Global Supply Chain Dynamics in the Mobile Handset Industry

by

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Finally, my family stood by me along my long journey of dissertating. I would like to dedicate my dissertation to my family, in the order of the duration I have known him or her: my parents, my brother, my sister-in-law, my wife Maddy O, my cat Lil' MO, my nephew, and my niece.

I love you all!

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ABSTRACT

The 21st century features disaggregated supply chains that can reduce costs but also limit firms' ability to monitor and control critical processes, including labor practices and the sourcing of supplies. My dissertation examines issues of sustainability, accountability, and organizational structure in today's world of globally dispersed supply chains. In particular, I empirically examine the evolution of buyer-supplier relationships in the mobile phone industry.

The first empirical essay concerns how labor issues affect buyer−supplier relationships at the dyadic level. I examine the manner and mechanisms by which mobile phone companies respond to labor protests targeting their suppliers. I find that user-generated social media content can help make buyer-supplier relationship more visible to the public, pushing firms to disengage from protested suppliers. I also compare the consequences of labor protests, for which suppliers are partially responsible, to natural disasters, for which suppliers are not responsible. Furthermore, I conduct an exhaustive search of press releases and newspaper articles, and find that firms rarely acknowledge supply chain labor issues. This essay suggests that increasing the visibility of buyer−supplier links through user-generated social media can make firms more accountable for supply chain labor issues.

The second empirical essay investigates how an industry-wide, sudden increase in the visibility of supply chains influences network mechanisms driving supply chain network evolution. I utilize stochastic actor-oriented models, specifying several events that occurred in 2010 as an environmental jolt. The findings indicate that the supply chain network became denser after the jolt, resulting in more opportunities for suppliers to attract new relationships. However, the level of network inequality also increased—previously popular suppliers captured most of the new opportunities. Thus, a previously dispersed and modularized network became more centralized, featuring a strong core-periphery structure. Firms' endeavors to achieve supply chain sustainability in the aftermath of environmental jolts may allow established suppliers to remain entrenched as central players in the network.

Overall, my dissertation underlines the importance of studying global supply chains to better understand industry evolution and corporate strategy in the 21st century. This work seeks to contribute to the research on organizational accountability, social movements, and social networks.

CHAPTER ONE

Introduction: Dissertation Overview

Nowadays, firms rarely operate as Ford Motor Company did in the 1930s. They do not make every part on-site. Neither do they own mines and plantations overseas. Instead, they rely on a network of suppliers. The 20th century's vertically integrated corporation has been supplanted by disaggregated global supply chains across many industries. "Nikefication" can be observed in close to all industries, from electronics to garments, and even pet food (Davis, 2013). Apple iPhones, Gap clothing and Nestlé Purina cat food are all manufactured by distant, unknown contractors, not by the brand name company that most consumers can easily recognize. Although dispersed supply chains can significantly reduce firms' cost structures, they also limit their ability to monitor and control critical processes, including labor practices and the sourcing of materials. This presents many challenges around effectively pursuing sustainability and social responsibility objectives beyond a focal firm's legal and physical boundary.

One major issue with globally dispersed supply chains is that it makes detecting the identity of suppliers extremely difficult (Kim & Davis, 2016). For example, in 2013 Bangladesh's Rana Plaza collapsed, killing over 1,100 garment workers. In the aftermath of the Rana Plaza disaster, authorities in Dhaka could not even determine the number of factories that fell under their jurisdiction, and some global brands reported that their products were being produced by unauthorized subcontractors. Companies like Apple and Hewlett-Packard have had

to spend extra efforts to vet their supply chains and clean their products from the use of conflict materials. While there is some evidence that working conditions at first-tier suppliers are getting better, even car manufacturers, which rely heavily on their supply chains, have difficulty identifying their fourth- or fifth-tier suppliers.

Another major issue with globally dispersed supply chains is that they make it challenging for firms to implement sustainability policies. One study found that in 2009, only six firms out of the Fortune 500 were able to disclose full information on greenhouse gas emissions across their entire value chain (Jackson, 2011). Indeed, more than half of a typical corporation's carbon emissions come from its supply chain rather than within its own boundaries (AT Kearney, 2011). Assessing overall environmental or social risks requires engagement with suppliers several steps back, which are often invisible to firms.

