

Leadership in the Face of Major Supply Chain Disruptions: Baseline and Contextual Traits

Authors

Iana Lukina, U. of South Florida, ianalukina@usf.edu

Arash Azadegan, Rutgers Business School, aazadegan@business.rutgers.edu

Robert Hooker, U. of South Florida, rhooker@usf.edu

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ABSTRACT

Supply chain disruptions can be complicated, surprising, infrequent, and often unforgiving to mediocre decisions. Leading organizations through such disruptions can be extremely challenging. This raises a fundamental question: What types of leadership traits are best suited in handling supply chain disruptions? In this paper we offer theoretical and empirical evidence to help address the question. The paper starts by first differentiating characteristics that make supply chain disruptions challenging. Next, based on a thorough review of the literature in crisis leadership, we carefully select traits that seem relevant in effectively handling supply chain disruptions. After validating the selected traits with industry professionals, we hypothesize relationships between the leadership traits and different types of challenging supply chain disruptions. Our investigation uses a combination of archival and survey data from a cross-section of 286 manufacturing firms to empirically test our hypotheses. Results suggest that, leader *decisiveness* has a positive effect and *deliberative leadership* has a detrimental effect on mitigating the effects of major supply chain disruptions. The same two traits are also important to consider when facing complex disruptions. In the face of disruptions with limited warning, leader *trust* plays an important role. These results offer further explanations on the nuances of supply chain disruptions. Leaders should consider emphasizing certain traits to better respond and recover from supply chain disruptions.

Key Words: Supply chain disruptions, Leadership traits, Complex disruptions, Unfamiliar disruptions, Surprising disruptions

Introduction

What traits should a leader placed in charge of handling a major supply chain disruptions have? By definition, disruptions are idiosyncratic dilemmas that defy a clear cut or “one size fits all” approach to handling them. Indeed, varied and contrasting leadership styles have been shown to be effective in facing disruptions (Azadegan & Hooker, 2015; [Boin & 't Hart, 2003](#)). For example, in the now classic 1980’s product recall case, James Burke, then chairman of Johnson and Johnson made a decisive move to pull and replace the entire stock of Tylenol tablets off of the market ([Prokesh, 1986](#)). Burke was widely admired for his “take charge” leadership style. In contrast, leadership at Renesas Electronics was praised for their participative and teambuilding leadership style during their unfortunate calamity. Renesas’s Naka, Japan facility was heavily damaged as a result of the Great East Japan earthquake of 2011. Leadership’s primary focus was in developing a sense of unity and teamwork and to eliminate barriers and obstacles that hindered recovery efforts ([Matsuo, 2015](#)).

Supply chain disruptions are unplanned events that breach the flow of resources across two or more organizations ([Skipper & Hanna, 2009](#); [Svensson, 2000](#)). For leaders, managing supply chain disruptions can be a challenging test of character. Today’s disruptions can be rapidly-changing events that demand quick and accurate decisions by the leader, despite the ambiguities of the situation ([Kilcarr, 2016](#)). While they require an urgent call to action, supply chain disruption can also be unforgiving to hasty decisions. Indeed, many believe that besides the disruption itself, the second major source of negative outcomes come from errors of commission or omission by leaders ([Dynes, Quarantelli, & Kreps, 1981](#)). While strong leadership can minimize the effects of a disruption, weak leadership makes matters worse, compounding the damage ([Kapucu & Wart, 2008](#)).

But the question remains: What traits should a leader placed in charge of handling a major supply chain disruptions have? Literature in crisis leadership offers an overabundance of suggestions on the traits that a crisis leader should carry ([Denison, Hooijberg, & Quinn, 1995](#)). However, much of the findings are based on leadership in facing political, social (governmental efforts in the face of major natural disasters) or humanitarian crises ([Van Wart & Kapucu, 2011](#)). What is expected of company leaders in the face of supply chain disruptions is often notably different from that of humanitarian, governmental or political crises. Therefore, we suggest that supply chain disruptions may require a distinct amalgamation of leadership traits.

Literature relating leadership to supply chain disruptions is scant on the research question posed. As such, we start our effort by first distinguishing what makes supply chain disruptions different from other disruptions. Next, based on previous literature and industry insights, we identify six leadership traits that are particularly pertinent to facing supply chain disruptions. We offer a series of hypotheses associating these select leadership traits with supply chain disruptions with distinctive challenges. We test the hypotheses using archival and survey data from a cross-section of 286 manufacturing firms.

Our contributions are to the literature in supply chain management and to crisis leadership. First, we offer leadership traits that are particular to the characteristics of industrial/supply chain disruptions. Moreover, depending on the significance of the traits, we differentiate them into baseline traits (those that seem important in facing all challenging supply chain disruptions) or contextual traits (those that are useful in facing disruptions with particular characteristics). Second, we offer the first categorization of major supply chain disruptions. Differentiating supply chain disruptions based on their characteristics can help researchers in their conceptualization and modeling of these phenomena. Finally, we offer evidence of the

applicability of situational leadership theory. There are contexts that require leaders to rely on certain traits more than others.

The remainder of the paper is structured as follows: In the first section, our conceptual approach on how review and analysis of the literature is explained. Here, we describe our methodology for review of literature as related to supply chain disruptions, and to crisis leadership traits. Next, we detail the hypotheses that relate leadership traits to supply chain disruptions. We then offer details about our data collection and analysis. In the latter sections, description of the results is presented. The work concludes by discussion and research limitations.

Conceptual Approach

Leadership literature in the past several decades has been burgeoning with traits that are useful in managing organizational crises (e.g. [Mitroff, Pearson, Clair, & Misra, 1997](#); [Pearson & Clair, 1998](#)). To effectively consider previous research and to relate it supply chain disruptions, we took a three-pronged approach. First, based on literature in risk, crisis and supply chain management we distinguished major supply chain disruptions into three types: complicated, rare (lack of familiarity) and surprising (lack of awareness). Second, based on a review of crisis leadership literature, we categorized leadership traits that are highly germane in facing organizational crises. We categorized these into personal attributes, interpersonal skills and organizational leadership behaviors. Next, by carefully combing through the logic and examples provided by extant works, we identified leadership traits that seemed particularly relevant to each of the three categories that are specifically relevant to supply chain disruptions. Q-methodology was used to investigate the perspectives of 35 supply chain managers during two regional

Institute for Supply Management (ISM) Conferences ([Militello & Benham, 2010](#)). We asked participants to rank-order the series of traits previously selected through literature review. Based on their assessment, we picked six leadership traits as candidates for further investigation and hypothesis development. In the next sections we explain the literature used to offer nuance to supply chain disruption types and in selecting the pertinent leadership traits used in our efforts.

