ABSTRACT

Title of Document: The Impact of Executives with Supply Chain Management and Operations Management Experience on Recall Performance and Risk Management

John-Patrick Paraskevas, Supply Chain Management, 5th Year

Directed By: Dr. Curtis Grimm, Logistics, Business and Public Policy
Dr. Thomas Corsi, Logistics, Business and Public Policy

This dissertation investigates the impact of the growing presence of executives with supply chain management and operations management (SCOM) experience on the top management team. My dissertation focuses on two major strategic areas in which an executive with SCOM experience may influence firm strategy and firm performance. The first area I have chosen to study is a firm's propensity to engage in product recalls along with their responsiveness to the quality glitches that lead to recall. The second area of study is risk and resilience within a firm's supply chain.

Essay 1 explores the impact of an executive with SCOM experience on product recall propensity and firm responsiveness. We utilize a unique dataset collected from multiple sources on executives' backgrounds and product recalls, and

we find that firms having top management executives with SCOM backgrounds have fewer recalls and faster recall responsiveness. The findings also indicate that the shortened speed to recall is enhanced when a firm engages in a proactive recall strategy.

The second essay studies the impact of top executives with SCOM experience as well as top executives with finance experience. We then propose original hypotheses regarding the impact of these two forms of experience on the firm's supply chain risk profile. We utilize a dataset of manufacturing locations over a three-year period. Our findings indicate that firms with SCOM experience on their top management teams have lower levels of location risk and higher levels of resilience at their production locations. On the other hand our findings indicate that firms with top management teams with finance experience are more likely to take on location risk at their production locations but are similar to firms with SCOM on their top management team in that they also have high levels of resilience. Lastly we explore the impact of an SCOM executive when the firm uses offshore production.

My findings for both essays contribute to upper echelons theory (UET) by proposing and testing novel hypotheses regarding the impact of the presence of executives with SCOM experience and finance experience on recall performance and supply chain risk management.

THE IMPACT OF EXECUTIVES WITH SUPPLY CHAIN MANAGEMENT AND OPERATIONS MANAGEMENT EXPERIENCE ON RECALL PERFORMANCE AND RISK MANAGEMENT

By

John-Patrick Paraskevas

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Advisory Committee:
Professor Curtis Grimm [Co-Chair]
Professor Thomas Corsi [Co-Chair]
Professor Sandor Boyson
Professor Martin Dresner
Professor Cinzia Cirillo [Dean's Representative]

Dedication

This dissertation is dedicated to John E. Paraskevas for his support of my education. As a poor Greek immigrant he worked hard for the opportunity to receive an education but was unable to complete it in part due to monetary constraints. He wished for his children and grandchildren to strive for excellence in their academic pursuits. Every time I talked to him he reminded me of the importance of seeking higher education. He left all of his grandchildren money to facilitate their university dreams. All of his children and grandchildren who are of age to go to college have achieved an undergraduate degree and have gone to graduate school. His encouragement and financial support have made my academic aspirations possible.

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Chapter 1: Overview

The two essays of this dissertation will focus on the influence of supply chain management and operations management (SCOM) experience in a top management team (TMT) on the supply chain strategies undertaken by the firm. Essay 1 will identify the impact of top executives with SCOM experience on firm recall performance and responsiveness. Essay 2 will focus on the impact of SCOM experience in the TMT on a firm's risk mitigation strategies. Essay 1 and essay 2 leverage archival data and econometric analysis to further develop upper echelons theory (UET) in supply chain management research.

Essay 1 of my dissertation analyzes a sample of 485 firms over a 7-year period. We craft original hypotheses regarding the impact of executives on the TMT with SCOM experience on the propensity of firms to recall and the speed with which a firm recalls. We propose that SCOM experience on the TMT will lower the firm's propensity to recall and will also improve the speed with which the firm recalls. In order to complete our analysis we utilize the Bloomberg executive database and the Consumer Product Safety Commission database to measure SCOM presence and recall propensity respectively.

Essay 2 analyzes a sample of 40 firms over a three-year period. Original hypotheses are tested examining the impact of the prevalence of TMT members with SCOM experience on the risk and resilience of a firm. We analyze the relative riskiness of the critical part production locations for the 40 firms in our sample. The Resilinc database includes risk profiles for each of these locations and has recorded

scores for local economic risk, geopolitical risk, risk of natural disaster, and recovery time. We propose that firms with high degrees of SCOM representation on the top management team will select locations with lower risk scores and will equip these locations to recover more quickly than firms without SCOM representation on the TMT. We further propose that top managers with a finance background will also play a key role in determining the level of risk and resilience the firm undertakes. Specifically we propose that a high degree of finance executives on the TMT will lead to higher risk scores and lower time to recovery.

Chapter 2: Supply Chain and Operations Management Experience in the C-Suite: A Study of Recall Propensity and Responsiveness

ABSTRACT

This study investigates how top management team composition is associated with product recall propensity and firm responsiveness. More specifically, the research develops theory regarding how the presence of executives with supply chain and operations management (SCOM) experience on top management teams is associated with the frequency of product recalls and with responsiveness to recall a product from the market. The moderating effect of recall strategy is also explored. Using a unique dataset collected from multiple sources on executives' backgrounds and product recalls, the study finds that firms having top management executives with SCOM backgrounds have fewer recalls and superior recall responsiveness. Our findings also indicate that the shortened time to recall is enhanced when a firm engages in a proactive recall strategy. This finding contributes to upper echelons theory (UET) by showing that executives' previous SCOM experience significantly influences the strategic decisions of their firms.

INTRODUCTION

The impact of problems leading to recalls can be clearly seen, as defective products may result in either injury or death. Large product recalls and slower response to quality failures have increasingly headlined the news cycle in recent years, since recalls have enormous implications for both consumers and firms. The well-publicized Takata airbag case that led to the recall of 60 million cars is a salient example of the cost of recalls to both consumers and manufacturing firms. Takata's faulty airbags have been linked to 14 deaths and hundreds of injuries. Takata itself is facing bankruptcy due to the recalls, as a result of replacement costs, lost sales, litigations, and damages to its brand reputation (Mullen, 2016; Soble, 2016). At the announcement of the airbag recalls, Takata reported that it experienced a 10% drop in their stock values and has further stated that it may have to absorb as much as $5 billion in recall-related expenses (Kubota & Stoll, 2015). Slower response to quality and safety failures impacts the consumer as well as the manufacturer. This is demonstrated by General Motors' (GM) announcement of recalls for over 30 million cars worldwide, for ignition problems that the company acknowledged it had detected over a decade earlier. Reports indicate that 120 deaths were caused by the problem, and GM settled the case with the US government for about $900 million (Department of Justice, 2015). In this paper, we investigate the relationships between the supply chain and operations management (SCOM) experiences of the top management team (TMT) and recall propensity and responsiveness.

Recent studies have identified numerous factors that can lead firms to recall but have not examined the impact of SCOM TMT experience (Hora, Bapuji, & Roth, 2011; Marucheck, Greis, Mena, & Cai, 2011; Steven, Dong, & Corsi, 2014). Sourcing strategies have been identified as one significant operational contributing factor (Li, Wang, & Liu, 2011; Steven et al., 2014). Further studies have identified that supplier selection can play a role in the quality problems that result in product recalls (Das, 2011; Tse & Tan, 2011). Characteristics of buyer-supplier relationships have also been found to lead to product recalls (Chao, Iravani, & Savaskan, 2009). ISO 9001 processes, on the other hand, have been found to lessen the probability of quality concerns and product recalls (Chiarini, 2015). Further studies have identified traceability as critical to reducing the quality problems that lead to product recalls (Alfaro & Rábade, 2009; Epelbaum & Martinez, 2014; Tse & Tan, 2012; Wang, Li, & O'brien, 2009).

Literature addressing recall responsiveness has been very limited and has not addressed the role of SCOM TMT experience. Hora et al. (2011) identified supply chain positioning and response strategy as drivers of recall responsiveness, measured as the time between product introduction to the market and recall announcement date. As highlighted by Wowak and Boon (2015), less attention has been given to non-operational factors that impact quantity and speed of recalls, such as the composition and background of the TMT. Our paper stands to fill this gap by examining the impact of SCOM work experience of top managers, thereby responding to the Wowak and Boon (2015) call for research on this topic.

This paper also contributes to the literature regarding SCOM influence on TMTs (Hendricks, Hora, & Singhal, 2014; Roh, Krause, & Swink, 2016). Increased levels of outsourcing and complexity in global sourcing have prompted an increase in SCOM presence on the TMT. However, the manner in which SCOM representation in the TMT might affect firm outcomes has not been well-studied. Only three studies explore that impact. Hendricks et al. (2014) note that appointments of SCOM executives result in improved stock market performance. Wagner & Kemmerling (2014) begin to explore the impact of chief supply chain officers (CSCO) on firm performance; however, their results are inconclusive. Roh et al. (2016) explore the conditions under which a firm is likely to appoint a CSCO. They further analyzed the relationship between the presence of a CSCO and firm profitability and found that the appointment of a CSCO improves firm return on assets (ROA). To the best of our knowledge there has been no work to explore the impact of executives with SCOM experience on firm operational outcomes, in general, or on recall behavior in particular. We are contributing to theory by investigating the impacts that SCOM executives have on both operational performance and strategy, by specifically focusing on the impact that SCOM executives have on recall propensity and responsiveness through the lens of upper echelons theory (UET).

This paper makes several contributions to the operations management (OM) literature. Firstly, we are contributing to the literature stream on quality and safety failures by being the first paper to explicitly link non-operational factors, such as the composition of the TMT, to recalls. Secondly, this research is the first to explicitly link TMT composition to recall propensity and responsiveness. Given the unabated

upward trend in recalls across all industries and the potential costs of recalls to both consumers and manufacturers, this exploration of recall drivers and of the drivers of recall responsiveness contributes significantly to both theory and practice. Thirdly, we are contributing to the stream of literature on TMT by investigating the linkage of TMT composition to operational strategy and outcomes. Our research finds that SCOM background of the TMT not only reduces recall incidents, but also results in faster recalls in cases when a product is recalled.

THEORY AND HYPOTHESIS DEVELOPMENT

Background and Theory

Upper Echelons Theory

Upper echelons theory has been extensively applied to questions of top management team characteristics and how those characteristics impact the firm (Hambrick & Mason, 1984). According to Hambrick (2007), UET has two primary assertions: firstly, top managers have their own interpretations of the strategic situations facing them, and they act based on their interpretations. Secondly, a manager's interpretation of a strategic event is informed by the manager's values, personality, and personal experiences. UET builds on the works of both Cyert & March (1963) and March & Simon (1958) on bounded rationality. Bounded rationality is the observation that humans "…are significantly constrained by limitations of information and calculation. Because of those limitations, explicit and timely calculations of optimality are costly or impossible" (Cyert & March, 1963). In this theory, managers may not always pursue economically optimal solutions to

business situations, but will be guided by their experiences and influenced by their perceptions of what the optimal solutions are.

There is a vast literature stream in UET research studying the impact of executive and top management team attributes on managerial actions, firm strategies, and firm performance. Many studies in this area focus on the compensation of CEOs and explore how the method of compensation (e.g. percentage of salary in stock options) and CEO personality influences firm performance (Hambrick, 2007). This literature also includes studies on the impact of CEO characteristics on firm actions and performance. Attributes of CEOs, such as their level of narcissism, their political leanings, and their career variety are linked to firm strategic actions (Briscoe, Chin, & Hambrick, 2014; Chatterjee & Hambrick, 2007; Crossland, Zyung, Hiller, & Hambrick, 2014; Gerstner, König, Enders, & Hambrick, 2013). Others have gone beyond the influence of the CEO and explored the impact of the TMT as a whole. TMT composition has been found to impact new product performance (MacCurtain, Flood, Ramamoorthy, West, & Dawson, 2010), initial public offering valuation (Pollock, Chen, Jackson, & Hambrick, 2010), and engagement in acquisition activities. While the management field has conducted research on prior experience of executives using variables such as career variety and educational background, so far, there has been no research that focuses on the SCOM experience of top executives. This study fills a gap by answering the call for research into the impact of SCOM experience in top management teams, specifically with respect to firm recall performance (Wowak & Boone, 2015).

Hypothesis Development

Supply chain management is of critical importance to a firm. A supply chain is defined as "the sequence of companies that contribute to the creation and delivery of a good or service to end customers. This goes from the point of origin of raw materials and subcomponents all the way to the point of consumption" (Prater & Whitehead, 2012). Supply chain management is the effective coordination and integration of various processes and functions inside and outside of the firm. Important processes to supply chain management include product design, supplier selection, demand forecasting, information exchange, order processing, raw materials inventory management, work in process inventory management, and finished goods inventory management, transporting and delivering products to customers, and operating a reverse logistics system to deal with returns and recalls.

SCOM experience-recall linkage

There are many factors that contribute to the propensity of a firm to recall its products. A defect that would compromise the quality and safety of a product could be caused by design errors, manufacturing defects, supply chain glitches such as handling problems, or packaging mistakes, any of which could result in a recall. Furthermore, factors in the supply chain such as supply chain complexity and hindered traceability make it difficult to trace product defects that pass through testing systems, make it difficult to address the source of the defects, and, hence, increase the chances that the defect is not detected until the product reaches the market, resulting in a recall.

The presence on the TMT of an SCOM-experienced executive, we suggest, would reduce manufacturing defects, improve supply chain coordination, and increase traceability, consequently reducing the likelihood of recalls. SCOM experience provides executives with a unique, holistic view of the firm and its exchange partners, as they bring experience managing the complex value chain, from raw materials extraction to assembly, then sale and potential return (Prater & Whitehead, 2012). Through gaining experience in SCOM functions, executives have acquired valuable knowledge and experience in managing internal processes focused on production efficiency and product quality. For example, Talbots, Inc., stated, when appointing Gregory Poole as chief supply chain officer: "He will be an invaluable asset in helping us to optimize our supply chain to generate greater efficiencies across the organization and improve the Company's overall operational and financial performance" (Business Wire, 2008). SCOM managers further possess experience in managing relationships with firms external to the company. As globalized offshore and often outsourced production has come to prominence, the expertise of supply chain management professionals has become critical to the success of many companies.

