dataset made 2.12 repeat purchases and the most experienced shopper completed 343 carts at a single e-merchant’s website.

### **3.4 RESEARCH METHODOLOGY**

Since the dependent variable “*Completed*” is binary, I use a logistic regression model. (Agresti, 2002). Using the comprehensive dataset, I estimate the following model.

$$\text{LOG}(\text{PI} \{I1\} / \text{PI} \{I0\}) = \beta_0 + \beta_1\text{Seal\_ON} + \beta_2\text{Cart Value} + \beta_3\text{Seal\_ON*Cart Value} + \beta_4\text{Merchant Size} + \beta_5\text{Seal\_ON* Merchant Size} + \beta_6\text{log(Total Number of Other Seals)} + \text{Categorical dummies} + \varepsilon$$

where PI {I1} is the probability that cart number I is completed and PI {I0} is the probability that cart number I is not completed.

In order to gather the data about a shopper’s repeat purchases at each e-merchant, I used the email addresses provided by shoppers as a unique ID. However, not all shoppers provided this information and I had to drop the carts without an email address.

Therefore, I estimate the following model using the limited dataset to test my shopper experience hypotheses.

$$\text{LOG}(\text{PI}\{I1\} / \text{PI}\{I0\}) = \beta_0 + \beta_1\text{Seal\_ON} + \beta_2\text{Shopper Experience} + \beta_3\text{Seal\_ON*Shopper Experience} + \text{Categorical dummies} + \varepsilon$$

The distributions of “Merchant size” and “Cart value” variables are highly skewed right. In order to address this non-linearity, I have tried two transformations on these two variables: logging or normalizing them. Normalization of a variable includes subtracting its mean (centering) and then dividing by its standard deviation (scaling). Finding that normalizing the cart value and merchant size variables provides a better fit, I have transformed these two variables into standard normal distribution. Thus, a unit increase in the normalized “Merchant size” variable refers to a one SD increase in actual merchant size.

As logistic regression is not subject to many of the Ordinary Least Squares (OLS) assumptions, such as normal distribution of the error terms, normal distribution of the dependent variables and homo-scedasticity, I have only tested for a possible “over-dispersion” of the model’s variance and could not find any evidence of over-dispersion in my model.

My primary purpose in this paper is to investigate the effect of online trust seals on likelihood of completion of shopping cart by a consumer, and to study some operational factors that could help online retailers better manage the display of trust seals on their websites. I first examine the relationship between the independent variable “*Seal\_ON*” and cart completion variable “*Completed*”. The independent variables include *Seal\_ON*, *Cart Value*, *Merchant Size*, *Number of Other Trust Seals* and *Shopper*

Experience. I also added interaction terms to investigate the possible moderating effects of the seal on other independent variables. Finally, I add control variables (product categories) for a more comprehensive model.

### 3.5 RESULTS

I have statistical support for three out of the five hypotheses. While acknowledging that large sample size could actually inflate t-statistics, the model fit statistics (log-likelihood, pseudo R-squared, AIC and BIC) in Table-14a show evidence that my model provides a reasonable fit to the data. In fact, several comparison models (see Appendix G) suggest that the model fit cannot be improved much further. Finally, the correlation matrix, provided in Table-13, show no indication of collinearity among independent variables.

**Table-13: Correlation matrix for the comprehensive model**

	<b>Seal_ON</b>	<b>Cart Value</b>	<b>Merchant Vol.</b>	<b>Total Number of Seals</b>
<b>Seal_ON</b>	1			
<b>Cart Value</b>	0.001	1		
<b>Merchant Volume</b>	-0.041	0.097	1	
<b>Total Number of Seals</b>	-0.016	-0.062	-0.376	1

Looking at the results in Table-14a, it is observed that all coefficients in my comprehensive model are highly significant, except two: “Total Number of Other Seals” variable and the interaction term “Seal\_ON x Cart Value”. Next, I test the hypotheses.

**Table-14a: Regression analysis results for the comprehensive model**

<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:</b> -153,810; <b>AIC</b> =307,642; <b>BIC</b> =307,758; <b>Pseudo R2:</b> 0.0348		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-1.380***	-164.99
<b>Seal_ON</b>	0.144***	15.72
<b>Cart Value</b>	-0.436***	-20.01
<b>Seal_ON x Cart Value</b>	0.019	0.63
<b>Merchant Volume</b>	0.267***	36.56
<b>Seal_ON x Merchant Volume</b>	-0.160***	-17.43
<b>Log (Total Number of Other Seals)</b>	-0.013	-0.96
<b>Categorical dummies</b>		
*** p < 0.001		

Table-14a shows that that the coefficient of the variable “*Seal\_ON*” equals 0.144 and is highly significant. Assuming all other independent variables at their means, this positive coefficient indicates that presence of the trust seal at an e-merchant’s web site increases the odds of cart completion at that web site by 15.49 percent ( $e^{0.144}$ ), hence lending support to Hypothesis-1. Thus, I can say that fewer carts are abandoned in the presence of the trust seal.