Differentiating supply chain disruptions – Complex, Unfamiliar and Surprising Disruptions

Crisis management literature has historically been dominated by research related to public sector response to community ([Quarantelli, 1997](#)) or humanitarian related disasters ([Comfort, 2007](#); [Littlefield & Quenette, 2007](#)). As related to the private sector (e.g. corporations) and their supply chains, much of the focus has been on steps to be taken at the executive level to minimize potential crises derailing a company's strategic plans ([Fink, 1986](#); [Mitroff & Alpasian, 2003](#); [Wooten & James, 2008](#)). While insightful, much of the recommendations offered by extant literature may not be fully in line with what is expected of leadership in the face of supply chain disruptions. For instance, whereas the primary objective for humanitarian, and community relief efforts are to minimize the damage (i.e. human suffering), in supply chains leadership is held responsible not only for limiting the human related damage, but also for fully re-establishing the production system to its fully functioning form. Second, whereas humanitarian, community and social crises focus primarily on responding to human needs, for supply chains an effective leader not only addresses the needs of the employees and other potentially affected persons, she is also responsible to mitigate the profitability, and reputation effects on company constituents. This multi-objective set of expectations from company leaders makes the research context unique from other settings in which crisis leadership has been studied.

By now, it is well established that supply chain disruptions can be costly and harmful ([Hendricks & Singhal, 2003, 2005](#)). However, not all of such disruptions cause the same level of challenge for organizations and their leaders. Certain supply chain disruptions occur more frequently, and cause limited damage ([Norrman & Jansson, 2004](#)). These are often the result of smaller random variations in demand, quality problems, absenteeism, or other such relatively common events that are part of the "cost of doing business." ([Sheffi, 2005](#); [Sheffi, 2007](#)). Since minor disruptions occur more often, the nature, gravity and the urgency of their impact can be better understood by finding commonalities among them.

As the size of disruptions increase, the likelihood that they are not easily addressed using existing rules and protocols rise ([Van Wart & Kapucu, 2011](#)). Managing these challenging disruptions requires skills, preparation and personality traits often reserved for selected leaders. A review of the literature suggests that among the primary differentiators of supply chain disruptions are their level of (1) complicatedness, (2) rarity and (3) surprise ([Blackhurst, Scheibe, & Johnson, 2008](#); [Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007](#); [Zsidisin, Ragatz, & Melnyk, 2004](#)). Complexity arises from the interaction among the numerous operators in an intertwined system ([Azadegan & Dooley, 2011](#)). Complicatedness in a supply chain disruption becomes a concern when more members of the supply chain are affected or when multiple streams of goods, information and finances are severed (Craighead et al. 2007; ([Azadegan & Jayaram, 2017](#))). With rising complicatedness of a disruption, the firm's ability to accurately appraise, react and respond decreases (Mumford et al. 2007). As such, the role of a leader becomes ever more important. Rare disruptions are unique in the sense of offering no past experience that parallels them such that the firm can draw lessons from (Lampel et al., 2009). In contrast to rare disruptions, familiar disruptions reside in the organization's task domains, and

can be more easily recalled, making them easier to manage (Kovoor-Mishra, 2002). Indeed, as the Tylenol case shared earlier demonstrated, the company did not know how to handle this rare and unusual event. Finally, surprising disruptions are those that happen without pre-warning or that take unexpected shapes as they unfold ([Cunha, Clegg, & Kamoche, 2006](#); [Kleindorfer & Saad, 2005](#)). Surprising disruptions are challenging because they leave no preparation time to collect information or to prepare for the onslaught of damage that will ensue ([Ansoff, 1975](#)). In many surprising supply chain disruptions, by the time sufficient information about the event becomes available, there is no time remaining to adequately complete an effective response ([Ansoff, 1975](#)). For instance, General Motors management had a 30-minute alert before a tornado touched down on their plant in Oklahoma City causing extensive damage to the paint shop, body shop and powerhouse ([Sheffi & Rice, 2005](#)). Superstorm Sandy created a similar issue for many companies in New Jersey and New York in 2012. Anne Strauss Weider, Director of Freight Planning notes: “This was [an] abrupt and rapid disruption. We had about 24 hours’ notice before Sandy hit.” ([Kilcarr, 2016](#))

Complicatedness, rarity, and the surprising nature of a supply chain disruption make them more challenging for leaders to address and resolve. The combination of these three characteristics underpins what is often referred to as a major supply chain disruption. In the remainder of the manuscript we differentiate between these disruptions and the more routine disruptions by referring to them as *major supply chain disruptions*.

Leadership traits in the face of supply chain disruptions

To compose a cogent picture of how literature has identified the crisis leadership traits, we conducted a literature review at the intersection of crisis management, supply chain disruptions,

and leader competencies. More than 50 articles in major academic outlets including *Journal of Business Logistics*, *Journal of Supply Chain Management*, *Decision Sciences*, *Leadership Quarterly*, and other related publications were extensively reviewed. Based on this analysis, leadership traits were grouped into three categories. Under each category, the major traits that are central for leaders operating during supply chain disruptions were identified (Table 1).

The first category consists of leader's *personal attributes*. This group includes skills related to cognitive capacities as well as personal characteristics such as stress-resistance, emotional intelligence, and confidence (Sun & Anderson, 2012; Van Wart & Kapucu, 2011; Bass and Avolio, 1993). Such traits are often listed as foundational to how a leader sets the stage in facilitating and directing the response and recovery efforts. The second category of crisis leadership traits is referred to as *interpersonal skills* because they involve relational and social skills on how the leader interacts with and influences others (Mumford et al. 2007; Van Wart, 2005). Included in this category are traits that are helpful in coordination of actions, negotiation skills in reconciling differences, establishing mutually amicable relationships, and persuasion skills (Boin et al. 2008; Devitt & Borodzics, 2008; Zaccaro, 2007). The third and last group consists of *organizational leadership behaviors*. These traits are often highly conceptual skills needed to take a systems perspective to fully grasp a complicated situation (Mumford et al. 2007). *Organizational leadership behaviors* can be divided into task-oriented and people oriented skills. Both subgroups deal with ambiguity and affect the influence in the organization (Liu, Chang, Zhao, 2009; Kovoov-Misra, 2002). Table 1 offers a summary perspective of our literature review.