Supply chain management emphasizes collaborative relationships characterized by knowledge-sharing, coordination, and integration – both among the different departments of a firm and between partnering firms. The ultimate goal of supply chain management is to minimize operational errors for the entire supply chain, both internal to the firm and from external sources, including supply chain partners (Prater & Whitehead, 2012). By pursuing close-knit relationships and

attempting to maximize positive operational outcomes for the supply chain as a whole, firms can exceed the financial and operational outcomes that are achieved by operating in a more confrontational manner (Dyer & Singh, 1998). Executives who have had experience working previously in SCOM functions will have an understanding and an appreciation for the value of monitoring and working closely with supply chain partners to improve operational efficiency.

Guided by the reasoning of UET, we propose that executives with SCOM experience will be well-suited to address quality concerns within the firm that could otherwise lead to recalls. This is supported by the appointment of executives as SCOM officers for the purpose of improving supply chain processes and efficiencies, which in turn lead to quality improvements. For example, upon the appointment of Bob Ostryniec as global chief supply chain officer, the H.J. Heinz Company stated that: "Bob's appointment reflects his exceptional performance in optimizing savings and efficiency in the Company's North American supply chain while building best-in-class supply chain processes." The listing goes on to identify that Mr. Ostryniec's new role will include building common, best-in-class supply chain processes, systems, metrics, and tools (Business Wire, 2010).

Upper echelons theory identifies behavioral integration as a key element in operationalizing strategic initiatives (Hambrick, 1994; Ling, Simek, Lubatkin, and Veiga, 2008). Behavioral integration is defined "the degree to which the group engages in mutual and collective interaction." (Hambrick, 1994 p. 189). A key element of behavioral integration is the quality and quality of information passed

between members of the TMT. Information is deemed to be high quality when it has exhibits richness, timeliness and accuracy.

We follow UET intuition in the assertion that the quality and quantity of information which is exchanged within the TMT in recall prevention efforts are significantly improved through the presence of SCOM experience. The presence of SCOM experience on the TMT will improve the timeliness of the information the team has at its disposal as strategies are made to reduce the quality failures that lead to recall as a member of the TMT will have experience in quality control and will be present in the room while plans are made. The information exchanged between members of the TMT in product quality strategic decisions will also have increased richness with SCOM experience on the team as an executive who has had hands-on experience dealing with quality concerns will be able to give insights into the nuances of the prevention of product defects. Lastly SCOM experience in the TMT will lead to increased informational accuracy in situations in which supply chain and operations functions are being discussed, such as quality measures.

Recalls are typically made as a result of failures in the quality control of either the focal firm or its supply chain partners. From the perspective of the focal firm, an executive with SCOM experience will be able to bring experience from the purchasing, production, and distribution portions of the firm and will have insight into the areas of potential quality failure. A manager with supply chain and operations experience will not only be cognizant of the importance of quality control, but will also have the skills necessary to implement the quality control measures needed within the supply chain. In addition to managing internal quality concerns, SCOM

executives have experience dealing with supply chain partners through managing exchange relationships. Given the heightened likelihood of recalls that outsourcing adds to the production process (Steven et al., 2014), supply chain managers are ideally suited to both identify and address quality issues with exchange partners.

Within the context of UET, managers with SCOM experience are more likely to have familiarity in troubleshooting internal and external causes of recalls than are managers who have not had exposure to the operations side of the firm. We hence identify that, from a managerial perspective, SCOM executive experience is an ideal background with which to address recalls.

As SCOM executives have extensive experience dealing with both internal and external drivers of recalls, we propose, within the framework of UET, that firms with supply chain and/or operations experience on their top management teams will face fewer recalls than will firms without SCOM experience on their top management teams. Indeed, SCOM-experienced managers will be able to identify strategies capable of limiting recalls for the firm. Additionally, by having a member of the TMT who has SCOM experience, there will be a voice in the decision-making process with both the awareness and the desire to address the types of quality concerns which result in recalls.

H1: The presence of SCOM experience on the TMT will be associated with fewer recalls for the focal firm.

Top management team SCOM experience and firm recall responsiveness

Firm responsiveness to quality failures is an important and understudied aspect of firm recalls (Wowak & Boone, 2015). When a product is found to be defective in that it poses a risk to the consumer or does not meet the manufacturer's standard for quality, the manufacturer will often issue a recall of the product. We operationalize firm responsiveness as the time between release of the product to the market and issuance of a recall, with shorter time indicating a higher degree of responsiveness. Key drivers of responsiveness include firm recall strategy, reason for recall, and proximity of the recalling supply chain entity to the end customer (Hora et al., 2011).

Once a defective product is released, there are several steps that must take place before a recall is implemented. First, the company must detect that there is a problem with their product, resulting from either internal identification of the quality glitch or customer complaints. Once a defect has been identified, the source of the problem must be found and addressed so that replacement products do not suffer from the same issue as the recalled products. The source of the problem could exist at any level of the supply chain. For instance, the problem could reside in the design process, in the manufacturing process of a component manufacturer, in the assembly process internal to the firm, or in many other points along the supply chain. Lastly, after the firm has addressed the problems which resulted in the recall, the firm must set up an avenue by which customers can return the product, resulting in a reverse logistics problem (Berman, 1999; Jayaraman, Patterson, & Rolland, 2003).

We theorize that, following UET's proposal that executives use their previous experiences in crafting strategy moving forward, top managers with supply chain management experience would place a heavy emphasis on operational and process improvements along the entire supply chain. For instance Ralph Lauren Corporation, on the appointment of Bill Campbell as global vice president of supply chain and inventory management stated: "He has been at Amazon Inc. for the past 11 years in key distribution and logistics leadership roles and has world-class expertise in managing inventory, improving supply chain performance and reducing delivery times for customers" (Business Wire, 2016). This statement shows that firms hire SCOM executives for their emphasis on supply chain performance, a key aspect of which is quality control.

We propose that firms with top managers who have previous SCOM experience will place an emphasis within their companies on SCOM issues, allowing them to be better equipped to detect, address, and respond when a product needs to be recalled. Further, SCOM experience is ideal for a speedy logistics setup that can receive and transport the defective product for necessary corrections or disposal. These areas of emphasis will manifest in greater responsiveness (shorter time to recall) in relation to firms without SCOM experienced executive on their TMTs.

H2: The presence of executives with SCOM experience on the top management team will be associated with speedier response to quality failures (shorter time to recall).

The moderating influence of recall strategy on the relationship between SCOM experience and firm responsiveness to quality failures

There are broadly two distinct types of recall strategies: proactive (preventative) and reactive. Proactive recalls are recalls made prior to any incidents occurring with the product (Beamish & Bapuji, 2008; Hora et al., 2011). Incidents range from minor injuries suffered due to faulty products to death of the user of the product. Reactive recall strategies are implemented by recalling a product after an incident has occurred with a user of the product.

One major difference between proactive and reactive recall strategies is that with reactive recalls, the firm must act very quickly to recall the product before any further injuries or deaths. This model of recall strategy does not allow for a great deal of planning on the part of the firm undertaking the recall. Conversely a proactive recall strategy is characterized by early detection and then response once the defect in the product is found. In this scenario, the company recalling the product experiences less pressure from regulators and consumers than in the case of a reactive recall. While a proactive recall should still be made quickly, the firm will have more time to identify a fix for the product and carefully plan out the reverse logistics process before announcing the recall to the public.

The presence of a SCOM-experienced executive on a TMT would impact firm responsiveness to quality and safety problems differently, we suggest, depending on the recall strategy adopted by the recalling firm. Proactive recalls are more discretionary than reactive recalls, and, hence, a firm has more time to plan its course of action and implement procedures to make the recall efficient and effective.

Improved detection systems and testing procedures for quality glitches in products are more useful when used to obviate recalls, or to implement necessary recalls before any incidents or deaths. And, as argued earlier, such procedures and systems are likely to be a key feature of a firm with SCOM experience on the TMT (Prater & Whitehead, 2012).

We propose, therefore, that the impact of SCOM-experienced executives on the TMT on the responsiveness of the firm to recalls will be stronger for proactive recalls.

H3: The moderating effect of proactive recalls is negative; in other words, the effect of the presence of executives with SCOM experience on the TMT on firm responsiveness to quality failures is stronger (shorter time to recall) for proactive recalls.

METHODOLOGY

Sample and Data

We tested our hypotheses with a panel data of 485 publicly-traded manufacturing firms from 2006 to 2012. Our dataset includes financial information on each firm, information on the previous job experience of each member of the firm's top management team, and information on recalls made by individual firms. In order to gather recall data, we utilized the US Consumer Product Safety Commission (CPSC) reporting on firm recalls. This agency is tasked with collecting information on recalls themselves as well as the time between when the product is introduced to

the market and when the firm makes the recall. In order to identify top managers, we utilized Bloomberg's executive profile database. The Bloomberg database includes both the current top managers and historical information on top managers of each firm. Bloomberg further includes career summaries for each executive listed in the database. These career summaries include the previous positions held by the executives as well as a brief description of every position. Finally, we use financial data for each of the firms collected from the Compustat database in our sample.

Our analysis requires two samples which are both drawn from the same dataset. In order to analyze our first hypothesis we use a dataset with a firm year as the unit of analysis following previous research in the recalls literature (Steven et al., 2014). In order to construct this dataset we gather all publicly-traded firms in the NAICS codes ranging from 31-33 that are available both in the Bloomberg database and the Compustat database, resulting in a sample of 485 firms. We then match that sample with the CPSC data on recalls in order to measure recall propensity. Some firms entered and exited our dataset throughout our time period of 2006-2012 so we have an unbalanced sample of 2,658 observations from our 485 firms. As our second and third hypotheses both address the response time of recalls, we follow Hora et al. (2011) and use the recall as the unit of observation in this analysis. We use the sample of firms gathered for the first analysis and identify individual recalls for each firm. Each one of these recalls becomes an observation. Our final sample consists of 158 observations in our second dataset used for hypotheses 2 and 3.

Variable Definitions and Measures

Dependent variables

Our first dependent variable (*recalls*) is the number of recalls a firm has in a given year. This variable is collected from the CPSC's database. Our dependent variable includes both firms which had recalls during the time period of 2006-2012 and firms which did not have any recalls during the period (Steven et al., 2014).

The second dependent variable *(responsiveness)* is firm recall responsiveness. It is calculated as the number of weeks between when the product was released to the public and when the recall announcement was made. This variable is collected by the CPSC and identifies how long a firm takes to recall a defective product once it has been released to the public.

Independent variable

Supply chain management and operations management experience (*SCOMexp*) is our main explanatory variable. The *SCOMexp* variable refers to the presence of one or more members of the top management team with SCOM experience. In order to identify which managers had supply chain or operations experience, we used Bloomberg database's executive profiles for each manager on the top management team. When a manager was found with SCOM experience, the variable was coded as 1; when no SCOM experience was found, the variable was coded as 0. We used the definition of SCOM experience from (Hendricks et al., 2014) in order to identify which job titles and descriptions corresponded with SCOM. Managers were deemed to have SCOM experience if they had previously held a

position which fell into the definition of a SCOM position in (Hendricks et al., 2014) at any point in their careers prior to the year of observation.

Control variables

We include a number of control variables at both the level of the firm and the level of the recall. At the firm level (estimating Equation 1), we include total sales for the year as a size control variable (*sales*), as there may be differences in the way firms handle recalls depending on the size of the firm. It is likely that larger firms will have more recalls as they have more products and have more opportunity to incur recalls. We also use research and development intensity (calculated as R&D expenditure/size) as a control variable (*R&D intensity*) in order to capture the impact increased levels of R&D could have on the propensity of a firm to recall. A firm with a high level of R&D expenditure relative to its size could be dealing with new, untested products and processes that have not yet been fully vetted for quality problems, as older, more proven technologies and processes have been. The focus on new products may increase the number of problems that could lead to recalls. We include the prior number of recalls the firm has undertaken (*prior recalls*), as firms with a high number of recalls may have a higher probability of incurring further recalls. Conversely, a firm with many prior recalls may have fewer recalls, as companies may learn from prior mistakes and correct the operational deficiencies that led to those mistakes. We also include *inventory turns* as a control variable, to take into account the degree to which the firm is using a lean inventory strategy. Inventory turns is defined as the firm's total inventory divided by sales for that year. We anticipate firms that use lean inventory strategies will have fewer recalls, as lean inventory strategies are

characteristic of firms with a high level of focus placed on supply chain performance. We also include capital expenditures (*capex*), adjusted for the size of the firm, as companies spending more on capital improvements may be able to limit the number of recalls they experience through improved processes and equipment. We also include a control variable for the number of executives (*number of execs*) on the top management team. It may be that firms with larger top management teams have increased difficulty in making decisions as more voices and viewpoints are added to the decision-making process.

At the recall level, following Hora et al. (2011), we include the recall strategy of the firm for a given recall. The CPSC keeps record of whether there are incidents causing injury, death, or other negative outcomes for consumers of recalled products. When firms wait until there is an incident before recalling the product, they are classified as reactive; when firms recall without an incident having occurred, they are classified as proactive. Previous research has operationalized this variable as a 1-0 dummy variable. The *proactive recall strategy* variable is coded as 0 when there was an incident before the recall was made and 1 when the recall was made before any incidents were reported (Hora et al., 2011). We also include a control variable for the cause of the recall in question. The CPSC identifies the cause of each product recall that is made. Previous research has created three categories for the various reasons that a recall can occur: manufacturing/raw material glitches, design failures, and product packaging errors. For the purpose of this study, we have created a dummy variable (*cause of recall*) which is coded as 1 when a recall is the result of a manufacturing error and 0 when the recall is the result of a design error. In our data

we did not have any examples of a packaging error. We follow previous research in our coding of this variable (Hora et al., 2011). We also include a variable indicating if the product was *offshored*, as previous research has found that offshoring production may lead to increased likelihood to recall a product (Steven et al., 2014). Lastly, we include the quantity and value of the product being recalled as separate control variables (*quantity recalled* and *price of product*, respectively), as it is possible that recalls with high quantity or value may be less likely to be recalled due to the high financial impact of these recalls. Further, it is likely that some variables which impact the likelihood and responsiveness of a firm in recall situations could have been omitted. To account for these potential omissions, we include firm (*companyID*) and *year* controls.

