ABSTRACT

Title of Dissertation:	THE IMPACT OF EXECUTIVES WITH SUPPLY CHAIN AND OPERATIONS MANAGEMENT EXPERIENCE ON THE FIRM'S SUPPLY PORTFOLIO MANAGEMENT AND INVENTORY INVESTMENTS
	Rohan S. D'Lima, Doctor of Philosophy, 2020
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The two essays of this dissertation focus on the influence of supply chain and operations management executives on the firm's supply chain strategies. Essay 1 focuses on the differences between supply chain and operations management roles and investigates how these differences impact the firm's supplier portfolio management strategies. Essay 2, in turn, investigates the impact of a chief supply chain officer on a firm's inventory investment when the firm pursues a global sourcing strategy.

THE IMPACT OF EXECUTIVES WITH SUPPLY CHAIN AND OPERATIONS MANAGEMENT EXPERIENCE ON THE FIRM'S SUPPLY PORTFOLIO MANAGEMENT AND INVENTORY INVESTMENTS

by

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Chapter 1: Overview

The two essays of this dissertation focus on the influence of supply chain and operations management executives on the firm's supply chain strategies. Essay 1 focuses on the differences between supply chain and operations management roles and investigates how these differences impact the firm's supplier portfolio management strategies. Essay 2, in turn, investigates the impact of a chief supply chain officer on a firm's inventory investment when the firm pursues a global sourcing strategy. Both Essays 1 and 2 leverage archival data and econometric data analysis to further the debate in supply chain and operations management research.

Essay 1 of my dissertation is grounded in upper echelons theory (UET) and analyzes how the supply chain and operations managers on the firm's top management team affect its supplier portfolio management strategies. The main difference between supply chain management and operations management lies in the focus of each of these disciplines – operations management emphasizes optimizing the firm's internal cross-functional processes, while supply chain management centers on optimizing processes within the context of the firm as a part of the whole supply chain. In the paper, I look at how these differences impact the firm's strategic Supplier Portfolio Management (SPM). SPM focuses on the effective and efficient management of a firm's portfolio of supplier relationships. Strategic SPM requires the firm to set up plans for its supply base as a whole as well as the individual relationships with its suppliers. These strategic SPM decisions have long-term effects on the firm's overall performance and are thus the responsibility of the firm's top

management team (TMT). However, little consideration has been given to the link between the firm's TMT and its SPM strategies. I leverage upper echelons theory and look at how differences in the supply chain and operations roles on a TMT impact two key aspects of strategic SPM – the firm's geographic sourcing strategy that impacts the firm's supply base and the firm's supplier relationship strategy that impacts the firm's relationships with its individual suppliers. To assess the validity of my claims, various econometric techniques are used to analyze a panel dataset of 14,530 observations of buyer-supplier dyads over four years. This panel dataset is based on consolidated data from Compustat, Bloomberg's SPLC module, and Bloomberg's executive database. The results provide consistent support for the hypothesized theory that the differences in supply chain and operations management lead to significantly different outcomes.

Essay 2 of my dissertation aims to shed light on this by juxtaposing agency theory and upper echelons theory to analyze how a chief supply chain officer (CSCO) on a firm's top management team impacts its inventory investment when it pursues a global sourcing strategy. Firms maintain inventory to buffer the effects of uncertainties. Inventory protects the firm from uncertainties but also affects its material availability, performance, cash flow, stock market performance, and survival. Hence, balancing inventory and uncertainty becomes a strategic consideration and the responsibility of the firm's top management team. However, existing research has not considered the effect of a firm's TMT on its inventory investment. At the same time, most industries have seen an increase in global sourcing. Using agency theory, I argue that firms pursuing a global sourcing strategy

are exposed to increased supply uncertainty from risk sharing and agency problems. This increased uncertainty leads to a need for increased inventory buffers. Supported by upper echelons theory, I build my hypothesis that a CSCO on the TMT results in lower inventory investments by focusing on reducing the firm's exposure to uncertainties. Furthermore, given their insights into supply chain relationships, CSCOs are uniquely suited to improve collaboration, coordination and information sharing with a firm's global sourcing partners, leading to lower uncertainties and thus lower inventories. To assess the validity of my claims, I use different econometric techniques to analyze a panel dataset of 2,883 observations over five years. I assembled this panel dataset by consolidating data from Compustat, Bloomberg's SPLC module and Bloomberg's executive database. I demonstrate that firms with a chief supply chain officer on their TMTs have lower inventory investments when a firm pursues a global sourcing strategy.

This document is structured as follows. The next section contains the complete first essay which is being revised for submission to the Journal of Business Logistics (with co-authors J.-P. Paraskevas, T. Corsi and C. Grimm). Subsequently, I include the second essay which is being prepared for submission to Production and Operations Management (with co-authors J.-P. Paraskevas, A. Steven and T. Corsi).

Chapter 2: Supplier Portfolio Management Strategies: Does Top Management Team Composition Matter?

INTRODUCTION

A Harvard Business School study published in 1994 concluded that a key driver in the decline of U.S. competitiveness in the international marketplace over the previous decade was a lack of firm investment in intangible benefits such as supplier relations (Macbeth and Ferguson, 1994). More recent research suggests that a strong relationship between a buyer and its suppliers can be a key source of competitive advantage (e.g. Anderson and Katz, 1998; Dyer and Singh, 1998; Flynn et al., 2010; Frohlich and Westbrook, 2001; Metters, 1997; Narasimhan and Jayaram, 1998; Singh and Power, 2009). Buyers and suppliers interact with each other and develop relationships in order to cultivate and enhance their resources (Turnbull and Wilson, 1989). Over time, these strategic collaborations engender mutual trust, encourage efficient conflict resolution, and facilitate the sharing of information, rewards, and risks (Ellram and Cooper, 1990; Heide and John, 1990; Poirier and Reiter, 1996). Indeed, as highlighted by Ford et al. (1996), the coordination, mobilization, and enhancement of a company's portfolio of relationships and shared resources forms the basis of its network position and, hence, its competitive advantage.

Supplier portfolio management (SPM) focuses on the effective and efficient management of a firm's portfolio of supplier relationships as a key element in achieving a competitive advantage (Bensaou and Anderson, 1999; Olsen and Ellram, 1997; Sako et al., 2016). Firms that effectively manage relationships with their suppliers can gain the most benefit from their supply chain (Bensaou and Anderson,

1999; Frohlich and Westbrook, 2001; Hartmann et al., 2012; Kannan and Tan, 2002; Spekman et al., 1999; Wagner and Johnson, 2004). However, these relationships are complex and dynamic in nature (Ford, 1980). So, firm's need to match the appropriate relationship style with each of its suppliers (Turnbull et al., 1996).

Strategic SPM requires the firm to set up plans for its supplier base as a whole as well as for the individual supplier relationships (Wagner and Johnson, 2004). First, when developing a supplier base, a firm can choose to pursue a global or a domestic sourcing strategy which affects the spread of the firm's supplier base, hereafter referred to as its geographic sourcing strategy. In many industries, a prevailing trend during the 1990s had been a focus on increased global sourcing (Harbison and Pekar, 1997), often with an emphasis on reducing the cost of material and labor. However, global sourcing also increases the scope of operations and affects the firm's resources, capabilities (Trent and Monczka, 2003), supply risks (Yoon et al., 2018), and inventory investments (Han et al., 2008; Jain et al., 2013), thereby increasing the overall cost of doing business. Dealing with domestic suppliers can lead to simplified operations as well as lower storage and logistics costs, among other benefits (Ketokivi et al., 2017). Thus, while unit prices may be higher for goods sourced locally, the overall benefits may outweigh the added costs of sourcing globally. In fact, a report by the Boston Consulting Group (Sirkin et al., 2011) predicted that many firms will begin reversing their global sourcing decisions due to the total cost consideration. The relative complexity and importance of this decision makes geographic sourcing strategy an important consideration for SPM.

Second, strategic SPM requires the firm to develop effective relationships with individual suppliers (Bensaou, 1999), hereafter referred to as supplier relationship strategy. One important characteristic of the relationship is the power dynamic between the focal firm and its suppliers. How power is distributed between the focal firm and its suppliers impacts the nature of each relationship (Mahapatra et al., 2010). A power advantage allows a firm to extract greater benefits from the relationship (Malhotra and Gino, 2011; Pfeffer and Salancik, 2003). However, a power imbalance that favors one firm and puts its partner at risk can negatively affect the performance of both firms (Elking et al., 2017; Ireland and Webb, 2007; Nyaga et al., 2013). At the same time, firms in an asymmetric power relationship can unilaterally initiate strategies to change the power balance with their partners (Emerson, 1962; Maloni and Benton, 2000). For instance, buyers can make a strategic choice to limit their supply options, to make a financial commitment to the supplier, or to implement supplier development initiatives (Wagner and Johnson, 2004). Each of these strategic choices lowers the firm's bargaining power over the supplier and signals a willingness to build commitment, reputation, and trust with the supplier (Carson et al., 2006; Gulati and Sytch, 2007; Macaulay, 1963; Mahapatra et al., 2010; Morgan and Hunt, 1994; Sako et al., 2016). Therefore, the supplier relationship strategy between the firm and its suppliers is another strategic aspect of effective SPM.

Thus, the geographic sourcing strategy and the supplier relationship strategy are important considerations for effective SPM. I, therefore, focus this research on these two factors. The buyer's geographic sourcing strategy that affects the dispersion

of the firm's supply base, and its supplier relationship strategy impacting the power dynamic between the buyer and its individual suppliers.

Since these two core SPM decisions are strategic, research has indicated that they are made at the highest level in the firm through its top management team (TMT) (Bantel and Jackson, 1989; Eisenhardt and Schoonhoven, 1990; Finkelstein and Hambrick, 1990; Goll and Abdul, 1997; MacCurtain et al., 2010; Michel and Hambrick, 1992; Wiersema and Bantel, 1992). Indeed, Ellram (1991) as well as Wagner and Johnson (2004) highlighted the fact that top management involvement is imperative for effective SPM strategic decisions. Strategic decisions that affect a functional business unit or area are influenced by the subgroup of the TMT that is responsible for that area (Jackson, 1992). Experience or expertise in a functional area leads to deference from other top managers for those decisions (Finkelstein, 1992; Magee and Galinsky, 2008; Simpson et al., 2012). Thus, I argue that two distinct areas of the TMT are instrumental for strategic SPM decisions: the Chief Supply Chain Officer (CSCO) and the Chief Operations Officer (COO).

A review of the annual reports of a subsample of firms in this dataset supports the notion that a CSCO engages in different SPM strategies as compared to those targeted by a COO. It was found that the self-reported challenges and opportunities identified in the companies' annual reports differed between firms with a COO and those with a CSCO. Firms with a COO are focused on internal efficiencies through cost reductions, asset performance, operational efficiency, productivity, increasing capacity, and managing acquisitions, while reducing risks in their operations. Firms with a CSCO emphasized supply chain efficiencies through supply chain

improvements, enhancing global purchasing, and managing joint ventures, while reducing purchasing costs and supply shortages. This difference in the identification of challenges and opportunities lends credence to my assertion that the COO and CSCO focus on different aspects and thus emphasize different approaches to SPM.

This paper contributes to theoretical gaps in the SPM and TMT literature by examining the impact that TMT members responsible for supply chain and operations management have on two key aspects of their firm's strategic SPM – their firm's geographic sourcing strategy and its supplier relationship strategy. A review of the literature on geographic sourcing strategy and supply base dispersion demonstrates that it has a direct effect on supply chain length (Levy, 1997), quality risk (Gray et al., 2011; Narasimhan and Talluri, 2009), product recalls (Steven et al., 2014), and product safety and security (Marucheck et al., 2011). Firms can also take action to change their geographic sourcing strategy at a strategic level. I contend that enhanced understanding of a firm's dynamic sourcing strategy comes from examining the differing effects of COOs and/or CSCOs on the geographic sourcing strategy, previously not the subject of systematic research. Next, research on the supplier relationship strategy and power dynamics has evaluated the impact of many antecedents (Casciaro and Piskorski, 2005; Emerson, 1962; Pfeffer and Salancik, 2003; Provan and Skinner, 1989) and outcomes (Benton and Maloni, 2005; Cool and Henderson, 1998; Dwyer et al., 1987; Handley and Benton Jr, 2012; Mahapatra et al., 2010; Malhotra and Gino, 2011; McEvily et al., 2017; Nyaga et al., 2013; Wilkinson, 1979) of power balance in the supply chain. A firm can take steps to change the power balance with its partners (Emerson, 1962; Maloni and Benton, 2000).

Changing the power balance with a supplier has to be a strategic decision as it impacts how the firm does business in the future. I believe that the field's understanding of power dynamics is enhanced through an examination of how a COO and/or a CSCO impact the firm's overall supplier governance strategy, an area not previously studied in detail, however of key importance to the long-term success of a company. Hence, this research contributes to theory by developing unique hypotheses on the impact of COO and CSCO presences on a TMT on these two aspects of SPM. Specifically, I address the following research questions:

1. How do the chief supply chain officer and/or the chief operations officer on a firm's TMT influence its geographic sourcing strategy?

2. How do the chief supply chain officer and/or the chief operations officer on a firm's TMT influence its supplier relationship strategy?

In this study, I apply upper echelons theory (UET) (Hambrick and Mason, 1984) to the firm's TMT and propose that the functional differences in the CSCO and the COO of a firm's TMT can help answer these questions.

This study offers several contributions to theory. First, it proposes unique hypotheses grounded in the logic of upper echelons theory (Hambrick and Mason, 1984) to explain the impact of a COO's and CSCO's functional focus on their respective cognitive bases, perceptions, interpretations, and decision-making, affecting the firm's geographic sourcing strategy and its supplier relationship strategy as key aspects of its overall SPM. Second, this research expands on the supply chain

and operations management literature in UET by demonstrating that a CSCO on the TMT can lead to significantly different firm decisions when compared to the effects of a COO. In this regard, I am the first to consider the possibility of a COO and CSCO leading to differing outcomes. Third, it contributes to the literature stream on SPM by being the first study to explicitly link non-operational factors, in this case the effect of COOs and CSCOs on the firm's TMTs, to the firm's geographic sourcing strategy and its supplier relationship strategy. These research questions are of immense practical significance, as they focus on the importance of COOs and CSCOs shaping the actions and outcomes of economic enterprises. Since CSCOs and COOs can have significantly different effects on SPM decisions, firms need to be aware of this phenomenon in order to implement the right strategies to meet their goals.

This paper first offers a brief overview of UET. Next, I discuss the concept of SPM and link it to the CSCO and COO on a firm's TMT. In the third section, I develop hypotheses focusing first on the geographic sourcing strategy (global or domestic) and then on the supplier relationship strategy (power advantage or disadvantage) in the buyer-supplier relationship. I subsequently explain the research methodology and present the results. This paper closes with the discussion of this study's findings, including managerial implications and limitations, and offers a final conclusion.

THEORY AND RESEARCH BACKGROUND

Upper echelons theory and the top management team

Upper echelons theory links managers' characteristics to their decisions. UET builds on the concept of bounded rationality (Cyert and March, 1963; March and Simon, 1958), stating that decision makers are constrained by limitations in their information-gathering and -processing capabilities. These limitations make the explicit and timely calculation of an optimal solution prohibitively costly or impossible. Thus, when faced with complex circumstances, the decision maker has to forego the quest for an optimal solution and instead rely on one's own set of 'givens' to analyze the situation and make a determination (Hambrick and Mason, 1984; March and Simon, 1958). Hambrick and Mason (1984) define these givens as the decision maker's cognitive base and values. These givens result from managers' knowledge and experiences gained through their interests, functional backgrounds, industry and firm tenures, educational credentials, affiliations, personalities, and values, providing decision makers with their own highly personalized lenses that filter their perceptions of situations and, thereby, the actions to be taken (Chin et al., 2013; Hambrick, 2007; Hambrick and Mason, 1984; March and Simon, 1958; Shepherd et al., 2017).

Hambrick and Mason (1984) elaborate on this using a three-step mechanism and explain that each of these steps are, in turn, influenced by managers' givens. First, due to bounded rationality, individual managers cannot keep track of every part of the organization or every situation that they encounter. Instead, they focus on those aspects that are in their fields of vision. This field of vision is influenced by a

manager's functional background, interests, experience, and expertise. Therefore, different managers focus on different aspects when managing the firm. Second, when faced with a complex situation, a manager's perceptions of the situation are filtered to only consider a smaller subset of all the information available. This filter is formed from the individual manager's functional background, industry and firm tenure, educational credentials, affiliations, personality, and values (Chin et al., 2013; March and Simon, 1958) allowing the manager to sift through the available information and select only reasonable subsets of information that the manager perceives to be influential. In the third step, the manager processes the selected information to interpret its meaning and determine the best outcome. The Manager's field of vision, their perceptions of situations, and their values all bias the interpretation and thus, influence their strategic choices.

Hence, managers with varying experiences view the same situation in different ways, leading to different firm outcomes. For instance, a manager with experience in accounting interprets a situation differently than a manager with a marketing background. Therefore, UET posits that researchers can reliably use information about a firm's top management team (TMT) to develop predictions regarding its strategic actions (Donald et al., 2001; Hambrick, 2007). The TMT is defined as "the relatively small group of most influential executives at the apex of an organization – usually the CEO (or general manager) and those who report directly to him or her" (Finkelstein et al., 2009 p. 10). This implies that different backgrounds and characteristics of the firm's TMT members affect their decisions and, in turn, the firm's performance. To this end, UET (Carpenter et al., 2004; Hambrick, 2007;

Hambrick and Mason, 1984) posits that the heterogeneity in companies' actions and outcomes is due to the different characteristics within their TMTs.

Research on UET is focused on how TMT diversity influences managerial actions, strategies, and firm performance (see Carpenter et al., 2004; Finkelstein et al., 2009; Homberg and Bui, 2013; Jackson, 1992). For instance, TMTs with lower average ages, shorter organizational tenures, higher team tenures, higher educational levels, higher educational specialization heterogeneity, and higher academic training in the sciences lead to an increase in firms' strategic changes (Wiersema and Bantel, 1992). Also, TMTs that are diverse in terms of functional backgrounds, education, and company tenure exhibited a greater propensity for action (Hambrick et al., 1996). Team heterogeneity in terms of size, tenure, and individual member innovativeness leads to greater team innovativeness (West and Anderson, 1996). Furthermore, increased TMT age diversity, educational level, and tenure positively impact new product performance (MacCurtain et al., 2010). Female board representation is positively related to accounting returns, boards' monitoring responsibilities, and strategy involvement (Post and Byron, 2015). In fact, female representation in the upper echelons reduces the strategic risk-taking and benefits the long-term financial performance of the firm (Jeong and Harrison, 2017).

A more recent development in UET research is a focus on supply chain (SC) and operations (OPS) and the TMT. For instance, Marcel (2009) demonstrates that including a chief operations officer on the TMT benefits firm performance when the TMT is diverse in terms of tenure and functional background. More recently, Hendricks et al. (2014) show how a decrease in a firm's return on assets (ROA) and

an increase in its total costs over sales in one fiscal year, both of which are supply chain and operations performance measures, leads to a higher likelihood of a supply chain and operations management executive appointment in the next fiscal year. In turn, Roh et al. (2016) find that the appointment of a chief supply chain officer to the TMT improves firm ROA under certain conditions. More recently, Kumar and Paraskevas (2018) establish that supply chain management experience within the TMT results in firms having a more proactive environmental strategy. Additionally, Lu et al. (2018) state that top management involvement positively affects the deployment of supply chain security practices.