Next, I examine the effect of each additional trust seal on cart completion likelihood. Surprisingly, the log-transformed “Total Number of Other Seals” variable is negative and insignificant, which indicates that additional trust seals do not increase the shopper trust and conversion rates. Thus, it seems that there is no statistical support for the second hypothesis. However, this rather surprising result led me to investigate alternative functional relationships between the number of seals and conversion. Recall that the log transformation postulates a relationship of diminishing returns which, a priori, seemed rather reasonable. However, the results show that diminishing returns appear to not hold in the context of online trust seals. An alternative (and somewhat

related) hypothesis is that the number of seals has a positive impact on conversion, at least up to a certain point, and that after that point the inclusion of additional seals will lead to a negative impact on conversion. Mathematically, this leads to an inverse U-shaped relationship. One can model such an inverse U-shape with the help of a second order polynomial in the total number of seals (i.e. via the inclusion of a linear and a square term). Table-14b shows the results. First, note that this model provides a better fit to the data (as evidenced by the higher values of the log-likelihood and pseudo R-squared and lower values of AIC and BIC). In other words, the inverse U-shape appears to better reflect the behavior of shoppers online.

**Table-14b: Comprehensive model with square terms**

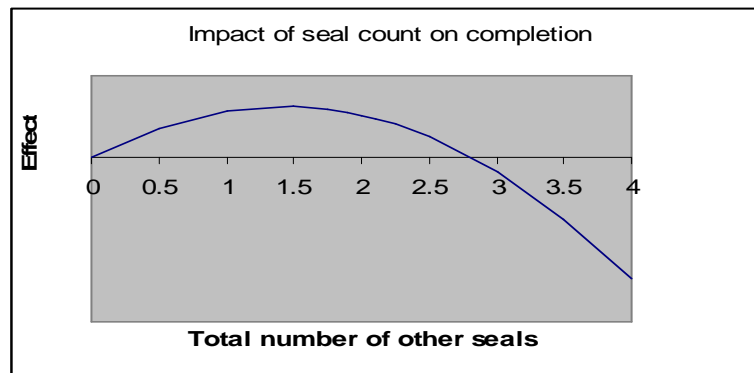
<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:-153,726; AIC=307,518; BIC=307,645; Pseudo R2: 0.0352</b>		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-1.390***	-165.63
<b>Seal_ON</b>	0.142***	15.52
<b>Cart Value</b>	-0.441***	-20.16
<b>Seal_ON x Cart Value</b>	0.018	0.62
<b>Merchant Volume</b>	-0.274***	37.48
<b>Seal_ON x Merchant Volume</b>	-0.158***	-17.26
<b>Total Number of Other Seals</b>	0.178***	9.39
<b>(Total Number of Other Seals)<sup>2</sup></b>	-0.063***	-10.85
<b>Categorical dummies</b>		
*** p < 0.01		

Table-14b shows that both the first degree and second degree polynomial terms are highly significant, which is surprising given the insignificance of the logarithmic relationship. I again take this as strong evidence for the inverse U-shaped effect.

The first degree term has a coefficient of 0.178 and the second degree term has a coefficient of -0.063, both being statistically significant. Taking the partial derivative of “Y=Completed” with respect to the variable “X= Total Number of Other Seals”, and

equating to zero, I find that the probability of cart completion is maximized at  $X_m = 1.413$ , which means displaying 1.413 other seals results in an optimum. Based on the regression model's coefficients, I have plotted Figure-11 to visualize this inverted "U" shape relationship. It is seen that displaying more than three other trust seals could even have a negative impact on sales of online stores and excluding the focal seal, the optimum range is between one and two other seals. As detailed in Appendix F, I also performed a series of additional robustness checks on the precise form of the functional relationship and the value of the optimal number of seals by combining all seals, adding a third degree polynomial term, and replacing the polynomial terms with dummies. The inverted "U" shape finding remains robust and the AIC values consistently improve over the first model in Table-14a.

**Figure-11: The impact of total number of other seals on cart completion likelihood**



Going back to the earlier results in Table-14a, the "Cart Value" variable has a negative significant coefficient of -0.436, indicating that higher value carts have a lower likelihood of completion. Contrary to my predictions, introduction of the seal does not moderate the impact of cart value on cart completion likelihood, as the interaction term



“Seal\_ON x Cart Value” has an insignificant coefficient. ( $Z = 0.63$ ) Hence, there is no statistical support for Hypothesis 3.

