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Bullwhip Effect Reduction and Improved Business Performance through Guanxi: An Empirical Study

1. Introduction

In modern global supply chains, the bullwhip effect continues to be a challenging problem. Researchers and practitioners are working to understand this issue and develop ways to mitigate it. During the past two decades, Eastern firms have increasingly taken up positions of importance in global supply chains, thus opening up a new arena in which to investigate the bullwhip effect. Government, business, and academic leaders are increasingly seeking to understand Eastern business practices to understand general differences in conducting business, as well as more specific issues like how Eastern firms address the bullwhip effect.

One concept that has come to the attention of many researchers, and one that is relevant in the discussion of the bullwhip effect, is the Chinese concept of *guanxi*. Guanxi connotes interpersonal and inter-organizational relationships with the implication of continued exchanges of favors over time (Cheng et al., 2012). When one organization provides a valuable favor to another, this builds the essential elements of guanxi by creating mutual obligations. In light of these benefits, and in light of the growing importance of Eastern firms in global commerce, there is a need for a robust understanding of guanxi in order to comprehend its potential value in addressing problems such as the bullwhip effect. While some studies have assessed the social capital benefits associated with guanxi, there is still much to be learned about the Eastern business context as well as about how guanxi and similar concepts can improve business performance and reduce the bullwhip effect.

The specific focus of this paper is how guanxi affects supply-chain efficiency by reducing the bullwhip effect. Because guanxi has been defined as having three main components – trust, information sharing, and control (Adler & Kwon, 2002) – and because these components have been elsewhere linked to supply-chain efficiency (Johnston, McCutcheon, Stuart, & Kerwood, 2004; Klein, Rai, & Straub, 2007; Lee, Padmanabhan, & Whang, 1997b; Yang, 1994), we suggest here that guanxi itself has a beneficial effect on supply chain performance through reduction of the bullwhip effect by facilitating the exchange of information. Furthermore, we suggest that guanxi improves business performance by facilitating the development of trust-based long-term relationships and enabling firms to exert control over supply chain partners.

This paper contributes to literature on supply chain management and business performance in two ways. First, we provide empirical evidence of a link between guanxi and supply-chain efficiency. Little operations research has been conducted on guanxi and we seek to address this gap in the literature. Our empirical results demonstrate that the benefits of guanxi include reducing the bullwhip effect, improving financial metrics, and increasing market share. To our knowledge, this paper presents the first empirical evidence linking guanxi to supply-chain efficiency. Second, while anecdotal and even some empirical evidence exists of the positive effect of guanxi on business performance, our review of the literature indicates that this research has yet to coalesce into a theoretical explanation. The findings of this study extend previous work on the link between trust and business performance (Zaheer, McEvily, & Perrone, 1998) by providing a theoretical explanation for how guanxi benefits firms.

In addition, insights are provided for practitioners explaining how guanxi can be used to improve supply chain efficiency. Understanding the inter-organizational use of social capital like guanxi is a key skill for managers in an increasingly globalized marketplace. The effect of

guanxi on bullwhip effect reduction has potentially far-reaching managerial and organizational benefits, including improving performance. We explain why this effect exists and why it will be most noticeable in less-competitive industries, but less noticeable in highly-competitive industries.

The paper will proceed as follows. First, we review relevant literature, beginning with research that investigates guanxi. In the description of guanxi, we explain how guanxi can be compared to and contrasted with the related concept of social capital. The literature review section also includes discussion of foregoing research on the bullwhip effect and business performance. Next, we develop our hypotheses, providing conceptual and theoretical support for the idea that guanxi has a number of beneficial effects. Specifically, we propose that guanxi is associated with business performance in two ways. Its positive impact on business performance could be direct, or it could be indirect, through bullwhip effect reduction. Our paper goes on to explain that the competitive intensity of the market moderates the relationship between guanxi and business performance. Then, we describe our survey methodology, our multi-sector sample (N=205), and our data analysis using structural equation modelling (SEM). We present our results, which indicate support for each of our five hypotheses. Finally, we discuss the theoretical and managerial implications of our findings for both researchers and practitioners. Finally, the paper concludes with the limitations of our study and suggests areas for potentially fruitful future research in this area.

2. Theoretical Background and Literature Review

2.1. Social Capital and Guanxi

Social capital has been defined as the “norms and networks facilitating collective actions for mutual benefit” (Woolcock, 1998). It is context-dependent, being built upon a network of

communications and interactions (Fukuyama, 1995, 1999; Lin, 1999; Putnam, 1993), and takes many different forms, including obligations within a group, trust, norms, and sanctions (Bourdieu, 1983). Social capital exists when there is an expectation that kindness and services will be returned. Social capital theory explains that the connections of an individual or organization can be valuable and helpful (Cross & Cummings, 2004). Relationships are established purposefully to generate both tangible and intangible benefits, which may be psychological and emotional for individuals, and economic for organizations (Lin, 1999, 2000).