While the TMT is responsible for the strategic actions of the firm (Bantel and Jackson, 1989; Eisenhardt and Schoonhoven, 1990; Finkelstein and Hambrick, 1990; MacCurtain et al., 2010; Murray, 1989; Wiersema and Bantel, 1992), UET proposes that the individual managers focus their attention on the functional areas that align with their expertise. As such, decisions regarding strategic issues that affect a specific firm function are usually made by a subgroup of the TMT with experience in that area (Jackson, 1992). This echoes Finkelstein's (1992) argument that experience or expertise in a strategically critical function is a source of power among the firm's top managers and leads to deference from other members (Magee and Galinsky, 2008; Simpson et al., 2012). Thus, when considering the effects of the TMT characteristics on the firm's actions, I first need to identify the subgroup that has experience in or is primarily responsible for the relevant functional area and then use the characteristics of those members to predict the firm's actions.

Supplier portfolio management

Supplier portfolio management (SPM) focuses on the development and implementation of strategies for the effective and efficient management of the firm's portfolio of supplier relationships (Bensaou, 1999; Olsen and Ellram, 1997; Wagner and Johnson, 2004). Each firm's portfolio of buyer-supplier relationships is dynamic in nature, evolves over time and goes through a series of stages characterized by increasing mutual adaptation, closeness, and commitment (Ford, 1980). These adjustments allow the company to adapt to the ever-changing business requirements (Brito, 2001).

When considering SPM strategies, the various dimensions of the existing relationships are important to explore (see Olsen and Ellram, 1997). Among these myriad dimensions, past research has highlighted the significance of a firm's supply base dispersion, i.e. social, cultural, geographic, and time distances (Olsen and Ellram, 1997), power dynamic, trust (Gambetta, 1988; Harrigan, 1986; Kraljic, 1983; Lewis and Weigert, 1985; McEvily et al., 2017; Olsen and Ellram, 1997) and contracting strategies (Sako et al., 2016) between the firm and its suppliers, as each of these can influence the firm's interactions with its suppliers. Other elements to consider are the purchased products' characteristics, i.e. their strategic and economic importance (Olsen and Ellram, 1997) and possible switching costs as this limits firms' choices for sourcing alternatives. Information characteristics in the relationship, including quality and sharing (Monczka et al., 1998), enable firms to better manage sourcing, while firms' supply network size, i.e. the number of trading partners (Olsen and Ellram, 1997), is also important, as group membership is related

to individual power (Brass, 1984; Ibarra, 1992). These dimensions are by no means a comprehensive list, but they pertain to and help categorize the various aspects of firms' relationships with their suppliers.

However, it is important to separate the short-term management of individual relationships from the longer-term development of an overall strategy for the company's portfolio of relationships (Turnbull et al., 1996; Turnbull and Valla, 1986). In fact, setting up plans for the supplier base as a whole as well as for the individual supplier relationships is vital for strategic SPM (Wagner and Johnson, 2004). In this regard, for effective SPM, the firm needs to select a portfolio of suppliers and then develop the relevant relationships with these suppliers to achieve optimized operational effectiveness and efficiency (Cox and Thompson, 1997; Das et al., 2006; Lambert and Schwieterman, 2012; Wagner and Johnson, 2004).

Supplier portfolio management and the top management team

Determining a portfolio of suppliers and then developing the relevant relationships with them will have long-term effects on the performance of the firm. These decisions are consequently strategic in nature, and, thus, are likely to be made at the highest levels of the firm – within the TMT. This concurs with Cooper and Ellram (1993) who explain that a firm's top management level generally examines the more strategic issues, while middle and line managers manage the day-to-day operations. So, the firm's TMT makes strategic decisions that affect the firm's long-term performance, which are then implemented by the middle and line managers.

Among these decision makers on the TMT, upper echelons theory suggests that the individual managers take responsibility for decisions that affect areas in which they have the most experience (Hambrick and Mason, 1984). As the complexity of the situation and the uncertainty of outcomes increase, managers' perceptions of the situation, their interpretations of the information, and thus, their decisions are tempered by their functional experiences and values (Hambrick and Mason, 1984). Thus, possessing area-specific expertise allows a manager to apply this expertise to issues facing the firm, the strategies proposed by other TMT members, and the options available to the organization (Wheel Wright, 1984).

SPM decisions that focus on selecting and developing relationships with suppliers directly impact the value creation and delivery of products and services to the customers, known as a firm's supply chain and operations. So, strategic SPM decision making requires an analysis of the firm itself, its individual relationships, and its overall relationship portfolio and network position (Turnbull et al., 1996). Such an in-depth analysis necessitates detailed know-how about a broad spectrum of the firm's operations and supplier relationships, including inter-firm coordination, cross-organizational trade-offs, and cross-organizational team building abilities, as well as knowledge of a firm's overall strategy and the analytical tools to assess inter-organizational processes (Mentzer et al., 2008). Thus, as these strategic SPM decisions impact the firm's supply chain and operations, they require decision makers with expertise in those areas, making them the purview of the firm's supply chain and operations managers.

Supply chain and operations managers possess valuable insights gained from managing complex value chains, including understanding raw materials extraction, assembly, sales, and potential returns, which gives them a holistic view of their firms and their exchange partners (Prater and Whitehead, 2013). Thus, when faced with the complex requirements of strategic SPM decisions, these managers are uniquely suited to apply their expertise to the analysis and decision making. A review of the existing literature indicates that the impact of supply chain and operations managers on the firm's strategic SPM decisions has not been systematically investigated. This study aims to fill this gap by illuminating how CSCOs and COOs on a firm's TMT impact the firm's strategic SPM.

Operations and supply chain managers on top management teams

Operations and supply chain management are often treated as an aggregate construct in research and academic journals (e.g. Chopra et al., 2004; Coughlan et al., 2016; Hendricks et al., 2015). So, when considering supply chain management and operations management, I acknowledge that these are similar fields that are intrinsically linked and dependent upon each other (Stevenson, 2018). However, a closer look at each of these functions leads to the observation that there are significant differences between these two areas.

Mentzer et al. (2008 p. 33) state that "operations management refers to decision-making and problem solving that involves application of operations research and management science (OR/MS) quantitative methods across functional areas of the firm." In fact, the authors further define operations management as "applying

analytical tools and frameworks to improve business processes that cross internal functional boundaries" (Mentzer et al., 2008 p. 36). At the same time, the aim of the operations function is to add value during the transformation process of turning inputs into goods or services in order to offer the firm a competitive advantage (Frankel et al., 2008; Hanna and Newman, 2001; Heizer and Render, 2008; Mentzer et al., 2006; Schroeder et al., 2000; Stevenson, 2018). So, operations management, and thus operations managers, focus on managing intra-firm cross-functional processes to add value, while transforming resources into goods or services to offer the firm a competitive advantage. This is evidenced in reviews of annual reports that show that firms with an operations officer on the TMT, but no supply chain officer, are focused on internal process efficiencies by improving asset performance, operational efficiency, productivity and capacity while managing acquisitions and minimizing inventories and risks in their operations. So, the focus of operations managers is to minimize operational complications, supply risks, quality risks, inventory and resource commitments, while increasing asset performance and productivity to maximize the returns for the firm (Hanna and Newman, 2001; Heizer and Render, 2008; Render and Heizer, 1999; Schroeder et al., 2000).

In contrast, supply chain management applies "analytical tools and frameworks to improve business processes that cross organizational boundaries" (Mentzer et al., 2008 p. 38). Esper et al. (2010 p. 162) state that supply chain management "focuses on the management of exchange flows within and across the members of the supply chain". Moreover, Mentzer et al. (2001 p. 18) define supply chain management as the "systemic, strategic coordination of the traditional business

functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole." This definition points out the need for strategic coordination between the trading partners as well as the aim of supply chain management to improve the long-term performance of the individual firms and the supply chain as a whole (Christopher, 2016; Cooper et al., 1997; CSCMP, 2018; Fugate et al., 2006; Gibson et al., 2005; Simchi-Levi et al., 2000). So, supply chain management, and thus supply chain managers, focus on strategically coordinating inter-firm cross-functional processes with a firm's supply chain partners to improve the long-term performance of the firm and the supply chain. This is supported through reviews of annual reports show that firms with a supply chain officer on the TMT, but not an operations officer, are focused on inter-firm process efficiencies through supply chain enhancements, improving global purchasing, and managing joint ventures while reducing purchasing costs, and supply shortages. So, the focus of supply chain managers is to manage the flow of materials and information along the organizations in the entire supply chain, coordinate and collaborate with partners and manage relationships in the network of organizations (Lambert and Enz, 2017; Schroeder et al., 2000).

While both supply chain management and operations management emphasize aspects like adding value, reducing costs, efficient and effective allocation of resources, and matching demand with supply, each of these fields highlights different areas to achieve these objectives. Operations managers focus on optimizing the firm's internal processes, while supply chain managers concentrate on optimizing cross-

functional processes within the firm and across the supply chain. Therefore, the two roles have differing foci and utilize different approaches to achieve their goals. Furthermore, companies clearly differentiate between operations and supply chain managers. As such, depending on the function of the manager on the top management team, different strategies are used. In this research, I, therefore, follow the lead of industry and distinguish between supply chain and operations managers on the TMT.

HYPOTHESES DEVELOPMENT

Effective supplier portfolio management begins with identifying a portfolio of suppliers and then developing relationships with these suppliers to achieve optimized operational efficiency (Wagner and Johnson, 2004). When selecting suppliers, the firm can make the strategic choice to pursue a global instead of a domestic sourcing strategy affecting its supply base structure. At the same time, the firm can implement strategies to impact the power dynamic between the firm and its suppliers influencing the relationship between them. These two aspects, the firm's supply base structure and the relationship between the firm and its suppliers, are two of the key elements of managing a supply chain (Lambert and Cooper, 2000). Thus, this study's analysis focuses on these two dimensions of SPM: the supply base dispersion strategy, which is affected by its geographic sourcing strategy, and the power dynamic in the relationship that is a key aspect of the firm's supplier relationship strategy.

Geographic Sourcing Strategy

Sourcing relationships provide the buying firm with access to required material inputs, but also offer them access to the resources, knowledge, and complementary capabilities of their suppliers (Dyer, 2000; Lee and Klassen, 2008). Indeed, sourcing has become an important way for firms to access and utilize supplier capabilities and resources to achieve a competitive advantage (Heide and John, 1990). Thus, selecting the right suppliers can result in a competitive advantage for a firm.

There are many factors to consider when selecting suppliers. For instance, Vidal and Goetschalckx (2000) list transportation costs, infrastructure, general business environment at the location, closeness to markets, trade and investment patterns, cash flow considerations, proximity to suppliers, taxes and duties, managerial issues, information flow, and the possibility of strategic alliances and joint ventures as important factors in selecting suppliers. However, recent research has highlighted a focus on cost, quality, and delivery (Gray et al., 2017; Kotabe and Murray, 2004; Luthra et al., 2017; Setak et al., 2012). Among these, cost has been a prominent consideration with research stating that firms should focus on the total cost of ownership. However, while "[t]otal costing has been discussed for more than half a century, evidence suggests that few complex decisions truly incorporate comprehensive total-cost analysis" (Fawcett and Waller, 2011 p. 119). Indeed, in the previous decades, most western firms focused on the lowest price sources of supply, while downplaying other considerations (Alguire et al., 1994; Chang et al., 2011; Ghodsypour and O'Brien, 1998).

Prioritizing lower unit prices made global sourcing an attractive option (Trent and Monczka, 2003). However, Kotabe and Murray (2004 p. 9) point out that the "cost-saving justification for international procurement in the 1970s and 1980s was gradually supplanted by quality and reliability concerns in the 1990s." This change in focus makes the choice between global and domestic sourcing an important consideration for firms. Choosing between a global or domestic sourcing strategy impacts the spread of the firm's supply base – the firm's supply base dispersion.

Global sourcing allows firms to source material at lower unit prices (Trent and Monczka, 2003), to access higher product quality, production and process technology, and also to introduce competition to the domestic supply base (Trent and Monczka, 1998, 2003). Thus, global sourcing can offer a firm and the supply chain access to long-term competitive advantages over the firm's competitors. However, it also requires the management of geographically dispersed suppliers and, thus, can create operational complications (Keough, 1993; Mol et al., 2004). These challenges arise from increased lead times and lead time variability, increased material storage and handling requirements, increased costs to rectify quality issues, foreign exchange rates, differences in language, culture, political and legal environments (see Cho and Kang, 2001; Das and Handfield, 1997; Gray et al., 2017; Jain et al., 2013; Olsen and Ellram, 1997). Additionally, global sourcing also has a leads to higher supply chain risk (Narasimhan and Talluri, 2009; Trent and Monczka, 2003; Yoon et al., 2018) and increased product recalls (Steven et al., 2014), while lowering product safety and security (Marucheck et al., 2011). Thus, while global sourcing enables the firm to source its requirements at lower unit prices, it also leads to more operational

complications and higher resource commitments. The current supply chain disruptions due to the 2019 novel coronavirus are clear manifestations of the risks associated with a globally dispersed supply base (O'Leary, 2020). Thus, for global sourcing to be successful, the firms involved require improved communications, collaboration, and coordination mechanisms; the development of long-term buyer-supplier relationships; and the movement of larger quantities of material at a time (Das and Handfield, 1997). This implies that the successful implementation of global sourcing strategies necessitates a long-term plan with substantial commitment to increases in the scope of operations, resources, capabilities and risk management (Trent and Monczka, 2003; Vos et al., 2016).

Dealing with domestic suppliers instead can minimize many of the challenges associated with global sourcing through easier communication, lower inventory requirements, simplified operations (Cho and Kang, 2001; Trent and Monczka, 2003), and lower supply chain risks (Yoon et al., 2018). Domestic sourcing can also enable the firm to meet legal requirements to produce locally or even improve market performance as a domestic supplier understands the market better (Ketokivi et al., 2017). Thus, firms sourcing domestically may offset higher unit-prices through savings from simplified operations (Vos et al., 2016). Furthermore, domestic sourcing enables firms to coordinate their schedules more easily, receive deliveries of smaller quantities, and maintain stable supply chain pipelines (Das and Handfield, 1997). Thus, while domestic sourcing may involve higher unit prices, it enables the firm to function with fewer operational complications and lower resource commitments.

Operations managers and the geographic sourcing strategy

Operations managers focus on optimizing intra-firm cross-functional processes to offer the firm a competitive advantage (Hanna and Newman, 2001; Heizer and Render, 2008; Render and Heizer, 1999; Schroeder et al., 2000; Stevenson, 2018). UET emphasizes that this focus influences the cognitive base and values that an operations manager brings to the geographic sourcing decision. These givens create a screen between the situation and the decision maker's perception of it, thereby affecting the different stages of information processing that an operations manager goes through to turn the information from their environment into the firm's geographic sourcing strategy (Hambrick and Mason, 1984).

First, the cognitive base and values of operations managers narrow their fields of vision to focus on aspects of the firm's sourcing strategy that can impact the firm's internal processes (Goldratt and Cox, 2016; Render and Heizer, 1999; Ronen and Pass, 2008). Next, when perceiving and interpreting information regarding the sourcing options, their givens lead them to identify opportunities and threats to their emphasis on minimizing operational complications, supply risks, quality risks, inventory and resource commitments, while increasing asset performance and productivity to maximize the returns for the firm (Hanna and Newman, 2001; Heizer and Render, 2008; Render and Heizer, 1999; Schroeder et al., 2000). Finally, when selecting the sourcing strategy, these givens lead the operations manager to choose strategies that allow the firm to achieve its goals by optimizing its internal processes.

Therefore, when evaluating the firm's geographic sourcing strategy, the cognitive base and values of operations managers lead them to select strategies that

enable them to optimize the internal processes to reduce operational complications and resource commitments. The challenges involved in global sourcing make it difficult to optimize the firm's internal processes. Thus, I posit that an operations manager on the TMT decreases the number of overseas sourcing partners. Hence:

H1: There is a negative relationship between the presence of an operations manager on the TMT and the firm's global sourcing strategy.

Supply chain managers and the geographic sourcing strategy

Supply chain managers focus on strategically coordinating inter-firm cross-functional processes with their supply chain partners to improve the long-term performance of the firm and the entire supply chain (Cooper et al., 1997; Fugate et al., 2006; Langley Jr and Holcomb, 1992; Li et al., 2006; Simchi-Levi et al., 2000). This focus influences the cognitive base and values of these supply chain managers. These givens then impact the manager's perceptions and thus their decisions regarding the firm's geographic sourcing strategy (Hambrick and Mason, 1984).

First, the givens narrow the fields of vision of supply chain managers to focus on aspects of the firm's sourcing strategy that can impact the inter-firm cross functional processes (Christopher, 2016; CSCMP, 2018; Mentzer et al., 2008). Second, when perceiving and interpreting information about the sourcing options, these givens lead supply chain managers to concentrate on opportunities and threats to the long-term performance of the firm and the supply chain (Christopher, 2016; CSCMP, 2018; Mentzer et al., 2008). Third, supply chain managers focus on coordinating and collaborating with partners, managing the flow of materials and

information along the organizations in the entire supply chain, and managing the relationships in the network of organizations (CSCMP, 2018; Lambert and Enz, 2017; Schroeder et al., 2000). These are all antecedents of successful global sourcing (Fugate et al., 2006; Kotabe and Murray, 2004).

When selecting the sourcing strategy, these givens lead the supply chain manager to choose strategies that lead to the long-term performance and competitive advantage for both their firm and their supply chain partners. Therefore, with regard to the firm's geographic sourcing strategy, the givens that supply chain managers possess lead them to select strategies that enable them to realize long-term benefits for the firm and the entire supply chain. Their focus on managing the flow of materials and information along the supply chain, coordinating and collaborating with partners and managing the relationships in the network of organizations allows them to mitigate some of the challenges in global sourcing. This enables them to realize the added benefits from global sourcing. Thus, I posit that managers with supply chain experience increase the number of global sourcing partners that their firms interact with. Hence:

H2: There is a positive relationship between the presence of a supply chain manager on the TMT and the firm's global sourcing strategy.

Supplier Relationship Strategy

The firms in buyer-supplier relationships are discrete yet interdependent entities that are linked together to collectively transform raw materials into finished

products (Hult, 2002; Mabert and Venkataramanan, 1998). However, these relationships are characterized by information asymmetries, bounded rationality, and the potential for opportunism (Ribbink and Grimm, 2014; Williamson, 1975). Being opportunistic, supplier firms lack the incentive to tie themselves to just one customer (Cox, 1999) and are, thus, often a part of multiple other supply chains (Mentzer et al., 2001). Consequently, their individual profit maximization objectives (Hanna and Newman, 2001; Porter, 1980) and commitments to other customers can lead to conflicts of interest (McCarter and Northcraft, 2007; Weber et al., 2004; Wit and Kerr, 2002), which in turn can negatively affect the performance of some supply chains of which they are a part. One way for a buyer firm to counter this and manage the relationship is through effective interorganizational governance mechanisms with its suppliers (Mahapatra et al., 2010).

In a sourcing relationship, the governance mechanism is the firm's contract with its suppliers (Sako et al., 2016). These contracts define the interaction type on a spectrum between a bargaining based relationship and a bilateral-exchange based sourcing relationship (Macneil, 1977, 1980; Mesquita and Brush, 2008; Sako et al., 2016). In these relationships, the power dynamic between the firm and its supplier affects the relationship and governance mechanism being used (Mahapatra et al., 2010).

In a bargaining based relationship, each party seeks to attain its own goals and gain the most benefits from the relationship (Schmidt and Kochan, 1977). Firms in such relationships look for ways to get their partners to concede to their demands. In this dynamic, anything that can offer a firm an advantage over its partners is

desirable. A firm with a power advantage over its partner can choose to exercise this power and extract the most benefits from the relationship (Brown et al., 1983; Emerson, 1962; Handley and Benton Jr, 2012; Lippman and Rumelt, 2003). This enables the firm to achieve its own goals and maximize its returns. Thus, firms that pursue a bargaining based strategy aim to reduce their switching costs, commitment towards and dependence on their suppliers (Inkpen and Beamish, 1997; Mahapatra et al., 2010; Pfeffer and Salancik, 2003; Sako et al., 2016) in order to increase their bargaining power in the relationship.