It is observed that carts created at websites of larger retailers have a higher likelihood of completion as the coefficient of “Merchant Volume” variable is positive 0.267 and significant. The coefficient of the interaction term “Seal\_ON x Merchant Volume” is negative, -0.160 and significant, which shows the moderating effect of the seal between merchant size and cart completion likelihood, and that smaller online retailers benefit more from the presence of the seal. Moving left by 1 SD at the “Merchant Volume” axis, i.e. from \$ 3.21 million (sample mean + 1 SD) down to \$ 1.48 million (sample mean), the odds of cart completion is reduced by 30.6 percent; however in the presence of the seal the reduction in odds of cart completion is only 11.3 percent. Thus, I have support for Hypothesis-4 as it is seen that presence of the seal moderates the impact of merchant volume on cart completion.

Finally, I examine the results for “shopper experience” (see Table-14c) and find support for Hypothesis 5. The “Shopper Experience” variable has a positive significant sign (0.391) which means repeat shoppers are more likely to complete their carts than novice shoppers at a particular online store. The interaction term “Seal x Shopper Experience” has a negative significant coefficient (-0.107) as well but smaller in magnitude when compared to Shopper Experience variable, meaning that the value of the seal is lower for more experienced shoppers, lending support to Hypothesis-5. Comparing two shoppers - Alice: novice shopper, and Bob: repeat shopper who has previously purchased once at a particular retailer’s web site, all else equal it could be seen that Bob’s odds of cart completion at that online retailer is higher by 20.97 percent compared to

Alice. In the presence of the seal, the odds of cart completion for Bob at that retailer are only 7.90 percent higher than for Alice. The value of the seal is significantly lower for an experienced shopper, indicating that trust seals and prior shopping experience at the retailer are partial substitutes.

**Table-14c: Regression analysis results for the experience model**

<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:-77,216, AIC:152,327, BIC:152,474, Pseudo R2: 0.0958</b>		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-0.025*	-1.91
<b>Seal_ON</b>	0.391***	30.36
<b>Shopper Experience</b>	0.183***	29.07
<b>Seal_ONx Shopper Experience</b>	-0.107***	-14.76
<b>Categorical dummies</b>		
*** p < 0.01    * p < 0.10		

### 3.6 DISCUSSION

My findings provide empirical evidence that the presence of trust seals in online retailers' websites increases the completion likelihood of shopping carts, thus resulting in increased sales for the retailers displaying the seal. The risk that originates from information asymmetry perceived by consumers when shopping from an unknown retailer is partially mitigated when a trusted third party endorses the quality claims of the e-merchant through a trust seal. The seal acts as an additional quality signal for the online retailer and reduces the amount of information asymmetry faced by the shoppers, thereby easing the purchasing decision of the shoppers.

To quantify the effect of the trust seal on final sales, let's assume that a typical online store, not displaying the trust seal, had \$1 million in revenue in 2007. Based on the descriptive statistics, where an average cart has a value of \$250 and one third odds of completion (completion rate = 0.25), an online store (with \$1 million in sales) has 4,000

completed carts (\$ 1 million / \$250) out of the 16,000 created carts (4,000 / 0.25) in 2007. The results show that the trust seal increases odds of cart completion by 15.49 percent. If the online store displayed the seal, its odds of completion would increase from 0.333 to 0.385, which would boost the total number of completed carts to 4,448. Inducing 448 more cart completions valued at \$250 each, the seal would bring in an additional \$112,000 revenue. This is just the seal's impact on the completion rates, assuming that presence of the seal does not help generate any new carts. Thus, I can conclude that presence of the seal at an online store increases the e-merchant's revenue by approximately 11.2 percent.

This study primarily focused on completion rates of shopping carts created by customers. My data does not allow us to examine the impact of trust seals on the creation of these shopping carts. However, the finding that "presence of trust seals increases odds of cart completion" can be generalized to conversion rates as well for two reasons: First of all, completion rate is a subset of conversion rate and assuming all else fixed, an increase in completion rate naturally leads to some increase in conversion rate. However, whether the online visitors who quit the store at the introductory stage perceive the trust seals as useful as shoppers who have actually created a cart is a valid question. Ba (2001) suggests that trust between two online parties could vary at different stages of the relationship depending on the degree of familiarity as elaborated in Table-15. However, McKnight *et al.* (2004) studied this issue in more depth and found no significant difference in trust factors (i.e. structural assurance, dispositional trust) between early introductory stages of an online B2C relationship and the following exploratory stages later. Thus, an additional support to my generalization, I can say that

the trust seals should be effective on visitors as well, although the extent of the influence may be more or less, a question suitable for future studies.