Model

Two different models (and two sets of data) are used to test our hypotheses. Our first model, corresponding to hypothesis 1, is estimated using an unbalanced panel dataset consisting of 485 firms over a seven-year period, resulting in 2,658 total observations. The statistical model is presented in Equation 1.

$$\begin{aligned} recalls = \beta_0 + \beta_1 SCOMexp + \beta_2 number\ of\ execs + \beta_3 prior\ recalls \\ + \beta_4 inventory\ turns + \beta_5 sales + \beta_6 R\&D\ intensity + \beta_7 capex + \beta_i year \\ + \beta_j companyID + \varepsilon - - - - - - - - - - - - - - - - - Eq.\ 1 \end{aligned}$$

Our second and third hypotheses focus on the response time of the company when faced with a recall. This investigation is, therefore, limited to firms that have made recalls during our period of investigation. We change the unit of analysis in this

second sample from the firm to the recall following previous research of time to recall (Hora et al., 2011), which results in 158 observations. Our dependent variable in this analysis is a count of weeks from the day at which the product was released to the public to the day that the recall announcement was made. The statistical model is presented in Equation 2.

$$\begin{aligned} \textit{responsiveness} = {} & \beta_0 + \beta_1 \textit{SCOMexp} + \beta_2 \textit{number of execs} + \beta_3 \textit{prior recalls} \\ & + \beta_4 \textit{inventory turns} + \beta_5 \textit{sales} + \beta_6 \textit{R\&D intensity} + \beta_7 \textit{capex} \\ & + \beta_8 \textit{offshored} + \beta_9 \textit{quantity recalled} + \beta_{10} \textit{price of product} \\ & + \beta_{11} \textit{proactive recall strategy} + \beta_{12} \textit{proactive recall strategy} \\ & * \textit{SCOMexp} + \beta_{13} \textit{cause of recall} + \beta_i \textit{year} + \varepsilon - - - - - \text{Eq. 2} \end{aligned}$$

RESULTS

Table 1 and Table 2 provide means, standard deviations, and correlations between pairs of variables. The highest correlations are between variables that are correlated with firm size, i.e., *R&D intensity* and *capex*. The independent variable, *SCOMexp*, is not highly correlated with any of the control variables, allaying multicollinearity concerns[1]

[1] We ran a VIF test and note the scores for all variables for both models falls well below 10. In context, this is an acceptable threshold because our sample size is large enough to rule out the possibility of a statistical fluke in our findings. Further, the highest VIF is the interaction term which naturally will have higher correlation with the individual terms.

Table 1: Descriptive statistics and correlations for recalls

	Mean	Std. Dev.	1	2	3	4	5	6	7
SCOM Experience (1)	0.8321	0.3738	1						
Number of Executives (2)	8.8811	5.146	0.3028	1					
Prior Recalls (3)	0.5245	2.8188	0.0481	0.2328	1				
Inventory Turns (4)	5.7045	6.974	0.0118	0.0463	0.0601	1			
Sales (5)	6,609.50	17,479.63	0.0815	0.3771	0.1401	0.133	1		
R&D (6)	0.1484	1.065	-0.01	-0.0174	-0.0184	0.1768	-0.0292	1	
Capex (7)	372.58	1,689.86	0.0569	0.2689	0.1074	0.0439	0.8615	-0.0164	1

Table 2: Descriptive statistics and correlations for responsiveness

Variable	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12
SCOM Experience (1)	0.8220	0.006	1.000											
Number of Executives (2)	15	10	0.066	1.000										
Prior Recalls (3)	12	12	0.150	0.259	1.000									
Inventory Turns (4)	7	9	0.065	-0.013	-0.071	1.000								
Sales (5)	23244	33009	0.000	0.705	-0.029	0.186	1.000							
R&D (6)	0.040	0.030	-0.076	0.203	0.021	-0.116	0.248	1.000						
Capex (7)	1876	3819	0.034	0.846	0.052	-0.017	0.909	0.220	1.000					
Proactive Recall Strategy (8)	0.463	0.035	0.158	-0.266	0.062	0.088	-0.273	-0.016	-0.300	1.000				
Cause of Recall (9)	0.673	0.033	-0.225	0.043	-0.049	-0.223	-0.083	-0.145	0.023	-0.240	1.000			
Offshored (10)	0.360	0.480	0.049	-0.372	-0.323	-0.170	-0.288	-0.004	-0.269	-0.009	-0.233	1.000		
Quantity of Products Recalled (11)	596136	3287844	0.035	-0.014	-0.087	0.021	-0.018	0.126	-0.043	-0.066	-0.078	0.140	1.000	
Price of Products Recalled (12)	2551	371	0.082	0.051	0.332	-0.047	0.009	0.018	0.031	-0.079	0.109	-0.233	-0.078	1.000

For all models, we use generalized estimating equations (GEE), an extension of generalized linear models ideal for handling multi-year datasets, to test our hypotheses. Under GEE, maximum likelihood estimates are derived in four parts, a linear component, a link function (which may be non-linear), a family of distributions, and a correlation structure. GEE is heavily used in the top management team literature (Henderson, Miller, & Hambrick, 2006; Ndofor, Sirmon, & He, 2015). Both dependent variables in this analysis are count variables. The first is a count of the number of recalls a firm had in a given year (*recalls*), and the second is the count of weeks between product introduction and recall announcement (*responsiveness*). Consequently, our dependent variables may follow a Poisson or a negative binomial distribution. Even though we found no substantive differences in the results between the two distributions, the negative binomial is used to avoid the distribution limitations of the Poisson technique.

To address concerns of contemporaneous correlations between the independent variable (*SCOMexp*) and the dependent variables, all independent variables, including the controls, are lagged by one year. This lag of the independent variables also accounts for the fact that it may take a manager some time to enact policies within the firm. We assert that the impact of a new manager entering the team will more likely be felt in the year after they arrive than in the year in which they arrive. To limit the effects of artificial correlations, all variables, except the binary variable *SCOMexp* and count variables *recall* and *responsiveness,* are standardized prior to estimating our models.

The regression results for hypothesis 1 are presented in Table 3. There are a total of two models: Model 1 shows only the coefficients of the control variables, and Model 2 shows the coefficients including *SCOMexp* variable (hypothesis 1). The regression results for hypotheses 2 and 3 are included in Models 4 and 5 in Table 4. Model 4 presents the results linking *SCOMexp* to *responsiveness* (time to recall), and Model 5 shows the moderating effect of *proactive recall strategy* on the *SCOMexp–responsiveness* linkage.

Overall, all three models have significant Wald Chi-squared statistics. For the *SCOMexp-recall* model, the change in Wald Chi-squared statistic from the base model is 614.80 and highly significant ($p < 0.01$). For the *SCOMexp-responsiveness* model, the change in Wald Chi-squared statistic is 95.05 and highly significant ($p < 0.01$) for the direct relationship, and 83.59 and highly significant ($p < 0.01$) when the interaction variable is included.

The coefficient for *SCOMexp* in Model 2 is negative (-0.851) and significant ($p < 0.05$), indicating that the presence of SCOM management experience on the top management team leads to fewer recalls. Hypothesis 1 is therefore supported. The coefficient for *SCOMexp* in Model 4 is also negative (-0.070) and significant ($p < 0.05$). Hypothesis 2 is therefore supported: firms with a SCOM-experienced executive on the TMT respond faster to quality failures (have shorter time to recall) than firms without SCOM experience on their TMTs. The coefficient for the interaction term between SCOM and proactive recalls presented in Model 5, is negative (-0.212) and significant ($p < 0.05$). Hypothesis 3 is therefore supported: the negative relationship between SCOM presence and time to recall is stronger for proactive recall strategy

than for reactive recall strategy. The interaction plot can be seen in Figure 1 and gives a graphical representation of the interaction term.

Table 3: Results table for hypothesis 1: Recalls

VARIABLES	Model 1 Recall Count	Model 2 Recall Count
Total Number of Executives	0.234***	0.372***
Prior Recalls	0.264***	0.264***
Inventory Turns	-0.0393	0.00711
Sales	0.837***	0.832***
R&D	-10.63***	-12.41***
Capex	-0.647***	-0.744***
SCOM Experience		-0.851***
Constant	-4.425***	-3.918***
Δ fit from Prior Model ($\chi 2$)	n.a.	614.80***
Observations	2,658	2,658
Number of Years	7	7
Number of Firms	463	463

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Results table for hypotheses 2 and 3: Responsiveness

VARIABLES	Model 3 Responsiveness	Model 4 Responsiveness	Model 5 Responsiveness
Total Number of Executives	0.00229*	0.00261*	0.00247*
Prior Recalls	-0.000384	-0.000105	9.45e-05
Inventory Turns	0.000484	0.000438	0.000354
Sales	-0.00236	-0.00262	-0.00260
R&D	-0.00141**	-0.00171**	-0.00183**
Capex	0.00110	0.00121	0.00174
Cause of Recall	-0.00125**	-0.00149***	-0.00140**
Quantity of Products Recalled	0.00207***	0.00233***	0.00254***
Price of Products Recalled	-0.00262*	-0.00262*	-0.00240*
Offshored	0.000964	0.00102	0.00136*
Proactive Recall Strategy	-0.00259***	-0.00260***	0.0113
SCOM Experience		-0.00446**	0.00868
SCOM Experience * Proactive Recall Strategy			-0.0181**
Constant	-0.00950***	-0.00547***	-0.0158*
Δ fit from Prior Model ($\chi 2$)	n.a.	95.05***	83.59***
Observations	158	158	158
Number of Years	7	7	7

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

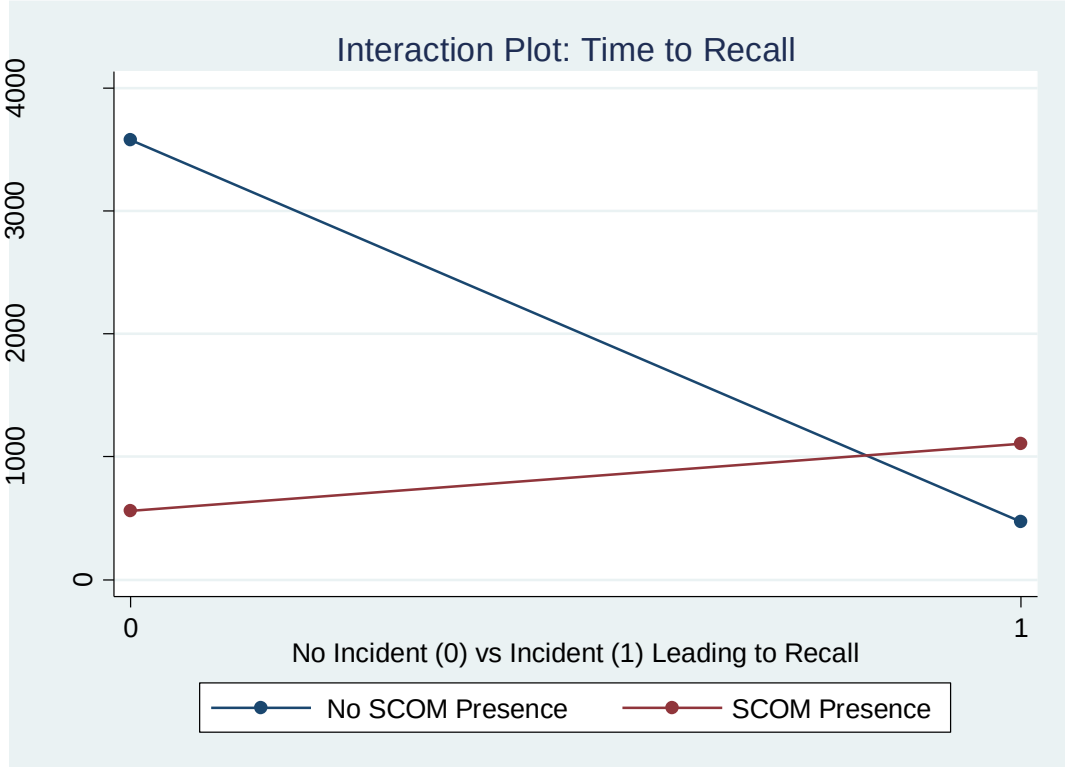

Figure 1: Predictive margins plot of interaction *SCOMexp*proactive recall strategy*

Robustness Test

Given that all explanatory variables are lagged by a year, concerns over endogeneity (or reverse causality) between the *SCOMexp* variable and the dependent variables is appropriately addressed. However, the appointment of an SCOM-experienced individual on a TMT itself may be influenced by some of our other independent variables. To address this endogeneity issue, we employ a common estimation method: two-stage residual inclusion (2SRI) (Terza, Basu, & Rathouz, 2008). This method is superior to the two-stage instrumental variable technique method for distributions such as the Poisson or the negative binomial (Terza et al., 2008; Wooldridge, 2015; Wooldridge, 2014). First we regress *SCOMexp* on *prior recalls*, *R&D intensity*, *inventory*, firm size as operationalized by *sales*, *number of execs*, and firm and time effects (*companyID* and *year*), in the first stage, and include

the residuals in re-estimating Models 2 and 4. The coefficients for *SCOMexp* remain negative and significant for both the *recall* and the *responsiveness* estimations, as shown in Table 5 and Table 6. Furthermore, the residuals are insignificant in both instances. Given the fact that the results are not substantively different from our base results, and that the coefficients for the residuals are not significantly different from zero, we suggest that our estimates are consistent and unaffected by endogeneity (Davidson & MacKinnon, 1993).