The literature review suggests that certain leadership traits are important regardless of the context, while others are significant only under certain conditions (Vessey et al. 2011; Mumford

et al. 2007). Specific to our research, baseline traits are those that are important regardless of the type of supply chain disruptions, while contextual traits become useful only under certain conditions. To reflect this finding, we differentiate leadership traits useful in facing supply chain disruptions into baseline traits and contextual traits. Our hypotheses follow in the next section.

Insert Table 1 about here

Hypotheses

Decisiveness and *situational awareness* were among baseline traits of leadership in the face of major supply chain disruptions. Decisiveness is based on the ability to avoid pushing off important decisions, to quickly determine possible options to resolving and matter as to streamline decisions, and being able to make a final determination without struggle. Decisiveness is particularly important in the face of disruptions, because of the inherent immediacy of the issues and the need to resolve them in a timely manner. As the extent of the damage caused by the disruption grows, the need for a decisive and determined leader that is clear in her directives grows (Cavanaugh et al., 2008). For example, previous studies show that police officers in charge of SWAT teams are required to reinforce and elaborate task activities, and make timely decisions (e.g. Bechky & Okhuysen, 2011). In situations where lack of decisiveness can place others' lives in danger, quickly determining how to approach the matter is critical. More specific to supply chain disruptions, the well-known example of how Nokia and Ericson in the face of a supplier caused disruption offers further anecdotal evidence. Faced with the same disruption, difference in managerial decisiveness made a major difference on the recovery by these two competitors (MacDonald & Corsi, 2013; Sheffi, 2005). While Ericson suffered from its leaders' inability to exercise prompt judgment, Nokia's leadership took a series of immediate and

proactive actions and recovered from the supply shortage. In short, it seems that during supply chain disruptions decisiveness is critical because the situation demands a quick call to action.

Situational awareness deals with assessing events within the given context subject to time limitations. Having a reasonably clear mental model of most situations, and being able to quickly understand the critical factors and changes in a situation help with situational awareness.

Situational awareness is especially important when dealing with crisis management because it describes our ability to understand a vague, fast moving and potentially devastating situation.

Situational awareness also helps picture the ramification of actions taken by the organization.

What will happen if we take this action over the other? Naturally, a lack of situational awareness by the leader can make the crisis worse because incorrectly assessed situations may lead to

implementing inappropriate procedures. For example, the analysis of American coast guards revealed that about 40% of all disruptions regarding faulty navigation at sea were caused by the lack of situational awareness. Ship captains simply were unable to “process” the full effect of their actions into their decision making model.

Given the multifaceted nature of supply chain disruption, being situationally aware of what is going on around one is of utmost importance (Richey, 2009). Indeed, the concern with being situationally aware has been the topic of discussion during supply chain related conferences, such as that held by Institute for Supply Management on Risk ([Busch, 2012](#)). Some supply chain professionals have placed noteworthy attention into developing training exercises (e.g. Supply chain disruption game, Disturbance mitigation game) that can help improve managers’ individual and shared situational awareness during supply chain disruptions ([Kurapati, Kolfschoten, Verbraeck, Corsi, & Brazier, 2013](#)).

Deliberative leadership is another baseline trait of leadership prominently mentioned in the literature. Deliberativeness comes from carefully considering potential options and approaches. Deliberative leaders re-examine assumptions, cautiously seek different views and suggest new ways to look at the issue at hand. However, while external collaboration and well-thought-out decisions are essential during routine operations, they can often be ineffective and even damaging to how disruptions are handled (Demiroz & Kapucu, 2012). To start, unnecessary contemplation can slow down decision making, making it more difficult to handle the threats posed by the supply chain disruption. For example, during the response to Hurricane Katrina, managers and officials conducted a prolonged investigation as well as extensive communication that delayed the delivery of much needed aid for victims ([Waugh & Streib, 2006](#)). Second, contemplative decision making is often perceived to be a reflection of a leader's ambivalence and hesitance. Clearly, in the face of disruptions, the pressure is on reaction. Leader's inability to generate a decision can create a negative perception of a leader (Skipper & Hanna, 2009). Therefore, we anticipate that deliberative leadership would be associated with a lowering of mitigation performance.

Based on the arguments, literature and anecdotal examples offered above, we propose that certain traits will affect the mitigation performance. Specifically, we hypothesize that decisiveness, situational awareness, and deliberative leadership are the baseline traits essential during any large supply chain disruptions.

H1a+b: In the face of major supply chain disruptions, (a) leadership decisiveness and (b) situational awareness improve the firm's mitigation performance.

H1c: In the face of major supply chain disruptions, deliberative leadership diminishes the firm's mitigation performance.

Leadership in the face of Complex Supply Chain disruptions

Inspirational motivation is one of the contextual traits thought to be important during complex supply chain disruptions. As complexity increases, it is harder for supply chain members to appraise what is the right move to make (Mumford et al. 2007, Ullrich-Bien, Marion, McKelvey, 2007). Thus, leaders need to be a source of inspiration to employees. Studies show that when the leaders act selflessly, caring more about the group than themselves, workers are more trusting, cooperative, dedicated, loyal, collegial, and committed (Seppala, 2016). As the levels of complexity increase, supply chain interdependency becomes more prevalent (Christopher, 1992). When situation is tough and complex, everyone is anxious, thus leaders must help employees stay engaged, focused and motivated. For example, after Samsung's failure of the fire-prone Note 7s, Samsung's Chief Executive Kwon Oh-hyun addressed the employees with inspiring statement and suggested to use this crisis as a chance to make another leap by re-examining and thoroughly improving how the company works ([Kharpal, 2017](#)).

H2: In the face of complex supply chain disruptions, leader's inspirational motivation improves the firm's mitigation performance.

Leadership in the face of rare Supply Chain disruptions

Familiar disruptions reside in the organization's task domains, and can be more easily recalled, making them easier to manage (Kovoor-Mishra, 2002). In contrast, rare disruptions offer no past experience that parallels them such that the firm can draw ideas on how to tackle the (Lampel et al., 2009). This lack of familiarity lowers the organization's confidence in their ability to effectively deal with the situation. Leaders that are effective, recognize the need to compensate for this inherent lack of organizational confidence by offering their own personal self-esteem.