Firms in a bilateral-exchange based relationship perceive mutual benefits and gains from interacting with each other (Schmidt and Kochan, 1977). These relationships are based on mutual trust and information exchange, with firms focusing on the long-term performance of the relationship (Frohlich and Westbrook, 2001; Lambert and Cooper, 2000). In these relationships, anything that can lead to the failure of the alliance is undesirable. A power imbalance in a relationship increases the threat of opportunism (Provan and Skinner, 1989) and can hamper relationship development and trust (McEvily et al., 2017; Thye et al., 2011). This power imbalance can reduce commitment, cooperation, compliance, and conflict resolution while increasing dissension, and lowering the performance of both firms (Brown et al., 1995; Ellram and Cooper, 1990; Lambert and Cooper, 2000; Nyaga et al., 2013; Thye et al., 2011), leading to the failure of the relationship (McCarter and Northcraft, 2007). However, firms can signal an interest in developing a close, partnership-type relationship by undertaking supplier development activities, making a financial commitment to the supplier or by reducing their supply options (Wagner and

Johnson, 2004). These steps reduce the firm's power advantage in the relationship and help build commitment, reputation, and trust (Carson et al., 2006; Gulati and Sytch, 2007; Macaulay, 1963; Mahapatra et al., 2010; Morgan and Hunt, 1994; Sako et al., 2016), which strengthen these bilateral-exchange based supply chain relationships.

Operations managers and supplier relationship strategy

The goal of an operations manager is to offer the firm a competitive advantage through optimization of its internal processes (Hanna and Newman, 2001; Heizer and Render, 2008; Mentzer et al., 2006; Mentzer et al., 2008; Render and Heizer, 1999; Schroeder et al., 2000; Stevenson, 2018). UET states that this goal influences the cognitive base and values that the operations manager brings to the situation (Hambrick and Mason, 1984). These 'givens' create a screen between the situation and the decision makers' perceptions of it that in turn affects the different stages of information processing that managers go through to turn the information from their environment into firm strategy.

First, the operations manager's givens narrow their field of vision to prioritize aspects of the firm's supplier relationship strategy that can impact their firm's processes (Hanna and Newman, 2001; Mentzer et al., 2008; Stevenson, 2018) and affect their goals of minimizing resource commitments and operational costs, while maximizing asset performance and returns (Hanna and Newman, 2001; Heizer and Render, 2008; Render and Heizer, 1999; Schroeder et al., 2000). Second, operations managers accomplish their goals by optimizing the returns from the firm's resources

and relationships (Goldratt and Cox, 2016; Render and Heizer, 1999; Ronen and Pass, 2008). So, when perceiving and interpreting information, operations managers are biased towards identifying aspects of each type of supplier relationship strategy that can impact the resource commitments, asset performance, cost savings and value addition for their firms. Third, when selecting the supplier relationship strategy, operations managers' focus on intra-firm optimization primes them to choose the strategy that leads to lower resource commitments, improved asset performance, increased cost savings and higher value addition for the firm itself.

Therefore, when evaluating the firm's supplier relationship strategy, operations managers' givens lead them to select the strategy that enables them to gain the most benefits from the relationship. In a buyer-supplier relationship, this goal can best be attained when the relationship is governed by a bargaining-based mechanism and the focal firm possesses a power advantage over its supplier. Hence, I posit that operations managers pursue a bargaining-based relationship to achieve a competitive advantage. Consequently, this leads them to increase their power advantage to gain the most from these relationships. Thus:

H3: There is a positive relationship between the presence of an operations manager on the TMT and the power advantage of the firm.

Supply chain managers and supplier relationship strategy

The goal of a supply chain manager is to improve the long-term performance of the firm as well as the entire supply chain through inter-firm process optimization (Christopher, 2016; Cooper et al., 1997; Fugate et al., 2006; Langley Jr and Holcomb,

1992; Li et al., 2006; Mentzer et al., 2008; Simchi-Levi et al., 2000). According to UET, this focus on the performance of the firm and its supply chain partners influences the cognitive base and values that the supply chain manager brings to a situation (Hambrick and Mason, 1984). They create a screen between the situation and the decision makers' perceptions of it that, thereby affecting the managers' information-processing stages to turn the input from their environment into firm strategy (Hambrick and Mason, 1984).

First, the supply chain manager's cognitive base and values narrow their field of vision to prioritize facets of the firm's supplier relationship strategy that can improve the inter-firm processes and lead to long-term performance across the supply chain (Christopher, 2016; CSCMP, 2018; Mentzer et al., 2008; Simchi-Levi et al., 2000). Second, these supply chain managers accomplish their goal by managing the flow of materials and information through the organizations in the entire supply chain, coordinating and collaborating with partners, and managing the relationships in the network of organizations (CSCMP, 2018; Lambert and Enz, 2017; Schroeder et al., 2000). So, when perceiving and interpreting information, they are biased to identify aspects of each type of supplier relationship strategy that can impact the inter-firm processes, the coordination and collaboration between partners and the relationships between them. Finally, when selecting the supplier relationship strategy, this bias steers the supply chain manager to choose the strategy that leads to improved flow of materials and information through the supply chain, increased coordination and collaboration with partners, and closer relationships in the network of organizations.

Therefore, when evaluating the options in the firm's supplier relationship strategy, the perspective that supply chain managers possess leads them to focus on ways to maximize the long-term value creation across their supply chains. In a buyer-supplier relationship, this goal can best be attained when the firms coordinate, collaborate, and manage the relationship to achieve a sustained competitive advantage for the entire supply chain. This is enabled by a bilateral-exchange based relationship with firms signaling an interest in developing close, partnership-type relationships. These firms thus take steps to reduce their power advantage. Thus, I posit that managers with supply chain experience pursue a bilateral-exchange based relationship to achieve a competitive advantage. Consequently, this leads them to reduce the power imbalance to gain the most from these relationships. Hence:

H4: There is a negative relationship between the presence of a supply chain manager on the TMT and the power advantage of the firm.

DATA AND METHODOLOGY

Data Sample

To test these hypotheses, I focus my analysis on a panel dataset of publicly held U.S. manufacturing firms and their major suppliers. I gathered this data from three data sources – Compustat, Bloomberg's SPLC supply chain module and Bloomberg's executive database. All Bloomberg data was accessed through a Bloomberg terminal. I first compiled a list of all manufacturing firms included in the Compustat database with a four-digit North American Industry Classification System

(NAICS) code in the range of 3111 to 3399. I then matched this list with Bloomberg's SPLC supply chain database module and eliminated firms that were not present in both databases.

I then used Bloomberg's SPLC database to collect data regarding the links between the remaining firms and their major suppliers. Since this data was collected from the Bloomberg database, I could only gain access to data for four years, from 2011 to 2014. There are two aspects of the Bloomberg SPLC database that make it ideal for testing my hypotheses. First, Bloomberg's SPLC database only focuses on the firms' major external suppliers. These suppliers are vital for the firm's performance and thus are monitored by the top management team. Second, the links between the buyer and supplier are quantified in terms of the percentage of a focal firm's total cost spent with each supplier and the percentage of each supplier's revenue attributable to the focal firm's purchases. This provides a measure of the power balance between these firms. A more detailed description of the Bloomberg SPLC module can be found in Steven et al. (2014) and Elking et al. (2017).

After eliminating firms with missing or incomplete data, the final data contained 15,226 buyer-supplier-year observations. This information was collected from the Bloomberg executive database, consistent with Kumar and Paraskevas (2018). This data sample included 538 unique focal firms linked to 3,898 unique suppliers (Cost of Goods Sold accounts) across the four years. This data sample is an unbalanced panel data set of buyer-supplier pairs in 2014. I use these buyer-supplier relationships with the buyer as focal firm for the unit of analysis.

Variables

Dependent Variables

Geographic sourcing strategy

For hypotheses 1 and 2, I theorize that supply chain and operations managers affect the geographic sourcing strategy of the focal firm. I measure the focal firm's geographic sourcing strategy as the ratio of the number of foreign suppliers to the total number of suppliers that it has in its supplier portfolio each year. This variable is operationalized in four steps. First, for each focal firm, I identify the location (foreign vs. domestic) of each of the suppliers in the dataset. Next, for each focal firm, I calculate the total number of foreign suppliers that it has in each year. I then compute the ratio of the foreign suppliers to total number of suppliers in the dataset. Finally, to facilitate comparisons between focal firms, for each focal firm, I calculate this ratio as a percentage (*% Foreign Suppliers*). An increase in this value indicates an increase in the number of foreign suppliers compared to the number of domestic suppliers. This measure is used in the analysis. The data for this variable was gathered from the Bloomberg SPLC database and is thus focused on the focal firm's major external suppliers only.

Supplier relationship strategy

For hypotheses 3 and 4, I theorize that supply chain and operations managers on a TMT impact the focal firm's supplier relationship strategy. In this study, the supplier relationship strategy is represented by the buyer's power advantage over each of its suppliers in the given year. This is operationalized by using a combination

of measures from past research (i.e. Elking et al., 2017; Emerson, 1962; McEvily et al., 2017). A firm's power over its supplier is the dependence of the supplier on the firm (Emerson, 1962). However, a firm's *power advantage* over its supplier is the ratio of its power to its supplier's power (McEvily et al., 2017). So, combining these two ideas, the power advantage in a buyer-supplier relationship is the ratio of the supplier's dependence to the buyer's dependence. So, if I consider the buyer to be firm "a" and its supplier to be firm "b", P_{ab} is the power of the buyer over its supplier; P_{ba} is the power of the supplier over the buyer. Analogously, D_{ba} is the dependence of the supplier on the buyer, and D_{ab} is the dependence of the buyer on the supplier. Using these conventions, the buyer's power advantage is represented by the following set of equations:

$$P_{ab} = D_{ba} \text{ and } P_{ba} = D_{ab} \tag{1}$$

$$Power\ Advantage = \frac{P_{ab}}{P_{ba}} = \frac{D_{ba}}{D_{ab}} \tag{2}$$

In a business relationship, the dependence of one firm on another is due to the resources that the first firm can gain access to through or from the other (Turnbull et al., 1996; Turnbull and Wilson, 1989). Among these, the financial resources and, thus, the financial dependence is an important consideration is as it affects the company's ability to operate (Turnbull et al., 1996). Elking et al. (2017) demonstrate that a supplier's financial dependence on its buyer can be measured by the percentage of its total revenue that it earns from the buyer, while the buyer's financial dependence on a supplier can be measured by the percentage of its total cost of goods sold that it spends with the supplier. This is represented by the following equation:

$$D_{ba} = \%rev \text{ and } D_{ab} = \%cost \tag{3}$$

Hence, based on equations 2 and 3, the power balance can be measured using the ratio of the percentage of the suppliers' revenue from the focal firm to the percentage of the focal firm's costs that it spends with the supplier. A value greater than 1 indicates that that buyer has more power than its supplier, while a value lower than 1 indicates that the supplier has more power than the buyer. In order to normalize the data distribution and to allow for ease of interpretation, I use the natural log of this measure for the analysis. The data for this variable was gathered from the Bloomberg SPLC database and is thus focused on the focal firm's major external suppliers only.

$$Power\ Advantage = \frac{P_{ab}}{P_{ba}} = \frac{D_{ba}}{D_{ab}} = \frac{\%rev}{\%cost} \tag{4}$$

$$Ln\ Power\ Advantage = \text{Natural log of Power Advantage} \tag{5}$$

Independent Variables

The first hypothesized independent variable, "*SC Manager*", is a dummy variable denoting the presence of a chief supply chain officer on the focal firms' TMTs in the previous year, while the second hypothesized independent variable, "*OPS Manager*", is a dummy variable denoting the presence of a chief operations officer on the focal firms' TMTs in the previous year. The data used to calculate these variables were collected through the Bloomberg executive database, consistent with Kumar and Paraskevas (2018). I operationalize these variables by examining the TMT of each focal firm and identifying the existence of a chief supply chain officer or a chief operations officer in the past year respectively.

To validate these measures, I took a random sample of the firms in this dataset that had multiple years of observations. I then analyzed their annual reports to identify their self-reported supply chain and operations risks. I find significant differences in the risks that the firms reported depending on whether they had a *SC Manager* or an *OPS Manager* on their TMT. According to their annual reports, firms with an *OPS Manager* are focused on cost reductions, asset performance, operational efficiency, productivity, increasing capacity and managing acquisitions while minimizing inventories and reducing risks in their foreign operations. Firms with a *SC Manager* emphasize supply chain improvements, improving global purchasing, and managing joint ventures while reducing purchasing costs, and supply shortages. Other than supply chain and operations disruptions, I find no overlap in the risks identified by firms with a *SC Manager* as compared to those flagged by firms with an *OPS Manager*. This supports the notion that the *SC Manager* and *OPS Manager* measures used in this research conform to the different roles as defined by the firms in this study.

Control Variables

The panel structure of the data accounts for some of the unobserved heterogeneity among the focal firms in the sample, but, for added robustness, I augment this unbalanced panel dataset with several lagged time-varying controls as recommended by past research. I include three variables to control for differences in focal firms. The first firm-level control is the natural log of the firm's revenue in the past year, "*Ln(Revenue)*" to account for the firm's size, which plays an important role

in its decisions and performance (Chen and Hambrick, 1995; Lieberson and O'Connor, 1972; Nadkarni et al., 2016). I next include the firm's return on assets in the past year, "*ROA*", since financial strength and past performance have a significant impact on a firm's decisions and performance (Boeker, 1997; Lieberson and O'Connor, 1972; Nadkarni et al., 2016). The third firm-level control is a size-controlled measure of a firm's capital expenditure in the past year, "*Capex*", and it is operationalized as the firm's total capital expenditure divided by its revenue. Capital expenditure can have a significant impact on a firm's expansion, technology changes, and investment decisions.

I include four variables to control for differences in each focal firm's TMT. First, as TMT size affects decisions and performance (Eisenhardt and Schoonhoven, 1990; Hambrick, 2007; Sanders and Carpenter, 1998; Smith et al., 1994), the total number of the executives in the firm's TMT in the past year, "*Total Number of Execs*" is added to the analysis. Next, the "*Average Age*" of the executives on the TMT in the past year is included as decision makers' ages affect their decisions (Taylor, 1975; Tihanyi et al., 2000). I also add "*Age Range*" of the members of the TMT in the past year as a measure of the differences in ages between the oldest and the youngest member of the TMT: the age range of the TMT can impact the dynamics of the decision-making process. The variable "*Percentage Male*" controls for the percentage of male executives on the firm's TMT in the past year, as gender differences can impact TMT behavior (Kumar and Paraskevas, 2018).

Finally, I incorporate controls for buyer industry effects using two-digit NAICS codes as industry characteristics can impact the firm's strategic actions

(Finkelstein and Hambrick, 1989). These industry segments are classified based on characteristics such as production processes, technologies, and product offerings, and are likely to affect firm performance. This control variable accounts for any industry-specific attributes that were omitted and may affect firm performance.

Furthermore, to test the effect of a SC manager and an OPS manager on power dynamic, I include an additional control variable that accounts for the "*Mutual Financial Dependence*" between the focal firm and each of its suppliers. This variable is operationalized using the dependence of the buyer on the supplier and the dependence of the supplier on the buyer. Specifically, the mutual financial dependence is the sum of the buyer's dependence on the supplier and the supplier's dependence on the buyer which is represented by the following:

$$Mutual\ Financial\ Dependence = D_{ba} + D_{ab} = \%\,rev + \%\,cost \qquad (7)$$

Descriptive Statistics and Correlations

Tables 1 and 2 provide the descriptive statistics for the variables used in the analysis for H1 and H2 (*% Foreign Suppliers*), and for H3 and H4 (*Ln Power Advantage*) respectively. As *Ln Power Advantage* is calculated as a ratio, observations where the denominator was 0 were excluded, thereby, reducing the sample when compared to *% Foreign Suppliers*. Similarly, Tables 3 and 4 show the correlations between the variables used in the analysis for H1 and H2, and for H3 and H4, respectively.

Table 1: Descriptive statistics: Supply base dispersion as Percentage of Foreign Suppliers

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
% Foreign Suppliers	14,185	46.881	19.612	0	100
SC Manager	14,185	0.218	0.413	0	1
OPS Manager	14,185	0.368	0.482	0	1
Revenue	14,185	55712.97	72796.6	0.16	390247
Ln(Revenue)	14,185	10.051	1.607	-1.832	12.875
ROA	14,185	0.048	0.106	-1.719	2.549
Capex	14,185	3666.106	7407.931	0	37985
Capex/Revenue	14,185	0.059	0.614	0	51.5
Total Number of Execs	14,185	14.429	5.464	1	34
Percent Male	14,185	0.865	0.098	0.5	1
Average Age	14,185	54.444	3.107	35	75
Age Range	14,185	18.835	6.439	0	46

Table 2:Descriptive statistics: Power dynamic as Ln Power Advantage

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Power Advantage	12,841	525.056	13179.81	0.0000082	860622.5
Ln Power Advantage	12,841	2.226	2.665	-11.714	13.665
SC Manager	12,841	0.221	0.415	0	1
OPS Manager	12,841	0.365	0.481	0	1
Revenue	12,841	55734	73523.12	0.16	390247
Ln(Revenue)	12,841	10.053	1.582	-1.833	12.875
ROA	12,841	0.051	0.105	-1.719	2.549
Capex	12,841	3691.85	7473.305	0	37985
Capex/Revenue	12,841	0.061	0.645	0	51.5
Total Number of Execs	12,841	14.362	5.437	1	34
Percent Male	12,841	0.866	0.098	0.5	1
Average Age	12,841	54.399	3.053	35	75
Age Range	12,841	18.796	6.468	0	46
Mutual Financial Dependence	12,841	2.466	6.789	.000014	100.047

Table 3: Correlations: Supply base dispersion as Percentage of Foreign Suppliers

	1	2	3	4	5	6	7	8	9	10
% Foreign Suppliers (1)	1									
SC Manager (2)	0.172*	1								
OPS Manager (3)	-0.131*	0.170*	1							
Ln (Revenue) (4)	0.151*	0.206*	-0.008	1						
ROA (5)	0.042*	-0.046*	-0.185*	0.203*	1					
Capex (6)	-0.013	-0.012	0.012	-0.072*	-0.013	1				
Total Number of Execs (7)	0.133*	0.251*	0.082*	0.409*	-0.001	-0.019*	1			
Percent Male (8)	0.118*	-0.012	-0.071*	-0.171*	-0.001	0.037*	-0.183*	1		
Average Age (9)	0.172*	0.007	0.077*	0.218*	0.021*	-0.001	0.202*	0.101*	1	
Age Range (10)	-0.097*	0.112*	0.176*	-0.054*	-0.069*	-0.008	0.357*	-0.009	0.139*	1

Table 4: Correlations: Power dynamic as Ln Power Advantage

	1	2	3	4	5	6	7	8	9	10	11
Ln Power Advantage (1)	1										
SC Manager (2)	0.085*	1									
OPS Manager (3)	0.026*	0.171*	1								
Ln (Revenue) (4)	0.571*	0.206*	-0.008	1							
ROA (5)	0.114*	-0.047*	-0.185*	0.203*	1						
Capex (6)	-0.012	-0.012	0.012	-0.072*	-0.013	1					
Total Number of Execs (7)	0.237*	0.251*	0.082*	0.409*	-0.001	-0.019*	1				
Percent Male (8)	-0.134*	-0.012	-0.071*	-0.171*	-0.001	0.037*	-0.183*	1			
Average Age (9)	0.101*	0.007	0.077*	0.218*	0.021*	-0.001	0.202*	0.101*	1		
Age Range (10)	0.011	0.111*	0.176*	-0.054*	-0.069*	-0.008	0.357*	-0.009	0.139*	1	
Mutual Financial Dependence (11)	0.149*	-0.002	0.013	0.046*	0.012	0.016	-0.023*	0.026*	-0.083*	-0.029*	1

With any statistical analysis, multicollinearity is an important consideration. While multicollinearity does not violate OLS assumptions (i.e. the OLS estimates are still linear unbiased estimators), it does lead to larger standard errors. These in turn lead to smaller t-statistics, making it harder to reject the null for correlated variables. Correlations greater than 0.6 are a good indicator of multicollinearity (Hair et al., 1998). However, as can be observed from the correlation tables above (Tables 3 and 4), the highest correlation value is 0.409 between Total Number of Execs and Ln(revenue). This indicates that multicollinearity is not an issue in this analysis.