We also test the sensitivity of our findings to the recall measure adopted in our study. Product recalls have been operationalized in the literature as a count of the announcements (Steven et al., 2014) and the quantity of affected products (Zavyalova, Pfarrer, Reger, & Shapiro, 2012). We, therefore, ran the results using a new dependent variable instead of our recall count measure, reflecting the quantity of products affected by the recall. As seen in Table 7, the results do not differ in any substantive way from our base results. Our findings are, therefore, not dependent on measurement form.

Table 5: Two-stage residual inclusion for recall estimation

VARIABLES	Model 6 SCOM Experience	Model 7 Recall Count
Total Number of Executives	0.328***	0.324***
Prior Recalls	0.0479	0.279***
Inventory Turns	-0.00215	-0.351***
Sales	-1.61e-05	1.260***
R&D	-0.0179	-10.59***
Capex	0.000168	-1.053***
SCOM Experience		-0.997***
Residual from First Stage		0.251
Constant	-0.673***	-4.037***

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 6: Two-stage residual inclusion for responsiveness estimation

VARIABLES	Model 8 SCOM Experience	Model 9 Responsiveness
Total Number of Executives	0.000788	0.000238*
Prior Recalls	0.0902	4.32e-05
Inventory Turns	1.585	0.00923
Sales	-1.179	-0.0955
R&D	-0.848	-0.0691**
Capex	14.06	0.472
Cause of Recall	-0.0790	-0.00306***
Quantity of Products Recalled	0.00351	0.000464**
Price of Products Recalled	0.00384	-0.000511*
Outsourced	0.0631	0.00201
Proactive Recall Strategy	-0.0654	-0.00560***
SCOM Experience		-0.00476**
Error from First Stage		0.0136
Constant	-0.702***	-0.00276

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 7: Robustness check for recall count as products affected

VARIABLES	Model 10 Quantity of Products Recalled
Total Number of Executives	5.36e-05***
Prior Recalls	9.97e-06***
Inventory Turns	-0.000137***
Sales	0.000284***
R&D	-0.000295***
Capex	-0.000386***
SCOM Experience	-2.40e-05***
Constant	-0.000171***

*** p < 0.01, ** p < 0.05, * p < 0.1

DISCUSSION

We contribute to theory by adding to the growing literature grounded in UET by exploring the impact of TMT executive SCOM experience on recall propensity and responsiveness. Our first major theoretical and practical contribution is the finding that firms with executives with SCOM experience have lower propensity to recall. This finding is a significant theoretical contribution to the quality literature, geared toward understanding the determinants of external quality failures. Further, our finding contributes to one of the primary tenets of UET by confirming that the previous experience of executives significantly influences their decision-making going forward. Practically, it points to the importance of appointing managers to positions of trust with due consideration to their practical experience in general, and,

as it relates to quality, their supply chain management background. Executives with supply chain management experience, even if they do not hold the title of CSCO, are capable of directing their firms to have fewer recalls than executives without this experience on the TMT. This finding has significant implications for firms as they make personnel decisions for their top management teams.

We also add to the studies that have explored various aspects of appointing functional executives including: the factors that influence the appointment of a chief strategy officer (CSO), the firm performance implications of having a CSO (Menz & Scheef, 2014), and the stock market reactions to the appointments of various functional officers such as chief finance officers (CFO), chief information officers (CIO), and chief marketing officers (CMO) (Chatterjee, Richardson, & Zmud, 2001; Mian, 2001; Nath & Mahajan, 2008). Our study is the first to link the composition of the TMT to product quality and safety and responsiveness to quality failures resulting in recalls.

Our second major contribution is the finding that firms with SCOM-experienced executives in the TMT are more responsive and move to recall defective products more quickly in relation to their counterparts without SCOM-experienced top managers. This paper, therefore, extends our understanding of the impact of SCOM experience on the top management team. This finding indicates that not only are firms less likely to recall when they have SCOM experience represented on the TMT, but they are also faster to recall when a recall is deemed necessary. This discovery affirms the predictions of UET that the prior experience of the members of the TMT will significantly influence the strategy and performance of the firm.

Hypothesis 3 explores the impact of proactive recall strategy as a moderating variable on the relationship between SCOM experience and responsiveness to quality and safety failures. We find that proactive recalls negatively moderate the relationship, indicating that SCOM experience is particularly helpful in reducing recall time when firms follow a proactive recall strategy as opposed to a reactive recall strategy. Our findings are very interesting and lend credence to our assertion that there is a fundamental difference between proactive and reactive recalls. When firms recall reactively they are forced to move quickly as the product is causing active harm to the consumers. In the event that a firm recalls reactively, the recall might be announced before the firm has fully finalized its plans for how it will conduct the recall, how it will get replacement product to its consumers, and how it will structure its reverse logistics process. In the event of a proactive recall, on the other hand, a firm has more latitude regarding how quickly it must move. In this scenario it would be more prudent to have all the above listed pieces of a recall planned carefully with an eye toward making the recall efficient and cost-efficient. Our finding follows logically from our argument that, in the case of a proactive recall, the executive with SCOM experience will have time to impact the speed of the recall, as proactive recalls are more of a planned, calculated operation, and SCOM experience allows the planning to proceed expediently. The impact of the presence of an executive with SCOM experience on the TMT is particularly apparent in Equation 3 and in Figure 1.

$$responsiveness = -0.118\ SCOMexp - 0.212\ SCOMexp * proactive - - - \quad \text{Eq. 3}$$

By differentiating with respect to *SCOMexp* to see the marginal effects of *SCOMexp*,

$$\frac{dresponsiveness}{dSCOMexp} = -0.118 - 0.212 * proactive - - - - - - - - - - \text{Eq. 3b}$$

it can be seen that the marginal effect of *SCOMexp* when the recall strategy is reactive (i.e. *proactive* goes to 0) is -0.118, and for a proactive recall strategy (i.e. *proactive* = 1), it is -0.33. In other words, the effect of an SCOM experienced manager on the TMT is three times larger for a proactive recall strategy vis-a-vis a reactive strategy.

There are a number of interesting findings relating to the control variables as well. *Number of executives*, for instance, has a positive and a significant coefficient in Model 1. This indicates that firms with larger top management teams have more recalls than firms with smaller top management teams. The intuition behind this result is straightforward; larger groups have more difficulty coming to a consensus, which adds complexity to decision-making. The increased number of executives may cause the executive with supply chain experience not to be heard in the larger discussion of how to construct supplier base and internal production quality control plans. If the supply chain-oriented executive has increased difficulty in expressing and implementing supply chain-focused ideas, it would follow that fewer such measures would be executed, leading to a higher number of recalled products. Secondly, *prior recalls* are a positive and significant predictor of firm recalls. This finding is interesting as it indicates that firms which recalled with higher frequency in the past are more likely to recall in the future and may not have learned from previous quality

errors. Our findings also indicate that investment in capital equipment improvements and R&D (*capex* and *R&D intensity*) does help to reduce the likelihood of recall as both variables are significant with a negative coefficient. This result is unsurprising as firms likely address the two primary causes of recalls, manufacturing errors and design errors, through purchasing improved manufacturing equipment and researching higher-quality product designs, respectively.

Our analysis of time to recall also provides some key insights into the drivers of time to recall. We find that capital expenditure investments lead to shorter recall times, as the coefficient of the *capex* variable is negative and significant. This finding is insightful and may indicate that firms which invest into newer machinery and updated detection equipment are able to more quickly detect errors in the production and assembly processes, leading to quicker recalls. We also find that firms have a shorter time to recall when the recall is done proactively as opposed to reactively. Another enlightening finding is that recalls that are caused by a manufacturing error are recalled more quickly than those due to a design flaw. This finding is also noteworthy as it indicates that manufacturing errors may be easier to detect than design errors. Alternatively, it could signify that firms are more quickly able to address the root cause of manufacturing errors and, hence, are able to perform recalls more quickly when no redesign is required.

CONCLUSION

In conclusion, we have contributed to UET by studying the impact of top management experience on both the number of firm recalls and the time in which a firm makes a recall. As of this study, there has been no research exploring the impact of SCOM-experienced executives on the top management team. Furthermore, there has been no research on how this SCOM experience impacts a firm's propensity to recall. Lastly, no study has yet looked at the impact of SCOM experience on the speed with which a firm conducts recalls.

Our findings provide key insights to both academics and practitioners. This paper gives support to the notion that the presence of SCOM experience on the top management team is critical to the recall performance and responsiveness of a firm. As executives are selected for top management team positions, this research makes clear that firms should consider the previous work experience of their executives and, in particular, should aim to have the SCOM skillset represented on the team.

For future research we would suggest that this analysis be extended to other contexts. The current study was done with publicly-traded manufacturing firms. It would be useful to explore the implications of supply chain experience in different industries. Furthermore, it would be an interesting area of further study to see what impact supply chain experience in the top management team has on other firm outcomes. Interesting examples could include supplier selection, supply chain performance and firm financial performance to extend the significant impact of this research to practitioners and academics.

Chapter 3: Supply Chain and Operations Management Experience in the C-Suite: Risk and Resilience

ABSTRACT

This research study explores the impact of top executives with supply chain management and operations management (SCOM) experience as well as those with finance experience on the firm's supply chain risk profile. Our study is grounded in Upper Echelons Theory (UET) and follows UET intuition by proposing that managers who have worked in SCOM or finance functions will be influenced by their experiences in their supply chain risk management and supply chain resilience strategies. We utilize a sample of 467 manufacturing locations from 40 firms over a three-year period. Our findings indicate that firms with SCOM executives on their top management teams (TMT) have less location risk at their production locations while also maintaining a high level of resilience. On the other hand, top management teams with finance experience have more location risk on average at their production locations while retaining a high level of resilience. Our findings also indicate that when a firm's production locations are offshored, SCOM executives are more risk-averse in their choice of production locations while having lower levels of resilience than in domestic supply chains.

INTRODUCTION

Risk management has become a critical component of any multinational organization. Recent natural disasters and political unrest have forced firms to better understand the risks in their supply chains and attempt to protect themselves from supply chain disruptions. Examples such as the 2011 tsunami and earthquake in Japan show the immense impact supply chain disruptions can have on the operational and financial performance of a firm. Two months after the tsunami disrupted Toyota's supply chain, the company reported that its profits had dropped by 77%, operating income had been reduced by $1.36 billion, and the forecasting of future earnings had become impossible due to uncertainty regarding return to full production levels for Toyota factories.[2] Scholars have also studied supply chain risk and have found further evidence that supply chain disruptions harm firm financial and operational performance (Hendricks & Singhal, 2003, 2005a, 2005b; Wagner & Bode, 2008).

Top management teams (TMT) have been found to significantly impact the risk decisions of the firm (Hoskisson, Chirico, Zyung, & Gambeta, 2017); however, very little research has explored the impact of the functional experience of TMT members on risk decisions. Studies have found decision-making is heavily influenced by the TMT (Child, 1972; Hambrick & Mason, 1984). With awareness of the increasing likelihood of major supply chain disruptions, an understanding of firm decision-making with respect to supply chain risks is very important to both scholars and practitioners. Specifically, the experience of the officers on the TMT helps shape

[2] http://www.nytimes.com/2011/05/12/business/global/12toyota.html?_r=0

the strategies firms choose to pursue and is a rich and little-studied space (Crossland et al., 2014).

Given the importance of supply chain risk management and the ability of the TMT to influence a firm's risk management decisions, it is surprising that there has been no work done to understand how TMTs affect firms' supply chain risk management strategies. This paper will explore the influence of TMT experience on the strategic decisions made by a firm regarding the riskiness of its supply base and the strategies undertaken to mitigate those risks. We contribute to UET by showing the importance of the functional characteristics of the TMT to supply chain risk management. We specifically highlight supply chain and operations management (SCOM) experience and finance experience on the TMT and propose that the prevalence of these two functional backgrounds on the TMT will be associated with different supply chain risk profiles.

This study will leverage a unique database consisting of supply chain risk data for 467 production locations across the world over a three-year period. This database will be linked with data on TMT experience, and executive data from publicly available sources. An econometric model is developed to identify the impact of the TMT experience on supply chain risk decisions.

THEORY AND HYPOTHESIS DEVELOPMENT

Theory Development

Upper Echelons Theory

We will utilize Upper Echelons Theory (UET) to guide our work. UET builds on the work of Cyert & March (1963) and March & Simon (1958) on the behavioral theory of the firm proposing that firms are not economically rational in all of their actions because of behavior factors within the organization. Specifically, imperfect information and bounded rationality hamper the firm from being a perfectly rational entity. The notion of imperfect information highlights the fact that managers do not possess all the information they would ideally have when making decisions. Bounded rationality takes this idea further and states that economic rationality is impossible when a manager's lack of perfect information is paired with the manager's information processing limitations.

UET has two primary tenets. The first tenet states that each top manager has his or her own interpretation of the situations and strategic landscape facing them. The second tenet is that each manager's differing understanding of the environment around them is driven by their previous experiences, values, and personality (Hambrick, 2007).

Building on the idea that managers influence firm actions, there is an extensive literature in UET, which explores how manager actions impact firm performance. Sanders & Hambrick (2007) explore the connection between CEO compensation and extremeness of firm performance outcomes. They specifically

hypothesize that firms having a greater proportion of their CEO's compensation in the form of stock options will have more extreme performance outcomes. This relationship between CEO behavior and firm performance also depends on the country in which the firm is located, as it has been shown that the variance in performance which is attributable to the CEO is greater in some countries than it is in other countries (Crossland & Hambrick, 2007). In further work on the variance in performance that can be contributed to the CEO, Crossland & Hambrick (2011) explore managerial discretion as the mediator between the location of the company and the variance that can be attributed to the CEO. Scholars have also measured firm performance in terms of new product performance and have found that TMT that have high levels of knowledge sharing, education level, age diversity, functional diversity, and tenure diversity have higher levels of new product performance (MacCurtain et al., 2010).