Self-esteem is having confidence in one's own worth and abilities. Leader self-esteem is based on her ability to recognize that people have faith in her, that she is trusted by others and that she can make a valuable contribution to helping the organization. Leader self-esteem is particularly important in the face of rare disruptions as it allows for others to become at ease with questions and doubts about this new, and unfamiliar set of circumstances. Indeed, previous research has shown that leaders who display confidence through self-esteem, instill willingness in them to make self-sacrifices and thus rise the chance for their organization to effectively respond to a devastating event (Sarros & Santora, 2001). Related to supply chains, the 1993 issue faced by PepsiCo's CEO Craig Weatherup offers an example. When a series of reports surfaced that syringes had been found in cans of Diet Pepsi, the company was caught by an unprecedented situation. Weatherup was confident in himself in the company's ability to handle the issue. He appeared on national television with visual evidence that cast heavy doubts on the reports as hoax. It was the assurance provided by PepsiCo's CEO that set the stage for the company to structure an effective response strategy to face the matter ([Novak, 2009](#)). The same ironclad style of self-esteem allowed Mary Barra to face the daunting task of leading the company in the face of one of its most rare forms of product recalls. In 2014 General Motors recalled 1.7 million cars with ignition switch defects. The rarity of this event had to do with the fact that company personnel may have known about the issue since 2005, but had hidden it from the public eye. Managing the issue required a critical look at how GM's quality assurance system was setup. For over a year, Ms. Barra was GM's front face of the crisis management effort, whether it was facing tough questions on Capitol Hill, apologizing repeatedly for putting lives at risk in the company's cars, or firing employees responsible for the decade-long delay in fixing the problem.

Here again, Barra's self-confidence in being able to handle the situation was a positive trait, necessary for handling the major corporate crisis ([Vlasic, 2016](#)). Based on the above, we posit:

H3: In the face of rare supply chain disruptions, leader's self-esteem improves the firm's mitigation performance.

Leadership in the face of surprising Supply Chain disruptions

Surprising disruptions are challenging because they leave no time for the company to gather information and to prepare for the onslaught of damage that will ensue ([Ansoff, 1975](#)). Without much warning, by the time sufficient information about the event becomes available, there is no time remaining to adequately complete an effective response ([Ansoff, 1975](#)). For example, in the Katrina disruption, all supply chain actors were caught up by "surprise," that paralyzed the entire response system, and produced more chaos and surprises of its own (Farazmand 2009).

In the absence of reliable information, it is hard to know who and what to depend on. Under these circumstances, a trustworthy leader is likely to be the most suited trait to unite the organization ([Wooten & James, 2008](#)). By definition, a trustworthy leader is someone that the organization can depend on and rest assured that the trust will not be betrayed. Such a leader is believed to fulfil her assigned responsibility - and as an extension, to not let down company expectations – no matter how startling and unusual a situation is ([Muffet-Willett & Kruse, 2008](#)). Empirical evidence supports this proposition, For example, the analysis of 82 major crises including pandemic flus, environmental disasters, and natural disasters, showed that a higher level of trust exhibited by the leaders is associated with better internal coordination of crisis communications with the organization's stakeholders (Longstaff & Yang, 2008).

Indeed, leaders who have established a trusting relationship with the rank and file at their organization are in a better position to be able to ask for them to face the unknown, no matter how shocking the situation may be. A case in point is how the CEO of Odwalla managed to rally company personnel in facing a major product recall. In 1996, Odwalla faced a devastating blow to its brand and company financials because of contaminated juice products that led to the death of a child and to having over 70 people seriously hospitalized ([Evan, 1999](#)). However, the company rallied behind its leader because they entrusted in him. The CEO, Greg Steltenpohl, had always been an advocate of a culture that nurtured trust and camaraderie with the firm. Outside the firm, Steltenpohl was viewed as a well-meaning CEO who cared about corporate social responsibility ([Rasmussen, 1997](#)). Based on the above, we posit that leadership traits related to sharing and deliberating of activities is important during surprising supply chain disruptions. Thus, we propose:

H3: In the face of surprising supply chain disruptions, leader's trusting personality improves the firm's mitigation performance.

Methods

Participants and Data Collection

A survey study was conducted to test the relationship between leadership traits and major supply chain disruptions (see above for definition). The cross-sectional firm sample was obtained from Aida - Bureau van Dijk (<https://aida.bvdinfo.com/>), a source of financial performance data and other information pertaining about firms operating in Italy and many other countries. In choosing the population of firms, we relied on contextual and organizational factors such as industry affiliation, firm size, and geographic ownership diversification.

At selected companies, a cover letter and the online questionnaire was sent to managers and employees directly involved in the disaster response process. Managers were also promised

an overall benchmark study to compare their responses to those of other participating managers. Sample members will be contacted via e-mail and asked to complete the survey instrument via Internet. The final sample population consisted of 1,000 organizations operating in Italy. After three follow ups, useful responses were obtained from a cross-section of 300 firms, which represents close to a 30% effective response rate. Responses from 14 managers were discarded due to excessive missing data. There were very rare instances of missing values for the retained firms and those appeared to be missing at random.

Instruments and Procedures

The supply chain, leadership, and operations literature were screened to identify relevant scales for the constructs used the study. For all constructs, multi-item 7-point Likert scale (1 - strongly disagree, 7 – strongly agree) described in the following paragraphs were used. We next examined the reliabilities of these scales as indicated by Cronbach's alpha. The reliabilities for all variables were higher than the recommended threshold (Nunnally, 1978).

Independent and Dependent variables

Decisiveness was assessed using a four-item scale adapted from Alban-Metcalf and Alimo-Metcalf (2000), e.g. "Our leader may struggle with a few decisions, but not very often." Bell and Waag (1995) scale was adapted to measure *situational awareness*. Bass and Avolio (1995) scale was applied to measure *inspirational motivation* (Cronbach's alpha of 0.92). For instance, we asked "Our leader says positive things about the work unit." *Self-esteem scale* was adapted from Rosenberg (1965). The construct was measured using items such as: "Our leader takes a positive attitude toward himself/herself" and "Our leader feels that he/she has a number of good qualities" (Cronbach's alpha of 0.86). *Trusting personality* was assessed using a five-item scale (Yamagishi & Yamagishi 1994), e.g. "Our leader behaves consistently over time and

across situations”. *Deliberative Leadership* was measured using a four-item scale (Metts 2011; Hannah, Balthazard, Waldman, & Jennings 2013).

Characteristics of major supply chain disruptions were measured using three separate variables: Familiarity, Surprise, and Complexity. *Disruption Complexity* was assessed using a two-item scale (Bozarth et al., 2009), e.g. “Number of links in the flow of goods between you and your suppliers affected by this disruption”. Bode et al. (2008) scale was applied to measure *disruption familiarity*. The examples of the four-items that were used in the study, include “Is a typical disruption that our business faces.” *Disruption surprise* was assessed using a four-item scale adapted from Cuhna et al. (2006), e.g. “Compared to other disruptions, we had ample warning before this disruption occurred.” A complete description of the measurements used in the study is presented in Tables 2a and 2b.