Model Specification

The hypotheses propose that the supply chain and operations managers on the focal firm's TMT have distinct and opposite impacts on the firm's strategic supplier portfolio management. This in turn affects the firm's power dynamic and supply base dispersion. H1 proposes that having an operations manager on the focal firm's TMT reduces its supply base dispersion, while H2 proposes that the presence of a supply chain manager on the focal firm's TMT leads to an increase in its supply base dispersion. To test these hypotheses, the following model was constructed:

$$\begin{aligned} \%\ foreign\ suppliers = {} & \beta_0 + \beta_1\ SC\ Manager + \beta_2\ OPS\ Manager \\ & + \beta_3\ Ln\ (Revenue) + \beta_4\ ROA + \beta_5\ Capex + \beta_6\ Total\ Number\ of\ Execs + \beta_7 \\ & Percent\ Male + \beta_8\ Average\ Age + \beta_9\ Age\ Range + \beta_i\ Industry \\ & + \beta_j\ Year + \beta_k\ Buyer/Supplier\ Dyad + \varepsilon \end{aligned} \tag{8}$$

Next, H3 proposes that an operations manager on a firm's TMT leads the firm to increase its power advantage while H4 proposes that a supply chain manager on the focal firm's TMT

leads them to lower their power advantage. To test these hypotheses, the following empirical model was constructed:

$$\begin{aligned} Ln\ Power\ Advantage) = {} & \beta_0 + \beta_1\ SC\ Manager + \beta_2\ OPS\ Manager \\ & + \beta_3\ Ln\ (Revenue) + \beta_4\ ROA + \beta_5\ Capex + \beta_6\ Total\ Number\ of\ Execs + \beta_7 \\ & Percent\ Male + \beta_8\ Average\ Age + \beta_9\ Age\ Range \\ & + \beta_{10}\ Mutual\ Financial\ Dependence + \beta_i\ Industry \\ & + \beta_j\ Year + \beta_k\ Buyer/Supplier\ Dyad + \varepsilon \end{aligned} \tag{9}$$

Now, each buyer in the dataset has sourcing relationships with different numbers of suppliers. Thus, the resulting dataset contains a variance in the number of suppliers each buyer has. With such a dataset, estimates using the local information of each group can be inaccurate as the sample size of some groups are smaller than others (Gelman and Hill, 2006). In this situation, a random effects model that uses partial pooling is a better technique than a fixed effects model, as the small sample size groups' effect estimates are based partially on the more abundant data from the other groups (Gelman and Hill, 2006). Another issue is the violation of the assumption of independence of observations necessary for ordinary least squares regressions as firm observations can correlate across years. The generalized estimating equation (GEE) addresses these issues and averages the effect over all the observations while estimating the within-subject covariance. This helps control possible unknown correlations between outcomes. Hence, I utilize a generalized estimating equation (GEE) linear regression model for the main empirical analysis. This model is often used in TMT research (see Henderson et al., 2006; Ndofor et al., 2015). For added robustness, I also perform the analysis with a random effects generalized least-squares (GLS) estimation with robust standard errors (Greene, 2003) and find no substantive differences. I check the distribution of the error term and determine that the error term is normally

distributed, and the residual plots of the error terms against the dependent variables show no discernable trends.

RESULTS

Analysis and results

The results of the analysis are presented in Table 5. Models 1 and 2 show the analysis for Hypothesis 1 and 2. Model 1 includes only the control variables while Model 2 shows the effect of the hypothesized variables *SC Manager* and *OPS Manager* on the firm's supply base dispersion. Hypothesis 1 proposes that a COO negatively affects the firm's global sourcing initiatives. Model 2 shows that *OPS Manager* has a negative and significant influence on the "*% Foreign Suppliers*", thereby supporting Hypothesis 1 ($p < 0.01$). This shows that there is a significant negative relationship between the presence of a COO on the TMT in one year and the supply base dispersion in the next year. The second hypothesis proposes that a CSCO positively affects the firm's global sourcing. Model 2 shows that *SC Manager* has a positive and significant influence on the *% Foreign Suppliers*, thereby supporting Hypothesis 2 ($p < 0.01$). This illustrates a significant positive relationship between the presence of a CSCO on the TMT in one year and the supply base dispersion in the next year.

Additionally, as seen in Models 1 and 2, some of the control variables have a significant effect on a firm's *% Foreign Suppliers*. A firm's *Revenue*, *Total Number of Executives*, *Percent of Males on the TMT* and *Average Age of the TMT* have a significant positive effect on their *% Foreign Suppliers*. However, the *Age Range of the TMT* has a significant negative effect on its *% Foreign Suppliers*. These results are consistent across the Models 1 and 2.

Table 5: Results

	% Foreign Suppliers		Ln Power Advantage	
VARIABLES	Model 1	Model 2	Model 3	Model 4
SC Manager		9.049***		-0.240***
		(0.391)		(0.050)
OPS Manager		-4.689***		0.103**
		(0.347)		(0.045)
Ln (Revenue)	1.863***	1.393***	1.045***	1.058***
	(0.118)	(0.117)	(0.015)	(0.015)
ROA	2.137	1.381	-0.062	-0.072
	(1.512)	(1.510)	(0.193)	(0.196)
Capex	-0.230	-0.154	0.152***	0.151***
	(0.255)	(0.249)	(0.031)	(0.031)
Total Number of Execs	0.157***	0.108***	-0.006	-0.004
	(0.035)	(0.035)	(0.004)	(0.005)
Percent Male	29.450***	25.390***	-1.297***	-1.214***
	(1.647)	(1.621)	(0.208)	(0.209)
Average Age	0.249***	0.413***	-0.023***	-0.027***
	(0.055)	(0.055)	(0.007)	(0.007)
Age Range	-0.373***	-0.379***	0.024***	0.025***
	(0.028)	(0.027)	(0.003)	(0.004)
Mutual financial dependence			0.055***	0.055***
			(0.003)	(0.003)
Constant	44.930***	41.490***	-7.183***	-7.076***
	(13.630)	(13.340)	(1.644)	(1.643)
Observations	14,185	14,185	12,850	12,850
Number of dyads	10,110	10,110	9,292	9,292
Wald chi^2	1721.65	2434.07	7527.60	7567.86

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(results for year, dyad, and industry effects have been omitted for brevity)

Next, the results of the analysis regarding Hypotheses 3 and 4 are presented in Models 3 and 4. Model 3 includes only the control variables while Model 4 shows the effect of the hypothesized variables *SC Manager* and *OPS Manager* on the *Ln Power Advantage* of the focal firm over its suppliers. The third hypothesis proposes that a COO positively affects *Ln Power Advantage*. Model 4 shows that *OPS Manager* has a positive and significant influence on the *Ln Power Advantage*, thereby supporting Hypothesis 3 ($p < 0.05$). This demonstrates a significant positive relationship between the presence of a COO on the TMT in one year and the power

advantage of the firm over its suppliers in the next year. The fourth hypothesis proposes that a CSCO negatively affects *Ln Power Advantage* of the buyer over its supplier. Model 4 again shows that *SC Manager* has a negative and significant influence on *Ln Power Advantage*, thereby supporting Hypothesis 4 ($P < 0.01$). This result reveals a significant negative relationship between the presence of a CSCO on the TMT in one year and the *Ln Power Advantage* of the focal firm over its suppliers in the next year.

Additionally, as seen in Models 3 and 4, some of the control variables significantly affect *Ln Power Advantage*. A firm's *Revenue, Capex, Age Range of the TMT* and *Mutual Financial Dependence* have a significant positive effect on *Ln Power Advantage*. While the *Percent of males on the TMT* and *Average Age of the TMT* have a significant negative effect on *Ln Power Advantage*. Interestingly, the *ROA* and *Total Number of Executives* do not have any significant effect on *Ln Power Advantage*. These results are consistent across Models 3 and 4.

Robustness and Endogeneity Checks

It is possible that endogeneity impacts the results of the analysis. Endogeneity arises from three primary sources – reverse causality, measurement error, and omitted variable bias. All three of these areas are addressed in this section. Firstly, there is possibility for reverse causality between the primary independent variables and the dependent variable. Perhaps instead of a CSCO and/or COO driving the outcomes I am predicting, those outcomes make firms more likely to hire a CSCO and/or COO. To address this concern, I perform a two stage least squares (2SLS) instrumental variable analysis for the *SC Manager* and *OPS Manager* variables.

Table 6: Robustness check: Using two-stage least-squares (2SLS)

VARIABLES	% Foreign Suppliers	Ln Power Advantage
SC Manager (estimated)	20.640***	-2.112***
	(2.050)	(0.271)
OPS Manager (estimated)	-10.480***	1.220***
	(1.742)	(0.222)
Ln (Revenue)	0.793***	1.162***
	(0.157)	(0.021)
ROA	0.587	0.101
	(2.200)	(0.290)
Capex	-0.059	0.134***
	(0.260)	(0.033)
Total Number of Execs	0.043	0.004
	(0.044)	(0.006)
Percent Male	20.260***	-0.479**
	(1.869)	(0.238)
Average Age	0.619***	-0.067***
	(0.067)	(0.009)
Age Range	-0.389***	0.026***
	(0.032)	(0.004)
Mutual financial dependence		0.053***
		(0.003)
Constant	37.290***	-5.905***
	(13.900)	(1.768)
Observations	14,183	12,848
R^2	0.085	0.283

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

In selecting instruments for this analysis, they need to correlate with the independent variable of interest and not correlate with the dependent variable. Upon evaluating potential variables, average inventory that the firm holds in a given year is correlated with the *SC Manager* variable but uncorrelated with either % Foreign Suppliers or *Ln Power Advantage*. Similarly, total accounts receivable for the firm is correlated with the presence of an *OPS Manager* but uncorrelated with either % Foreign Suppliers or *Ln Power Advantage*. To validate these instruments, I use the Cragg and Donald (1993) minimum eigenvalue statistic and determine that the eigenvalue is higher than the minimum threshold of 11 for reliability in the case of multiple endogenous regressors (Stock et al., 2002). This is true of both instruments. I

also analyze the first stage regression statistics and find that the F-statistic is greater than the critical values of the 2SLS and LIML Wald tests, which allows me to reject the null hypothesis that the instruments are weak (Hausman et al., 2005a). The findings of the 2SLS instrumental analysis as presented in Table 6 are consistent with the findings in Table 5. This demonstrates that the results are not biased by reverse causality.

For added robustness, I also consider a different measure of the hypothesized variables. I create two variables, "% TMT SC Experience" and "% TMT OPS Experience", that measure the percentage of supply chain and operations experience on the top management team, respectively. To create these variables, I first examine the past work experience of each member of the TMT to identify the percentage of the team that has had experience working in supply chain management or in operations management roles in the past. To identify the relevant SC and OPS experience, I first looked at existing literature in each of the fields that defined the each of the roles (e.g. CSCMP, 2018; Fawcett et al., 2011; Hendricks et al., 2014; Lambert and Cooper, 2000; Mentzer et al., 2008). Subsequently, I include additional keywords identified from the job descriptions of various Fortune 100 firms. Thus, a manager with roles that include words like sourcing, procurement, supply chain, logistics, and manufacturing is defined to have supply chain experience, while a manager with responsibilities that included the word operations, for example chief operations officer or global operations officer is defined to have operations (OPS) experience. These classifications are consistent with previous research (see Kumar and Paraskevas, 2018). I then used these measures in the robustness analysis. The results are presented in Table 7. I find no substantive differences between the results of this analysis compared to the GEE model.

Table 7: Robustness check: Using alternate measure for SC and OPS

VARIABLES	% Foreign Suppliers	Ln Power Advantage
% TMT SC Experience	10.07***	-1.203***
	(2.061)	(0.277)
% TMT OPS Experience	-40.92***	0.790***
	(1.610)	(0.217)
Ln (Revenue)	1.567***	1.091***
	(0.132)	(0.0182)
ROA	-5.923***	0.385
	(1.795)	(0.239)
Capex	-0.302	0.153***
	(0.244)	(0.0318)
Total Number of Execs	0.210***	0.00253
	(0.0400)	(0.00541)
Percent Male	26.07***	-1.124***
	(1.860)	(0.253)
Average Age	0.465***	-0.0313***
	(0.0616)	(0.00844)
Age Range	-0.270***	0.0221***
	(0.0324)	(0.00437)
Mutual financial dependence		0.0723***
		(0.00413)
Constant	45.18***	-7.751***
	(13.15)	(1.725)
Observations	14,530	13,173
R^2	0.178	0.396

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

The second source of endogeneity is measurement error in the independent variables. It is possible that there is some overlap between the duties of a *SC Manager* and an *OPS Manager* resulting in measurement error in the primary independent variables. I do two things to address this concern. First, I expect that firms which have switched the name of their TMT title from COO to CSCO or vice versa may have simply changed the name of the role without changing the duties. In the sample, I did not find any firms that changed the name of the position from CSCO to COO; however, in two firms the name of the position changed from COO to CSCO. To ensure

that the results are robust with respect to this potential for measurement error, I re-run the analysis without the two firms. Please refer to Table 8 for the results of this analysis.

Table 8: Robustness Check: Firms that switched from COO to CSCO were dropped

	% Foreign Suppliers		Ln Power Advantage	
VARIABLES	Model 1	Model 2	Model 3	Model 4
SC Manager		9.033***		-0.237***
		(0.392)		(0.051)
OPS Manager		-4.689***		0.102**
		(0.347)		(0.045)
Ln (Revenue)	1.868***	1.397***	1.044***	1.057***
	(0.118)	(0.117)	(0.015)	(0.015)
ROA	2.213	1.458	-0.058	-0.067
	(1.512)	(1.509)	(0.193)	(0.196)
Capex	-0.227	-0.151	0.152***	0.151***
	(0.255)	(0.249)	(0.031)	(0.031)
Total Number of Execs	0.160***	0.110***	-0.005	-0.004
	(0.0351)	(0.0347)	(0.004)	(0.004)
Percent Male	29.61***	25.49***	-1.304***	-1.220***
	(1.648)	(1.622)	(0.209)	(0.209)
Average Age	0.247***	0.411***	-0.023***	-0.027***
	(0.0553)	(0.0546)	(0.007)	(0.007)
Age Range	-0.374***	-0.380***	0.024***	0.025***
	(0.0276)	(0.0272)	(0.003)	(0.003)
Mutual financial dependence			0.055***	0.055***
			(0.003)	(0.003)
Constant	44.90***	41.52***	-7.170***	-7.066***
	(13.62)	(13.33)	(1.644)	(1.643)
Observations	14,178	14,178	12,843	12,843
Number of dyads	10,104	10,104	9,286	9,286
Wald chi^2	1728.60	2438.60	7521.93	7561.18

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

Another method to address endogeneity arising from measurement error and omitted variable bias is two-stage residual inclusion (2SRI). This method has been used in supply chain management, management, and economics literatures (Kumar and Paraskevas, 2018; Terza et al., 2008; Wiersema and Zhang, 2011; Wowak et al., 2015). 2SRI is performed similarly to 2SLS by

first estimating the endogenous variable in the first stage with a set of regressors. In the second stage, unlike 2SLS, the residual from the first stage is included as an independent variable in the second stage. This allows me to control for endogeneity in the second stage.

Table 9: Robustness check: Using two-stage residual inclusion (2SRI)

VARIABLES	% Foreign Suppliers	Ln Power Advantage
SC Manager	9.324***	-0.247***
	(0.394)	(0.0505)
OPS Manager	-4.815***	0.0971**
	(0.349)	(0.0447)
SCO Error	-35.10	-13.31***
	(28.68)	(3.808)
COO Error	228.7***	-16.53***
	(32.12)	(4.151)
Ln (Revenue)	1.697***	1.037***
	(0.124)	(0.0161)
ROA	5.580***	-0.575***
	(1.596)	(0.206)
Capex	-0.586**	0.233***
	(0.261)	(0.0321)
Total Number of Execs	0.0914***	0.00107
	(0.0352)	(0.00454)
Percent Male	24.68***	-1.231***
	(1.630)	(0.210)
Average Age	0.393***	-0.0226***
	(0.0549)	(0.00719)
Age Range	-0.382***	0.0239***
	(0.0272)	(0.00349)
Mutual financial dependence		0.0551***
		(0.00307)
Constant	-15.40***	-6.423***
	(3.498)	(0.457)
Observations	14,149	12,814
Wald chi^2	2391.59	7488.31

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

Since there are two variables which may be endogenous (*SC Manager* and *OPS manager*), each one is estimated separately, the residuals are saved, and both residuals are used in the second stage regression. The first stage regressions have *SC Manager* and *OPS Manager*

as the respective dependent variables. The independent variables are the same across both regressions and are as follows*: Ln(Revenue), ROA, Capex, Total Number of Executives, Percent Male, Average Age, Age Range*. I also add both average inventory and accounts receivable as two additional variables for the first stage regression as I find them to be correlated with the independent variables of interest in the 2SLS analysis. The results of the 2SRI (see Table 9) show that there is no substantive difference between the hypothesized results and the results when the residuals for the first stage are included. I therefore conclude from these analyses that the results are not biased by endogeneity.

The next concern with this analysis is the nested structure of the data. To address this, I run a hierarchical linear mixed effects model (HLM). I include three levels of nesting: the focal firms are nested within the industries that they operate in; both key independent variables, *SC Manager* and *OPS Manager*, are nested within the focal firm; and finally, the focal firms also share suppliers and are therefore nested within the list of suppliers. The findings are for the most part consistent with the earlier results as can be observed in Table 10.

Finally, I also ran the analysis with a dummy variable *SCOM* to signify the presence of both a COO and a CSCO on the TMT. In the first case, I see that this variable has a positive effect on the *% Foreign Suppliers*. Consistent with earlier results, the *SC Manager* has a positive impact on *% Foreign Suppliers*, while *OPS Manager* has a negative impact. Put together, firms with both a chief operations officer and a chief supply chain officer on the TMT are more likely to work with overseas suppliers. In the next analysis, I observe that this variable has a negative effect on *Ln Power Advantage*. Consistent with earlier results, the *SC Manager* has a negative impact on *Ln Power Advantage*, while *OPS Manager* has a positive impact. When combined, firms with both a chief operations officer and a chief supply chain officer on the TMT are more

likely to decrease their power advantage over their suppliers. The results are displayed in Table 11.