Building on factors that affect manager behavior, TMT studies have sought to understand how manager behavior and manager characteristics affect firm behavior. Scholars have found that when CEOs are more narcissistic they will tend to have higher levels of change in firm strategies (Chatterjee & Hambrick, 2007). Further studies on firm strategy dynamism find that CEOs with higher levels of career variety will lead their companies to be more dynamic in the strategic decisions that are made as well (Crossland et al., 2014).

Studies have further explored the idea of firm strategic behavior being influenced by the CEO through looking more specifically at strategic actions by firms. Sanders & Hambrick (2007) find that firm investment decisions are impacted

by what proportion of CEO compensation comes through stock options. Gerstner et al. (2013) find that firms with a more narcissistic CEO will pay more attention to new, discontinuous technology. Firms are also more likely to utilize a strategy focusing on corporate social responsibility when they have a CEO with a liberal political ideology (Chin, Hambrick, & Treviño, 2013). Additionally, firms are more likely to undertake risky strategies when the CEO has had recent social praise, leading to arrogance in decision-making (Chatterjee & Hambrick, 2011).

Supply chain risk management

One important aspect to firm strategy is risk management. The wide-ranging effects of supply chain disruptions have led researchers to explore the impact of supply chain disruptions on firm performance. As supply chains have become more global and the vulnerability of the global supply chain has become increasingly apparent, a greater interest in the impacts of supply chain disruptions has developed. In a study of stock market reactions to supply chain disruptions, scholars have found that supply chain "glitches" have a negative impact on firm stock price for several years after the event (Hendricks & Singhal, 2003). Subsequent studies have found that firms also face negative stock market performance, increased equity risk, financial leverage, and asset risk after the announcement of a supply chain disruption (Hendricks & Singhal, 2005a). Further research has shown that the impact of supply chain disruptions can also be seen in firm financial and operational performance. Hendricks & Singhal (2005b) found that firms which sustain a supply chain disruption face lower levels of profitability and net sales, increases in costs and, at the

same time, experience poorer asset and inventory performance than firms which did not sustain supply chain disruptions.

Authors have further studied how increased risk in a supply chain impacts operational performance, supply chain performance, and labor performance. Wagner & Bode (2008) used surveys to identify supply chain risk and found that companies with more demand- and supply-side risks have inferior supply chain performance. This study defined supply chain performance as order fill capacity, delivery dependability, customer satisfaction, and delivery speed. Jiang, Baker, & Frazier (2009) identify workforce turnover as a labor risk and identifies job evaluation, job satisfaction and alternative opportunities as drivers of labor force turnover and, hence, contributors to labor force risk. A more recent study coined the idea of supply chain "risk management maturity" as a driver of supply chain risk performance (Hoffmann, Schiele, & Krabbendam, 2013). In this setting, supply chain risk management maturity refers to a company's progress in integrating supply chain risk management into its business processes.

Given the linkage between supply chain disruptions and both firm financial performance and firm operational performance, an understanding of what causes these disruptions is critically important and has led to numerous studies. Kleindorfer & Saad (2005) study a sample of 1,945 chemical-release accidents between 1995 and 1999 and find that the facility location, the types of hazards present at that facility, and the characteristics of the company or owner of that facility all contribute to the likelihood and severity of supply chain disruptions. The authors further find that regulations and enforcement activity in the local area will affect both the likelihood

and the severity of supply chain disruptions. Furthermore, the socio-demographic characteristics of the host community play a role in likelihood and severity of supply chain disruptions, as some cultures are more likely than others to bring pressure against a facility that is not adhering to safety regulations. Studies have also uncovered technological uncertainty in product markets as well as "thinness" in the supply chain as drivers of both likelihood and magnitude of disruptions (Ellis, Henry, & Shockley, 2010). Thinness in this context refers to a lack of alternative sources of supply of a given component. Further studies have focused on ways to mitigate the negative impacts that can be seen through supply chain disruptions. Hendricks, Singhal, & Zhang (2009) found that operational slack, business diversification, and higher levels of vertical relatedness all help mitigate the negative impact of disruptions on stock market performance.

Location risks

There are three primary location-specific risks that a firm must take into account when deciding on production locations. The first of these is the local risk of natural disasters. For example, Western Digital was hampered in its production of hard drives when severe flooding struck Thailand in 2011.[3] Flooding during the monsoon season in Thailand is common and must be taken into account when companies decide on the location of production facilities. While it is impossible to know exactly how a region's climate will affect a supply chain in a specific year,

[3] http://www.nytimes.com/2011/11/07/business/global/07iht-floods07.html

general trends in local climate can and should be taken into account when making sourcing decisions.

Another important location-specific risk to take into account is the health of the local economy in a potential sourcing area. This factor is of primary concern when sourcing from a local supplier in an area that is struggling economically. If a local economy is in distress, it is likely that a supplier in that area will be affected by the general downturn in business and may itself have a higher likelihood of becoming insolvent. By way of example, Deloitte released a report during the financial crisis in the United States identifying the auto industry's danger of supplier bankruptcies and, hence, a potential disruption in supply of automotive parts.[4] The example of the US auto industry highlights the impact that a negative local economic climate can have on the supply chain.

The last location-specific risk that will be addressed is social instability or geopolitical risk. Instability in a country's geopolitical system increases the likelihood of supply chain disruption for any operations that are located in that country. Incidents like political coups and civil war create a business environment of uncertainty and can present an unfriendly environment for businesses. The recent unrest in Egypt and the consequential exit of the country by the United Kingdom's oil giant BG Group highlights the impact that local unrest can have on a firm. With greater social unrest, a firm's supply chain becomes more uncertain and risky.

[4] http://www.cbsnews.com/news/more-auto-suppliers-going-bankrupt-report-says/

Supply chain resilience

Ambulkar, Blackhurst, & Grawe (2015) define supply chain resilience as the ability to reconfigure resources in the event of a supply chain disruption. Recent natural disasters have shown the need for supply chain resilience to help recover and adapt to an ever-changing and unpredictable environment. Scholars have begun to attempt to understand what drives supply chain resilience. Braunscheidel & Suresh (2009) propose that organizations that exhibit a high level of internal integration, external integration and external flexibility will generally have higher levels of supply chain resilience.

Research has identified that supply chain resilience is a critical capability for a firm and complements traditional risk management efforts (Fiksel, Polyviou, Croxton, & Pettit, 2015). Studies have found that backup storage facilities (Ratick, Meacham, & Aoyama, 2008), inventory management (Boone, Craighead, Hanna, & Nair, 2013), careful supplier selection (Rajesh & Ravi, 2015), business continuity plans (Torabi, Baghersad, & Mansouri, 2015), and backup suppliers (Yang & Xu, 2015) all play a critical role in increasing the resilience of a firm. Studies have also found that resilience decreases the vulnerability of the firm to supply chain disruptions (Jüttner, Peck, & Christopher, 2003). The impact of resilience is immense when the financial effect of supply chain disruptions is considered. Studies have found large negative stock price impact and an increase in costs are possible as a result of supply chain disruptions (Hendricks & Singhal, 2003, 2005b).

The need for this ability to reconfigure resources is made clear through the case of Nokia and Ericsson (Sheffi, 2007). In this case, both cellphone companies

used the same supplier, Phillips in Albuquerque, to produce the computer chips in their cellphones. When Phillips experienced a fire that shut down its production at the Albuquerque location, Nokia and Ericsson both needed to find an alternate way to produce their chips. In Nokia the news traveled quickly to the top of the organization and within weeks there was a plan in place to use Phillips' slack production in other plants around the world to produce the necessary chips. Ericsson on the other hand did not realize the potential magnitude of the impact of this disruption, had a company culture of that prevented news from traveling quickly, and was very slow to react. Consequently, by the time Ericsson acted to find new production locations for its chips, Nokia had already purchased all of Phillips' slack capacity and Ericsson was unable to release its flagship phone in time to compete with Nokia. Ericsson's cell phone division reportedly lost $2.34 billion as a result of the fire in Albuquerque over a nine-month period, prompting their exit from the cellphone market and entering into a joint venture with Sony to continue designing and manufacturing cell phones (Sheffi, 2007). In this example, Nokia had a plan to quickly recover and reconfigure its production processes in order to adapt to a disruption. This real-world example highlights the importance of a resilient supply base in the face of supply chain disruptions.

Hypothesis Development

Top management team's impact on risk management

Management research has given us important insights into the impact that the TMT can have on firm risk-taking (Hoskisson et al., 2017). Executive compensation packages have been found to affect the likelihood of a firm making risky decisions

(Carpenter, Pollock, & Leary, 2003; Devers, McNamara, Wiseman, & Arrfelt, 2008; Sanders & Hambrick, 2007). Research has also theorized that monitoring by the board of directors and by owners can help managers take an optimal amount of risk (Hillman & Dalziel, 2003). The behavioral agency model has proposed that executives' risk preferences are also dictated by the executives' perceived gain or loss in the situation, which in turn can be influenced by the time to maturity of the stock options with which they have been compensated (Devers et al., 2008; Martin, Washburn, Makri, & Gomez- Mejia, 2015; Martin, Gomez-Mejia, & Wiseman, 2013). Executives who have a larger amount of their stock options available to exercise are less likely to take risks (Matta & Beamish, 2008). Executives who manage family-run businesses and are themselves related to the family are also more risk-averse (Zellweger, Kellermanns, Chrisman, & Chua, 2012).

UET has contributed prominently to our understanding of risk-taking by moving beyond financial and oversight incentives and toward executives' values and personality characteristics. Studies have found that executives that think more highly about themselves, as seen by having high core self-evaluations, are more likely to undertake strategies that can be seen as risky such as strategic dynamism, strategic deviation, and entrepreneurial orientation (Hiller & Hambrick, 2005; Simsek, Heavey, & Veiga, 2010). Studies have also found that narcissistic CEOs are more likely to engage in strategic dynamism and adopt discontinuous technologies (Chatterjee & Hambrick, 2007, 2011; Gerstner et al., 2013). Executive hubris is also found to increase risky activity as measured by acquisition activity and investment in innovation (Roll, 1986; Tang, Li, & Yang, 2015). Studies have also identified that

overconfident executives are more likely to engage in acquisition activity and conduct risky product launches(Liu, Taffler, & John, 2009; Simon & Houghton, 2003).

UET has also explored the impact of observable CEO experience on firm risk-taking (Hoskisson et al., 2017). CEOs with longer tenure make fewer changes and take fewer risks (Hambrick & Fukutomi, 1991; Hambrick, Geletkanycz, & Fredrickson, 1993; Miller, 1991). On the other hand, newer CEOs are more likely to engage in actions that are deemed risky, such as new product-market entry, technological innovation, and subprime mortgage-lending (Boeker, 1997; Kimberly & Evanisko, 1981; Lewellyn & Muller- Kahle, 2012). Studies report the impact of a CEO with an MBA is mixed, with some studies finding having a CEO with an MBA is related to risk (Bertrand & Schoar, 2003; Palmer & Barber, 2001) and some not finding evidence of a link (Barker III & Mueller, 2002; Geletkanycz & Black, 2001; Grimm & Smith, 1991). Studies have also looked at the gender and age of CEOs and found that older CEOs take fewer risks. Female CEOs are also found to accept less risk (Elsaid & Ursel, 2011; Grimm & Smith, 1991).

The impact of SCOM representation on the TMT on location risks

Firms with TMTs with higher levels of SCOM experience will likely be able to identify location risks (natural disaster, economic, and geopolitical), as SCOM professionals would have dealt with them to a large extent in their previous positions. Following UET logic leads us to the hypothesis that when managers have had previous experience facing certain supply chain specific risks, those experiences would lead them to emphasize addressing those risks in their future decision-making. We anticipate that firms which have top managers with SCOM experience will

carefully consider supply chain location-specific risks in their strategic decision-making.

SCOM executives will spend a great deal of their career addressing supply chain- and operations-related interruptions to the consistent and timely flow of goods and services in order to keep the organization producing at optimal levels. Studies have found that humans who experience a negative event are likely to overestimate the probability of that event happening again (Kahneman & Tversky, 1982; Tversky & Kahneman, 1974; Tversky & Kahneman, 1985). Hence we argue that the career experience of executives who have spent their time working in SCOM functions will bias them toward the expectation that disruptive events happen more frequently than has a basis in reality. This bias will cause SCOM executives to prefer lower risk at their production locations.

We follow UET logic in proposing that firms with higher degrees of SCOM representation in their TMTs will have less location-specific risk at their production locations. Executives with SCOM backgrounds will have a greater cognizance of location-specific risks and the potential impact of those risks from their experience handling the operational problems of the firm. Following Tversky & Kahneman (1985) we also propose that SCOM executives will overestimate the probability of disruptive events occurring. Specifically, we propose that firms with a higher degree of SCOM experience in the top management team will be associated with lower levels of natural disaster risk, economic risk, and geopolitical risk at production locations. We hence propose the following hypothesis:

H1: Firms that have a higher percentage of their TMT members with SCOM experience will be associated with lower levels of supply chain location risk (natural disaster, economic, geopolitical).

The impact of finance representation on the TMT on location risks

There has been limited research exploring the impact of executives with finance backgrounds on the TMT. Executives with finance backgrounds are proposed to be more capable of successfully acquiring other firms and creating the synergies necessary to realize a positive return from acquisitions due to their functional backgrounds (Hitt & Ireland, 1985). Authors have also found that executives with finance experience are more likely to engage in acquisition activities than executives without substantial finance experience (Finkelstein, 1992). Finance-experienced CEOs are also found to make acquisitions in less-related industries, hence diversifying the acquiring firm (Jensen & Zajac, 2004).