Insert Tables 2a and 2b about here

Monitoring the performance of any production system should include both internal and external measure to the firm (Stank, Crum, & Arango 1999). Thus, our outcome performance scale consisted of seven items, including sales, access to technology, delivery reliability, etc. (add citation). In this context, we were interested in how the organization’s response and recovery efforts helped lower the effects of a supply chain disruption. We asked respondents to evaluate the negative effect of the disruption, while keeping the response and recovery efforts in mind. Our question stem was “Without the response/recovery activities effect of the disruption on the following performance measures would have expected to be significantly higher” (7 point Likert 1-strongly disagree, 7–strongly agree). The reliability of the scale for the outcome variable

(mitigation performance) was acceptable (Cronbach's alpha of 0.89), suggesting that mitigation performance can be considered as a unidimensional construct in the analyses.

Control variables

We controlled for factors that could influence firms' mitigation performance in facing supply chain disruptions. Firm characteristics (sales), industry membership, and dynamism of firms' business context were included as controls. The first control variable assessed firm sales. As noted by previous research, firms with higher sales values have abundant resources and routinized processes, which might enhance or limit their response capability to supply chain disruptions. Survey responses are used for private firms that financial information is not available in COMPUSTAT, while COMPUSTAT financial data was used for public firms. The values for 3 years (2009, 2010, and 2012) were recorded. In order correct for normality distributions, the values were later re-coded into seven categories. The second control variable concerns industry memberships. Performance of the company during supply chain disruption can be affected by industry wide factors, such as infrastructure, demand patters, manufacturing processes, etc. As samples in many sectors were small, we regrouped the 21 registered categories into 8 subgroups using the first two-digit of their NAICS codes. Finally, environmental dynamism was used as the third control variable. A dynamic business context can affect leader's ability to access events and determine what leadership traits are necessary in order to respond to a particular supply chain disruption.

Results

Descriptive statistics

Table 3 shows the means, standard deviations, and zero-order correlations among the constructs used in the study. As shown in the table, no correlations among the theoretical

variables is large enough to pose estimation problems. All the constructs have skew and kurtosis scores within acceptable range (± 2.99) and most are close to zero indicating the acceptability of the normal distribution assumptions under the multiple regression model.

Hypotheses testing results

Multiple regression analysis was employed to test the proposed model using a two-step sequence of tests (Daugherty et al., 2002). First, direct relationship of the independent variables on the performance outcomes ($H1$) were tested using multiple regression analysis. Step two tested the relationships between leadership traits and supply chain performance and the surprise, complexity, and rarity that moderate these effects ($H2-H4$). Changes in R-squared were evaluated to determine if there are significant increases when the moderation variable was added into the regression equation. In addition, in order to evaluate the hypotheses, the coefficients and their corresponding P-values were employed. All statistic information about these criteria are displayed in the following section.

Table 4 shows the multiple regression results. The main effects (hypotheses $H1_a$, $H1_b$ and $H1_c$) asked about the direct effect of leaderships traits on mitigation performance. $H1_a$, positing that decisiveness helps mitigation performance, was supported ($H1_a$: $\beta=0.215$, $p<0.05$, Model 2, Table 4). $H1_b$, positing that situational awareness helps mitigation performance, was not supported ($H1_b$: $\beta=0.005$, $p=n/s$, Model 2, Table 4). Interestingly, we find support for the effects of situational awareness in analysis of particular types of supply chain disruptions, which will be discussed in upcoming sections. $H1_c$, positing that deliberative leadership hinders mitigation performance, was supported ($H1_b$: $\beta=-0.197$, $p<0.05$, Model 2, Table 4).

Insert Tables 3 and 4 about here

The next set of hypotheses looked at the importance of leadership traits in facing disruption complexity, surprise, and unfamiliarity. Hypothesis 2 posited that under high disruption complexity, inspirational motivation is important. Hypothesis 2 was not supported ($\beta=-0.523$, $p=n/s$, Model 3, Table 4). Hypothesis 3 enquired about self-esteem in the face of supply chain disruptions with low familiarity. These results ($\beta=0.141$, $p<0.05$, Model 4, Table 4) were in line with what we expected. However, given that the direct effects of self-esteem on mitigation performance was negative, and as confirmed by the interaction charts, we notice that the effect is in the opposite direction to what was hypothesized. Therefore, H3 was not supported. Finally, Hypothesis 4 posited that trusting personality plays an important role in the face of surprising disruptions. The results confirmed H4 ($\beta=0.723$, $p<0.01$, Model 5, Table 4). While not hypothesized, we notice support for the moderating effects of situational awareness. Situational awareness has a positive effect on mitigation performance when facing unfamiliar disruptions ($\beta=0.005$, $p<0.10$, Model 5, Table 4). To confirm and better illustrate the moderation effects, we graphed the interaction effects following procedures set forth by Cohen and Cohen (1987). Figures 1, 2 and 3 show these results.

Insert Figures 1,2 and 3 about here

Discussion and conclusions

Results of our tests carry some very interesting findings to share. To start, the fact that there is overall support in how decisiveness improves supply chain disruptions should be of value to researchers and practitioners. Considering that we assessed the effects of a multitude of other traits, and only one trait (i.e. leader decisiveness) carried a direct and positive effect is interesting. This finding is, to some degree, corroborated by the reverse effects of deliberative

leadership. The clear message offered from these results is that major supply chain disruptions are not occasions for re-examining assumptions, or deliberating on evaluation and analysis of perspectives by leaders. Instead, leaders that quickly and efficiently decide on a course of action are better able to help their company.

A second finding is on the effects of leaders with trusting personality in the face of surprising disruptions. As can be seen in Figure 2, there is a clear rise in mitigation performance when a surprising disruption is led by a leader that carries strong versus weak trust. More interestingly, is the fact that leadership trust seems unnecessary when the organization is facing a disruption that is not-so surprising. In such circumstances, a trustable leader seems unnecessary to help with mitigation efforts. Results for the interaction of rare supply chain disruptions (low familiarity) with confidence did not offer the insights we expected. In fact, we found that the direct effect of leader self-confidence showed to be in the opposite direction that was hypothesized. This may be due to the way that the items on the self-confidence scale were interpreted/read by the respondents. Additional research may help in clarifying this outcome. The item scales (Table 2), included questions about how people interpreted leader's over-confidence instead of her self-esteem. Literature on excessive leader confidence does suggest that those with overt self-assuredness, presumptuousness and do hinder performance ([Collinson, 2012](#); [Shipman & Mumford, 2011](#)).