This paper defines *guanxi* as a form of social capital, one that is an important cultural and social element of Chinese society (Cai & Yang, 2013), and one that has been identified as having an important influence on behavior (Lee & Humphreys, 2007). *Guanxi* is grounded in Confucian ideals and is composed of the Chinese concepts of *renqing*, the moral obligation to maintain a relationship, *ganqing*, the depth of an interpersonal relationship, and *mianzi* ("face"), meaning reputation, social status, or prestige (Park & Luo, 2001). *Guanxi*, more specifically, has been defined as the relationship networks that carry obligations to facilitate the exchange of favors among individuals (Park & Luo, 2001; Xin & Pearce, 1996). The term *guanxi* includes the ideas of relationship, reciprocity, and ongoing long-term commitment grounded in trust, mutual obligations, and shared experiences (von Weltzien Hoivik, 2007). It has the potential to provide benefits to partners whose relationship is governed by it. At an interpersonal level, *guanxi* implies that people can draw on their connections to secure favors in their business relationships (Luo, 1997). Interpersonal *guanxi* networks are so extensive that they form an institution of both formal rules and informal norms to structure human interactions in an inter-organizational context (North, 1990). *Guanxi* thus affects inter-organizational relationships by influencing individual behaviors in personal relationships (Cai & Yang, 2013).

In China, the business environment overlaps with widespread personal guanxi networks governing the exchange of favors through three rules: (1) obligation, such that people must offer favors to others according to the level of their relationships (Wang, 2007); (2) reciprocity, such that a recipient must return a favor when asked (Fan, 2002); and (3) empathy, requiring a sense of goodwill between individuals (Wang, 2007). The concept of guanxi is similar to “social exchange” proposed by Blau (1964) but involves the actual exchange of favors.

There are three key differences between social exchanges in the West and guanxi-governed social exchanges in China. First, in China a person may return a personal favor by offering a business favor, thus expanding the avenues for potential inter-organizational relationships and for the building of social capital. For example, a supply chain manager might provide speedier service to a friend’s firm because that friend helped the manager’s child get into a prestigious school (Dunfee & Warren, 2001). In return, this friend might offer better and timelier information on customer demand. In contrast, in Western cultures people tend to separate social and business relationships (Lin & Si, 2010) offering fewer avenues for reciprocity. Second, guanxi is transferrable to different parties in China (Park & Luo, 2001). This is especially useful in complex supply chain networks. For example, consider three individuals: A, B and C. In China, Person A’s guanxi with person B is able to be transferred to person C, when A introduces C to B. Person B can then offer a favor to Person C to return a favor from Person A (Cai and Yang, 2014). Whereas, in Western cultures, the initial recipient of a favor is generally the one that must return the favor. Third and finally, reciprocity in the West suggests exchanges of equal benefits to both parties, whereas in guanxi, a weaker or less powerful organization may call for a special favor without incurring an equal level of reciprocal obligation (Park & Luo, 2001). For example, large Chinese multi-national organizations conducting business with small

organizations which may include only a few individuals do not necessarily expect equal levels of reciprocation.

Guanxi is not contractual trust, based on a paper (or electronic) contract, but rather is implied through an enduring relationship and the culture in which that relationship exists. In Chinese culture, when one person in a partnership receives a favor or is provided for by the partner, it is expected that the former will reciprocate; otherwise, guanxi cannot be maintained (Quian, Razzaque, & Keng, 2007). This leads to predictable actions from partnerships, and predictable actions lead to a deeper sense of trust and greater commitment to maintaining the relationship in the future (Svensson, 2001). Thus, guanxi is a long-term, relational form of trust, and implies a long-term agreement between partners. It is established and built by following through on promises, treating others with courtesy, and contacting partners frequently. It provides the basis for mutual trust or credit, is regarded as mutually beneficial, and reduces dysfunctional conflicts (Zhuang, Xi, & El-Ansary, 2008).

Because guanxi is an expression of long-term, relationship-based trust, we believe that it should also have an impact on long-term supplier relationships. While previous research has linked guanxi to supplier communication and trust (Cheng et al., 2012), to our knowledge, no studies have yet linked guanxi directly to supply-chain efficiency. To address this gap in literature, this paper examines how guanxi may be linked to bullwhip effect reduction, and ultimately to improved organizational performance.

2.2. Bullwhip Effect

The bullwhip effect has a long research history that deals with the causes and remedies of variance amplification (Miragliotta, 2006; Towill et al., 2007; Wright & Yuan, 2008). Orders to the supplier have a larger variance than sales to the buyer and this propagates upstream in an

amplified form, with the greatest variability occurring in the upstream sites (Lee, Padmanabhan, & Whang, 1997a). The bullwhip effect impacts numerous entities in the supply chain including retail stores, distributor's warehouses, market warehouses, manufacturer's warehouses, and plant warehouses. Variation in demand can lead to cost issues like excess raw material cost due to unplanned purchases of supplies by the manufacturer; manufacturing expenses, excess warehousing expenses, reduction in product quality, and additional transportation costs (Lee, et al., 1997a; McCullen & Towill, 2002).

A number of causes, as well as ways to counter the bullwhip effect, have been identified. Causes include demand signal processing, the rationing game, order batching, and price variations (Lee, et al., 1997a). The bullwhip effect can be countered through information sharing of sell-through and inventory status data, the use of radio frequency identification (RFID), the simplification of pricing and promotional manufacturer activities, and coordination of information and planning along the supply chain (Lee, et al., 1997a; Ouyang & Li, 2010).