We follow UET logic and propose that, in a setting in which executives must analyze supply chain risk, the executives with finance backgrounds will focus on the broad risk-return tradeoff of production location decisions, which may lead these executives to different strategic decisions than a SCOM executive would make. In choosing a production location, executives must be mindful of potential tradeoffs. Executives must evaluate cost of labor at that production location. A location may have higher natural disaster, geopolitical, or macroeconomic risk and yet still be a desirable location for production due to a lower cost of labor that offsets the presence of risk (Chopra & Sodhi, 2004). We argue that an executive with a finance

background will identify that this risk-return tradeoff exists and may choose the riskier location in the presence of a favorable cost structure.

While risks of natural disaster, economic risk, and geopolitical instability have the potential to severely disrupt a production operation, they are only costly if a disruptive event occurs. We argue that an executive with a finance background will see this as a risk-return tradeoff and may decide to locate in the area with natural disaster and geopolitical risk due to the perception that the probability of disaster is not high enough to offset the cost benefits of the risky location. Tversky and Kahneman (1974) identify that decision-makers often erroneously assume that their personal experiences are representative of the actual probability of an event occurring. It is likely that executives who have spent their careers in the financial functions of a firm will have had less exposure to the supply chain events that a SCOM executive is regularly addressing. Lack of experience in the SCOM functional area will lead those executives to underestimate the probability of a supply chain disruption occurring (Tversky & Kahneman, 1974).

Studies have also identified that executives who are incentivized through financial means underrate risk (Cole, Kanz, & Klapper, 2015). While all members of a TMT are incentivized through a combination of stock bonuses and monetary bonuses based on the success of the firm, executives working in a finance position and executives working in an SCOM position are likely incentivized differently before they are promoted to the TMT. While the future-executive working in finance will be incentivized based on the financial outcomes of the firm, the SCOM future-executive will be incentivized based on operational efficiency metrics such as on-time

delivery and defect rates in parts, as one of the primary goals of supply chain is the efficient, uninterrupted flow of goods and services (Mentzer, DeWitt, Keebler, Min, Nix, Smith et al., 2001). The difference in prior incentives will cause the two executives to have different perceptions of the riskiness of strategic actions and focus on different aspects of the firm's performance. We propose that the previous financial incentives of a member of the TMT with a finance background will predispose that executive toward taking risks.

We conclude this section by proposing that TMTs with higher degrees finance experience will be more likely to locate their production in risky areas. Our rationale behind this hypothesis is that the finance background of these executives will lead them to evaluate the problem from a perspective of risk-return as opposed to risk avoidance. Areas that are higher risk may have other favorable attributes like low cost of labor that are appealing from a risk-return perspective. We also highlight that the lack of experience of location-specific risk events makes finance-experienced executives more likely to underrate the possibility of a disruptive event occurring at a given location. This logic leads us to our second hypothesis:

> *H2: Firms that have a higher percentage of their TMT members with finance experience will be associated with higher levels of supply chain location risk (natural disaster, economic, geopolitical).*

Top management team's impact on resilience

We propose that the TMT plays a critical role in a firm's decisions regarding resilience. For many firms, implementing a culture and strategy of resilience requires

a cultural and strategic change within the firm (Soni, Jain, & Kumar, 2014). Leadership support from the TMT has been found to be necessary in creating and maintaining a culture of resilience (Christopher & Peck, 2004). Furthermore, studies have found that the implementation of resilience strategies can result in cost increases (Sheffi & Rice Jr, 2005). Without TMT buy-in, managers within the firm would be unable to implement the potentially costly strategic measures, such as redundant suppliers, business continuity plans, and strategic inventory management, that are necessary to create a resilient supply chain (Mentzer et al., 2001).

The impact of SCOM representation on the TMT on resilience

Research has identified three phases of supply chain resilience: anticipation, resistance, and recovery/response (Kamalahmadi & Parast, 2016). Anticipation requires foreseeing potential disruptions and risks and proactively planning for them. In this framework, resistance takes the form of preventing supply chain disruptions from causing a cascading effect throughout the supply chain. Lastly, recovery and response refers to the ability of the firm to restore itself as quickly as possible to the state in which it operated before the disruption took place.

Following UET reasoning, we theorize that the presence of SCOM executives on the TMT would improve resilience at each step of the Kamalahmadi & Parast framework. In order for a firm to anticipate the potential dangers in a given location, or along a supply chain, key decision-makers must have an in-depth understanding of how a supply chain can be disrupted. The personal experience that a TMT member with a SCOM background has gained through witnessing and managing supply chains in the presence of disruptions will cause that executive to have a richer and

more nuanced view of the potential dangers in the supply chain. Through the deeper understanding of the risks posed by disruptions, and where those disruptions are likely to crop up within the supply chain, the SCOM-experienced executive can guide the firm in planning for mitigation of disruptions. The second element of supply chain resilience, resistance, requires that the firm quickly address disruptions so that they do not cause a ripple effect throughout the supply chain. In the face of a disruption, an executive with SCOM experience will be able to more quickly identify what dangers the disruption poses and move to prevent the disruption from causing far-reaching impacts throughout the supply chain. Furthermore, SCOM experience will guide executives in determine how best to address the disturbance to prevent it from causing further harm. Lastly, in order to recover and respond the firm must utilize the plan that was developed in the anticipation phase and implement the plan quickly, diverting the supply chain around the disruption, addressing the disruption itself, and finally restoring the supply chain to operational readiness (Kamalahmadi & Parast, 2016). SCOM-experienced executives on the TMT will prove vital to this effort, as they will have a greater understanding of the steps to implement the recovery plan and, hence, will guide the process along more quickly.

We also theorize that TMTs with SCOM experience will be more likely to recognize the criticality of resilience in the supply chain and will hence be more likely to lend their support to the implementation of resilience efforts. To borrow from the example above, Nokia's executives realized the danger of disrupted supply that the fire in Albuquerque posed to the company while Ericsson's executives did not understand the magnitude of the impact such a disruption could have on business.

It should be expected that TMTs with more SCOM experience would understand the need for supply chain resilience and place a priority on designing supply chains that are resilient. In our context, we will define resilience as the time to recovery that firms have at each of their production locations. We expect that firms with higher degrees of SCOM experience in the TMT will have lower times to recovery at their respective locations.

> *H3: Firms that have a higher percentage of their TMT members with SCOM experience will be associated with higher levels of supply chain resilience (measured by lower time to recovery).*

The impact of finance representation on the TMT on resilience

As has been theorized throughout this chapter, executives with experience in finance will view situations differently than their SCOM counterparts; however, we propose in the case of resilience that both will come to the same conclusion for several reasons. As proposed in hypothesis 2, finance executives will likely take more risk in their choice of production locations in order to take advantage of the inherent risk-return tradeoff. Due to the decision to locate in riskier areas, the need for resilience will be greater for TMTs with finance backgrounds. In order to mitigate the large downside risk of a significant disruption that could occur in areas with high location risks, we propose that firms with executives on the TMT with finance experience will have high levels of resilience.

Building on UET we propose that executives who have gained their business experience in the finance world will have had experiences dealing with insurance and

hence will have an affinity toward seeking insurance. We propose that resilience is a form of self-insurance for a firm that has significant supply chain-related risk. Arrow (1971: 134) discusses insurance as something a firm pays for today to guard against an uncertain future event. Traditional insurance against disasters can be a useful tool to guard against certain downsides, but recent events have shown that the opportunity cost of losing a production facility for an extended period cannot be fully recovered through insurance alone.[5] Resilience provides the finance executive with another form of insurance to protect against supply chain disruption.

We also argue that TMT members with financial backgrounds, such as CFOs, may have an advantage of influence and resources when attempting to implement resilience in the supply chain. Studies have identified that financial executives in the C-suite often report directly to the CEO and hence can have a strong voice in both the strategic decisions and financial allocation within the firm (Banker, Hu, Pavlou, & Luftman, 2011). We propose that through the connections that financial executives such as CFOs possess, they will be able to effectively implement resilience in the supply chain.

When finance executives are faced with the decision of whether to implement the cultural and operational measures necessary to create resilience in the firm, they will look at the probability of disruption as well as the consequences of such a disruption (Arrow, 1971). This analysis will take place through the lens of the decisions they have made regarding location risk as well, the need for insurance

[5] http://www.nytimes.com/2011/11/07/business/global/07iht-floods07.html

against such a risk, and the financial efficacy of engaging in a strategy of resilience. Due to the higher risk that has been taken elsewhere in the supply chain as well as the perceived need for insurance against major disruptions, we theorize that the firm with higher proportions of executives with finance experience on the TMT will be associated with higher levels of supply chain resilience.

> *H4: Firms that have a higher percentage of their TMT members with finance experience will be associated with higher levels of supply chain resilience (measured by lower time to recovery).*

Offshoring and SCOM representation on the TMT

We propose that offshoring will provide an environment in which the executive with SCOM experience will be particularly well-equipped to provide guidance to the firm regarding risk management and resilience. In a globalized economy, a career in supply chain management or operations management requires significant interaction with supply chain partners and in-house production facilities that are in foreign countries (Schoenherr, Tummala, & Harrison, 2008). Firms often find that offshoring is operationally more difficult than expected and that the process is rife with hidden costs (Larsen, Manning, & Pedersen, 2011). Studies have also found that firms find it difficult to coordinate the activities of offshore operations (Kumar, Van Fenema, & Von Glinow, 2009).

In the uncertain and managerially-complex world of offshoring, we propose that the experience of SCOM executives will guide firms toward being more conservative in situations where production is taking place in an offshore location.

We propose that as a result of this more conservative strategy, a SCOM executive will bias the firm away from risky locations and toward building resilience into production locations. We hence propose that offshoring will negatively moderate the relationships between SCOM experience on the TMT and location risk as well as resilience. Therefore, we propose that for firms with SCOM representation on the TMT there will be downward pressure on risk and time to recovery (resilience) at production locations that are offshore.

H5a: Offshoring will negatively moderate the negative relationship between SCOM representation on the TMT and location risk.

H5b: Offshoring will negatively moderate the negative relationship between SCOM representation on the TMT and resilience.

METHODOLOGY

Sample and Data Sources

We test our hypotheses with a panel data spanning years 2012-2014 and including 467 manufacturing locations for 40 publicly-traded manufacturing companies, for a total of 934 observations. Our data are gathered from four datasets. The first source of data is Bloomberg's executive database in which top managers for publicly traded firms are recorded along with their career history. This information was analyzed and relevant career information was identified for each top manager. The second source of data is the ExecuComp database. This database provides basic demographic information for each top management team member. The third database

is the Compustat database from which we gather financial data on each firm. The fourth source of data is the Resilinc database, in which supply chain risk management and resilience data is provided for the production locations of the firms in our sample from 2012-2014. We began our data collection by limiting our sample to the publicly-traded manufacturing firms in the NAICS codes ranging from 31-33 that were included in the Resilinc database during the three years for which Resilinc has collected this data. We then searched for these firms in the Bloomberg database and limited our sample further to publicly-traded manufacturing firms that were both included in the Resilinc database and had top management team career data available in the Bloomberg database. We next linked this database to the Compustat and ExecuComp databases. The resulting sample of firms that had complete data consisted of 40 firms with 467 production locations.

Variable Definitions and Measures

Dependent variables

The first dependent variable is the *location risk score*. This risk score is collected by Resilinc and is an aggregate measure of three location risk measures. The first component that is included in this variable is the economic risk score of the country in which the production facility is located. This measure is provided to Resilinc by the Economist Intelligence Unit. This measure ranges from 0-10 with 10 being the highest level of economic risk for the country in which the production facility is located. The second component is the geopolitical risk of the production location's country. This measure is also provided to Resilinc by the Economist Intelligence Unit and ranges from 0-10 with 10 being the highest level of geopolitical

risk. The last component is the risk of natural disaster. This measure is calculated by Resilinc and is region-specific rather than country-specific, as many countries may have different risks of natural disasters in different regions within the country. This measure also ranges from 0-10 with 10 being the highest risk of natural disaster. To create the location risk score Resilinc averages these three components for a score ranging from 0-10 with 10 being the highest level of risk possible for a location. We use this composite value as our location risk score.

Our second dependent variable is *resilience*. We measure resilience following the definition of Ambulkar et al. (2015) that supply chain resilience is the ability to reconfigure the supply chain in the case of a disruption. The Resilinc database indicates, for each supplier location, the number of weeks required to bring production back on-line in the event of a disruption. The database also indicates, if applicable, the presence of an alternate production site that is capable of replacing the original production location in the event of a disruption. When an alternate site is listed, the number of weeks needed to bring the secondary production facility on-line is also included. In order to measure the resilience of a supply chain, we first determine, for each production location, whether the recovery time for a location or the alternate site bring-up time is shorter. The assumption is made that, in the face of a supply chain disruption, a firm will wish to bring production back on-line as quickly as possible and consequently will use whichever option is faster: bringing the original manufacturing site back up or bringing the alternate site on-line to replace the original production site. Using this logic, we calculate a site-specific recovery time measure

that is given as the minimum number of weeks a firm will take to bring production back on-line in the event of a disruption at a production location.

Independent variables

Our first hypothesized independent variable, TMT SCOM experience (*SCOMexp*) is measured by examining the work experience of each member of the TMT and identifying what percentage of the team has either operations management or supply chain management working experience in their past. This data has been collected through the Bloomberg executive database through a thorough analysis of the career histories of each executive. We take the number of executives with SCOM experience and divide it by the total number of executives on the TMT. This gives us a value ranging from 0% to 100% indicating the percentage of the TMT that has SCOM experience. In order to identify SCOM experience for TMT members, we utilize the key words used to identify SCOM experience in Hendricks et al. (2014).

Our second independent variable is finance experience on the TMT (*FinanceExp*). We again use the Bloomberg executive database to identify which executives have worked in finance functional positions in their previous work. We once again take the number of executives with finance experience and divide it by the total number of executives on the TMT. This gives us a value ranging from 0% to 100% indicating the percentage of the TMT that has finance experience.