Table 10: Robustness check: Using hierarchical linear mixed effects model HLM

VARIABLES	% Foreign Suppliers	Ln Power Advantage
SC Manager	8.115***	-0.165***
	(0.410)	(0.0514)
OPS Manager	-3.593***	0.0290
	(0.299)	(0.0261)
Ln (Revenue)	1.159***	1.018***
	(0.121)	(0.0159)
ROA	5.061***	-0.441***
	(1.259)	(0.111)
Capex	-0.299	0.151***
	(0.231)	(0.0325)
Total Number of Execs	0.155***	0.0103**
	(0.0361)	(0.00412)
Percent Male	11.27***	-0.404**
	(1.633)	(0.169)
Average Age	0.502***	-0.00332
	(0.0554)	(0.00592)
Age Range	-0.269***	0.000800
	(0.0256)	(0.00239)
Mutual financial dependence		0.00902***
		(0.00147)
Constant	46.71***	-7.931***
	(12.68)	(1.719)
Observations	14,185	12,850
Number of dyads	10,110	9,292

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

Table 11: Robustness check: Using SCOM

VARIABLES	% Foreign Suppliers	Ln Power Advantage
SC Manager	5.441***	-0.163**
	(0.532)	(0.0678)
OPS Manager	-6.721***	0.147***
	(0.401)	(0.0519)
SCOM	7.647***	-0.165*
	(0.767)	(0.0985)
Ln (Revenue)	1.274***	1.061***
	(0.117)	(0.0154)
ROA	0.680	-0.0598
	(1.506)	(0.197)
Capex	-0.156	0.151***
	(0.248)	(0.0306)
Total Number of Execs	0.106***	-0.00415
	(0.0346)	(0.00448)
Percent Male	24.49***	-1.196***
	(1.618)	(0.209)
Average Age	0.502***	-0.0294***
	(0.0552)	(0.00727)
Age Range	-0.383***	0.0248***
	(0.0271)	(0.00349)
Mutual financial dependence		0.0548***
		(0.00307)
Constant	37.27***	-6.977***
	(13.30)	(1.644)
Observations	14,185	12,850
Number of dyads	10,110	9,292

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

Discussion and Contributions

The key contribution of this research is the use of the differing functional roles of chief supply chain officers and chief operations officers to develop the hypotheses and the testing of these hypotheses empirically. In doing so, I extend Mentzer et al.'s (2008) proposition that supply chain and operations managers operate with different foci. Grounding the arguments in upper echelons theory, I hypothesize that the functional background of the decision maker impacts the cognitive base and values they bring to new situations, and, hence, their strategic

decisions. Since the functional background of a supply chain manager leads them to focus on the firm within the greater context of a supply chain, their decisions differ from those made by operations managers who have an intra-firm focus. I find empirical support for this argument: the findings of this research show that there is a significant difference between the effects of a supply chain manager and an operations manager with regard to firm decisions about the geographic sourcing strategy and the power dynamics of the firm. The presence of a supply chain officer is associated with an increase in global sourcing as opposed to the presence of an operations officer, which results in a decrease in global sourcing. I also find that a supply chain officer is associated with a lower power advantage than an operations officer. Hence, this study contributes to the supply chain and operations management literature by providing empirical support for the distinction between the functional areas of supply chain management and operations management. The results clearly show that this distinction is reflected in strategic decision making in companies.

Second, I contribute to the literature on strategic supplier portfolio management by focusing on how supply chain and operations managers on the firm's TMT can affect two key areas of its strategic SPM: the power dynamic and supply base dispersion in buyer-supplier dyads. Wagner and Johnson (2004) use case studies to highlight the importance of top management team involvement in strategic SPM. However, the link between TMT involvement and strategic SPM has not yet been studied in detail. This paper extends the work of Wagner and Johnson (2004) by looking at how TMT composition can impact the firm's strategic SPM. The results show that the functional backgrounds of the supply chain and operations managers lead them to significantly different decisions in terms of the geographic sourcing strategy and the power dynamics of the firm. Thus, firms should be cognizant of these differences when setting up the TMT as TMT composition plays an important role in the firm's strategic SPM decisions.

Third, I contribute to the literature on supplier selection by focusing on how the functional backgrounds of the TMT affect their firm's geographic sourcing strategy. Pursuing a global or a domestic sourcing strategy limits the firm's choice of suppliers and alters the factors that are used for supplier selection. This strategic choice should therefore be made at the TMT level. However, a review of the existing literature has not considered the link between this strategic choice and the supply chain and operations roles on the TMT. The results of this study show that a COO on a TMT in one-year is subsequently associated with lower levels of global sourcing in the next year, whereas, a CSCO on a TMT in one year is subsequently associated with higher levels of global sourcing. Thus, I demonstrate that these non-operational factors influence the firm's strategic sourcing decisions and, thus, the firm's supply base. Therefore, firms looking to optimize their supply base should be aware that TMT composition can impact their supplier selection strategy.

Fourth, I contribute to the power and dependence literature by focusing on how the functional backgrounds of members of the TMT affect the firm's power advantage over its suppliers. Power between the buyer and supplier is dynamic and each of these parties can take steps to alter the power dynamic. However, doing so requires the commitment of resources and can impact the firm's future sourcing options. This strategic decision requires top management support as it can impact the firm's future performance. However, past research has not considered this link. I show that an operations manager on a TMT in one year is subsequently associated with a higher power advantage over its suppliers in the next year, while a supply chain manager on a TMT in one year is subsequently associated with a lower power advantage over its suppliers. As a result, firms should be conscious of the fact that TMT composition can impact the relationships with their suppliers in different ways.

Fifth, I contribute to the TMT literature by demonstrating the importance of supply chain and operations management in strategic decision making. Past research has highlighted the importance of top management team involvement in strategic decision making. I build on this by being the first to theorize and find support for the decision-making impact of supply chain and operations managers on the TMT regarding strategic SPM. By investigating this link, I demonstrate the importance of supply chain and operations management in strategic decision making.

Finally, I contribute to the upper echelons theory (Hambrick and Mason, 1984) by demonstrating that functional backgrounds can impact the decision making process and lead to different strategic outcomes. This study is the first to theorize that the functional backgrounds of supply chain and operations managers affect their cognitive base and values which in turn impacts their decision making. I argue that having a supply chain or operations background defines the decision maker's field of vision, their selection of information and their interpretation of the selected information. This in turn leads them to choose strategies that follow their functional focus. I find empirical support for this argument in that operations managers make their decisions with an intra-firm focus in mind, whereas supply chain managers make their decisions with an inter-firm focus in mind.

Limitations and Future Work

There are a few limitations to this study. First, this research is focused on two aspects of strategic SPM – *geographic sourcing strategy* and *supplier relationship strategy*. Future research should look at the impact of supply chain and operations managers on other factors that are important for effective SPM. Second, the data are based on public manufacturing firms in the

United States; caution should be exercised in generalizing the results beyond this scope. Third, data limitations restrict the study to a panel dataset for a four-year time period. A study using a panel dataset for a longer timeframe may allow for better investigation of causal factors. Fourth, the use of archival data limits this analysis to a measure of financial power within the supply chain. While this provides an important contribution to the literature, there are several other sources of power that may influence the performance of a buyer firm. This includes aspects like the technological, political, and historical dependencies between the firms (Cousins, 2002). Fifth, the data limits the measure of supplier location to that of its headquarters. Further research should consider the location of the suppliers' manufacturing and distribution facilities. Lastly, while this study looks at the effects of buyers' supply chain managers and operations managers on the power dynamic and supply base dispersion, it would be fruitful to explore how suppliers' supply chain and operations experience affects their decisions.

Future research should extend and test different aspects of SC and OPS experience on this important topic. Another avenue for research could explore the outcome when both firms in the dyad possess supply chain and operations experience, or when they possess a combination of the two. It would also be interesting to identify other areas where supply chain managers and operations managers lead to differing outcomes.

CONCLUSION

This study provides both a theoretical and empirical contribution to the timely topic of how supply chain and operations managers on top management teams affect a firm's strategic supplier portfolio management. Using the upper echelons theory as a lens, the hypotheses explore the direct effects of supply chain managers and operations managers on firms'

geographic sourcing strategy and supplier relationship strategy. This study finds that supply chain managers demonstrate a willingness to spread their supply base globally while operations managers tend to lower the spread of their supply base. Additionally, supply chain managers reduce the firms' power advantage over suppliers, while operations managers increase it.

Chapter 3: Inventory and Global Sourcing: The Moderating Role of a Supply Chain Officer on the Top Management Team

INTRODUCTION

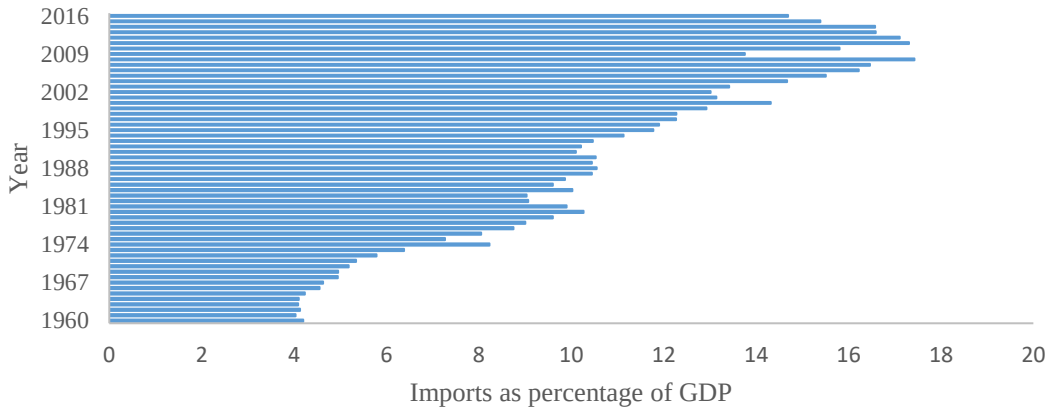
In this paper, I investigate the relationship between global sourcing and inventory investment with a focus on the impact of a chief supply chain officer (CSCO) on those relationships. I examine the role of a CSCO on a firm's executive team due to the connection between inventory decisions and the unique insights, roles, and prominence of the CSCO. I theorize that the presence of a CSCO on the top management team (TMT) results in lower inventory investments. I make this connection along two dimensions: a direct relationship via upper echelons perspective, and a mitigating influence through reduced uncertainties associated with the length and complexity of supply chains for global sourcing intensive firms. First, I confirm that global sourcing results in higher inventory investments (e.g. Jain et al., 2013) due to increased upstream uncertainties caused by risk sharing and agency problems (Eisenhardt, 1989)[1]. Second, supported by upper echelons theory (UET) (Hambrick and Mason, 1984), I theorize that CSCOs on the TMT result in lower inventory investments by reducing supply uncertainties. Third, I contend that, given their insights into supply chain relationships, CSCOs are uniquely suited to foster better collaboration through information sharing, rigorous application of optimized inventory modeling, and real-time monitoring of inventory levels with the firm's global sourcing partners, and consequently, to reduce the uncertainties associated with

[1] Sourcing relationships are generally subject to increased uncertainty due to risk sharing and agency problems Eisenhardt, K.M., 1989. Agency theory: An assessment and review. Academy of management review 14, 57-74. The firms in global sourcing relationships are exposed to increased lead time variability, foreign exchange rates, differences in language, culture, political, and legal environments. These factors all contribute to the risk sharing and agency problems.

global supply chains. This in turn alleviates the upward pressure of global sourcing on inventory investments.

Most industries have seen an increase in international sourcing due to needed inputs from global markets, ranging from business processes and information technology (Corbett, 2005) to production and manufacturing (Wilhelmsson et al., 2004). In fact, imports accounted for over 17% of the U.S. GDP in both 2011 and 2012. As can be seen in Figure 1, U.S. imports have increased over significantly from 1960 up to 2016 (World Bank, 2020). The significance of global sourcing to current manufacturing processes has made evaluating the impact of global sourcing on different aspects of firm performance a key management challenge. Consequently, researchers have looked at several unintended consequences of global sourcing. For instance, global sourcing increases sourcing complexity (Bozarth et al., 2009; Dornier et al., 2008), coordination challenges (Kumar et al., 2009), total expected lead time (Levy, 1997), logistical challenges (Hausman et al., 2005b), and also the risk of disruption and delay in the supply chain network (Cohen and Mallik, 1997). Global sourcing has also been linked to lower product quality as manifested through product recalls (Steven and Britto, 2016; Steven et al., 2014). These unintended consequences increase the supply uncertainty for the buyer firm.

Figure 1: U.S. Global sourcing levels as percentage of GDP



One outcome of the increased supply uncertainties associated with global sourcing has been the implementation of management techniques to reduce the likelihood of detrimental events occurring or to reduce the effects if they do occur (Zsidisin and Ellram, 2003). In many industries, inventory investments have been used to buffer the buying firm from these supply uncertainties (Arnold et al., 2008; Lee and Billington, 1993; Tersine, 1994). In effect, increased global sourcing has led to increased supply uncertainty and, in turn, to a greater likelihood of higher inventory levels than for comparable buyer firms with lower reliance on global sourcing (Jain et al., 2013). This puts an upward pressure on operating costs.

Within the last decade, increased prominence and importance is placed on the supply chain management (SCM) function. Many firms are pushing the SCM role to the forefront by creating top management positions for supply chain management executives (Wagner and Kemmerling, 2014). Firms have created specialized positions responsible for all SCM functions including coordinating the supply chain, procurement, logistics, and distribution (Roh et al., 2016). These executive-level positions are most often referred to as chief supply chain officers (CSCOs). In many cases, CSCOs today report directly to chief executive officers (CEOs) or chief operating officers (COOs).

The CSCO's main focus is "on the management of exchange flows within and across the members of the supply chain" Esper et al. (2010 p. 162). CSCOs'objectives include improving the performance of the firm as well as its supply chain partners by being efficient and cost-effective across the entire system (Cooper et al., 1997; Fugate et al., 2006; Langley Jr and Holcomb, 1992; Li et al., 2006; Simchi-Levi et al., 2000). Thus, according to upper echelons theory, the CSCOs' cognitive base and values are inclined toward supply chain issues to reduce

risks and uncertainties across the entire system (Davis, 1993). Therefore, the CSCO, at the strategic level, may play a prominent role in decisions relating to inventory investments.

The intersection of uncertainties as a result of heightened global sourcing and the appointment of supply chain officers to senior level executive roles elicits significant research questions. Global sourcing, both in terms of the extent of outsourcing and the geographic dispersion of the supply base, results in complex and uncertain business operations and outcomes, putting upward pressures on inventory investments. At the same time, reduction of uncertainty through supply chain coordination and monitoring is a significant functional objective of a CSCO. I therefore pose the following research questions:

1) How does the inclusion of a CSCO on a firm's TMT impact the firm's inventory investment, and

2) How does the relationship between global sourcing and inventory, in terms of both the extent of offshoring and the geographic dispersion of the supply base, change in the presence of a CSCO?

These questions are of great practical significance, as they focus on the importance of supply chain experience in shaping the actions and outcomes of firms in the current business environment. In trying to answer these questions, I apply the mechanism proposed by UET to the CSCO on the TMT and argue that the cognitive base and values of the CSCO help the firm reduce the uncertainty and risk associated with a global sourcing strategy. So, in today's world in which firms are often dependent on their overseas suppliers, including a CSCO on the TMT allows the firm to lower its inventory investment and, thus, its costs.

This study offers several contributions to both theory and practice. First, this paper expands upper echelons theory research by proposing unique hypotheses grounded in the logic of UET that explain the impact of a CSCO's cognitive base and values on the firm's inventory

management. Second, I expand on the supply chain management literature by exploring how the functional background of a CSCO can influence risk sharing and agency problems associated with global sourcing. This study therefore extends the boundaries of both UET and agency theories by showing that the intersection of the two theories provides context to the application of each theory. That is, the unique supply chain experiences of the CSCO particularly reduce the coordination difficulties associated with global sourcing, thereby, reducing the associated uncertainties. Third, I contribute to the literature stream on inventory management by being the first study to explicitly link non-operational factors, in this case the cognitive base and values of a CSCO, to the firm's inventory investment. Fourth, I contribute to the literature stream on global sourcing by being the first to demonstrate a moderating influence of a CSCO on the increased inventory investment effect of global sourcing.

The rest of the paper is organized as follows. In the next section, I provide a brief overview of both agency theory and upper echelons theory. I then develop the hypotheses focusing first on the predictions of agency theory on the firm's inventory when the firm pursues a global sourcing strategy, and then applying UET to predict the effect of a chief supply chain officer (CSCO) in this situation. Subsequently, the data and variables used are explained. In the analysis and results section, I elaborate upon the empirical analysis. I conclude with a discussion of the results and implications, followed by a section on the limitations of this study and suggestions for further research.

THEORY AND RESEARCH BACKGROUND

Agency theory

With its roots in the information economics literature (Lambert, 2001), agency theory is a grand theory that seeks to understand the nuances of agency relationships. These agency relationships exist when one party (the principal) contracts one or more other parties (the agents) to perform some service or to act on its behalf (Eisenhardt, 1989; Fama and Jensen, 1983; Jensen and Meckling, 1976; Ross, 1973; Rungtusanatham et al., 2007). In doing so, the principal delegates some decision-making authority to the agent in order to meet a defined objective (Eisenhardt, 1989; Jensen and Meckling, 1976). This implies that agency theory can apply to virtually all contractual arrangements (Ross, 1973), like those between the state and the governed (Ross, 1973), employer and employee (Eisenhardt, 1985; Ross, 1973), retailer and vendor (Rungtusanatham et al., 2007), and board relationships (Fama and Jensen, 1983), among others. Furthermore, Jensen and Meckling (1976 p. 8) point out that "contractual relations are the essence of the firm, not only with employees but with suppliers, customers, creditors, and so on". This makes the theory directly applicable to a wide range of business situations.

Agency theory builds on a few important assumptions broken down along three categories – human, organizational, and information (Eisenhardt, 1989). The human category can be further distinguished into self-interest, risk aversion, and bounded rationality. Self-interest implies that the decision makers of both the principal and the agent act to maximize their expected utility. They do this while attempting to reduce their risks under bounded rationality. The second category, the organizational category, includes partial goal conflict among participants, efficiency as the effectiveness criterion, and information asymmetry between principal and agent. Thus, the parties in the relationship can have different and conflicting goals

that are enabled by the existence of information asymmetries between the contracting parties and can lead to lowering the efficiency of the relationship. The last category is built on the assumption that information is a purchasable commodity. So, each of the parties can choose to incur additional costs to increase the relationship-related information available to them.

These assumptions lead to two potential problems – risk sharing and agency problems (Eisenhardt, 1989; Jensen and Meckling, 1976; Ross, 1973). Risk sharing problems arise when the parties "have different attitudes toward risk" (Eisenhardt, 1989 p. 58). As each party evaluates risks differently, they each assign different weights to the risks identified. This can lead to each party implementing different risk mitigation strategies, potentially resulting in a process misalignment between the principal and agent. These risks can arise from factors outside of the parties' control, making it difficult to assign responsibility in case of a failure, as the outcomes are only partly influenced by the parties' behavior (Eisenhardt, 1989). At the same time, each party's self-interest and utility-maximizing goals lead them to try to minimize their costs by trying to transfer responsibility to their partner. This can result in disagreements about the risk mitigation actions to be taken as these add cost to the party that implements them. Consequently, the relationship is more susceptible to negative impacts of the risks and, thus, faces increased uncertainty.

The latter, agency problems, arise when "(a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing" (Eisenhardt, 1989 pg. 58). In this case, due to conflicting goals, the parties differ in their prioritizations of the required tasks. This can lead to suboptimal outcomes and process breakdowns. Simultaneously, there is an information asymmetry between the parties as the principal faces difficulties in verifying the actions of the agent. So, the principal is exposed to

increased uncertainty as it lacks the required information to verify that the actions of the agent are aligned with the contract.

Based on these assumptions of agency theory, agency relationships are characterized by increased uncertainty that arises from risk sharing and agency problems (Eisenhardt, 1989; Jensen and Meckling, 1976). The problems arise due to conflicting goals and/or differences in risk assessment and are further exacerbated by bounded rationality and the existence of information asymmetries between the parties. For a more detailed overview of the agency theory, see Eisenhardt (1989).