Trust has also been tied to the bullwhip effect where researchers have described "shortage gaming" (Lee, et al., 1997a). Buyers tend to order more from a supplier than what is needed because they anticipate that they will be getting less during periods of shortage. This generates further amplifications of the incoming order level upstream. As such, suppliers tend to downscale incoming demand levels. The mutual trust between the buyer and the supplier would encourage both parties to provide the correct demand figures to each other and hence can prevent such amplification of misinformation (Akkermans, Bogerd, & Doremalen, 2004; Lee, et al., 1997a; Sterman, 2000).

Guanxi, a form of relational trust, has the potential to reduce distrust and mitigate the problems arising from the bullwhip effect. Because trust has been identified as a component of

guanxi, and because trust has been linked to bullwhip effect reduction, we argue that research on trust and guanxi should be integrated with research on the bullwhip effect to identify effects on supply chain performance.

3. Research Hypotheses

This paper’s conceptual model depicts the relationships between four constructs: guanxi, bullwhip effect reduction, competitive intensity, and business performance.

INSERT FIGURE 1 HERE

While figure 1 presents a conceptual model of the relationships between each construct, figure 2 presents a bivariate view. The bivariate view indicates that the constructs in our model (guanxi, bullwhip effect reduction, competitive intensity, and business performance) can be split into several different dimensions. Precedents exist for the bivariate description that we have proposed for guanxi (Adler & Kwon, 2002; Gu, Hung, & Tse, 2008), bullwhip effect reduction (Lee, et al., 1997a), competitive intensity (Gu, et al., 2008), and business performance (Badri, Davis, & Davis, 2000; Ward & Duray, 2000). The models described in figures 1 and 2 will be tested as we investigate our hypotheses. The models are described in greater detail in the remainder of this section. The individual dimensions of each construct are described both in this section as well as the subsequent Research Methodology section.

INSERT FIGURE 2 HERE

3.1. Guanxi and Business Performance

Business performance is multi-dimensional and is comprised of various different aspects including market growth, financial performance, and company reputation (Huang et al., 2013). Guanxi provides numerous ways to improve each aspect of business performance through social capital and ultimately improving operations. The advantages provided by guanxi can be classified into three broad areas: trust, information sharing, and control. Trust is defined as an enduring relationship with an expectation that favors will be reciprocated; trust often arises with strong community ties (Adler & Kwon, 2002; Gu, et al., 2008). Information sharing is defined as shared organizational culture in operating procedures (Gu, et al., 2008). And control is defined as a set of obligations that have been built up between managers of a company causing an increase in control over partners' attitudes, decisions, and behaviours (Gu, et al., 2008).

The dimensions of trust, information sharing and control are those that have been used to describe both social capital (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998; Uzzi, 1997), as well as the social capital concept that is specific to the Chinese context, guanxi (Gu, et al., 2008). As previously noted, the Chinese business context is one in which it is expected that favors will be reciprocated (Quian, et al., 2007). Guanxi, unlike Western social exchange, expands opportunities for firms to engage in reciprocation of favors by not separating social and business relationships. The expanded avenues for reciprocation have various social capital benefits. For example, reciprocation leads to predictable actions from partners and a commitment to maintain the relationship created by the mutual obligations of guanxi. This ultimately leads to a deeper sense of long-term relational trust (Svensson, 2001), a form of trust which is stronger than the contractual-based trust often found in Western business relationships. The trust facilitated by guanxi helps increase goodwill and cooperation among partners in a channel system (Doney &

Cannon, 1997). This ultimately enhances opportunities for firms to gain privileged access to information and resources which enables relationship sustainability in an uncertain environment (Gu, et al., 2008). Further, guanxi has been explained as a way to provide supply-chain partners with control benefits, such as the ability to prepare for changes (Zhang, Cavusgil, & Roath, 2003). These relationships also provide control benefits by improving flexibility in the supply chain (Stevenson & Spring, 2009), and by improving business relations through supplier-driven collaboration (Leeuw & Fransoo, 2009).

The social capital built from guanxi ultimately enhances business performance. For example, because partners trust each other, guanxi enables firms to gain access to more diverse information sources and high-quality information on time and at lower costs (Burt, 1997; Coleman, 1988). When guanxi partners exchange information for mutual benefit, they lower information search costs, something that has been identified in transaction cost economics as a benefit to firms (Williamson, 1975). Along with decreased transaction costs (Gulati, 1995) other benefits of guanxi include: enhanced dispute resolution (Ring & Van De Ven, 1994), long-term supplier interest in customer needs (Zineldin & Jonsson, 2000), improved supplier operational performance (Carr, Kaynak, Hartley, & Ross, 2008), and better alignment of competitive priorities such as cost, quality, flexibility and delivery (Vachon, Halley, & Beaulieu, 2009). Elsewhere, it has been shown that trust and information sharing improve supply chain performance (Akkermans, et al., 2004), and that long-term collaboration between suppliers is beneficial (Yusuf, Gunasekaran, Adeleye, & Sivayoganathan, 2004). Thus, trust, information sharing, and control each have been shown to improve business performance in supply chain relationships.