A third interesting finding is related to the contingent effects of situational awareness. While we thought that situational awareness would be a trait of impact in facing major supply chain disruptions, the fact is that it carries a positive effect only in the face of surprising disruptions. Indeed, charting the results suggest that in the face of more surprising disruptions, leaders that have a reasonably clear mental model of the situation do help in mitigation

performance. However, situational awareness did not carry a positive effect in other situations. Arguably, it is only under the time pressure and ambiguity associated with surprising disruptions that supply chain personnel rely on the situational awareness of their leader.

Contributions to Theory and Practice

The business scene is populated by an assortment of individuals who, at unscheduled times, have risen to lead organizational efforts in the face of adversity (e.g. [Gattiker & Carter, 2010](#); [Gattiker, Carter, Huang, & Tate, 2014](#)). Similarly, literature is replete with cases where lack of an effective response strategy from the leader has led to mis-management which made the matter worse ([Shaw & Goda, 2004](#)). For instance, the lack of leadership was considered as one of the biggest factors hindering the governmental relief efforts in the wake of Hurricane Katrina ([Kapucu, 2009](#)). Leadership in the face of disruptions is of particular concern for supply chains. Yet, research on this topic is exceedingly sparse. Given the complexity, and potentially devastating effects of these events, it is imperative to have individuals that are capable to decide on a plan of action and direct resources.

This study highlights leadership traits that play particularly notable part in addressing supply chain disruptions. The primary contribution of the study is in offering a rigorous and multi-step approach which investigates a plethora of leader skills, as well as characteristics and attributes needed to identify those which are particularly nascent in facing supply chain disruptions. We believe this streamlined set of traits can be a contribution to research as it allows supply chain researchers to place their focus in areas that are of more value in studying leadership traits.

Our second contribution to research is in offering a distinction between leadership traits that are considered omnibus in the face of supply chain disruptions in contrast to those that may

be more suited for disruptions with particular characteristics (i.e. baseline versus contextual traits). We theorized, offered anecdotal examples, and empirical evidence on how leader decisiveness and lowered deliberativeness seem to be particularly important for all forms of supply chain disruptions studied. Others, such as self-esteem and trusting personality are traits that may be necessary for more contextual circumstances. Our work here offers further evidence to the limited empirical work that explores this area (e.g. Gordon & Yukl, 2004).

Our third contribution is in offering a theoretical and literature-based differentiation of types of supply chain disruptions. Research on supply chain risk management has primarily concentrated on preventing disasters and planning for a response in advance (citation). Much less focus has been placed in empirical assessment of how supply chain disruptions are actually managed. The limited works on supply chain disruptions differentiates them as major and minor disruptions based on their level of severity and frequency of occurrence (Chopra and Sodhi, 2014; Norrman & Jansson, 2004). We extend research in studying supply chain disruptions by suggesting that major supply chain disruptions can offer varied challenges based on the level of their complicatedness, rarity and surprising effects. Here again, we believe better refinement and definition of these forms of major supply chain disruptions allows researchers to better focus their efforts in studying the phenomenon.

In terms of managerial relevance, our work here helps streamline the process of selecting individuals that are to be chosen for directing company efforts to minimize the damage caused by supply chain disruptions. Having to face supply chain disruptions and their impact is, regrettably, an almost inevitable fact. As the business environment for many companies continues to evolve into a more complex network of interdependent supply chain partnerships, the need for leaders that can spear head business interruptions becomes an important aspect of

mainlining one's competitiveness. Our empirical results point to particular traits that should be of value in that regard. While companies may be bombarded with an overabundance of advice based on soft evidence, the study here offers hard evidence based on statistical analyses and credible peer-reviewed research. These findings should help company decision makers to confidently select those who are to take charge in times of crises.

Limitations and Future research

As with any research effort, this paper has limitations that could impact the generalizability and validity of the results. Respondents were representatives from Italian companies. A wider range of respondents could make the results more generalizable. Future studies to examine whether the same leadership traits essential for supply chain disruptions in other countries. Additionally, the data is cross-sectional. Due to the difficulty in collecting firm-level primary data, we relied on cross-sectional data, and combined it with COMPUSTAT style archival information. However, the findings will be more convincing if longitudinal data is applied. This research primarily investigated main effects of leadership traits on disaster's impact on operational performance without examining the mediation process. We note that the relationships were simplified by looking at each unique trait separate from the effect of others. Future research can expand our study by adding the mediating and moderating effects mechanism.

Additionally, future research may consider alternative designs and examine related theories. Depth interviews with industry experts may be useful in uncovering additional factors relevant to leadership during supply chain disruptions, which can further be tested with experiments, surveys, or modeling techniques. Additionally, the results need to be considered in relationship with various leadership theories. For example, as a variety of leadership contingency theory, situational leadership theory has seen a dwindling level of interest from

researchers in recent years, yet may offer an important perspective through which to examine leadership within supply chain disruptions. We hope that this study offers a foundation from which future investigations on this important topic can be developed.

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TABLE 1
Literature in leadership traits during crisis

	Explanation	Research	Supply Chain Disruption Traits	Selected for Analysis and Hypotheses (based on literature and Q-Sorting)	Definition:
Personal Attributes	<p>Definition: Skills related to cognitive capacities as well as other personal characteristics that effect leader’s decision making</p> <p>Examples: 1) Stress-resistance 2) Emotional development 3) Cognitive ability 4) Confidence 5) Charisma 6) Flexibility 7) Personal integrity</p>	Dubrin, 2013; Sun & Adnerson, 2012; Van Wart & Kapucu, 2011; Vessey et al., 2011; Boin et al 2008; Devitt & Borodzics, 2008; Van Wart, 2005; Schoenberg, 2004; Grant and Mack, 2004; Bass and Avolio, 1993; Atwater et al., 1991;	1. Self-confidence 2. Decisiveness 3. Resilience 4. Optimism 5. Self-esteem	1. Decisiveness 2. Self-esteem	<p><u>Decisiveness:</u> Exercises good judgment by making sound and well-informed decisions. Perceives the impact and implications of decisions. Makes effective and timely decisions, even when data are limited or solutions produce unpleasant consequences.</p> <p><u>Self-esteem:</u> Feels comfortable with himself. Demonstrates confidence in the ability to successfully achieve the goals. Does not feel threatened by others ideas.</p>
Interpersonal Skills	<p>Definition: Skills required for coordination of actions of oneself and others, for reconciliation of differences among employee perspectives, and for influencing others to accomplish organizational objectives</p> <p>Examples: 1) Negotiation skills 2) Persuasion skills</p>	Dubrin, 2013; Sun & Adnerson, 2012; Boin et al. 2008; Devitt & Borodzics, 2008; Zaccaro, 2007; Klann 2006; Van Wart, 2005; Schoenberg, 2004; Wallace & Suedfeld, 1988;	1. Trusting personality 2. Communication skills 3. Inspirational motivation 4. Social skills 5. Influencing and negotiation	1. Trusting personality 2. Inspirational motivation	<p><u>Trusting personality:</u> Trusts partners and employees. Believes what others say, trusts that other people have good intentions, delegates responsibilities. Is not suspicious of others. Allows subordinates to be empowered to accomplish things.</p> <p><u>Inspirational motivation:</u> Possess idealized influence. Has a charismatic personification of the</p>