Control variables

We use numerous control variables in our analysis at the firm level, the TMT level, and the location level. At the firm level we collect control variables from the

Compustat database. We first control for the size of the firm by using the total revenue for the firm in that year (*revenue*). It is important to control for size, as firms that are larger may have more resources to dedicate to both location risk planning and resilience strategies. Financial performance of the firm is also an important control variable as firms that are underperforming may feel pressure to take risks in order to improve performance. We measure financial performance by using return on assets (*ROA*). We also control for the amount of inventory a firm has on hand as inventory stockpiles can be seen as a way to reduce risk and increase operational slack. We control for inventory by taking each firm's total inventory for the year and dividing it by revenue (*inventory*). This measure is size-adjusted to account for the possibility that larger firms will have more inventory on hand solely due to their size. Lastly, at the firm level we control for supply chain performance using the cash-to-cash cycle time (*CCC*). This measure represents the efficiency of a firm's supply chain.

We also control for several TMT characteristics. We utilize the Bloomberg data to identify how many executives are on each TMT (*number of execs*). We include this variable in our analysis as a simple count of total executives on the TMT in a given year. We next include the percentage of the TMT which is male (*percent male*) and the average age (*age*) of the TMT as controls. We included these control variables as previous research has indicated that there can be differences in risk preferences between males and females and individuals of different ages. Both of these control variables are taken from ExecuComp, as the Bloomberg database does not include either of these variables.

We also control for whether the site has an alternate production location (*alternate location*). We do this because firms with multiple production sites may be willing to take more risk than firms that have no redundancy for their production locations. This variable is coded 1 if an alternate location exists and 0 if no alternate exists. We also control for whether the production location is based in the same country as the company headquarters (*offshore*). Lastly, in order to control for any location, firm, or year idiosyncratic effects, we include effects for production site location (*siteID*), firm (*companyID*), and *year*.

Model

We estimate four equations in order to answer our hypotheses. First, as shown in Equation 1, we test the effect of our first two hypothesized variables on the location risk score of a production location. For our third and fourth hypotheses we use Equation 2, in order to test the impact of SCOM and finance experience on the TMT on resilience. All equations have the same independent variables, with the difference between the models being the dependent variables and/or the effects.

$$\begin{aligned} \textit{location risk score} &= \beta_0 + \beta_1\, SCOMexp + \beta_2 FinanceExp + \beta_3\, number\ of\ execs \\ &+ \beta_4 percent\ male + \beta_5\, age + \beta_6 revenue + \beta_7 ROA + \beta_8 offshored \\ &+ \beta_9 inventory + \beta_{10} CCC + \beta_{11} alternate\ location + \beta_i year \\ &+ \beta_j siteID + \beta_k companyID + \varepsilon \quad \text{Eq. 1} \end{aligned}$$

$$\begin{aligned} resilience &= \beta_0 + \beta_1\, SCOMexp + \beta_2 FinanceExp + \beta_3\, number\ of\ execs \\ &+ \beta_4 percent\ male + \beta_5\, age + \beta_6 revenue + \beta_7 ROA + \beta_8 offshored \\ &+ \beta_9 inventory + \beta_{10} CCC + \beta_{11} alternate\ location + \beta_i year \\ &+ \beta_j siteID + \beta_k companyID + \varepsilon \quad \text{Eq. 2} \end{aligned}$$

RESULTS

Table 8 provides the means, standard deviations and correlations for our independent variables and control variables. We conducted a variance inflation factor (VIF) test and found that none of our independent variables or control variables has scores above the acceptable threshold of 10. For our study, this is an acceptable threshold, as our sample size is large enough to rule out a statistical fluke in our findings.

In all of our models we use generalized estimating equations (GEE). GEE is an extension of generalized linear models that allows for multi-year datasets. Maximum likelihood estimates are derived in four parts with GEE: a linear component, a link function that does not need to be linear, a family of distributions, and a correlation structure. GEE is frequently used in the TMT literature (Henderson et al., 2006; Ndofor et al., 2015). We use GEE estimation with controls for year, firm, and production site location.

In order to address concerns of contemporaneous correlations between the TMT variables (*SCOMexp, FinanceExp, number of execs, percent male,* and *age*) we follow commonly accepted econometric practices and lag these variables by one year. This lag takes into account the possibility that managers take some time to enact policies within their firms. We argue that the actions of a member of the TMT are more likely to be felt in the following year.

The GEE results for hypotheses 1 and 2 are provided in Model 12, shown in Table 9. The coefficient for *SCOMexp* is negative and statistically significant as

indicated by the p-value at the < 0.05 level. This supports hypothesis 1 stating that a higher percentage of executives with SCOM experience on the TMT will be associated with lower location-specific risk scores. Hypothesis 2 is also supported as indicated by the positive coefficient for the variable *FinanceExp* and the < 0.05 p-value. This hypothesis stated that a higher percentage of executives with finance experience on the TMT would be associated with higher risk scores.

Hypotheses 3 and 4 are both tested using the results of Model 15, shown in Table 10. Hypothesis 3 states that firms with a higher percentage of their TMT having SCOM experience will be associated with lower recovery times at their production site locations, indicating higher resilience. This hypothesis is supported, as the coefficient is negative and highly statistically significant at the $p < 0.01$ level. Hypothesis 4 proposes that firms with greater representation of finance experience on their TMTs would be associated with lower recovery times. This hypothesis is also supported with a negative coefficient and a highly significant p-value < 0.01.

Hypotheses 5a and 5b both propose interaction effects on the relationship between SCOM experience on the TMT and risk/resilience from offshoring. Hypothesis 5a postulates that offshoring would negatively moderate the negative relationship between SCOM representation on the TMT and location risk score. The negative moderation is supported in Table 9, Model 13 as the multiplicative term of *SCOMexp*offshore* is negative and significant with a p-value < 0.01. This interaction can be seen graphically in Figure 2. Hypothesis 5b proposed that offshoring would negatively moderate the negative relationship between SCOM representation on the TMT and resilience. This hypothesis is not supported as the interaction effect,

*SCOMexp*offshore*, has a negative coefficient and a significant p-value < 0.01 as seen in Table 10, Model 16. This interaction can be seen graphically in Figure 3.

Table 8: Descriptive statistics and correlations for risk and resilience

	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11
SCOM Experience (1)	27%	0.15	1										
Finance Experience (2)	23%	0.11	0.002	1									
Total Number of Executives (3)	11.49	4.39	0.123	-0.554	1								
% Male (4)	95%	0.09	0.140	-0.422	0.420	1							
Average Age (5)	55	3.26	0.111	-0.083	0.058	0.183	1						
Revenue (6)	$ 6,036.44	12667.25	-0.018	0.084	0.215	-0.187	0.049	1					
ROA (7)	0.04	0.09	0.220	-0.120	0.364	0.086	0.087	0.273	1				
Inventory/Revenue (8)	0.12	0.06	0.009	-0.192	-0.104	0.205	0.476	-0.173	-0.016	1			
Cash to Cash Cycle Time (9)	90.83	38.97	-0.138	-0.303	-0.061	0.238	0.414	-0.185	0.146	0.772	1		
Offshore (10)	0.79	0.40	-0.016	0.080	-0.152	-0.118	-0.079	-0.211	-0.083	-0.062	-0.084	1	
Alternate Location (11)	0.18	0.38	-0.001	0.082	-0.070	-0.054	0.293	-0.044	0.094	0.225	0.137	0.018	1

Table 9: Results table for hypotheses 1, 2, and 5a: Location risk score

VARIABLES	Model 11 Risk Score	Model 12 Risk Score	Model 13 Risk Score
Total Number of Executives	0.046***	0.046***	0.047***
% Male	0.492	0.954	0.998
Average Age	0.022	0.012	0.013
Revenue	-3.61e-05	1.05e-05	1.08e-05
ROA	-0.601**	-0.995***	-1.017***
Inventory/Revenue	-3.180***	-3.449***	-3.268***
Cash to Cash Cycle Time	-0.001	0.001	0.001
Alternate Location	-0.015	-0.047	-0.043
Offshore	1.875***	1.876***	2.174***
SCOM Experience		-1.358***	-0.402
Finance Experience		1.139**	1.226**
SCOMexp * Offshore			-1.138***
Constant	1.188	1.235	0.781
Wald χ^2	941***	943***	975***
Observations	934	934	934
Number of Production Locations	467	467	467

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Results table for hypotheses 3, 4, and 5b: Resilience (time to recovery)

VARIABLES	Model 14 Recovery Time	Model 15 Recovery Time	Model 16 Recovery Time
Total Number of Executives	1.487***	1.823***	1.839***
% Male	27.920**	17.240	16.460
Average Age	-0.023	-0.554*	-0.570*
Revenue	-0.001**	-0.001*	-0.001*
ROA	-16.460***	-23.280***	-22.950***
Inventory/Revenue	-10.610	-22.980	-25.820
Cash to Cash Cycle Time	-0.042**	-0.054**	-0.053**
Alternate Location	-22.910***	-22.300***	-22.430***
Offshore	-2.798*	-2.827*	-7.511***
SCOM Experience		-16.460***	-31.510***
Finance Experience		-53.160***	-54.480***
SCOMexp * offshore			17.910***
Constant	18.260	67.880***	75.170***
Wald χ^2	269***	347***	356***
Observations	934	934	934
Number of Production Locations	467	467	467

*** p < 0.01, ** p < 0.05, * p < 0.1

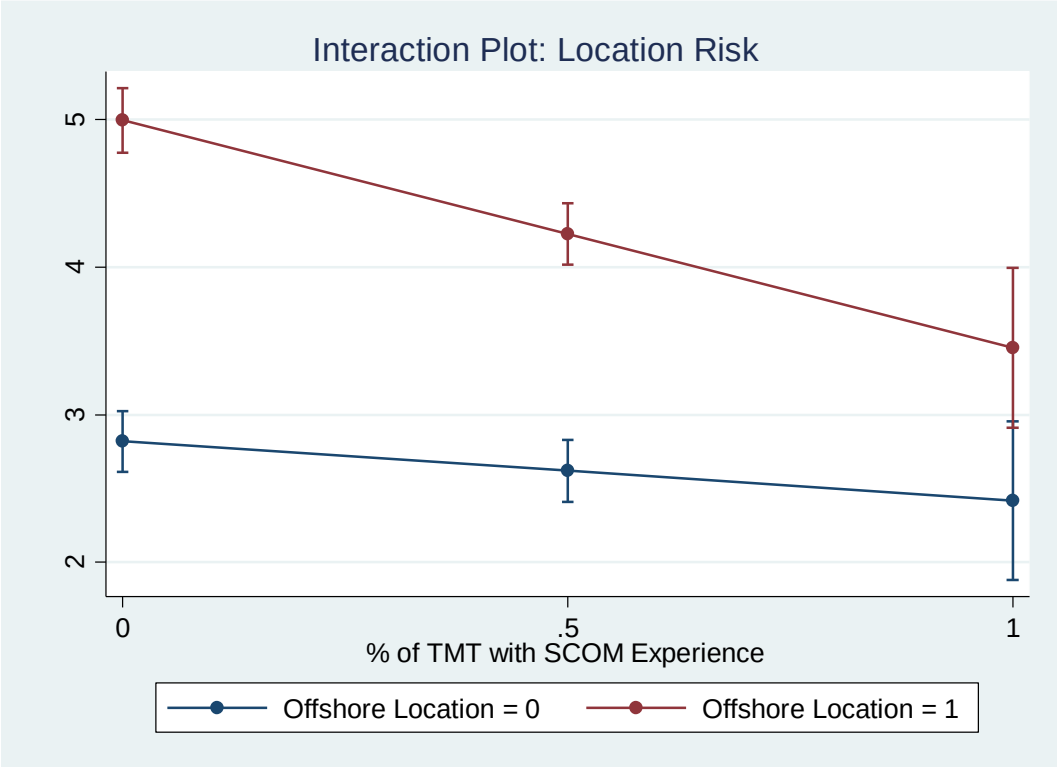

Figure 2: Predictive margins plot of interaction SCOM*Offshore (location risk score)

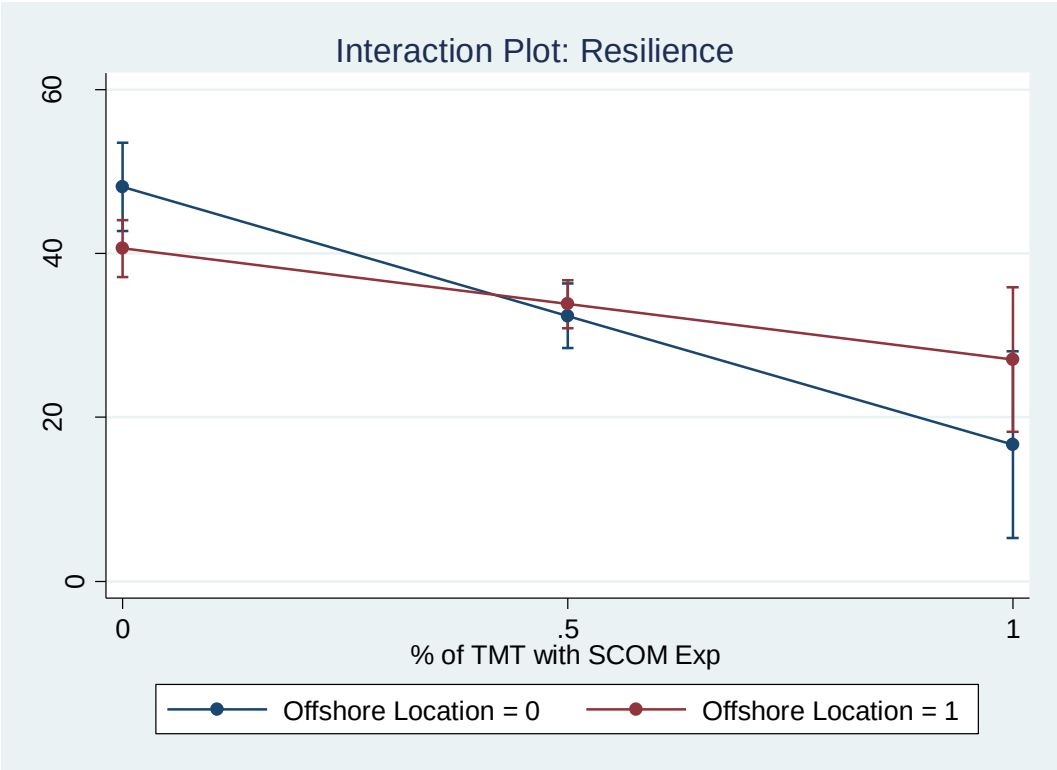

Figure 3: Predictive margins plot of interaction SCOM*Offshore (resilience)