We argue that the relationship between guanxi and business performance operates in the following way. As relationships are initiated and develop between suppliers and buyers in a Chinese context, a growing sense of trust, reciprocity, and mutual obligation develops because of the cultural context in which these relationships are formed. This trust-based relationship facilitates the exchange of information between the suppliers and buyers and allows them to predict, and to some extent even to control, each other's behaviour through the exchange of favors and information. Information-sharing and control take place because reciprocal interaction is expected and because each partner can be expected to follow through on promises. The results of this relationship are that conflict between supplier and buyer is reduced and that information sharing enables additional predictability of partners' behavior. In this way, buyers can improve operational performance as they receive suppliers' shipments on time, at a good price, and in the appropriate quantity. Accurate, timely shipments enable buyers to produce and deliver their products and services consistently, efficiently, and reliably. These operational gains can then be translated into financial performance gains, expanded market share, and improved reputation for the buyer, among other benefits. Therefore, we hypothesize that

Hypothesis 1: *A firm's guanxi network has a positive effect on that firm's business performance.*

3.2. Guanxi and the Bullwhip Effect

One way in which the bullwhip effect can be mitigated is the sharing of information among partners in the supply chain (Dejonckheere, Disney, Lambrecht, & Towill, 2004; Lee, et al., 1997a). Before such information can be shared, however, a foundation of trust and reciprocity must exist. As previously noted, trust is one of the core benefits that is derived from social capital (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998; Uzzi, 1997) and reciprocity is one of the hallmarks of guanxi (Park & Luo, 2001; Xin & Pearce, 1996).

With the understanding that guanxi is a form of social capital and is a common set of understandings and expectations about how two parties will behave in ongoing transactions, it can be seen that guanxi has the potential to foster trust. One valuable outcome of trust is the willingness of suppliers and buyers to share information with one another. This information sharing among supply chain partners has the potential to reduce the consequences of the bullwhip effect. If the buyer and supplier can trust one another to provide the correct demand figures, this can prevent the amplification caused by the bullwhip effect (Akkermans, et al., 2004; Lee, et al., 1997a; Sterman, 2000). We argue that trust and information sharing, two aspects of guanxi, are thus likely related to bullwhip effect reduction.

Additionally, because guanxi is defined as relationship networks that carry *obligations* to facilitate the exchange of favours, the network can be utilized by a buyer to call upon a supplier to fulfil an obligation or reciprocate an earlier action. The ability to obligate or informally require supply chain partners who are a part of a firm's guanxi network to fulfil a particular order in a particular way at a particular time for a particular price represents a means of controlling suppliers. Being able to predict and influence the actions of one's partners is one type of control. Because control over partners reduces uncertainty, which is one of the causes of variance amplification in the bullwhip effect, greater accuracy can be ensured in order quantities (Tangsucheeva & Prabhu, 2013). Control also enables buyers to hold less inventory because they can use this control to reliably, dependably procure shipments when needed. Thus, the "control" aspect of guanxi also has the potential to reduce the bullwhip effect. Based on these arguments, we hypothesize:

Hypothesis 2: *A firm's guanxi network has a positive impact on bullwhip effect reduction.*

3.3. The Bullwhip Effect and Business Performance

The bullwhip effect has been measured by assessing the accuracy of order quantity, product quality, and the dependability of delivery (Lee, et al., 1997a). Once guanxi has been established between supply chain partners and information is being freely shared, we argue that each of these aspects of the bullwhip effect can be addressed effectively, ultimately enhancing business performance.

As we have previously noted, trust and information sharing exist in relationships that are governed by guanxi. While previous literature supports that information sharing can reduce the bullwhip effect, we argue that guanxi provides additional leverage of inter-organizational trust and mutual obligations between parties which can significantly reduce the bullwhip effect leading to enhanced business performance. More specifically, guanxi propagates enhanced inter-organizational relationships resulting in more accurate orders to suppliers. Clearly, more accurate orders mitigate the variance amplification of the bullwhip effect (Lee, et al., 1997b). Furthermore, these more accurate orders will serve to reduce inventory at each point along the supply chain (Lee, et al., 1997b). An additional benefit of guanxi is that orders will be placed in a timely manner so that they can then be delivered in a timely manner. This dependability in the process of order fulfilment also reduces the bullwhip effect (Lee, et al., 1997b). Increased accuracy in order quantity, improved delivery dependability, and improved product quality all present opportunities for improved business performance. Thus, substantial cost savings can be realized by reducing the bullwhip effect (Lee, et al., 1997a; Zhao, Xie, & Leung, 2002). These financial benefits can facilitate market growth and improve the company's reputation among investors (Badri, et al., 2000; Ward, Leong, & Boyer, 1994).

The association between the bullwhip effect and business performance is not novel in literature. However, much foregoing research is based on simulation and secondary data. Furthermore, many of these studies do not provide background on specific strategies like guanxi used to reduce the bullwhip effect. In this study we wish to verify the following hypothesis using data collected through survey analysis.