Finally, as supply chains are increasingly becoming longer, more dispersed, and more complex. Companies are also increasingly exposed to high impact low probability discrete events along their supply chains (Kleindorfer & Saad, 2005). From the buying company's perspective, these events can lead to a failure in cost reduction, in quality and in volume. Such supply chain disruptions may not only impair the production process, but may also tarnish stakeholders' perceptions of the focal company (Hoejmose, Roehrich, & Grosvold, 2014). As a result, both financial performance and reputation can be affected by how a firm manages disruptions occurring outside its direct control.

My dissertation explores the interplay between social supply chain sustainability and supply chains dynamics. Specifically, my two research questions are as follows: (1) what are the manners and mechanisms by which companies respond to social movements targeting their

suppliers?; (2) what network mechanisms drive network evolution following a shift in field-level attention and visibility that pertains to labor issues in supply chains?

Theoretically, my dissertation is motivated from three interrelated literatures in organizational research. First, research on covert and corrupt networks suggests that the networks consisting of actors who have unethical or secretive objectives typically feature a distinct network structure with distinct properties (e.g., Aven, 2015; Baker & Faulkner, 1993; Erickson, 1981; Krebs, 2002). Staying invisible and achieving the necessary coordination between its members are often incompatible goals that force a trade-off. Insights from this line of research can be drawn to identify network structures that are likely to be associated with secretive, unethical behaviors (Lauchs, Keast, & Yousefpour, 2011), or to design network structures that optimize communication among network members while minimizing the probability of being exposed (Lindelauf, Borm, & Hamers, 2009). Given the dispersed, opaque nature of global supply chains, I am interested in understanding the impact of supply chain visibility, which can be defined as "the identity, location and status of entities transiting the supply chain, captured in timely messages about events" (Francis, 2008: 182). I investigate how a sudden increase in the network visibility changes firm behavior and subsequent network structures. I also differentiate between different types of networks which correspond to different breadths of exposure (or visibility): When a certain node or dyad has been exposed (or becomes visible) due to a negative event, will firms sever that relationship? If the entire industry faces such an increase in exposure, how will firms' networking patterns change? Given the recursive nature of social actions and social structures (Giddens, 1984), I explore how social structures constrain actors' underlying networking patterns, and how actors modify social structures by changing their previous networking patterns.

Second, research on visibility teaches us that firms that receive high levels of public attention are subject to greater levels of external pressures and demands (Salancik, 1979). Visible firms receive more media attention, making them more vulnerable to shareholder activism and protests (King & McDonnell, 2015; Rehbein, Waddock, & Graves, 2004). Visible firms also receive more diverse and intense stakeholder demands, and they seek to accommodate diverging interests from stakeholders (Brammer & Millington, 2006; Fiss & Zajac, 2006). This line of research suggests that visibility, either at the node, dyad, or field level, may push firms to be more highly sensitive to social and political stakeholders. I link these arguments with the attention-based view of the firm (Ocasio, 1997), which argues that firm behavior is the result of how an organization channels and distributes the attention of its decision-makers. I propose a model in which external stakeholders (e.g., social media users, journalists) increase the visibility of select parts of supply chain networks, which influences firm decision-makers' assessment of how much attention they should focus on particular issues and answers. Throughout my dissertation, I argue that firms' decision-making is partially determined by outsiders' or public attention which shapes the particular situation in which the firm finds itself; and the efforts intended to raise outsiders' or public attention can be an effective social movement strategy targeting firms (e.g., Luo, Zhang, & Marquis, 2016).