Upper echelons theory and top management teams

Upper echelons theory posits that information about a firm's decision makers can be used to develop predictions regarding its strategic actions (Donald et al., 2001; Hambrick, 2007). In developing the theory, Hambrick and Mason (1984) build on the concept of bounded rationality (Cyert and March, 1963; March and Simon, 1958), which states that decision makers are constrained by limitations in their information gathering and processing. Therefore, when faced with a complex scenario, the explicit and timely calculation of an optimal solution is prohibitively costly or impossible to undertake. In such situations, decision makers often have to sacrifice their quest for an optimal solution and instead rely on their own set of '*givens'* or perspectives to analyze the situation and make their decisions (Hambrick and Mason, 1984; March and Simon, 1958). Thus, identifying the decision makers' givens allows researchers to make predictions about their decisions.

In UET, these givens represent the decision makers' cognitive base and values (Hambrick and Mason, 1984). They result from the decision makers' knowledge and experiences gained

through their functional backgrounds, industry and firm tenures, educational credentials, affiliations, interests, and personalities (Chin et al., 2013; March and Simon, 1958). In turn, due to bounded rationality, when faced with a complex situation, these givens act as a personal lens that filter the decision makers' perceptions of the situation and, thereby, their decisions (Chin et al., 2013; Hambrick, 2007; Hambrick and Mason, 1984; March and Simon, 1958; Shepherd et al., 2017).

Hambrick and Mason (1984) elaborate on this mechanism using a five-step process and explain how each of these steps are influenced by the decision makers' cognitive base and values. Due to bounded rationality and the complex nature of modern firms, the individual decision makers cannot keep track of every part of the organization or every situation that they encounter. As a first step in this approach, the individual focuses on aspects that are in their field of vision. This field of vision is influenced by the decision maker's functional background, interests, experience, and expertise – the decision maker's cognitive base. As such, decisions regarding specific firm functions are usually made by the decision makers with specific experience in that area (Jackson, 1992). When dealing with complex situations, a decision maker is often exposed to large amounts of information. Gathering and analyzing all the available information to identify the actionable points can be quite overwhelming. As a second step, the decision maker's cognitive base and values act as a filter to selectively perceive only the information that they consider to be influential. This allows the decision maker to consider just a subset of all the available information. In the third step, the decision maker interprets the selected information to identify the salient aspects about the situation. However, as each individual decision maker's cognitive base and values help filter the information that they consider; they each process a different subset of the available information. Hence, each decision maker's cognitive base and values also influence the way that the information is interpreted. Therefore,

unique decision makers focus on different aspects, thus, interpreting the situation differently. In the fourth step, the decision maker combines their cognitive base and values with their managerial perceptions to identify possible strategies to achieve a desired outcome. This allows an individual to use the knowledge gained from past experiences and their interpretation of the situation to identify the best strategies to achieve their goals. In the final step of decision-making process, the decision maker chooses the strategy that they believe will achieve the desired result. Once again, their cognitive base and values come into play as they rely on their knowledge to select the strategy that is most likely to succeed.

Thus, decision makers' cognitive base and values influence each of the five stages in the decision-making process. Decision makers with different "givens" arrive at different strategies to overcome the same issues faced. Therefore, UET predicts that diversity in actions and outcomes of different firms in a similar context are due to the different givens of their decision makers (Carpenter et al., 2004; Hambrick, 2007; Hambrick and Mason, 1984).

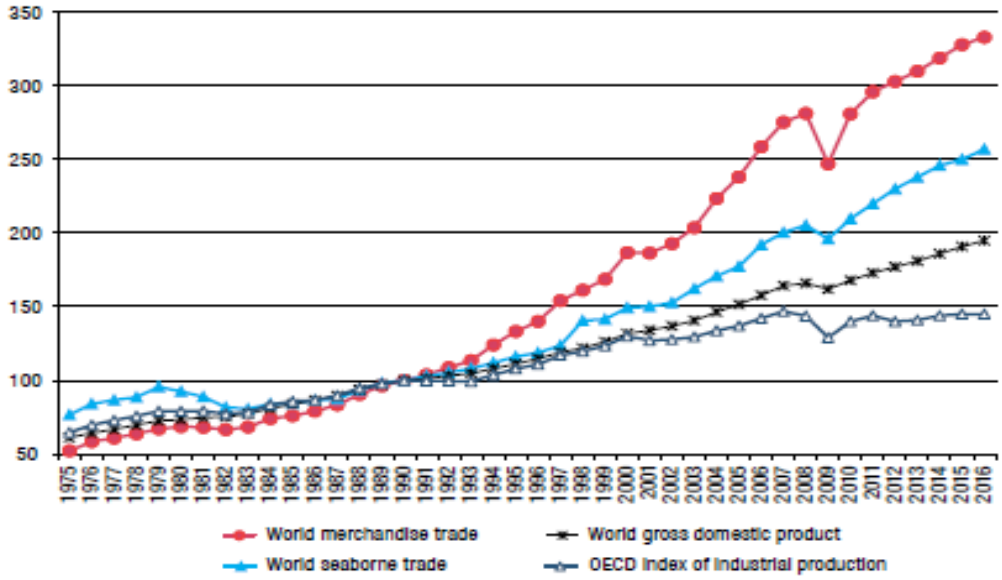
When it comes to decision making within the firm, Cooper and Ellram (1993) explain that the firm's top management level generally examines the firm's strategic issues, while middle and line managers manage the day-to-day operations. Therefore, according to UET, information about a firm's top management team's givens can enable researches to develop predictions regarding its strategic actions (Donald et al., 2001; Hambrick, 2007). In this context, the TMT is defined as "the relatively small group of most influential executives at the apex of an organization – usually the CEO (or general manager) and those who report directly to him or her" (Finkelstein et al., 2009 p. 10).

HYPOTHESES DEVELOPMENT

Global sourcing

A firm pursuing a global sourcing strategy purchases a portion of its requirements from suppliers located in a different country. Indeed, the past four decades have seen an increase in worldwide trade volumes (UNCTAD, 2017). Thus, firms in various industries have increased their reliance on global sourcing (Cohen and Mallik, 1997; Harbison and Pekar, 1997). This makes the impact of global sourcing an important consideration for firms in today's business environment.

Figure 2: Organization for Economic Cooperation and Development index of industrial production and world indices: Gross domestic product, merchandise trade and seaborne shipments, 1975–2016 (1990 = 100) (Source: UNCTAD, 2017)



When studying aspects of global sourcing, past research has highlighted several factors that need to be considered. Examples of these include the industry that the firm operates in (Han et al., 2008), the firm's supply base dispersion, i.e. social, cultural, geographic, and time

distances (Jain et al., 2013; Mol et al., 2004; Olsen and Ellram, 1997), the number of trading partners (Olsen and Ellram, 1997), and the extent of global sourcing (Jain et al., 2013; Mol et al., 2004). While these are all important considerations, I focus this research study on the factors highlighted by Jain et al. (2013) and Mol et al. (2004) – the extent of offshoring and the geographic dispersion of the suppliers.

Offshoring extent and inventory investment

Firms in sourcing relationships participate in an agency relationship where the buyer is the principal and the other parties are the agents (Zsidisin and Ellram, 2003). By nature of this relationship, these firms are exposed to risk sharing and agency problems leading to increased supply uncertainty (Eisenhardt, 1989). Risk sharing problems occur when the parties involved in the sourcing relationship (i.e. the buyer, the supplier and the other contact points) have different attitudes toward the risks that they face. This in turn results in different notions of mitigation measures and, therefore, in increased supply uncertainty (Eisenhardt, 1989).

As a firm sources more of its requirements from foreign suppliers, it increases its reliance on its global supply chain. These global supply chains are very complex, and increased complexity exposes the participating firms to higher risks of disruptions (Blackhurst et al., 2011; Craighead et al., 2007; Manuj and Mentzer, 2008; Tomlin, 2006; Whitney et al., 2014; Yigitbasioglu, 2010). Global sourcing results in increased geographical, cultural, and temporal distance (Christopher et al., 2011) as well as differences in infrastructure along the delivery route (see Cho and Kang, 2001 p. 547; Das and Handfield, 1997 p. 244; Han et al., 2013 p. 337). These differences lead to increased uncertainty. For instance, congestion at seaports along the supply line, delays from previous ports, and bad weather at sea significantly decreases the reliability in delivery time (Jain et al., 2013 p. 1205). A disruption at any of these contact points

can propagate through the whole network (Rice and Caniato, 2003). Hence, global sourcing relationships are exposed to a higher number of supply risks.

Notwithstanding the multiplicity of risks in a global supply chain, there are several reasons why parties in global sourcing relationships have different attitudes towards risks. Firms in such relationships are exposed to differences in language, culture, and time zones (Meixell and Gargeya, 2005) that can hamper communication between the parties, leading to difficulties in understanding and acting on threats. First, the parties involved are discrete firms (Hult, 2002; Lee and Billington, 1993; Mabert and Venkataramanan, 1998), with their own individual profit maximization objectives (Hanna and Newman, 2001; Porter, 1980). This, coupled with cultural contexts, leads them to evaluate risks differently. Second, cultural differences can have a negative impact on commitment in the relationship (Ndubisi, 2011). This results in differing attitudes toward mitigating the risks. Thus, as the extent of a firm's offshoring increases, resulting in clashes of differing cultures, its supplier relationships become more vulnerable to risk sharing problems and, thus, increased supply uncertainty.

Next, agency problems occur when 1) there is interest misalignment, and 2) it is difficult for the buyer to verify that the other parties are acting in the best interest of the relationship (information asymmetry). In a buyer-seller relationship, it is reasonable to assume that each independent firm strives for optimal profits even at the expense of the other party (Hanna and Newman, 2001). This is particularly true in a global setting where business cultures are influenced by larger environmental practices. Information asymmetry in a global sourcing relationship arises due to the higher complexity (Bozarth et al., 2009), as well as the increased physical (Hennart, 2001) and cultural distances between the parties. These lower the effectiveness of information and knowledge transfer between the contractual parties (Cummings and Teng, 2003; Galbraith, 1990; Gray et al., 2011; Lester and McCabe, 1993; Steven and Britto,

2016). So, the buyer (principal) finds it increasingly difficult to gather information and monitor its suppliers and other contact points, leading to greater information asymmetry between the parties. The presence of information asymmetry, coupled with misalignments in interests, incentivizes supplier firms to deviate from contractual terms. That is, the supplier cheats if they can without the knowledge of the buyer. As the extent of a firm's offshoring increases, the associated information asymmetry increases the firm's exposure to agency problems and thus increases the supply uncertainty.

In conclusion, increased reliance on offshoring exposes a buyer to increased supply chain complexities along physical distances and variable physical and institutional infrastructure. These complexities result in an uncertain supply chain. Furthermore, offshore relationships are emblematic of cultural differences and language barriers resulting in differing attitudes towards risks, compounding the association between global supply chains and risks. This increases supply uncertainty. Global supply chains are also characterized by poorer transparency and reduced visibility (Wagner and Bode, 2006). This increases information asymmetry and, combined with interest misalignments present when two independent firms enter a contractual relationship, increases the opportunity for moral hazards. In effect, global sourcing increases supply risks, results in differing attitudes toward risks, and increases the risk of moral hazards. The combination of these three elements of global sourcing, as suggested by agency theory, increases supply uncertainties.

One management strategy to buffer against supply uncertainties is inventory investments (Arnold et al., 2008; Lee and Billington, 1993; Tersine, 1994). This allows companies to reduce the detrimental impact of the supply uncertainties without intervening in supplier operations (Lee and Billington, 1993; Zsidisin and Ellram, 2003). Therefore, firms facing increased supply

uncertainties due to their dependence on offshoring are likely to increase their inventory buffers. Stated formally,

H1: Higher levels of a firm's offshoring extent are associated with higher inventory levels.

Geographic dispersion of a firm's suppliers and inventory investment

Lambert and Cooper (2000) identify the firm's supply base structure as a key consideration in managing a supply relationship. An important element here is the dispersion of the firm's supply base. Olsen and Ellram (1997) highlight four components of this supply base dispersion – social, cultural, geographic, and time distances. Among these, I follow Jain et al. (2013) and focus this research on the geographic dispersion of the firm's supply relationships, which refers to the spread of the firm's supply base across different countries.

As the buyer spreads its supply base across multiple countries, it adds to the length, complexity, and number of contact points of its sourcing relationships. The supply risks due to the increased complexity, longer physical distances, and additional contact points, (Blackhurst et al., 2011; Craighead et al., 2007; Manuj and Mentzer, 2008; Tomlin, 2006; Whitney et al., 2014; Yigitbasioglu, 2010) are amplified as the buyer sources from additional suppliers across multiple countries. At the same time, spreading the supply base across multiple countries increases the firm's exposure to communication problems, different profit maximization objectives (Hanna and Newman, 2001), and lower commitments within the various relationships (Ndubisi, 2011) that can lead to differing risk evaluations. According to agency theory, the increased risks and communication problems that arise from spreading the supply base amplify the risk sharing problems, leading to higher supply uncertainties in these relationships.

Similarly, spreading the supply base across different countries increases the agency problems in the relationships. The complexity of the firm's global supply relationships (Bozarth et al., 2009) are further intensified because of the increased number of cross-border relationships. The different profit maximization objectives (Hanna and Newman, 2001) and lower commitments in the various relationships (Ndubisi, 2011) increase the incidence of differing goals (Ribbink and Grimm, 2014). Furthermore, the lower effectiveness of information and knowledge transfer over geographically dispersed parties (Cummings and Teng, 2003; Galbraith, 1990; Gray et al., 2011; Lester and McCabe, 1993; Steven and Britto, 2016) and the difficulties faced in remotely monitoring parties (Hennart, 2001) are amplified with an increase in the number of such global relationships. This results in greater information asymmetry between the parties. This increase in goal conflict and information asymmetry increases the agency problems in these globally dispersed relationships.

In conclusion, as buyers spread their supply base across multiple countries, they face increased risks, goal misalignment and information asymmetries. This increases the risk sharing and agency problems in these relationships, leading to higher supply uncertainties. So, agency theory predicts that firms face increased uncertainty when they spread their supply base across multiple countries. Consequently, firms facing increased supply uncertainties due to spreading their supply base across multiple countries will in turn increase their inventory buffers. Therefore,

H2: Higher levels of a firm's geographic dispersion are associated with higher inventory levels.

The effect of a chief supply chain officer (CSCO) on inventory

Inventory helps the firm buffer itself from uncertainties (Lee and Billington, 1993; Tersine, 1994; Zsidisin and Ellram, 2003). However, it also adds to the firm's costs through storage space requirements, obsolescence risks, and capital commitment (Lee and Billington, 1993; Tersine, 1994). At the same time, excess inventory also signals a demand-supply mismatch that negatively impacts the firm's net cash flow and stock price (Hendricks and Singhal, 2009). Since inventory is a key driver of the firm's performance and survival (e.g. Chen et al., 2007; Chen and Shimerda, 1981; Hendricks and Singhal, 2009), it is often an important metric for firms looking to improve performance. As such, the firm tracks its inventory investment as the capital deployed as inventory (Jain et al., 2013).

A firm can lower its inventory investment by minimizing its exposure to uncertainty, allowing it to reduce its inventory buffers. To accomplish this, the decision maker must have experience in managing the firm's complex value chains including planning, sourcing, production, distribution, and returns – in other words, the supply chain. This supply chain experience provides the decision makers with valuable insights and a holistic view of their firms and their exchange partners (Prater and Whitehead, 2013). The firm's supply chain managers are uniquely suited to apply their experiences and insights to help reduce the firm's exposure to uncertainty and thus its inventory. This view is supported by Wisner and Tan (2000), who point out that reducing inventory is one of the key objectives of supply chain management. Furthermore, selecting and implementing effective strategies to help lower uncertainty requires knowledge of a firm's overall strategy and the analytical tools to assess inter-firm coordination, cross-organizational trade-offs, cross-organizational team building abilities, and inter-organizational processes (Mentzer et al., 2008). It also requires the commitment of resources that can impact the firm's future options. Hence, taking steps to reduce the firm's exposure to supply

uncertainty and, in turn, lower the firm's inventory investment becomes a strategic consideration. Therefore, it becomes the responsibility of the supply chain managers at the highest levels of the firm – the Top Management Team (TMT). Decisions that affect the firm's inventory levels and consequently the firm's exposure to inventory-related uncertainty are influenced by its chief supply chain officer (CSCO) as the voice of supply chain management on the TMT.

Supply chain management focuses on the "management of exchange flows within and across the members of the supply chain" (Esper et al., 2010 pg. 162). The goal is to set up the supply chain to increase customer service, reduce overall inventory investments, and help build a competitive advantage for the supply chain (Cooper and Ellram, 1993; Wisner and Tan, 2000). So, supply chain management aims to improve the performance of the firm as well as its supply chain partners by being efficient and cost-effective across the entire system (Cooper et al., 1997; Fugate et al., 2006; Langley Jr and Holcomb, 1992; Li et al., 2006; Simchi-Levi et al., 2000). In fact, a key part of supply chain management is to focus on reducing uncertainty across the entire system (Davis, 1993).

Upper echelons theory proposes that bounded rationality leads the CSCO to rely more on their cognitive base and values when faced with complex scenarios like reducing the firm's exposure to uncertainty. These *givens* can be influenced by the CSCO's functional background, knowledge, prior experience, interests, etc. (Chin et al., 2013; Hambrick, 2007; Hambrick and Mason, 1984; March and Simon, 1958; Shepherd et al., 2017). According to UET, a CSCO brings these givens to every complex, new situation that they encounter (Hambrick and Mason, 1984). These givens create a screen between the CSCO and the situation and, thus, influence the five stages of the decision-making process. They affect the CSCO's field of vision, their perceptions of situations, their interpretation of the information, the managerial perceptions that

they bring in to identify the possible choices, and also their strategic choices (Hambrick and Mason, 1984).

In the first stage, the cognitive base and values of a CSCO forms a screen between the CSCO and their firms' overall business environment. This screen frames their field of vision to consider the scenario wherein the firm's exposure to uncertainty leads to an increase in its inventory (Tersine, 1994). In the second stage, these givens act as a filter that allows the CSCO to selectively perceive information that they consider influential to reducing uncertainty and thus the firm's inventory. One of the main reasons to maintain inventory is to buffer the firm from uncertainties in its demand and supply (Lee and Billington, 1993; Tersine, 1994; Zsidisin and Ellram, 2003). These uncertainties arise from sources like the firm's "demand (volume and mix), process (yield, machine downtimes, transportation reliabilities), and supply (part quality, delivery reliabilities)" (Lee and Billington, 1993 pg. 835). Consequently, the CSCO's givens will direct them to selectively perceive information from their environment that highlights these sources of uncertainty. In the third stage the CSCO's cognitive base and values influence their interpretation of the selected information. Since uncertainty leads to a need for increased inventory buffers (Tersine, 1994), the CSCO will interpret this information through a lens highlighting the necessity of uncertainty reduction (Davis, 1993) as part of the desire to reduce the firm's inventory investments (Cooper and Ellram, 1993; Wisner and Tan, 2000). In the fourth stage, the CSCO's cognitive base and values influence the managerial perceptions that they deploy to identify ways to achieve their goal. These managerial perceptions enable them to identify the most appropriate management techniques to achieve the desired outcome. In SCM, these management techniques include the regulation of the flow of materials and information through the organizations in the entire supply chain, coordinating and collaborating with partners, managing the relationships in the network of organizations, and using key cross-

functional business processes (CSCMP, 2018; Esper et al., 2010; Lambert and Enz, 2017; Schroeder et al., 2000). In the fifth stage, the CSCO's cognitive base and values influence the strategic choices that they make to achieve the desired result. Each of the management techniques highlighted above leads to improvements in the communication and the coordination between the involved parties (Fugate et al., 2006). These improvements reduce the uncertainty and allows the firm to lower its inventory buffers (Golini and Kalchschmidt, 2011).