Hypothesis 3: *Bullwhip effect reduction has a positive effect on business performance.*

3.4. The Moderating Effect of Competitive Intensity

Competitive intensity, or the degree of competition an organization faces, requires organizations to be flexible and adapt (Llorens et al., 2005). The effects of guanxi are greatly reduced during times of technological turbulence and competition (Gu, et al., 2008). Increased consciousness of competitive intensity will lead companies to value economic transactions over guanxi obligations (Dunfee & Warren, 2001).

Indeed, research has shown that increased competition will lead to the abandonment of guanxi-governed business transactions (Guthrie, 1998). Competitive intensity also has been shown to have an impact on the relationship between supply chain relationship quality and supply chain performance (Fynes et al., 2008). Additionally, while prior guanxi has a positive effect on export performance, increased competitive intensity has been shown to have a negative effect on the performance of some types of firms (Ambler, Styles, & Xiucun, 1999). Based on these foregoing studies we hypothesize:

Hypothesis 4: *Competitive intensity diminishes the positive effect of guanxi on a firm's business performance.*

3.5. Competitive Intensity and Business Performance

The competitive intensity of a given market or industry is one of the most commonly-studied variables in business research. Competitive intensity has been linked to choice of strategy (Thun, 2008) as well as supply chain performance (Fynes et al., 2008). Generally, it is believed that an environment with little competition is one in which strong performance is possible (Porter, 1979).

While guanxi can help improve social capital and increase supply chain efficiency, there are specific environmental factors that may impede performance regardless of guanxi's benefits. For example, even with high levels of guanxi, when competitive intensity is high, profits are threatened and can be eroded through price competition, innovation, or the development of substitute products and services. This explanation about highly-competitive environments and decreasing business performance has become almost axiomatic within business research. To verify previous work, we examine the following hypothesis:

Hypothesis 5: *Increasing competitive intensity has a negative effect on a firm's business performance.*

4. Methodology

4.1. Variables and Measurement

This study uses a two-part research design in order to increase the reliability and validity of the data collected. Part one involves constructing a questionnaire. This process began with reviewing and analyzing previous literature, and then moved to developing the theoretical framework. These steps have been reported in sections 2 and 3 of this paper. The next step involved constructing the questionnaire.

Our research model includes four constructs: guanxi, the bullwhip effect, the competitive environment, and business performance. All survey items were adapted from previous literature

(Jaworski & Kohli, 1993; Chan et al., 1997; Sabherwal & Chan, 2001; Fawcett et al., 2007; Gao et al., 2007; Gu et al., 2008). The guanxi construct consists of three dimensions, trust, information sharing, and control (see Table 1 for definitions). Our items were adopted from foregoing research in marketing that builds on social capital theory (Gu, et al., 2008). Foregoing research has often explored guanxi as an individual-level construct. In this paper, we consider how this individual-level construct has a bearing on organizational performance. Essentially, through guanxi networks, corporate exchange and favoritism are personalized. Managers can use interpersonal networks to create a pattern of corporate obligations, enabling firms to gain broader access to needed resources or protection that may be otherwise unavailable (Gu, et al., 2008; Handfield & McCormack, 2005; Szeto, Wright, & Cheng, 2006). The guanxi of the managers accrues to the firm, which benefits from the sum of these individual guanxi networks. Guanxi can also be considered a firm-level asset that influences resource availability and supplier relationships. Therefore, individual guanxi has an organizational-level impact on business performance.

INSERT TABLE 1 HERE

The bullwhip effect reduction construct also has three dimensions: accuracy in order quantity, delivery dependability, and product quality (Lee, et al, 1997b). Competitive intensity is composed of two dimensions, price competition and product differentiation, both of which have also been used in prior work (Jaworski & Kohli, 1993). All responses, adapted from previous studies, are measured on a seven-point Likert scale.

The business performance construct is a complex and multi-faceted concept (Chan, Huff, Barclay, & Copeland, 1997). In business strategy literature, it has often been suggested that multiple measures should be used when trying to assess business performance (Chan, et al., 1997; Chan, Huff, & Copeland, 1998; Sabherwal & Chan, 2001; Venkatraman & Ramanujam, 1986). Most operations strategy research, however, has employed only a single measure, profitability, when assessing business performance (Badri, et al., 2000; Ward & Duray, 2000). In an attempt to overcome the limitation of unidimensional measures of business performance, multiple measures are employed (Chan, et al., 1997; Venkatraman & Ramanujam, 1986). The business performance instrument used in this research includes three dimensions: market growth, financial performance, and company reputation that are used to create a composite measure of business performance¹. These measures have been used in information systems strategy research and were found reliable (Chan, et al., 1998; Sabherwal & Chan, 2001). In this study, the business performance measures were adapted from an earlier study with a small modification (Chan, et al., 1997). Although the perceptual nature of the data gathered is a limitation of the current study, perceptual data are frequently used in this type of research and their use is considered to be acceptable (Chan, et al., 1997; Sabherwal & Chan, 2001).