**Table-15: Classification of customers at an online store**

<b>Visitor</b>	<b>Shopper</b>	<b>Buyer</b>
Introductory stage	Exploratory stage	Final stage
Just browses the e-merchant's web site	Adds some items to the cart	Completes the cart and purchases from the e-merchant

The analysis also sheds light on how the trust seal interacts with some e-commerce variables, which could aid e-merchants in re-designing some operational processes. First of all, my expectations that the seal would be more effective towards completion of high value carts, was not supported empirically. This finding suggests that shoppers could be considering the additional risk brought by higher value purchases before adding items to the cart, perhaps simultaneously considering it with merchant's reputation, quality of the web site, or initial viewing of the trust seals. Thus, the results point to the need for additional research in investigating the relationship between shopping stages and price related risk perception in online shopping.

Similar to conventional environments, a shopper's trust in an online retailer is likely to increase after a few successful online transactions. Thus, experienced shoppers are less likely to pay attention to quality signals but focus on details of the transaction. However, shoppers who have not yet interacted sufficiently with a particular retailer - novice shoppers - have more difficulty in making a purchase decision. This research finds that these novice shoppers feel more comfortable when the online retailer displays the seal on its website. The additional risk faced by a shopper due to lack of enough

experience with a particular e-merchant is mitigated significantly by the presence of a trust seal.

Not surprisingly, large online retailers such as amazon.com do not display any trust seals on their websites. In this model, I have proxied the sum of an e-merchant's completed carts (business volume) for its reputation. Online retailers with larger sales volume are likely to have built a good reputation and be known and trusted by more consumers. The results complete the puzzle by finding that the presence of the seal at small e-merchants' websites is likely to bridge the reputation gap suffered by the e-merchants. In the presence of the seal, the additional risk perceived by shoppers due to smaller e-merchant size is partially mitigated by the presence of the trust seal. Thus I find that the online trust seal partially substitutes for both shopper experience, as well as seller size/sales-volume.

At this stage, it is important to acknowledge that some online retailers' web sites could display more than one trust seal. Referring to the results in Table-14a, I don't see a diminishing marginal return of an additional trust seal. Further analysis indicates that there is an inverted "U" shape relationship between the total number of other seals and cart completion likelihood, with a maximum point " $X_m$ " at 1.41 other seals. The presence of the main trust seal has been controlled for by the "Seal\_ON" variable, which has a mean of 0.49 (due to the random ONs and OFFs). Thus, it can then be said that the optimum number of trust seals for an online retailer to display is equal to 1.90 ( $1.41 + 0.49$ ). The results suggest that online retailers benefit the most by limiting the number of trust seals displayed on their websites, with more seals even harming their shoppers' purchase/completion rates.

The inverted “U” shaped relationship between the number of seals displayed by the retailer and the odds of cart completion could be attributed to the following. Firstly, it is possible that some shoppers may not be aware of the function of the different trust seals and could be confused by the presence of many seals which would then lead to an abandoning of carts. Secondly, shoppers may suffer from “feature fatigue” and find it too complex to process the additional information brought about by the presence of many seals. As suggested by Mick & Fournier (1998) and Thompson *et al.* (2005), while more features increase the attractiveness of a product, the addition of new features also increases product complexity, resulting in consumer anxiety and stress. Finally, the presence of too many seals may make the shoppers skeptical about the online retailer’s trustworthiness. It is possible that the presence of a large number of trust seals signals the “desperation” of a less reputable seller to attract consumers. Additional empirical studies would be needed to further tease out these effects.

### **3.7 IMPLICATIONS**

This research offers several implications for different stakeholders in e-commerce: the seal providers, the online retailer displaying those seals, and the broader e-commerce world, which are discussed below.

First of all, I believe that the findings can help bridge the gap between the conflicting findings of the academia and industry figures that strongly support the effectiveness of online trust seals. Despite the mixed findings of the academia highlighted earlier in Section 3.1, industry publications consistently regard online trust seals highly. For example, VeriSign claims that use of its seal and SSL solutions result in twenty percent average increase in transactions. BuySAFE claims an average ten percent

increase in website conversion, while TRUSTe publishes on its web site that presence of its privacy seal at online stores results in up to twenty nine percent increased sales. The results offer seal providers independent empirical validation regarding the value of trust seals. Based on actual shopping data, rather than on a survey of consumer perceptions, I show that the presence of trust seals reduce the percentage of abandoned shopping carts, thus increasing completion and conversion rates of online retailers.

Seal providers would benefit by targeting small online retailers as a customer base that can make most use of trust seals. As I have shown, small e-merchants benefit more from the presence of the trust seal. Consequently, trust seal providers can benefit by re-designing their pricing policies and provide discounts to attract larger merchants who are less likely to benefit from the presence of trust seals on their web sites. Some seal providers keep a directory of their approved online retailers on their web sites and allow shoppers to search for certified online stores. This search mechanism can direct consumer traffic to the more profitable e-merchants based on the seal pricing policy, hence optimizing profits for the provider.