	<p>3) Meeting skills 4) Motivation 5) Social adeptness 6) Leadership style 7) Communication skills</p>				values and mission of the organization. Has ability to inspire and motivate followers
Organizational Leadership Behaviors	<p>Definition: Skills that enable leaders to deal with ambiguity and affect the influence in the organization as well as skills related to specific functional areas that create the context in which most leaders work.</p> <p>Examples: 1) Strategic thinking 2) Decision making 3) Problem solving 4) Managing innovation and creativity 5) Continual learning 6) Operations planning 7) Moral reasoning</p>	<p>Van Wart & Kapucu, 2011; Liu, Chang, Zhao, 2009; Kapucu & Van Wart, 2008; Devitt & Borodzics, 2008; Van Wart, 2005; Kovoov-Misra, 2002. Atwater et al., 1991; D'Aveni & MacMillan, 1990;</p>	<p>1. Deliberative 2. Strategic Planning 3. Situational Awareness 4. Operations planning 5. Problem solving</p>	<p>1. Situational Awareness 2. Deliberative Leadership</p>	<p>Situational Awareness: Involves being aware of what is happening in the vicinity, to understand how information, events, and one's own actions will impact goals and objectives, both immediately and in the near future</p> <p>Deliberative: Thinks carefully and often slowly, as about a choice to be made. Consults with another or others in a process of reaching a decision.</p>

TABLE 2a

Measurement Items and Reliability of Leadership Traits

Constructs	Measurement Items	Cronbach's Alpha
Self-Esteem	believes he is taken seriously by others	0.861
	believes people have faith in him	
	believes he is trusted by others	
	believes he is valuable to the organization	
	believes he has a number of good qualities	
Trusting Personality	behaves consistently over time and across situations	0.892
	tells the truth and keeps promises	
	shares and delegates control	
	's communications about decisions are accurate and forthcoming.	
	shows consideration and sensitivity for employees' needs	
Deliberative Leadership	re-examines assumptions	0.876
	seeks different views	
	suggests new ways	
	suggests different angles	
Inspirational Motivation	says positive things about the work unit	0.923
	encourages people to see changing environments as situations full of opportunities	
	articulates a vision of future opportunities.	
	talks optimistically about the future.	
Decisiveness	never pushes off making important decisions	0.878
	's decision are timely	
	rarely struggles with making decisions	
	usually can see the one best solution to a problem quickly	
Situational Awareness	is able to make sense of things happening around him/her	0.908
	has a reasonably clear mental model of most situations	
	understands the critical factors and changes in a situation	
	understands what the changes in the environment mean when they are integrated together	
	has an appreciation for what may happen in the near future	

Note: Questions all started with "Our Leader...."

TABLE 2b
Measurement Items and Reliability for Disruption Type and Outcome variable (Mitigation Performance)

Constructs	Measurement Items	Cronbach's Alpha
Unfamiliar Disruptions	Is similar to what we experience frequently	0.767
	Is a typical disruption that our business faces	
	Is one we are experiences in managing and responding to	
	People were not surprised to hear about	
Complicated Disruptions	Number of links in the flow of goods between you and your suppliers affected by this disruption.(each buyer-supplier connection is one link)	0.839
	Number of links in the flow of goods between you and your customers affected by this disruption. (each buyer-supplier connection is one link)	
Surprising Disruption	Compared to other disruptions, we had ample warning before this disruption occurred	0.844
	Compared to other disruptions, we had adequate preparation time before the disruption's effects were felt	
	Compared to other disruptions, warning signals for this disruption were more certain	
	Compared to other disruptions, the size and effect of this disruption was predictable in advance	
Mitigation Performance	1. Overall efficiency of our operations 2. Responsiveness to customer demands 3. Delivery reliability (on-time delivery, order accuracy) 4. Sales 5. In terms of procurement costs & price of purchased items 6. Product quality of our final product(s) 7. Access to technology	0.885

TABLE 3
Descriptive Statistics

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1 Decisiveness	5.03	1.27	1											
2 Situational Awareness	5.18	1.19	0.770**	1										
3 Deliberative Leadership	5.3	1.27	0.667**	0.715**	1									
4 Inspirational Motivation	5.36	1.32	0.721**	0.746**	0.749**	1								
5 Self-Esteem	5.85	0.87	0.391**	0.391**	0.318**	0.371**	1							
6 Trusting Personality	5.18	1.19	0.739**	0.698**	0.762**	0.769**	0.337**	1						
7 Disruption Complexity	4.54	1.64	0.09	0.064	0.056	-0.005	0.108	0.049	1					
8 Disruption Familiarity	2.6	1.61	-0.042	-0.038	-0.057	-0.032	-0.136*	-0.039	-0.09	1				
9 Disruption Surprise	5.01	1.57	0.027	0.009	0.05	0.019	0.035	0.034	0.04	-0.654**	1			
10 Size (sales)	2.84	1.95	0.052	-0.027	-0.004	-0.046	-0.031	0.029	0.015	0.163**	-0.082	1		
11 Dynamism	4.42	1	0.012	0.002	-0.017	-0.027	0.08	-0.051	0.217**	0.06	-0.193**	0.054	1	
12 Mitigation Performance	4.80	1.26	0.102	0.05	-0.046	0.073	0.02	-0.002	0.160*	0.01	-0.01	0.017	0.198**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Note: Industry category (eight binary variables) are not included for purpose of parsimony

Sample Size: 286

TABLE 4
Multiple Regression Analysis – Outcome variable: Supply Chain Disruption Mitigation Performance