Two control variables were used in the current study: firm size and industry type. Firm size is often used as a control variable for studies in OM and MIS research (Schniederjans et al., 2012; Bharadwaj et al., 2009; Ranganathan and Brown, 2006). In this study, we follow Bharadwaj et al. (2009) and Ranganathan and Brown (2006) using the natural log of total assets of the

¹ The authors also conducted supplemental data analyses where each of the three dimensions of business performance were used individually as the dependent variable (rather than in a composite measure). The results were very similar to those with the composite business performance measure. These additional results are available from the authors upon request.

company as the proxy for firm size. Industry type was controlled by using the SIC code as a dummy variable that is assigned for each company (Gujarati 1970).

After assembling a preliminary version of our instrument based on prior literature, we then conducted interviews with key employees of Chinese manufacturing companies to check for content validity of the questionnaire. After our initial questions were refined, a pilot study was conducted by distributing the preliminary questionnaire² to the managers of several Chinese manufacturing companies in Shanghai, China. Managers were asked to examine the degree to which the preliminary questionnaire captured the measured constructs and how easy or difficult the preliminary questionnaire was to complete. Based on feedback received in this pilot study, minor adjustments were made in the instrument before conducting the survey. Content validity was thus established by defining the topic of concern, describing items to be scaled, developing the scales to be used, and using a panel of experts to judge the quality of the instrument (Cooper & Schindler, 1998).

4.2. Sampling and Data Collection

The unit of analysis in our study is the firm. The surveys were sent to one senior executive and one middle manager in the selected firms. Senior executives include chief executive officers (CEOs), chief operations officers (COOs), and general managers (GMs). Middle managers include supply chain/logistics managers, production managers, inventory managers, and supply chain coordinators. Surveys were mailed to firms in five different industries in the manufacturing sector: apparel manufacturing, computer and electronic product manufacturing, machinery manufacturing, chemical manufacturing, and transportation equipment manufacturing.

² The primary questionnaire was professionally translated and back translated from Chinese to English and vice-versa to ensure conceptual equivalence.

A total of 800 questionnaires were distributed in a single mailing in 2008 to current and former members of the Shanghai Logistics Industry Association (SLIA). From that mailing, 222 were returned. Of the 222 responses, 205 were usable resulting in an actual response rate of 25.6%³. The 15 unusable responses did not contain sufficient data for further analysis. This response rate is not unusual when the unit of analysis is the firm and the questionnaire involves extensive organizational level questions (Griffin, 1997). Table 2 presents the descriptive statistics for our sample and Table 3 displays correlations.

INSERT TABLE 2 HERE

INSERT TABLE 3 HERE

To examine possible non-response bias, responding companies were compared to non-responding companies on the distribution of their number of employees (firm size), by conducting a t-test (Flynn, Schroeder, & Sakakibara, 1994). Results of this analysis appear in Table 4, suggesting that respondents differ from non-respondents in terms of the size of the firm. Extra analyses were ran to both ensure the robustness as well as see if there are different results for firms with <500, for 500-1000 employees, and for >1000 employees (see Table 4) for 205 usable responses. Results show that there are no differences among these three groups.

³ According to Frohlich (2002), OM's response rates are historically low as compared with other areas in business school (e.g., marketing and management) let alone other science domains (e.g., medicine or social sciences) and do not show any upward improvement trend in recent years. To counter this issue, we examined the possible non-response bias using the t-test (please see section 4.2 of the paper for details).

INSERT TABLE 4 HERE

4.3. Reliability

For the variables measured by the questionnaire, reliability was assessed by both Cronbach's alpha and composite reliability scores. Cronbach's alphas were calculated for all constructs and dimensions in the conceptual model (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990). Cronbach's alpha is based on the correlations among the indicators that comprise a measure, with higher correlations among the indicators associated with high alpha coefficients (Pedhazur & Schmelkin, 1991). Cronbach's alpha is the most widely used method of reliability assessment in operations management research (Davis, 1995). The Cronbach's alpha values for all constructs and dimensions in this study (see table 5) exceed the suggested alpha value of 0.70 generally considered as 'adequate' for assessing reliability in empirical research (Nunnally, 1978). Thus, it is assumed that the scale items used in this research can be considered reliable. Both Cronbach's alpha and composite reliabilities are larger than 0.8 and deemed acceptable (Table 5). EFA results (loadings) show all standard loadings to be above the 0.60 threshold. Therefore, all items were retained in the data analysis (Table 6).

INSERT TABLES 5 & 6 HERE

4.4. Validity

Instrument validity includes both criterion-related validity and construct validity. Criterion-related validity is the degree to which the survey instrument correlates with one or more criteria. The expected cross-validity index (ECVI) is one measure for criterion-related validity (Kline,

1998). The ECVI values of all three constructs (largest being 0.76) in this research are well below the value of 1 rule for “adequate” in a criterion-related validity test.

Construct validity was examined using a two-step procedure. First, exploratory factor analyses were conducted for guanxi, bullwhip effect reduction, competitive intensity, and business performance. Factor solutions were consistent with prior studies. Second, to assess the convergent and discriminant validity of the constructs, constructs were separated into two models/groups. One group included guanxi, bullwhip effect reduction, and competitive intensity. The other group contained control variables and performance measures. (Li & Atuahene-Gima, 2002). Latent constructs were allowed to be correlated while constraining the measurement items and their error items to be uncorrelated. A confirmatory factor analysis (CFA) was performed to assess convergent validity. As Table 5 shows, all items loaded well on their respective factors (at least 0.66) and are statistically significant at the 0.01 level, strongly suggesting the presence of convergent validity (Bagozzi et al. 1991).