The results also provide some useful guidelines for the design of online retailers' operations. For example, based on my findings that the seal is more effective in converting novice shoppers, online retailers can make the seal more visible and salient during sessions initiated by first time visitors. Also, given that "more is not necessarily better" with trust seals, online retailers would do well by being selective about displaying only the most effective seals. Finally, addressing the warnings of researchers that establishing trust in the online world is critical to the development of e-commerce, I

provide evidence that trust seals indeed do function to partially bridge the inherent trust gap in the internet.

The findings are also of importance to policy makers and regulatory authorities. While the lack of institutionalized regulation has arguably contributed to the rapid growth of online commerce, it has also led to the emergence of several fly-by-night operators making it difficult for consumers to credibly verify the quality of several online sellers. Given that online trust seals and certificates are valued by consumers, encouraging them to consummate their purchases at online retailers, it is important that these third-party certifiers themselves act as independent entities. Consumers and the market as a whole would benefit if these third-party certifiers are held to high standards by regulatory oversight.

### **3.8 CONCLUSION**

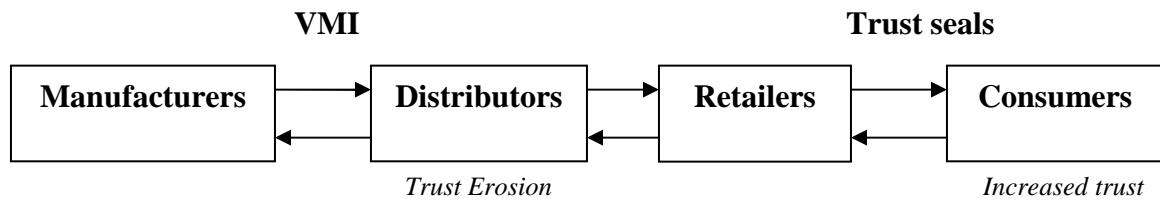
Using actual shopping-cart and purchase data collected from field experiments conducted on certified online retailer web sites by a leading trust-seal provider, this study quantifies the effectiveness and value of online trust seals as a form of trust transfer mechanism in a B2C setting. Overall, I find that trust seals help convert more shoppers into buyers; however they could be more effective if online retailers re-design some operational processes such that these trust seals are displayed two at a time, displayed more prominently to first-time shoppers, and made more salient at smaller retailers' websites. Not all trust seals possibly adhere to the same high standards, but trust seals serve as quality-signaling mechanisms assuring online shoppers that the certified online retailers are reliable and trustworthy. This is among the first large-scale study of the value of online trust seals that provides tangible evidence of their effectiveness.



## CHAPTER 4: DISSERTATION CONCLUSION AND FUTURE RESEARCH

Through our findings in this dissertation, we can conclude that supply chain technology solutions could influence the trust among supply chain members in different ways. While, downstream in the supply chain, trust seals could increase the consumers' trust in the online retailer, upstream distributors using VMI could experience trust erosion in their relationship with the manufacturers as depicted in Figure-12. Thus, in adopting boundary-spanning supply chain technologies, it is of utmost importance to consider the effects of the technology on relationship parameters, such as trust.

**Figure-12: Effect of VMI and Trust seals on relationships along the supply chain**



More specifically, our findings have some important implications on the users of supply chain technologies. Manufacturers that use VMI to replenish their distributors' inventories should make sure that adoption of VMI does not decrease the communication with distributors. Multi-lateral communication with the distributors could help ensure that any violation of the psychological contract with the distributor is realized before it breaks down distributor trust in the manufacturer. Both the distributors and manufacturers should be explicit and clear in designing the terms of the VMI relationship and write these down in the form of a formal contract to limit the ruling of psychological contract later in the relationship. Online retailers, especially small-to-medium sized ones, could

bridge the confidence gap felt by shoppers by using trust seals. The retailers could design their operations such that these seals are displayed more prominently to first time visitors and only a few of these seals are displayed at a time.

The two essays in this dissertation have some limitations accompanied by future research opportunities. The cross-sectional nature of the data makes it impossible to validate the causal links of our model in the first essay. In the future, it will be of significant importance to validate the causal links using longitudinal data. Surveying manufacturers to investigate the evolution of their trust in distributors would be an important enhancement to our study as well. We have proposed that VMI relationships are subject to trust erosion because of some idiosyncratic attributes of the VMI. However, we do not make any generalization of this conclusion to all buyer-supplier relationships (including those not using VMI). In the future, our model could be tested on a sample including both adopters and non-adopters of VMI to find out whether inter-organizational trust evolves differently in a general buyer-seller relationship. Finally, upon collection of a larger set of observations, Structural Equation Modeling (SEM) could be used in Essay-1, to model the relationship between our multiple constructs in a single model.