Robustness Test

Since the hypothesized independent variables of *SCOMexp* and *FinanceExp* are lagged by one-year, concerns over endogeneity resulting from reverse causality are addressed. However, it is possible that other omitted variables may also influence our results. In order to address this potential area of endogeneity we utilize a common estimation method: two-stage residual inclusion (2SRI) (Terza et al., 2008). This method is found to have results that are more consistent than the two-stage instrumental variable technique (Terza et al., 2008; Wooldridge, 2015; Wooldridge, 2014). In order to conduct this estimation we must first predict the variable that could be endogenous. In this case, we have chosen both *SCOMexp* and *FinanceExp* as variables which could be influenced by omitted variables. In order to conduct our estimation we first regress *SCOMexp* on *number of execs, percent male, age, revenue, ROA, inventory, alternate location, offshore,* and *CCC*. We then save the error resulting from this analysis and include the error as an independent variable in Models 18 and 19 in Table 11. We can see from this analysis that no substantive differences result in either the sign of the coefficient or the p-value of *SCOMexp,* indicating that endogeneity from omitted variables does not bias the results of either hypothesis 1 or hypothesis 3. Next we conduct a similar analysis by regressing *FinanceExp* on *number of execs, percent male, age, revenue, ROA, inventory, alternate location, offshore,* and *CCC.* We then save the error from the first stage and once again insert it into the equations both for resilience and risk score. We find that once again the coefficients and p-values of our primary hypothesized variables of interest remain unchanged, as can be seen in Models 21 and 22 in Table 12. This indicates that omitted variables are not biasing the results of hypothesis 2 or 4.

As a robustness check we also substitute a dummy variable for SCOM experience for the percentage variable we use in the analysis. This dummy variable is coded as 1 when any executive on the TMT has SCOM experience and 0 when no executive on the TMT has SCOM experience. There are no substantive differences in our results when we make this change. We do the same for the finance experience variable and again find no substantive differences.

Table 11: Two stage residual inclusion for SCOM experience

VARIABLES	Model 17 SCOM Experience	Model 18 Risk Score	Model 19 Recovery Time
Total Number of Executives	0.005***	0.048***	1.823***
% Male	0.165*	0.954	17.240
Average Age	-0.012***	0.012	-0.554*
Revenue	2.81e-05***	1.05e-05	-0.001*
ROA	-0.313***	-0.995***	-23.28***
Inventory/Revenue	-0.310*	-3.449***	-22.980
Cash to Cash Cycle Time	0.001**	0.001	-0.054**
Alternate Location	-8.15e-09	-0.0487	-22.30***
Offshore	3.96e-10	1.876***	-2.827*
SCOM Experience		-1.358***	-16.46***
Finance Experience		1.139**	-53.160***
SCOM Error		-4.073	1,475***
Constant	0.600***	1.238	66.830***

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 12: Two stage residual inclusion for finance experience

VARIABLES	Model 20 Finance Experience	Model 21 Risk Score	Model 22 Recovery Time
Total Number of Executives	0.005***	0.048***	1.822***
% Male	-0.271***	0.964	17.150
Average Age	-0.007***	0.012	-0.556*
Revenue	-6.45e-06***	1.05e-05	-0.001*
ROA	-0.034*	-0.997***	-23.250***
Inventory/Revenue	-0.138	-3.457***	-22.860
Cash to Cash Cycle Time	-0.001**	0.001	-0.053**
Alternate Location	0.003***	-0.048	-22.280***
Offshore	-0.001	1.876***	-2.830*
SCOM Experience		-1.359***	-16.440***
Finance Experience		1.135**	-53.120***
Finance Error		93.990	-1,487.00
Constant	0.780***	1.185	68.580***

*** p < 0.01, ** p < 0.05, * p < 0.1

DISCUSSION

The findings of our study contribute to theory in two major ways. Firstly, we contribute to UET by proposing and testing unique hypotheses regarding the impact that TMT member backgrounds have on supply chain risk and resilience. Secondly, we contribute to the supply chain risk management and resilience literature streams by identifying the differing impact of SCOM executive experience and finance executive experience on these operational outcomes.

Our findings regarding the impact of SCOM experience on supply chain risk and resilience are novel and interesting from both a theoretical and a practical perspective. We find that SCOM experience on the TMT is associated with higher levels of location resilience (lower recovery times). This finding indicates that executives with SCOM experience consider the investment required to create resilience at a production location to be worth the expense. We propose that these executives think this way due to the experience they have had within SCOM functions in their career. These experiences have caused them to focus their attention on creating a resilient supply chain. Again we argue that the previous experiences of SCOM executives give them insight into the potential dangers of productivity loss through supply chain disruption. We see that this experience leads to less risky supply chain location selections.

We also contribute to theory by identifying the impact of finance experience on supply chain risk management decisions. We find that having higher levels of finance representation on the TMT leads to higher levels of location risk at the firm's production locations. We expected this outcome, as locations with higher risk would likely only be desirable when there are other attractive attributes such as low cost labor and potential for agglomeration economies. In this case there is a risk-return trade-off that an executive with a finance background might be keen to exploit. Our findings indicate that firms with higher levels of finance presence on their TMT have higher levels of risk at their production locations.

Where an executive with an SCOM background may view the cost of resilience as a necessary expense, we argue that finance executives are more likely to

view resilience as a form of insurance and to do a cost-benefit analysis to take into account the added expense of this form of insurance. We further theorized that since finance executives are more likely to take risks in the production locations selected, they are also likely to need the added insurance resilience provides. We found this result in Table 9. We would also like to note that a careful look at the coefficients of the *SCOMexp* variable and the *FinanceExp* variable in Model 6 show that the coefficient for *FinanceExp* is much larger than the coefficient for *SCOMexp*. This result indicates that executives with finance backgrounds on the TMT understand the risk that has been taken through locating facilities in riskier areas and hence are placing more emphasis on resilience than their SCOM counterparts who have already partially mitigated risk by having lower risk scores at their production locations.

The finding that there is a difference in risk preferences between SCOM executives and finance executives is very interesting, and behavioral research on risk preferences is a powerful guide to understanding this finding. SCOM executives are trained through their experiences and incentives to focus on operational aspects of the firm, such as an uninterrupted flow of goods, cost efficiency, and waste minimization. In the event that a disruption takes place in the supply chain, the firm will incur a loss. Behavioral studies have found that individuals are loss-averse. In the words of (Holmes Jr, Bromiley, Devers, Holcomb, & McGuire 2011: 1016), individuals "find the displeasure of losses to be greater than the pleasure of equivalent magnitude gains." Since the supply chain and operations functions within the firm operate with the goal of minimizing losses for the firm, in the form of cost reduction throughout the supply chain and a smooth flow of goods and services, a disruption in the supply

chain would be seen as a loss. On the other hand, finance executives are trained to focus on the bottom line of the firm and are incentivized to maximize the profit of the firm. When a finance executive looks at the same problem of risk within the supply chain, the finance executive is not viewing the problem as a loss minimization problem but instead is viewing the situation from the perspective of profit maximization. According to Prospect Theory the difference in viewing the problem (loss minimization vs. profit maximization) will cause managers to behave differently (Kahneman & Tversky, 1979). We see the impact of this viewpoint difference in the result of H2 that firms with a higher level of finance-experienced executives are more likely to take risk in production location decisions.

Another potential contributing factor to our finding is the view with which the two types of executives perceive the risk in these situations. While an executive with a finance background may look at a cost-benefit analysis of resilience and a risk-reward tradeoff with location risk from an academic standpoint, it is possible that the SCOM executive has experienced a supply chain disruption in their day-to-day activities and, hence, overestimates the probability of its reoccurrence. In their seminal work on behavioral biases, Tversky and Kahneman (1974) identify that the behavioral bias of availability exists when an individual attempts to estimate the probability of a future event happening by recalling events in the past. Often an individual may remember some event that happened to them and think that since it occurred once, there is a higher probability of it happening again than is realistic. It is hence possible that due to their experience working in the supply chain and operations side of the firm, executives with SCOM background may overestimate the

probability of disruptions due to their daily tasks of fixing supply chain and operations glitches.

It is also possible that incentives play a significant role in the risk decisions of a firm. Studies have found that when incentivized monetarily, executives are more likely to underestimate the probability of a negative result (Cole et al., 2015). It is likely that executives who worked in finance positions throughout their careers have become accustomed to being incentivized based on the bottom line of the firm. SCOM executives, on the other hand, are more likely to be incentivized based on the timely and uninterrupted flow of goods and services throughout the supply chain. While executives in the C-suite are most likely all incentivized in the same way, it is important to realize that the incentives from previous jobs will likely play a role in shaping an executive's attitudes toward risk. Our findings support the notion that SCOM executives are prioritizing the uninterrupted flow of goods and services while finance executives are primarily focused on the maximization of profits.

The results of H5a and H5b present an interesting and important theoretical finding regarding the impact of SCOM experience on the TMT in the presence of offshore production locations. The finding of H5a is, as hypothesized, that when firms with SCOM executives on their TMTs opt to produce internationally they will tend to want to minimize risk. This finding is supported by our analysis and gives insight into the decision-making of SCOM-experienced executives. The finding of H5b, that firms with SCOM representation on the TMT have lower levels of resilience when offshoring, is a surprising and interesting finding. One possible takeaway from these results is that executives with SCOM representation are

choosing to address risk in offshore locations by avoiding risky locations altogether instead of using resilience as a mitigation technique.

Studies have found that firms find it difficult to coordinate the activities of offshore operations (Kumar et al., 2009). We propose that implementing strategies in order to be resilient will be more difficult when offshoring. It may be more difficult for a manager to anticipate the potential dangers at an offshore location, as the manager will likely be less familiar with the foreign country than with the firm's home country. Furthermore, the challenge of containing disruptions, preventing their spread throughout the supply chain, and recovering after the disruption becomes more complex when the manager is guiding response to disruption from a distance.

We also find several interesting results in our control variables. We find that the presence of a second production location is a significant predictor of both recovery time and location risk score. Having an alternate location is associated with a higher recovery time, indicating that firms with an alternative production location seem to have lower levels of resilience at their production locations on average. This finding is interesting from a strategic standpoint. When firms have lower levels of resilience at production locations, they may choose to have an alternate production location in order to protect themselves from the possibility of disruption. Additionally, we find it interesting and surprising that the impact of an alternative location on the location risk is negative. This finding indicates that production sites which have alternative locations are less risky on average. It may be that firms which are risk-averse locate their production in areas with low location risk scores and are also likely to have an alternate production location due to their risk aversion.

LIMITATIONS AND FUTURE RESEARCH

This study has limitations which offer new areas of potential study. The setting for this research is the manufacturing sector from years 2012-2014. This setting is good for exploring supply chain risk management decisions; however, it may be interesting and useful to extend this analysis to other sectors, such as the retail sector. Furthermore, the scope of this study is limited to supply chain risk; however, it may be interesting to extend this research to other types of risk (e.g. entrepreneurship, innovation, acquisition activity) to determine what impact SCOM and finance experience have in regards to those types of risk. Lastly, it would be interesting to extend this research by including other functional areas, such as marketing or information systems to determine how representation on the TMT of those types of experience influences a firm's propensity to take risk of various kinds.

Future studies could also build on the results of the interaction effects that indicate firms with SCOM experience on their TMTs prefer avoiding risks to creating resilience at their production locations when those locations are offshore. This result is surprising, and future research could utilize survey methods and semi-structured interviews to learn more from executives with SCOM experience to understand further why risk avoidance as a form of risk mitigation is seen as favorable in offshoring situations.

CONCLUSION

This study contributes to UET by extending our knowledge of the impact of SCOM and finance experience on the TMT. The study further adds to knowledge by theorizing and finding that SCOM and finance experience on the TMT both drive the risk profile of the firm's production locations. Our findings indicate that higher levels of SCOM presence on the TMT lead to decreased risk and increased resilience within the supply chain of the firm while higher levels of finance presence on the TMT leads to increased risk and increased resilience. Our findings shed light on the important topic of the impact of the TMT on risk decisions and provide useful insights for both academics and managers.

Chapter 4: Future Extensions

This dissertation has highlighted numerous opportunities for future study. The impact of SCOM executives on the TMT is likely to be far-reaching and to dramatically change how firms make strategic decisions. Toward the continued study of increasing SCOM representation in the C-suites of many firms, I have two specific areas in which I have begun to explore.

Recent research has identified that supply chain dependence significantly impacts profitability and the efficacy of lean inventory strategies (Elking, Paraskevas, Grimm, Corsi, & Steven, 2017). I would like to explore the impact that SCOM presence has on the strategic sourcing decisions of the firm, specifically regarding the degree to which the firm is dependent on its supply chain partners. I expect that a higher degree of SCOM experience will be associated with lower levels of supply chain dependence as firms with SCOM expertise on their TMTs will understand the danger of over-dependence.

I would also like to explore the impact of SCOM experience on the TMT on the environmental performance of the firm. Many environmentally-friendly practices are aligned with the incentives and priorities of an executive with SCOM experience. I expect that an executive with SCOM experience will prioritize many green measures, including lean production, waste reduction, inventory efficiency, and transportation efficiency.

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