In addition, stand-alone fit indices were used to test the discriminant validity. They are based on the maximum likelihood fitting function, which performs much better than those indices derived from the generalized least squares approach (Hu & Bentler, 1998). Stand-alone fit indices include competitive fit index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI), and root-mean-square-error of approximation (RMSEA) (Marsh, Balla, & McDonald, 1988). The recommended maximum cut-off value close to 0.06 for RMSEA (Hu & Bentler, 1998). A minimum cut-off value close to 0.9 is suggested for CFI, GFI, AGFI, and IFI (Bollen, 1989). Also the chi-square test (χ^2) is employed to assess the discriminant part of the construct validity (χ^2 difference test using a significance of $p = 0.01$

level). These statistics appear in Table 7, where they have been calculated both for our base model as well as our model with interaction terms.

INSERT TABLE 7 HERE

Both models provide satisfactory fit, indicating unidimensionality of measures (Anderson & Gerbing, 1988). The recommended value of χ^2/df is less than 3.0 (Kline, 1998). In our case, values of χ^2/df are both less than 3.0 threshold. It also meets the criteria of five observations per estimated parameter. In our study, sample size is 205 with 19 parameters or about 11 observations per parameter and as such it is over the fit threshold of five. Loadings of items on their respective factors are all positive, high in magnitude, and statistically significant, showing that the scale had satisfactory convergent validity (Anderson & Gerbing, 1988). The results suggest that for every pair of factors in the measurement model, a two-factor model fits the data significantly better than a one-factor model, demonstrating satisfactory discriminant validity (Churchill, 1979; Spector, 1992). Taken together, the measures have good convergent and discriminant validities.

5. Results

SEM (LISREL) allows us to assess the relationships in our model. Our five hypotheses are summarized in Table 8. Our hypotheses are then tested in three different ways using both first order (i.e., factor level) and second order models (i.e., construct level). We begin by examining the direct effect of guanxi on bullwhip effect reduction (H2). This relationship is positive and significant, as shown in the initial column of results in both Tables 9 and 10. While Table 9 shows results of the second order models, Table 10 presents results from the first order models.

INSERT TABLES 8, 9, and 10 HERE

Then, we test the main effects in our research model, examining the influence of guanxi, bullwhip effect reduction, and competitive intensity on business performance (H1, H3, and H5). These results are denoted as ‘Model 1’ in Tables 9 and 10. The effect of guanxi on business performance (H1) is shown to be positive and statistically significant. In a confirmation of prior work, bullwhip effect reduction has a positive and significant impact on business performance (H3) and increasing competitive intensity has a negative and significant impact on business performance (H5).

Finally, we test the main as well as interaction effects in our model (H1, H2, H3, H4, and H5). To estimate the effects of interacting variables, a two-step estimation approach using SEM (Ping, 1995) was employed. The first step of the approach involves calculating the loading and error variance for the single indicator of the latent product using measurement model parameter estimates. The second step fixes the loading and error variance at their calculated values in the structural model. Our proposed moderating relationship, where competitive intensity reduces the positive effect of guanxi on business performance (H4) is statistically supported as well. These results are also shown in Tables 9 and 10. In all models, relationships are statistically significant and in the direction hypothesized.

6. Discussion

This paper has contributed to supply chain management literature in two ways. First we establish the novel link between guanxi and supply chain efficiency. Second, theoretical

knowledge was used to explore the links between guanxi, competitive intensity, bullwhip effect reduction and business performance.

The results of this study indicate that guanxi reduces the bullwhip effect and increases business performance as measured by market growth, financial performance, and company reputation. More generally, we have confirmed that social capital theory can be applied to the Chinese concept of guanxi to help understand how guanxi impacts personal and business relationships. The results also indicate that competitive intensity negatively affects business performance, and moderates the positive effect of guanxi on business performance. These results demonstrate that guanxi can be useful in reducing the bullwhip effect and aiding business performance. However, guanxi effectiveness may be reduced in periods of high competitive intensity.

6.1. Theoretical Implications

These results provide three key theoretical implications. First, we build on earlier work that has linked trust with business performance (Zaheer, et al., 1998). Our results both confirm this earlier work and affirm that trust does indeed have beneficial effects on business performance. Our results add to earlier work by showing that trust may play a relatively larger role in business relationships in some national/cultural contexts than it does in Western contexts. We suggest additional research to explicitly examine this possibility.

Second and most notably, our results have provided a logical and theoretical explanation for how guanxi provides benefits for firms. We have built on social capital theory to explain that reciprocity and mutual obligation develops in buyer-supplier relationships that develop in a Chinese context. These relationships are governed by the cultural concept of guanxi and enable partners to trust one another, to share information with one another, and even to control one

another. Trust, information sharing, and control, are then used to predict supply-chain partners' behaviour and reduce the negative effects of the bullwhip effect. Operational performance gains result, which are then translated into performance improvements for the business.