The second essay of this dissertation is also subject to some limitations as well. At an online store, many visitors just browse and leave without creating any cart. The dataset of the second essay is comprised of shopping carts which allows us to measure the impact of the seal among shoppers, who actually created a cart. Thus, the dataset provides no clues regarding how visitors, who quit early before creating the cart, view the trust seal. Follow-up studies could use actual sessions or click-stream data gathered from online merchants to verify the value of trust seals on both conversion (converting browsers to

shoppers) as well as completion rates. The second limitation is that the results are valid for US merchants and shoppers in general but require caution before generalizing to other regions. Hofstede (1980) views trust as a variable that distinguishes one society from another. Gefen *et al.* (2008) suggest that culture is a moderator of trust. Thus, external validity of the results can be enhanced by testing the research questions with non-US data.

Finally, in this second essay, we have investigated in details the impact of a single well-known trust seal on shoppers' purchasing behavior. Although, we believe that the results can be generalized to other quality trust seals, each seal category could still have some inherent differences. For-example, in terms of inducing trust, check-out seals such as "PayPal" and "Google Check-Out" may be perceived differently compared to price comparison seals, such as "BizRate" and "NexTag". Also it is important to note that not all seals are of equal quality. The differential impact of seal types on conversion rates may be an interesting area for further research.

## **APPENDIX A: Pre-notification letter**

Dear [First Name],

Back in May 2010 at our annual Forum, we had a speaker from the Speed of Trust. For those of you who were unable to attend, his presentation talking to the value of trust in our business relationships was very thought provoking and well received. As it so happens, Koray, Martin and Oliver – researchers at the University of Maryland and Lehigh University, then contacted me about their research project in evolution of trust in collaborative buyer-supplier relationships. I would like to inform you about this exciting project today as your firm is an active user of VMI.

This research project aims to investigate the users' satisfaction with the VMI technology and the impact of VMI on their relationship with suppliers. Koray plans to conduct an online survey of buyers (distributors) actively using VMI and also asked us if we could provide data about inventory results of these VMI relationships. He would then like to correlate those inventory results to the inter-organizational trust characterized by the answers to the survey. I think the idea that Koray is looking at is very interesting and I would like to help him.

I invite you to participate in this online survey which takes about 15-20 minutes to complete. The link to join this survey will soon be emailed to you. As you know the data is yours not ours so I also need your permission to share your inventory results. Towards the end of the survey, you will find a box to check if you would allow us to share your inventory transaction results with the University of Maryland. I have been assured that no attributable data will be shared beyond the survey team and that a summary report of the research will be sent to the interested participants.

Yours sincerely

xxxxxx

CEO, xxxxxxxx

## **APPENDIX B: Solicitation letter**

Dear [First Name],

I am contacting you to follow up on a recent email that you received from Carl Hall, CEO of Datalliance. He emailed you to ask for your participation in a study of Vendor Managed Inventory (VMI) relationships being conducted by researchers at the University of Maryland and Lehigh University. Both Carl and I believe that a better understanding of VMI relationships will allow users to cultivate more profitable, longer lasting business partnerships.

I am asking you to participate in this study. Your answers will be held strictly confidential. Only summary results of the study will be released.

As a token of appreciation, if you complete the survey, I will donate \$2 to the National Wildlife Federation (<http://www.nwf.org>), a charity that is helping wildlife recover from the recent Gulf oil spill. It should only take 10 minutes. Please click on the following link.

<http://www.surveymonkey.com/VMI.aspx>

This link is uniquely tied to this survey and your email address. Please do not forward this message.

If you have any questions, please email me at [kozpolat@rhsmith.umd.edu](mailto:kozpolat@rhsmith.umd.edu) or call me at 301 405-5775.

Thank you very much for helping with this important study.

Sincerely,

Koray Özpolat  
PhD Candidate  
R. H. Smith School of Business  
University of Maryland, College Park

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

<http://www.surveymonkey.com/optout.aspx>

## **APPENDIX C: First reminder email**

Dear [First Name],

Sorry, for the follow-up email, but I am contacting you regarding the recent note that you received from Carl Hall, CEO of Datalliance asking for your participation in a study of Vendor Managed Inventory (VMI) relationships being conducted by researchers at the University of Maryland and Lehigh University.

I would greatly appreciate you completing the VMI survey by April 1. It should only take 10 minutes. Your input is very important to us and will be held strictly confidential. As a token of appreciation, I will donate \$2 to the National Wildlife Federation (<http://www.nwf.org>), a charity that is helping wildlife recover from the recent Gulf oil spill, for your completed survey. Please click the link provided below to access our VMI survey:

<http://www.surveymonkey.com/VMI.aspx>

If you have any questions or would prefer to complete a paper survey, please call me at 301 405-5775 or email me at [kozpolat@rhsmith.umd.edu](mailto:kozpolat@rhsmith.umd.edu).

Thank you very much for helping with this important study.