	Model 1 Controls		Model 2 Direct effects		Model 3 Disruption Complexity		Model 4 Disruption Familiarity		Model 5 Disruption Surprise	
	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value
Control Variables										
Size (Sales)	-0.031	n/s	-0.040	n/s	-0.048	n/s	-0.043	n/s	0.034	n/s
Industry Category	0.193	n/s	0.257	n/s	0.123	n/s	0.157	n/s	0.910	n/s
Dynamism	0.268	0.002	0.268	0.002	0.231	0.008	0.281	0.001	0.462	0.002
Baseline Leadership Traits										
Decisiveness [H1a]			0.215	0.040	0.244	0.080	0.619	n/s	0.407	n/s
Situational Awareness [H1b]			0.005	.965	-0.020	n/s	-0.409	n/s	0.270	n/s
Deliberative Leadership [H1c]			-0.197	0.030	-0.188	0.013	-0.141	0.019	0.018	0.069
Contextual Leadership Traits										
Inspirational Motivation					1.410	n/s				
Self-Esteem							-0.424	0.032		
Trust									0.176	n/s
Disruption Type (Direct Effect)										
Complexity					-0.199	n/s				
Familiarity							0.007	n/s		
Surprise									0.064	n/s
Moderation Effects										
Complexity* Inspirational Motivation [H2]					-0.523	n/s				
Familiarity*Self-Esteem [H3]							0.141	0.020		
Surprise*Trust [H4]									0.723	0.004
<i>Surprise*Situational Awareness</i>									0.005	0.054
Intercept	3.505		3.461		4.533		5.705		3.587	
R²	0.061		0.09		0.145		0.135		0.148	
<i>delta R²</i>	0.061		0.029		0.055		-0.010		0.013	
<i>Adjusted – R²</i>	0.025		0.043		0.084		0.067		0.081	
<i>delta Adjusted – R²</i>	0.025		0.018		0.037		-0.017		0.014	
F-value	1.709	0.088	1.921	0.033	2.389	0.003	1.998	0.009	2.208	0.004

TABLE 5
Summary of results

Hypotheses	Independent Variable	Moderator	Dependent Variable	Results
H1a	Decisiveness	-	Mitigation Performance	Supported
H1b	Situational awareness	-	Mitigation Performance	Partially Supported*
H1c	Deliberative Leadership	-	Mitigation Performance	Partially Supported
H2	Inspirational Motivation	Complexity	Mitigation Performance	<i>Not Supported</i>
H3	Self-esteem	Familiarity	Mitigation Performance	<i>Not Supported</i>
H4	Trusting Personality	Surprise	Mitigation Performance	Supported

* Situational Awareness carries a positive effect on mitigation performance in the face of surprising disruptions.

FIGURE 1
 Moderation effect of disaster familiarity on how leader's self-esteem affects firm expected performance (H3)

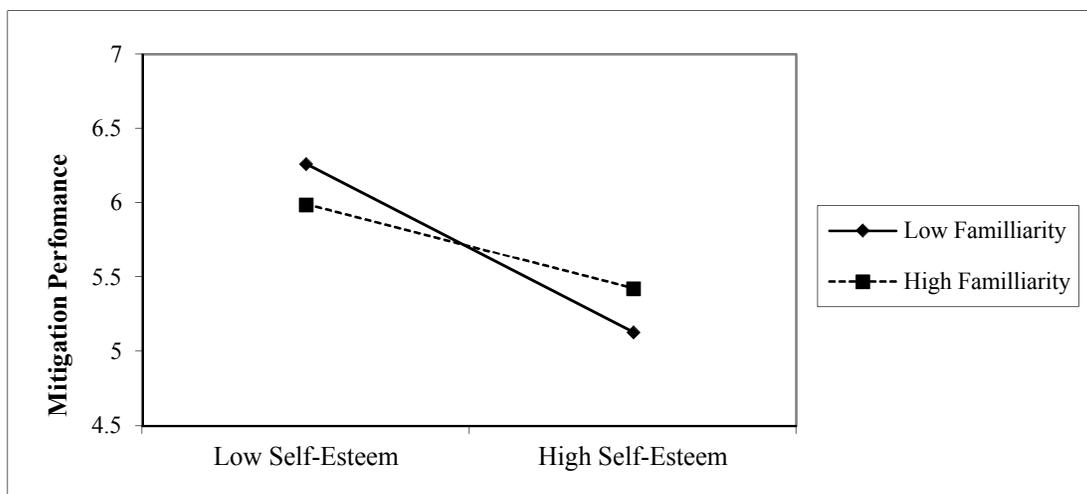


FIGURE 2
 Moderation effect of disaster familiarity on how leader's self-esteem affects firm expected performance (H4)

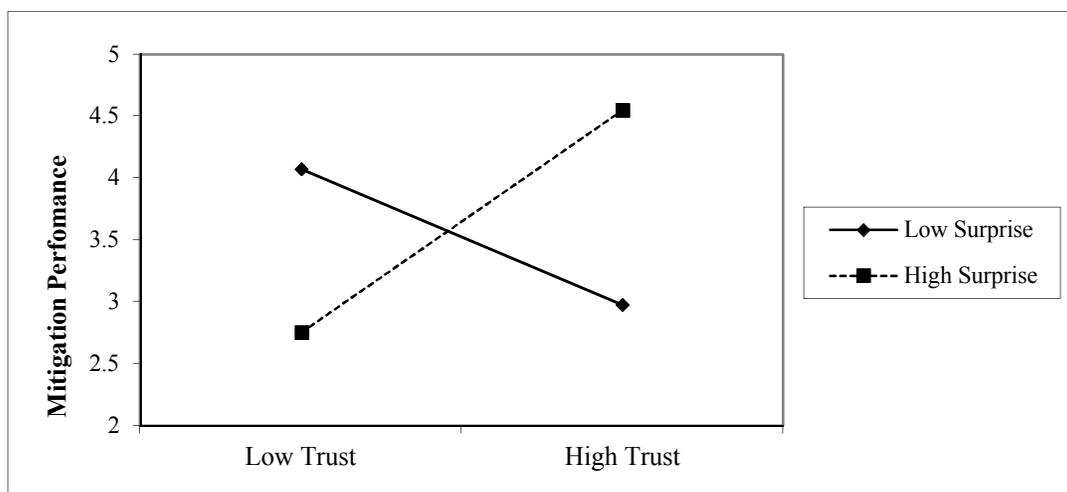


FIGURE 3
Moderation effect of disaster familiarity on
how leader's self-esteem affects firm expected performance (Partial Support for H1b)