Third, our results provide support for the impact of competitive intensity on the relationship between guanxi and business performance. As stated previously, guanxi provides benefits for firms, however, this relationship may be contextual in nature. In competitive environments, guanxi may not maintain the same level of performance benefits that it might in a non-competitive environment. We thereby add to the plethora of previous research that discusses the benefits of guanxi by providing researchers one insight into a factor that can impede the performance benefits of guanxi.

6.2. Managerial Implications

In addition to the aforementioned theoretical implications, our study has three main managerial implications as well. First, this study has demonstrated that managers can affect their firm's market growth, financial performance, and company reputation by using guanxi in their daily activities when dealing with other firms or partners in a global context. Thus, a clear implication of this study is that managers whose businesses have operations in China should seek to cultivate relationships with their partners there. Developing guanxi with business partners is a way to improve supply chain efficiency by reducing the bullwhip effect and enhancing business performance. Managers should consider not only how to develop guanxi directly with Chinese partners, but they may also want to select Chinese partners based on those partners' guanxi networks. It can be very valuable to be in relationship with people and firms that have the guanxi to gain key government approvals, and to gain key resources and information. Admittedly, the

task of analyzing the strength of a potential partner's guanxi network will be challenging, but it is clearly a factor worth considering.

Second, even in non-Confucian cultures, managers should be aware that they can leverage trust, information sharing, and control to increase product quality, increase accuracy in order quantity, and increase delivery dependability. The use of guanxi is not only useful when dealing with Chinese organization counterparts, but it may also be useful when dealing with supply chain partners domestically or among non-Chinese businesses. Guanxi, as previously mentioned, expands the avenues through which managers and their firms can cultivate close, trust-based relationships. These relationships, as previously argued and shown, enable and enforce mutual obligations, lower information costs, and enhance control over business partners. Managers who rely solely on contractual clauses or Western "social exchange" strategies to ensure performance are not making use of all the social capital at their disposal.

Third, our results have confirmed the conventional wisdom that competitive intensity reduces business performance. A new finding in our research is that competitive intensity also reduces the ability of guanxi to improve business performance. Based on this finding, we remind managers that high levels of competition reduce the usefulness of many of the tools that they have available to help their firms compete and succeed. Managers may be tempted to feel secure in the trust they have developed with suppliers, the high degree of information exchanged, and even the control they possess in some supply chain relationships. Nevertheless, even these helpful forces may not be enough to protect or improve a firm's competitive position. Managers in these types of highly competitive settings should work to develop not only guanxi, but every additional advantage possible.

6.3. Limitations and Future Research

Various limitations exist in all research studies; some that are present in this study are listed here. First, while our article focuses on China, there are several other countries that have similar, related ethical concepts that may alleviate the effects of bullwhip effect within the supply chain more so than *guanxi*. Future research may examine these additional national-cultural contexts to identify the boundary conditions beyond which our claims cannot be generalized. Our results seem most likely to generalize to other Confucian cultures, where the concepts of *kankei* in Japan, *kwankye* in Korea are analogous to *guanxi* (Yeung & Tung, 1996). Generalization to other cultures with relationship networks similar to *guanxi* may be possible as well. Two such examples are the Russian concept of *blat* and the Arab concept of *wasta*. Again, future research should be undertaken to confirm our suggestions that the results of this study may also hold in these other cultural contexts.

Second, we have focused in this study on the upstream portions of the supply chain. We do this for three reasons. First, the bullwhip effects are most acutely felt at the upstream end as opposed to the downstream. Second, the bullwhip effect is most noticeable and challenging for upstream managers as opposed to downstream managers. Third, the effects of *guanxi* are more than likely to be observed by upstream members of the supply chain. . Retailers, wholesalers, manufacturers, and suppliers of raw materials are the linkages where personal relationships in *guanxi* networks have the potential to mitigate the propagation of the bullwhip effect. However, it is important to acknowledge that additional research on the bullwhip effect can be conducted at the downstream end as well.

Third and finally, our paper suggests the possibility that the relationship between *guanxi* and business performance may be more nuanced than the current study reveals. More specifically, it may be that *guanxi* has a simple positive relationship with business performance as our data

indicates. However, additional future work may reveal the presence of an inverted-U relationship at some high levels of guanxi. Such a relationship might be observed when good relationships between supply-chain partners lead them to ignore innovation and threats from potential competitors. This study finds no evidence for such a relationship in our data, but future work should not ignore this possibility.

6.4. Conclusion

With the realization that this is an era of ever increasing globalization, defined by complex supply chain networks, there is a need for organizations throughout the world to understand strategies to reduce supply chain complexity problems like the bullwhip effect. Additionally, the steady economic growth in the Eastern economy gives impetus for a deeper cultural knowledge of Eastern business customs and ethical standards.

Our paper provides both researchers and managers theoretical and empirical evidence that a firm's guanxi network has a positive effect on a firm's business performance. Our results confirm guanxi impacts business performance both directly and indirectly by alleviating the bullwhip effect in the supply chain. However, we also provide evidence of specific environmental contexts which may impede the usefulness of guanxi including a highly competitive environment. While guanxi has received considerable attention in the fields of marketing and organizational behavior, this paper will bring additional attention to this topic in operations management.

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