Sincerely,

Koray Özpolat  
PhD Candidate  
University of Maryland

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

<http://www.surveymonkey.com/optout.aspx>

## **APPENDIX D: Second reminder email**

Dear [First Name],

I would like to kindly remind you that our VMI survey is still active for your participation and would appreciate if you could take just 10 minutes to complete the survey by clicking the link below:

<http://www.surveymonkey.com/VMI.aspx>

This research project will help us learn more about the influence of using VMI on buyer-seller relationships. We will also donate \$2 to the National Wildlife Foundation as a token of appreciation for your contribution.

This is the last invitation email and we will permanently close the collectors for this survey on Friday April 8.

Thanks for your time!

Koray Özpolat  
PhD Candidate  
University of Maryland  
Tel: 301-405-5775

To opt-out of future invitations please click: <http://www.surveymonkey.com/optout.aspx>

## APPENDIX E: The questionnaire

1. I am familiar with most aspects of our relationship with this supplier  
a) Strongly agree    b) Agree    c) Not sure    d) Disagree    e) Strongly disagree
2. What position do you hold in your firm? \_\_\_\_\_
3. Which supply chain position do you consider as the main part of your business?  
a) Retailer    b) Manufacturer    c) Service Provider  
d) Wholesaler or distributor    e) Raw materials supplier
4. How many employees does your firm have (all locations)?  
a) Less than 50    b) 51 – 200    c) 201 – 500    d) 501-1000    e) 1,001 or more
5. Please indicate the total revenues for your firm (all locations) in 2010 (or fiscal year 2010) by selecting the appropriate number below.  
a) Less than \$ 1 million    b) \$ 1 million - \$ 4.99 million    c) \$ 5 million - \$ 19.99 million  
d) \$ 20 million - \$50 million    e) More than \$ 50 million
6. What was your firm's Return on Sales in 2010  
a) Negative    b) 0-5 percent    c) 6 -10 percent    d) More than 10 percent    e) I don't know
7. How long has your firm been doing business with this supplier? (Round to the nearest year)  
a) Less than a year    b) 1-2 years    c) 3-4 years    d) 5-6 years    e) 7 years or more
8. How long have you been personally involved in your firm's relationship with this supplier?(Round to the nearest year)  
a) Less than a year    b) 1-2 years    c) 3-4 years    d) 5-6 years    e) 7 years or more
9. How long has your firm been using VMI with this supplier? (Round to the nearest year)  
a) Less than a year    b) 1-2 years    c) 3-4 years    d) 5-6 years    e) 7 years or more
10. Is your firm an independent distributor of this supplier?  
a) Yes    b) No
11. The communication between our firm and this supplier has increased since adoption of VMI.  
a) Strongly agree    b) Agree    c) Not sure    d) Disagree    e) Strongly disagree
12. This supplier had a strong influence in our firm's decision to adopt VMI  
a) Strongly agree    b) Agree    c) Not sure    d) Disagree    e) Strongly disagree
13. In what industry does your firm mainly operate? Please circle the appropriate option or, write the industry next to the "Other" choice.  
a) Electrical    b) Plumbing    c) Truck parts    d) Health Care  
e) Consumer Goods    f) Other \_\_\_\_\_
14. Approximately what percentage of firms in your industry uses a VMI arrangement with their suppliers?  
a) Less than 20%    b) 20-40 %    c) 41-60 %    d) 61-80 %    e) 81 – 100 %
15. Who has the ownership of inventory at your premises?  
a) We have the ownership of inventory at our premises  
b) Our VMI supplier has the ownership of inventory at our premises



<b>Construct*</b>	<b>Items (adopted from)</b>
<b>TRUST</b>	<ol style="list-style-type: none"> <li>1. We receive fair treatment from this supplier. (<i>Dyer and Chu, 2000</i>)</li> <li>2. If given a chance, this supplier could take unfair advantage in our business relationship. (<i>Dyer and Chu, 2000</i>)</li> <li>3. When making important decisions, this supplier considers our firm's welfare as well as its own. (<i>Doney and Cannon, 1997</i>)</li> <li>4. Based on past experience, we can rely on this supplier to keep promises made to our firm. (<i>Zaheer et al., 1998</i>)</li> <li>5. This supplier is competent and capable of providing us with required products according to our specifications in a timely fashion. (<i>Self developed</i>)</li> <li>6. This supplier has a reputation for trustworthiness in the business world. (<i>Dyer &amp; Chu, 2000</i>)</li> </ol>
<b>PCV - Psychological Contract Violation</b>	<p>When I think about what our firm contributed to the relationship with this supplier and what we received in return, I feel (<i>Hill et al., 2009</i>)</p> <ol style="list-style-type: none"> <li>1. pleased</li> <li>2. angry</li> <li>3. frustrated</li> <li>4. satisfied (<i>self developed</i>)</li> <li>5. cheated</li> </ol>
<b>PTT – Propensity to Trust</b>	<ol style="list-style-type: none"> <li>1. Most business partners can be counted on to do what they say they will do. (<i>Mayer and Davis, 1999</i>)</li> <li>2. These days, our business should be alert; otherwise some other firms are likely to take advantage of us. (<i>Mayer and Davis, 1999</i>)</li> <li>3. In dealing with our suppliers and customers, each and every aspect of the relationship should be written in a contract to prevent opportunistic behavior. (<i>Self developed</i>)</li> </ol>
<b>PERFORMANCE</b>	<ol style="list-style-type: none"> <li>1. Use of VMI has improved our fill rate to our customers.</li> <li>2. Use of VMI has allowed us to reduce our inventory related costs.</li> <li>3. Use of VMI has increased our inventory turnover. (<i>All self developed</i>)</li> </ol>