Therefore, building on the UET principles, a CSCO's givens leads them to implement strategies to lower the supply uncertainty. This lower supply uncertainty allows the firm to lower its inventory investment. Hence:

H3: The presence of a SCO on the firm's TMT is associated with lower inventory levels.

The effect of a CSCO on inventory investment for firms with extensive offshoring and geographic dispersion of their suppliers

Earlier, I hypothesize that the extent of the firm's offshoring and the geographic dispersion of the firm's suppliers both have a positive impact on the firm's inventory. I argue that the firms in these agency relationships (Zsidisin and Ellram, 2003) are exposed to risk sharing and agency problems (Eisenhardt, 1989) that increase the supply uncertainty for the buyer (Lambert, 2001). This increased supply uncertainty leads them to increase their inventory buffers (Lee and Billington, 1993; Lee et al., 1997; Tersine, 1994; Zsidisin and Ellram, 2003). So, a firm that minimizes the uncertainty from its global sourcing relationships can reduce its inventory investments.

With a complex global sourcing scenario as a backdrop, a CSCO relies on their cognitive base and values when making decisions (Hambrick and Mason, 1984). As argued earlier, the CSCO's cognitive base and values are inclined towards supply chain issues with a focus on reducing uncertainty (Davis, 1993) and inventory (Wisner and Tan, 2000). The cognitive base and values create a screen between the CSCO and the scenario and, thus, influence each of the five stages of the decision-making process (Hambrick and Mason, 1984).

In the first stage of decision making in the UET framework, the CSCO's cognitive base and values lead them to keep supply chain issues in their field of vision. This makes them cognizant of global sourcing exposing the firm to increased supply uncertainty and the associated increase in the inventory (Tersine, 1994). In the next stage, their givens enable them to selectively perceive information influential to the supply uncertainty from its global sourcing relationships. The increased uncertainty from these global sourcing relationships is due to the risk sharing and agency problems (Eisenhardt, 1989). These problems can be traced back to the increased risk of supply disruptions, different attitudes towards the supply chain risks, possible goal conflicts, and ineffective communication between the supply chain partners. The CSCO's cognitive base and values will enable them to identify these factors as the sources of uncertainty. In the third stage, the CSCO's givens influence their interpretation of the selected information. Since the increased supply uncertainty from global sourcing leads to increased inventory (Tersine, 1994), the CSCO will focus on reducing the uncertainty (Davis, 1993) in order to reduce the firm's inventory investments (Cooper and Ellram, 1993; Wisner and Tan, 2000). So, the CSCO's givens will lead them to focus on mitigating the causes of the risk sharing and agency problems in the firm's global sourcing relationships.

In the fourth stage of decision making in the UET framework, the CSCO's cognitive base and values combine with their managerial perceptions to influence their identification of the

appropriate strategy to achieve the desired outcome. Supply chain management focuses on applying analytical tools and frameworks to improve business processes that cross organizational boundaries (Davis, 1993; Mentzer et al., 2008). So, the CSCO considers supply chain management tactics like the management of the flow of materials and information through the organizations in the entire supply chain, coordinating and collaborating with partners, and managing the relationships in the network of organizations to improve the inter-firm business processes (CSCMP, 2018; Esper et al., 2010; Lambert and Enz, 2017; Schroeder et al., 2000). In the last stage of the decision-making process the CSCO implements the strategies most likely to achieve the desired result. With the goal of reducing the firm's supply uncertainty, the CSCO will focus on strategies to lower the impact of the supply disruption risks, possible goal conflicts and ineffective communication. The negative impact of each of these factors can be countered by the tactics mentioned above, as each of them lead to improvements in the inter-firm business processes through improved communication and coordination between the involved parties (Fugate et al., 2006). The improved coordination allows the supply chain partners to lower their supply chain risks and goal conflicts while improving their responses to risks (Cohen and Mallik, 1997), whereas improved communication lowers the information asymmetries and improves the knowledge transfer, which is important for firms aiming to achieve their SCM-related goals (Linderman et al., 2010). Thus, implementing strategies for improved supply chain coordination and communication enables the SCO to lower the firm's supply uncertainty and, thus, its inventory buffers.

Therefore, building on the UET principles, a CSCO's cognitive base and values lead them to identify the causes of the increased uncertainty when the firm increases its sourcing from foreign suppliers or spreads its sourcing across different countries. Next, their experience in supply chain management techniques enables them pick strategies that address the causes of the

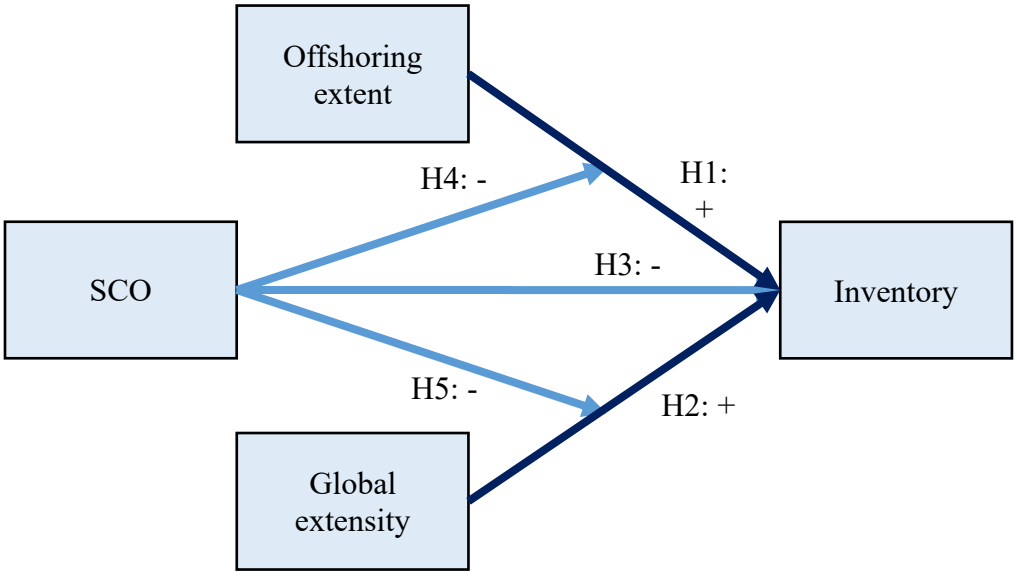
risk sharing and agency problems. This reduces the supply uncertainty and allows the firm to lower its inventory buffers. Hence:

H4: The presence of a CSCO on the firm's TMT weakens the impact of the firm's offshoring extent on its inventory investment.

H5: The presence of a CSCO on the firm's TMT weakens the impact of the firm's geographic dispersion on its inventory investment.

Figure 3 provides a graphic representation of these hypotheses.

Figure 3: Model



DATA AND METHODOLOGY

Data Sample

The population for this study consists of publicly traded manufacturing firms from 2011 to 2015. The dataset was constructed by linking three data sources. First, I collected information such as end of quarter inventory investments about all manufacturing firms included in the Compustat database with a four-digit North American Industry Classification System (NAICS)

code in the range of 3111 to 3399. Next, using Bloomberg's SPLC database, data regarding the links between these firms and their major suppliers for five years, from 2011 to 2015, were collected. Bloomberg's SPLC module provides data about the relationship between publicly held U.S. manufacturing firms and their major suppliers. Given my focus on the inventory investment, I only considered relationships marked as "*cost of goods sold (COGS)*", excluding relationships characterized by SG&A, R&D, and CAPEX. In addition, this dataset provided access to information regarding headquarters location for each of these suppliers as well as the amount of the focal firm's demand sourced from each supplier. Steven et al. (2014) and Elking et al. (2017) give a detailed account of Bloomberg's SPLC data. Following Kumar and Paraskevas (2018), I gathered information regarding the top management team for each of the buyer firms from the Bloomberg executive database. This dataset allows me to analyze the hypotheses empirically while controlling for various firm-level characteristics that are known to influence inventory investments.

After eliminating firms with missing or incomplete data, the final sample consists of quarterly observations for 543 focal firms. I use this quarterly data with the focal firm (buyer) as the unit of analysis. The final sample consists of a total of 2,883 observations over five years. The panel structure of the data provides the possibility to account for some of the unobserved heterogeneity among the focal firms in this sample. However, for added robustness, I augment this panel dataset with several lagged time-varying controls as recommended by past research.

Variables

Dependent Variable

Average quarterly inventory investment

The dependent variable *"Inventory scaled (log)*" is a measure of the firm's inventory investment in a quarter. This inventory investment represents the capital that the firm deploys for inventory (Jain et al., 2013). The data used to calculate this variable was collected from the Compustat database. It is operationalized in three steps. First, the average inventory investment (*AINV*) for each firm *i* in quarter *q* is calculated:

$$AINV_{iq} = (\frac{INV_{iq}+INV_{iq-1}}{2}) \quad (10)$$

where, INV_{iq} is the end-of-period inventory value for firm *i* in quarter *q* (Compustat: INVTQ).

For this variable to be comparable across the entire dataset, the measure was scaled according to the market value (*MKVAL*) of each firm *i* in the quarter *q*:

$$AINV_{iq_scaled} = \frac{AINV_{iq}}{MKVAL_{iq}} \quad (11)$$

Next, to normalize the data distribution and make the results easier to interpret, I took the log of this variable. *Inventory scaled (log)* is the dependent variable in my analysis.

$$Inventory\ scaled(log) = log\ (AINV_{iq_scaled}) \quad (12)$$

Independent Variables

Supply Chain Officer

The first hypothesized variable, "*Chief Supply Chain Officer*" denotes the presence of a chief supply chain officer on the focal firm's TMT in the previous quarter. The data used for this variable was collected from the Bloomberg executive database. To generate this variable, I examined the titles of the individuals listed as top managers for keywords that indicate the

presence of a chief supply chain officer. Following Roh et al. (2016), a firm is considered to have a supply chain officer if the title was "Chief Supply Chain Officer", included the abbreviation "CSCO", or included the words "Supply Chain" resulting in the coding of this dummy variable as 1 if the firm used one of these terms in their description of a member of the TMT.

Offshoring extent

The next independent variable "*Offshoring (log)*" denotes the percentage of the focal firm's cost of goods sold (*COGS*) that arise from foreign suppliers. Using the list of buyer-supplier relationships from the Bloomberg SPLC database, for each buyer, I first identified the domestic and foreign suppliers. Once this was completed, I calculated the percentage of the firm's total cost of goods sold that arise from foreign suppliers:

Offshoring = % COGS spent on foreign suppliers (13)

Finally, to normalize the data distribution and make the results easier to interpret, I took the log of this variable:

Offshoring (log) = log (Offshoring) (14)

Geographic Dispersion

The next independent variable "*Geographic dispersion (log)*" measures the geographic dispersion of the firm's sourcing. The data used to calculate this variable was collected from the Bloomberg SPLC database. For each focal firm, I first identified the various countries from which the focal firm sourced. Next, I calculated the cost of goods sold from each country in each quarter. I also calculated the total cost of goods sold for each focal firm in each quarter. Next, I calculated the global extensity (*GLOEXT*) as the sum of squares of shares of *COGS* spent in each country.

$$Geographic\ dispersion = GLOEXT = 1 - \sum \left(\frac{COGS_{icq}}{COGS_{iq}}\right)^2 \quad (15)$$

where $COGS_{icq}$ represents the *COGS* for the firm *i* in country *c* in the quarter *q*, while $COGS_{iq}$ represents the *COGS* for the firm *i* in the quarter *q*.

Finally, to normalize the data distribution and make the results easier to interpret, I took the log of this variable, which makes the second independent variable.

Geographic dispersion (log) = log (GLOEXT) (16)

Control variables

To account for some of the other factors that can affect the firm's inventory investment, I included lagged time-varying controls as recommended by past research. The first set of these lagged time-variables account for differences in the firms. Following Jain et al. (2013), I included control variables to account for the *capital intensity*, *gross margin*, *sales surprise*, *demand uncertainty*, *cost of goods sold*, *sales*, and the *previous quarter's inventory*, as each of these impact the relative inventory level of the firm.

Capital intensity (log) for a given firm *i* in a given quarter *q* was derived as follows:

$$Capital\ intensity\ (\log) = \log(\frac{PPE_{iq}}{TA_{iq} - INV_{iq}}) \quad (17)$$

where PPE_{iq} is the net investments in property, plant, and equipment (Compustat: PPENTQ); TA_{iq} measures the firm's gross total assets (Compustat: ATQ); and INV_{iq} denotes the end-of-period inventory value for firm *i* in quarter *q* (Compustat: INVTQ).

Gross margin (log) and *Sales surprise (log)* for a given firm *i* in a given quarter *q* was derived as follows:

$$Gross\ margin\ (\log) = \log(\frac{REV_{iq} - COGS_{iq}}{COGS_{iq}}) \quad (18)$$

$$Sales\ surprise\ (\log) = \log(\frac{REV_{iq}}{SF_{iq}}) \quad (19)$$

where REV_{iq} is the firm's revenue in the quarter (Compustat: REVTQ), $COGS_{iq}$ is the firm's cost of goods sold in the quarter (Compustat: COGSQ), and SF_{iq} is the sales forecast for quarter q. The sales forecast (SF_{iq}) was estimated using a using a linear trend model with seasonal dummies (Rumyantsev and Netessine, 2007).

Demand uncertainty, which also affects the inventory investment (Jain et al., 2013; Rumyantsev and Netessine, 2007), is estimated as follows:

$$Demand\ uncertainty\ (\log) = \log\left(\frac{1}{3}\sqrt{\sum\left(REV_{iq} - SF_{iq}\right)^2}\right) \qquad (20)$$

Additional variables included are: *Sales (log)* to account for the firm's sales (Compustat: SALESQ) and *ROA (log)* to control for the firm's efficiency (Compustat: ROA). Furthermore, I estimated a variable for *COGS scaled (log)* to control for the cost of goods sold:

$$COGS\ scaled\ (\log) = \log\left(\frac{COGS_{iq}}{MKTVAL_{iq}}\right) \qquad (21)$$

To measure the inventory investment from the previous quarter and control for the impact of the existing inventory strategy, Inventory scaled (log) was lagged by one quarter.

Next, to account for differences in the top management teams of the firms, I include "*Total number of execs*", "*Percent male in the TMT*" and "*Average age of the TMT*". These variables are lagged by one period: the size of the top management team affects the decisions made and, thus, firm performance (Sanders and Carpenter, 1998; Smith et al., 1994); gender differences can impact top management team behavior (Kumar and Paraskevas, 2018); and the decision makers' ages can affect their decisions (Taylor, 1975; Tihanyi et al., 2000).
Finally, I include industry controls using "*NAICS*" dummies (Han et al., 2008). These industry segments are characterized by similarities in their production processes, technologies, and product offerings, and are likely to affect firm performance. This helps account for any unobserved industry-specific effects.

Tables 12 and 13 provide the descriptive statistics and pairwise correlations, respectively, for the variables used in this analysis.

Table 12: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Inventory scaled	2,883	0.216	1.191	0.001	48.304
Inventory scaled (log)	2,883	-2.350	1.158	-8.482	3.878
Offshore outsourcing	2,883	0.091	0.166	0.001	1.280
Offshoring extent (OE)	2,883	-3.870	1.981	-9.210	0.247
Geographic dispersion (GD)	2,883	-0.071	0.308	-3.361	-0.00000001
Chief Supply Chain Officer (CSCO)	2,883	0.139	0.346	0	1
COGS	2,883	1480.332	4118.504	0.059	53457
COGS scaled (log)	2,883	-2.276	1.255	-6.258	4.063
Gross margin	2,883	1.017	1.210	0.000001	15.155
Gross margin (log)	2,883	-0.655	1.901	-13.816	2.718
Sales	2,883	2287.782	5421.506	0.015	65395
Sales (log)	2,883	6.298	2.019	-4.211	11.088
Demand uncertainty	2,883	0.052	0.183	0.001	7.941
Demand uncertainty (log)	2,883	-3.875	1.251	-8.556	2.072
Capital intensity	2,883	0.221	0.160	0.002	0.918
Capital intensity (log)	2,883	-1.814	0.848	-6.393	-0.086
Sales surprise	2,883	1.032	0.453	0.023	10.312
Sales surprise (log)	2,883	-0.010	0.275	-3.759	2.333
ROA	2,883	0.240	0.162	0.001	3.612
ROA (log)	2,883	-1.578	0.593	-7.291	1.499
Total number of execs	2,883	10.194	4.775	1	29
Percent male in the TMT	2,883	0.889	0.111	0	1
Average age of the TMT	2,883	53.581	3.596	42	75

Table 13: Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Offshoring extent (OE) (1)	1												
Geographic dispersion (GD) (2)	-0.331*	1											
Chief Supply Chain Officer (CSCO) (3)	-0.005	0.006	1										
COGS (4)	-0.026	-0.045*	0.056*	1									
Gross margin (5)	0.072*	-0.022	0.028*	-0.436*	1								
Sales (6)	0.100*	-0.027	0.123*	0.139*	0.113*	1							
Demand uncertainty (7)	0.005	-0.026	0.054*	0.720*	-0.269*	-0.070*	1						
Capital intensity (8)	-0.043*	0.004	0.164*	0.413*	-0.132*	0.284*	0.204*	1					
Sales surprise (9)	0.036*	-0.036*	0.007	0.112*	0.112*	0.150*	0.010	0.034*	1				
ROA (10)	-0.016	-0.038*	0.131*	0.523*	0.004	0.182*	0.347*	0.412*	0.136*	1			
Total number of execs (11)	0.058*	-0.025	0.251*	-0.033*	0.082*	0.528*	-0.132*	0.166*	0.006	0.028*	1		
Percent male in the TMT (12)	0.076*	-0.037*	-0.037*	-0.003	0.020	-0.063*	0.005	-0.031*	0.003	0.006	-0.144*	1	
Average age of the TMT (13)	-0.065*	0.014	-0.053*	-0.030*	-0.029*	0.043*	-0.093*	0.045*	-0.087*	-0.021	0.016	0.081*	1

RESULTS

Analysis and results

There are a few empirical challenges that I need to overcome to conduct this analysis. First, procurement costs, gross margin, demand and inventory all influence each other (see Kesavan et al., 2010). Second, the extent of a firm's outsourcing can directly influence the procurement costs and thus the firm's demand. Finally, global sourcing can have a positive impact on the appointment of a chief supply chain officer (Roh et al., 2016). This codependence between the dependent and several independent variables leads to correlations between the regressors and the error term in the estimation model. If not controlled for, this correlation can result in inconsistent estimates. Therefore, I need to account for this correlation between the variables, in this regression analysis.

In order to address this challenge, I use a simultaneous equation model developed by Kesavan et al. (2010) that uses instrumental variables to determine these independent variables simultaneously as an equilibrium outcome. I first identify instruments for these variables. I then follow Jain et al. (2013) and use a two-stage least squares (2SLS) single equation method (see Greene, 2008 p. 371 - 375) with the error component two-stage least squares (EC2SLS) estimator to evaluate the coefficients of this equation system. This EC2SLS estimator performs better than the generalized two-stage least square estimator when used with "smaller" panels (Baltagi and Liu, 2009). The EC2SLS estimator is a matrix-weighted estimator of the fixed-effect and the between-effect estimator (Greene, 2008). As such, it uses both a cross-sectional variation (using the between estimator) and a within-firm variation (using the fixed-effect estimator) of the explanatory variables.

Table 14: Results

	Log (Inventory scaled)				
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Offshoring extent (OE)		0.077***		0.076***	0.068***
		(0.012)		(0.012)	(0.016)
Geographic dispersion (GD)		0.171***		0.170***	0.159***
		(0.031)		(0.031)	(0.039)
Chief Supply Chain Officer			0.010	0.001	-0.203***
(CSCO)			(0.018)	(0.015)	(0.070)
OE * CSCO					-0.049***
					(0.016)
GD * CSCO					-0.127**
					(0.051)
COGS	0.242***	0.128***	0.243***	0.127***	0.120***
	(0.013)	(0.012)	(0.013)	(0.012)	(0.011)
Gross margin	0.061***	0.017*	0.061***	0.017*	0.018**
	(0.010)	(0.009)	(0.010)	(0.010)	(0.009)
Inventory (lagged)	0.768***	0.892***	0.767***	0.892***	0.895***
	(0.010)	(0.008)	(0.010)	(0.008)	(0.008)
Sales	-0.024***	-0.022***	-0.024***	-0.022***	-0.019***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Demand uncertainty	0.045***	0.028***	0.044***	0.0281***	0.030***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Capital intensity	0.035***	0.022***	0.034***	0.022***	0.024***
	(0.009)	(0.007)	(0.009)	(0.007)	(0.011)
Sales surprise	-0.040**	0.037**	-0.041**	0.037**	0.038**
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)
ROA	-0.191***	-0.103***	-0.192***	-0.103***	-0.106***
	(0.014)	(0.012)	(0.014)	(0.012)	(0.012)
Total number of execs	0.002	0.004***	0.002	0.004***	0.003***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Percent male in the TMT	-0.040	0.016	-0.041	0.016	-0.005
	(0.052)	(0.044)	(0.053)	(0.044)	(0.043)
Average age of the TMT	0.0032**	-0.001	0.0032**	-0.001	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Constant	0.044	0.410***	0.035	0.408***	0.407***
	(0.142)	(0.119)	(0.143)	(0.120)	(0.131)
Observations	2,883	2,883	2,883	2,883	2,883
Wald chi^2	37543.02	62059.28	37404.72	62234.67	65482.32
R^2	0.9647	0.9559	0.9647	0.9561	0.9595

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

Table 14 provides an overview of the findings. Model 1 shows the estimation results for the base model that only includes control variables. This model provides a baseline for the

analysis to help comparisons with past studies. Model 2 looks at the direct effects of offshoring and global extensity on inventory position. As such, it confirms the findings of Jain et al. (2013). Model 3 includes the variable of the Chief Supply Chain Officer and its effect on inventory. Model 4 combines the direct effects of both Model 2 and Model 3. Finally, the key results of this analysis, including the interaction effects of the SC Officer with offshoring and with global extensity, are reported in Model 5.

The first hypothesis posited a positive effect of a firm's offshoring on its inventory levels. The results from Model 2 show that offshoring has the predicted direct effect. The results are significant at the 1% level ($\beta = 0.077$, $p = 0.000$). Similarly, H2 proposed a positive effect of geographic dispersion of the firm's suppliers on its inventory levels. Again, the results confirm this hypothesis in Model 2: Global extensity, the measure of geographic dispersion, has a positive, statistically significant effect on inventory levels ($\beta = 0.171$, $p = 0.000$). Both of these findings replicate the conclusions from Jain et al. (2013) and establish a direct link between a firm's strategic decisions of offshoring and geographic supplier dispersion on inventory. In H3, I proposed that the presence of a Chief Supply Chain Officer has a negative effect on the level of inventory a firm carries. Model 3, testing this direct effect, does not support this hypothesis. Instead, the effect is insignificant ($\beta = 0.010$, n.s.). This result is consistent even when including the direct effects of offshoring and geographic dispersion (see Model 4, $\beta = 0.001$, n.s.).

The main contributions of this paper are tested in Model 5. Hypothesis 4 states that the presence of a CSCO weakens the impact of the firm's offshoring extent on its inventory investment. The empirical results support this. While offshoring has a significant, positive effect ($\beta = 0.068$, $p = 0.000$), the CSCO ($\beta = -0.203$, $p = 0.004$) as well as the interaction term of CSCO with offshoring ($\beta = -0.049$, $p = 0.002$) both have statistically significant, negative effects on the level of inventory investments. Looking at the linear combined effect here, I find that the effect

is also statistically significant and negative ($\beta = -0.171$, $p = 0.032$). Therefore, I find that the presence of a Chief Supply Chain Officer weakens the impact of a firm's offshoring extent on its inventory investments. Analogously, in H5, I posit that the presence of a CSCO on the firm's TMT weakens the impact of the firm's geographic dispersion on its inventory investment. The empirical findings in Model 5 support this claim. While geographic dispersion of the supply base has a statistically significant, positive effect on inventory investment ($\beta = 0.159$, $p = 0.000$), the SCO ($\beta = -0.203$, $p = 0.004$) and the interaction term of CSCO with geographic dispersion ($\beta = -0.127$, $p = 0.012$) both have statistically significant, negative effects. Again, I test the linear combined effect of these terms and find that it is significant and negative ($\beta = -0.184$, $p = 0.010$). So, the results presented here provide empirical evidence that the presence of a Chief Supply Chain Officer weakens the impact of a firm's geographic dispersion on inventory investments.

I include several control variables. In the main model (Model 5), the effects of *cost of goods sold*, *gross margin*, the *previous period's level of inventory*, *demand uncertainty* and *capital intensity* on inventory investment are all significant and positive. These findings are aligned with Jain et al. (2013). In addition, I include controls for *sales* and *ROA*, which both have a significant and negative effect on the level of inventory. These findings are aligned with my expectations. As *sales* increase, companies are more likely to use their inventory. *ROA* is a measure of a firm's efficiency. Hence, a more efficient firm has lower investments in inventory. Finally, I include *sales surprise* to control for mismatches in demand and supply. I find a statistically significant and positive effect of a sales surprise in one period and the firm's inventory in the next period, which is aligned with my expectations.

Robustness and Endogeneity Tests

I first focus on addressing the possible endogeneity issues in the analysis. I am concerned about endogeneity issues caused by reverse causality. I account for the possible reverse causality in two ways. First, I use lagged variables in the analysis. Additionally, I employ a two stage least squares (2SLS) instrumental variable analysis. Both help to address the reverse causality concerns.

Now, even though I find support for the theory-driven hypotheses, it is important to test the robustness of the results. To do this, I estimate multiple versions of the simultaneous equations using alternative ways to construct the hypothesized variables and alternative analysis functions. In the first case, I predict the presence of a CSCO on the top management team using several lagged variables as highlighted by Hendricks et al. (2015) and Roh et al. (2016). I then use this predicted value (*CSCOHat*) in the analysis. I find no significant differences when compared to the initial results. This also helps address possible measurement error issues in the CSCO variable. The results of this analysis are presented in Table 15.

Next, I run a single-equation with instrumental variables analysis with the limited-information maximum likelihood (LIML) option that allows an instrumental-variables regression and weighted instrumental-variables regression to fit one equation from a system of equations without specifying the functional form of the remaining equations. In the presence of weakly correlated instruments, some Monte Carlo evidence suggests that the LIML estimator performs better than the 2SLS and GMM estimators as it yields less bias and the confidence intervals have better coverage rates (Stock et al., 2002). Once again, I find no significant differences when compared to the initial results. Table 16 displays the results of this analysis.

Table 15: Robustness check: Using the predicted value for CSCO (CSCOHat)

	Log (Inventory scaled)				
VARIABLES	Model 6	Model 7	Model 8	Model 9	Model 10
Offshoring extent (OE)			0.077***	0.079***	0.063***
			(0.012)	(0.012)	(0.018)
Geographic dispersion (GD)			0.171***	0.175***	0.152***
			(0.031)	(0.031)	(0.043)
CSCOHat		-0.013		-0.023**	-0.199***
		(0.013)		(0.011)	(0.073)
OE * CSCOHat					-0.041**
					(0.017)
GD * CSCOHat					-0.119**
					(0.047)
COGS	0.242***	0.242***	0.128***	0.128***	0.532***
	(0.013)	(0.013)	(0.012)	(0.012)	(0.018)
Gross margin	0.061***	0.061***	0.017*	0.017*	0.122***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.014)
Inventory (lagged)	0.768***	0.767***	0.892***	0.892***	0.512***
	(0.010)	(0.010)	(0.008)	(0.008)	(0.014)
Sales	-0.024***	-0.024***	-0.022***	-0.022***	-0.058***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)
Demand uncertainty	0.045***	0.045***	0.028***	0.028***	0.029***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Capital intensity	0.035***	0.035***	0.022***	0.023***	0.054***
	(0.009)	(0.009)	(0.007)	(0.007)	(0.013)
Sales surprise	-0.040**	-0.039**	0.037**	0.038**	-0.266***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.024)
ROA	-0.191***	-0.191***	-0.103***	-0.102***	-0.295***
	(0.014)	(0.014)	(0.012)	(0.012)	(0.018)
Total number of execs	0.002	0.002	0.0039***	0.004***	0.005**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Percent male in the TMT	-0.040	-0.041	0.016	0.016	-0.113
	(0.052)	(0.052)	(0.044)	(0.045)	(0.076)
Average age of the TMT	0.003**	0.003**	-0.001	-0.001	0.009***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Constant	0.043	0.059	0.410***	0.447***	0.145
	(0.142)	(0.143)	(0.119)	(0.122)	(0.267)
Observations	2,883	2,883	2,883	2,883	2,883
Number of focal firms	349	349	349	349	349

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

Table 16: Robustness check: Using Two Stage Least Square with LIML (2SLS LIML)

	Log (Inventory scaled)				
VARIABLES	Model 11	Model 12	Model 13	Model 14	Model 15
Offshoring extent (OE)			0.595***	0.598***	1.041***
			(0.131)	(0.132)	(0.353)
Geographic dispersion (GD)			1.299***	1.305***	2.330***
			(0.295)	(0.297)	(0.800)
CSCO		0.00815		-0.0150	-4.080***
		(0.0151)		(0.0637)	(1.418)
OE * CSCO					-0.967***
					(0.335)
GD * CSCO					-1.980***
					(0.730)
COGS	-0.102***	-0.102***	0.121*	0.123*	0.0752
	(0.0160)	(0.0159)	(0.0635)	(0.0639)	(0.0937)
Gross margin	-0.103***	-0.103***	-0.146***	-0.145***	-0.207**
	(0.0133)	(0.0134)	(0.0488)	(0.0489)	(0.0892)
Inventory (lagged)	0.957***	0.957***	0.944***	0.944***	1.082***
	(0.00877)	(0.00878)	(0.0365)	(0.0367)	(0.0782)
Sales	0.00700**	0.00709**	-0.0786***	-0.0793***	-0.108**
	(0.00337)	(0.00338)	(0.0220)	(0.0222)	(0.0423)
Demand uncertainty	0.0732***	0.0730***	-0.0162	-0.0164	-0.0619
	(0.00604)	(0.00605)	(0.0301)	(0.0303)	(0.0572)
Capital intensity	0.0101	0.00961	0.0388	0.0399	0.0911*
	(0.00715)	(0.00723)	(0.0305)	(0.0309)	(0.0549)
Sales surprise	0.166***	0.167***	0.112	0.111	0.144
	(0.0202)	(0.0202)	(0.0816)	(0.0819)	(0.131)
ROA	-0.00170	-0.00187	-0.0561	-0.0566	-0.0743
	(0.0133)	(0.0133)	(0.0541)	(0.0544)	(0.0868)
Total number of execs	4.34e-05	-0.000129	0.0184***	0.0189***	0.0302**
	(0.00121)	(0.00125)	(0.00639)	(0.00662)	(0.0131)
Percent male in the TMT	-0.0462	-0.0473	0.219	0.222	0.130
	(0.0448)	(0.0449)	(0.197)	(0.198)	(0.307)
Average age of the TMT	-0.000293	-0.000281	-0.0154**	-0.0155**	-0.0204*
	(0.00131)	(0.00131)	(0.00654)	(0.00658)	(0.0113)
Constant	-0.0547	-0.0582	3.870***	3.895***	6.657***
	(0.102)	(0.102)	(0.951)	(0.960)	(2.356)
Observations	2,883	2,883	2,883	2,883	2,883

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

Discussion and Contribution

This research provides unique insights into the impact of the composition of the firm's top management team on its inventory investments. Specifically, it addresses how the presence of a Chief Supply Chain Officer on the TMT affects the direct and indirect relationship of offshoring and geographic supply base dispersion to the firm's inventory investments. The findings help underline the need to assess both strategic and tactical decisions in a broader context.

The key findings of this study provide empirical support for the moderating impact of a Chief Supply Chain Officer on the relationship of the firm's extent of outsourcing and the firm's geographic supply base dispersion to its inventory investment. In particular, I find that a CSCO's presence reduces the positive impact of each of these global sourcing measures on inventory. As a firm increases its offshoring extent, it sources more of its requirements from overseas. As such, it relies more on its global supply chain. These global supply chains are generally longer, more complex and have more parties involved than domestic supply chains. Now, as the buyer increases the geographic dispersion of its supply base, it spreads its supply chain across multiple countries. In doing so, it adds to the length, complexity, and number of contact points of its supply chain. Agency theory predicts that these global supply chains are exposed to increased risk sharing and agency problems. The risk sharing issues can be traced back to the increased risk of disruptions in global supply chains, as well as to the parties having differing attitudes towards mitigating risks. Agency problems, in turn, arise from conflicting goals and the existence of information asymmetries between the involved parties. Thus, increased reliance on offshoring and increased geographic supply base dispersion leads to greater supply uncertainty and thus higher inventory investments for the buyer firm. In contrast, per upper echelons theory, the functional background of CSCOs leads them to reduce the uncertainty in the supply chain. In

order to manage the uncertainty, CSCOs implement strategies that manage the flow of materials and information through organizations in the entire supply chain; they coordinate and collaborate with partners, manage the relationships in the network of organizations, and improve key cross-functional business processes. The findings of this research clearly show juxtaposing effects of agency and upper echelons theories in strategic decision making as it manifests in firms' tactical inventory investments. Therefore, this paper allows me to extend the existing discussion of both theories – the strategic choice to include a Chief Supply Chain Officer on the Top Management Team has a significant effect on the day-to-day operations of the firm. Hence, when looking at tactical outcomes, it is important to keep the overarching outlook of the firm in perspective.

Research on inventory management states that uncertainty is one of the leading drivers of inventory. So, as uncertainty increases, the firm maintains higher inventory levels to buffer against uncertainty. Using agency theory, I argue that global sourcing exposes the firm to increased supply uncertainty, which in turn leads to higher inventory investments. The results confirm this relationship by demonstrating a significant positive relationship between a higher dependence on outsourcing and a geographically dispersed supply base on the firm's inventory investment. A firm that ignores this link grossly overestimates the benefits of global sourcing or, even worse, employs a global sourcing strategy with an inferior supplier dispersion strategy.

However, using upper echelons theory, I also argue that the functional background of a CSCO allows them to reduce the firm's exposure to uncertainty. The results demonstrate that this effect is significant for firms that have a higher dependence on outsourcing and a geographically dispersed supply base. Therefore, the strategic choice of including a CSCO on the TMT can help the firm lower its exposure to uncertainty and thus its inventory when it increases its dependence on global sourcing. Thus, I contribute to research on inventory management, global sourcing and

supply chain management by linking the functional background of the CSCO, a non-operational factor, to the firm's exposure to uncertainty and its inventory investment.

Interestingly, in the absence of global sourcing, the results indicate that a CSCO does not have a significant effect on the firm's inventory investments. This is likely due to the firm's exposure to uncertainty from a number of different sources. Lee and Billington (1993 pg. 835) highlight uncertainties arising from the firm's "demand (volume and mix), process (yield, machine downtimes, transportation reliabilities), and supply (part quality, delivery reliabilities)". So, while CSCOs focus on lowering the firm's exposure to uncertainty (Davis, 1993), they may not impact all of the different sources of uncertainty. For instance, inaccurate forecast figures can lead to large mismatches between demand and supply. This is evidenced by *demand uncertainty* having a significant positive effect on the firm's inventory across all the regressions. The CSCO can implement strategies to improve communication and collaboration (CSCMP, 2018; Fugate et al., 2006) leading to a smaller effect of *demand uncertainty*, but the variable remains significant and positive. This leads me to believe that some of the other functions, for instance, sales and marketing, are better positioned to improve the forecast accuracy with direct feedback from the customers.

Limitations and future work

Using the Bloomberg SPLC database to gather information about the firm's supply base limits this analysis to just a few years. Gathering supply chain information for a larger timeframe would help researchers test for macroeconomic effects on the firm's inventory investments. Next, the Bloomberg SPLC database only provides information about the firm's major suppliers. Having information about the entire supply chain would allow researchers to check whether

tested results hold for the whole supply chain or if the firm only focuses on reducing the uncertainty in its major relationships. Furthermore, the supplier location is based on the supplier's headquarters. This does not allow me to consider situations where an international supplier has a domestic manufacturing or distribution facility. Running a similar analysis using that information may yield interesting results. Finally, I focus this research on how the CSCO impacts the firm's inventory investment when it pursues a global sourcing strategy. It would be interesting to identify other performance variables that the supply chain officer can influence in a global sourcing context.

CONCLUSION

While there is a wealth of research that addresses tactical supply chain issues like inventory optimization, any initiatives taken should match the firm's overall strategy. This requires input from the firm's strategic decision makers with the knowledge and authority to drive these initiatives from the strategic level – the Chief Supply Chain Officer on the Top Management Team. Hence, the CSCO is a critical factor in the firm's supply chain management. However, the link between the CSCO and the firm's tactical initiatives is not well researched.

This study helps bridge this gap by examining the impact of a Chief Supply Chain Officer on firm performance. In this research, I look at the effect that a CSCO has on the firm's inventory investment and demonstrate that the CSCO can help the firm lower its inventory investment when it pursues a global sourcing strategy. This is due to the CSCO's focus on improving inter-firm cross-functional business processes, which leads to lower uncertainty for the firms involved. Given the global nature of business, I expect that this function will only gain prominence in the future.

Chapter 4: Dissertation conclusion

In the two essays of this dissertation, I focus on the impact that supply chain and operations executives in top management teams have on their firms' strategic actions. In Essay 1, I leverage upper echelons theory to argue that the differences in the supply chain and operations roles lead to differing outcomes in two key aspects of strategic supplier portfolio management – the firm's geographic sourcing strategy that impacts the firm's supply base, and its supplier relationship strategy that impacts the power balance between the firm and its suppliers. Using econometric techniques, I find that firms with a supply chain manager on their TMT are more likely to spread their supply base globally while firms with an operations manager on its TMT are more likely to lower the global spread of their supply base. Additionally, firms with a supply chain manager on their TMT are more likely to reduce the firms' power advantage over their suppliers, while firms with an operations manager on their TMT are more likely to increase it.

Essay 2 builds on the results from Essay 1 by focusing on the benefit of having a chief supply chain officer (CSCO) on the firm's TMT in a global sourcing context. In this essay, I first leverage agency theory to argue that global sourcing leads to an increase in supply uncertainty and, thus, the need for increased inventory investments. Next, I ground my arguments in upper echelons theory and argue that the functional background of a CSCO helps reduce the firm's exposure to supply uncertainty and, therefore, the need for increased inventory. Using econometric techniques, I demonstrate that the presence of a CSCO on the TMT leads to lower inventory investment when the firm pursues a global sourcing strategy.

While there is a wealth of research that addresses tactical supply chain issues like supplier selection, power dynamics and inventory optimization, any initiatives taken at the tactical level should match the firm's overall strategy. This requires input from the firm's

strategic decision makers with the knowledge and authority to drive these initiatives from the strategic level – the chief supply chain officer and the chief operations officer on the top management team. In the two essays of this dissertation, I first demonstrated how supply chain and operations managers on a firm's TMT can have differing impacts on some of the firm's strategic decisions. This is an important consideration as firms generally separate the supply chain and operations roles on their TMTs. Next, I demonstrated how a CSCO can help the firm lower its inventory investments when it pursues a global sourcing strategy. This opens the door to research on other tactical aspects that a CSCO can impact when the firm pursues a global sourcing strategy.

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