\* Measures employ the following 5 point scales:

- a) Strongly agree    b) Agree    c) Not sure    d) Disagree    e) Strongly disagree

## APPENDIX F: Additional trust seals analysis

I have provided evidence in Section 3.5 that as the number of trust seals at an online store increases, shoppers’ propensity of cart completion first increases, reaches a maximum point at roughly two seals then decreases as more seals are displayed. Robustness checks of the inverted “U” shape finding are provided below.

**1) Count the seal with other seals:** I generate a new variable “Total Number of all Seals” which counts not only other seals but the presence of the seal as well. Then I run the model by removing the “Seal\_ON” variable to prevent collinearity. The results show that 1.99 seals maximize the likelihood of shopper conversion. Thus, I find support to the inverted “U” shape finding as detailed in Table-9a

**Table-16a: Results of “All Seals” model with a 2<sup>nd</sup> order term**

<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:-153,726; AIC=307,474; BIC=307590; Pseudo R2: 0.0353</b>		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-1.417***	-158.71
<b>Cart Value</b>	-0.428***	-19.93
<b>Seal_ON x Cart Value</b>	-0.003	-0.12
<b>Merchant Volume</b>	0.295***	39.96
<b>Seal_ON x Merchant Volume</b>	-0.192***	-20.38
<b>Total Number of All Seals</b>	0.247***	20.08
<b>(Total Number of All Seals)<sup>2</sup></b>	-0.062***	-18.72
<b>Categorical dummies</b>		
*** p < 0.01		

**2) Add a third order term to test for further non-linearity:** Next, I extend the first robustness check by adding a third order “Total Number of All Seals” term and see that the third order term is insignificant. The results in Table-9b show that 2.06 trust seals maximize cart completion likelihood. Thus, inverted “U” shape finding is supported.

**Table-16b: Results of “All Seals” model with a cubic term**

<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:-153,726; AIC=307,476; BIC=307603; Pseudo R2: 0.0353</b>		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-1.417***	-154.11
<b>Cart Value</b>	-0.428***	-19.92
<b>Seal_ON x Cart Value</b>	-0.003	-0.12
<b>Merchant Volume</b>	0.295***	39.80
<b>Seal_ON x Merchant Volume</b>	-0.192***	-19.92
<b>Total Number of All Seals</b>	0.244***	11.73
<b>(Total Number of All Seals)<sup>2</sup></b>	-0.059***	-4.24
<b>(Total Number of All Seals)<sup>3</sup></b>	-0.0005	-0.22
<b>Categorical dummies</b>		

3) Use dummies: The shopping carts in my dataset were exposed to a number of trust seals ranging from zero to five (including the seal). I take the “zero trust seal” as the reference and code other cases with 5 different dummies. For example, “3 seals” dummy is coded “1” when the total number of all seals displayed is equal to three. The dummies of four and five seals have negative coefficients while one, two and three seals dummies are positive. Inverted “U” shape finding is again supported as detailed in Table-9c.

**Table-16c: Results of “All Seals” model with seal dummies**

<b>Dependent Variable: Completed</b>		
<b>LogLikelihood:-153,679; AIC=307,387; BIC=307535; Pseudo R2: 0.0356</b>		
	<b>Coefficient</b>	<b>Z-Value</b>
<b>Constant</b>	-1.415***	-153.33
<b>Cart Value</b>	-0.427***	-19.85
<b>Seal_ON x Cart Value</b>	-0.006	-0.19
<b>Merchant Volume</b>	0.291***	39.16
<b>Seal_ON x Merchant Volume</b>	-0.185***	-19.02
<b>Dummy One Seal</b>	0.184***	16.43
<b>Dummy Two Seals</b>	0.194***	10.98
<b>Dummy Three Seals</b>	0.343	13.40
<b>Dummy Four Seals</b>	-0.235***	-5.42
<b>Dummy Five Seals</b>	-0.237***	-4.44

<b>Categorical dummies</b>		
*** p < 0.01		

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