Finally, my dissertation draws heavily from research on network dynamics and field evolution (Ahuja, Soda, & Zaheer, 2012; Fligstein & McAdam, 2011, 2012; Powell, White, Koput, & Owen-Smith, 2005). Firms as collective actors are made up of an organizational field, and interorganizational networks facilitate or constrain economic action among members. While usually these fields (or networks as a whole) reproduce themselves (Bourdieu & Wacquant, 1992), the dominant logics that make these fields persistent and sticky can be challenged. Extant

literature suggests the source of such challenges can be both local (i.e., affects a part of the field) and global (i.e., affects the entire field). Within a field, there are challengers who occupy less powerful positions within the field and normally have little influence over the constitution of the dominant logic. However, at times the challengers can mobilize and create contentious episodes (Gamson, [1975]1990). Such episodes of contention, in turn, can change the interaction pattern between the dominant incumbent and the challengers (Fligstein & McAdam, 2012). At the same time, destabilizing shocks or jolts occasionally occur and they perturb the stability of the logic constituting the social structure. Such "shocks" to a system "…can destabilize it and result in a tip in the rules of affiliation and the resulting combinatorial possibilities" (Powell et al., 2005:1190). Therefore, the occurrence of an environmental jolt, i.e., a low probability discrete event impacting all market participants, provides an opportunity to investigate the process by which an organizational field transforms. My focus on supplier labor protests directly draws from this argument, investigating how such events change network dynamics both at the dyadic level and the global network level.

Data availability has been one of the biggest challenges of empirically studying supply chain relationships. Organizational scholarship on supply chain relationships has typically relied on survey methods (with Uzzi, 1997, being a notable exception), asking company managers to recall a list of their suppliers. Sometimes researchers work with a single target company, which gives them detailed insider information on the company's suppliers. However, given the increasing complexity of supply-chain networks, which often incorporate multiple tiers of suppliers (i.e., second, third, and above), many manufacturers may have limited insight into the functioning of the overall supply-chain network.

Brammer and his colleagues' (2011) review on the sustainable global supply chains literature best describes the state of the research. The literature is presently dominated by case-based and anecdotal analyses that highlight the problems and issues faced when managing global supply chains. The most popular research method is face-to-face interviews (emphasis on qualitative approaches), followed by postal surveys. The rigor of research is often questioned, showing relative lack of theoretical contributions. Another problem is the selection issue in terms of the industries researchers are choosing to study. About half of all studies focus on the textiles/apparel industry, which can be described as a labor-intensive, non-high-tech field with a sufficient number of replaceable suppliers along the supply chain.

Therefore, in this my dissertation I chose to study the supply chain network in the mobile handset industry. This industry is highly competitive, making it very difficult for a company to maintain competitive advantage for a prolonged period (e.g., Motorola, Nokia). Most users abandon their cellphones in 20 months. Production usually spans multiple countries, and to make mobile handsets, one needs both state-of-the-art chipsets as well as sweatshops for assembly. The complex nature of the industry also invites a long list of technology-related problems (e.g., patent war between Apple and Samsung) as well as labor-rights-related problems (e.g., Flextronics's indentured servitude).

Overall, this dissertation has three goals. First, I aim to underline the importance of understanding global supply chains in order to better understand industry evolution and corporate strategy in the 21st century. Given today's organizations' heavy reliance on global supply chains, the small number of organizational theories and methodologies addressing global supply chain dynamics is surprising. Second, I seek to contribute to the research on supplier selection by introducing how the concern for social sustainability can shape supplier (partner) choice. This

complements existing research, which focuses on the cost minimization and risk management objectives of suppliers. Finally, I seek to provide new data sources (e.g., teardown reports of a product, social media posts) and methods (e.g., topic modeling, simulation) to improve research on organizational accountability. As much as a significant portion of sustainability-related issues stem from the dispersed and opaque nature of the production process, researchers also need to equip themselves with innovative way of capturing the problem. In this regard, I hope to show how new "big data" research can help address perennial organizational questions.

The remainder of this dissertation consists of four chapters. In the following chapter, I provide an overview of supply chain networks in the mobile handset industry (Chapter Two). In Chapter Three, I investigate the manner and mechanisms by which social movements (e.g., labor protests and strikes) influence buyer-supplier relationships, using a sample of mobile handset manufacturers and their first-tier suppliers from 2002 to 2014. In Chapter Four, I study how an industry-wide, sudden increase in the visibility of the supply chains influences the evolution of organizational fields, using the events that occurred in 2010 as an environmental jolt in a simulation study. Finally, in Chapter Five, I summarize the key findings and provide implications for future research.

CHAPTER TWO

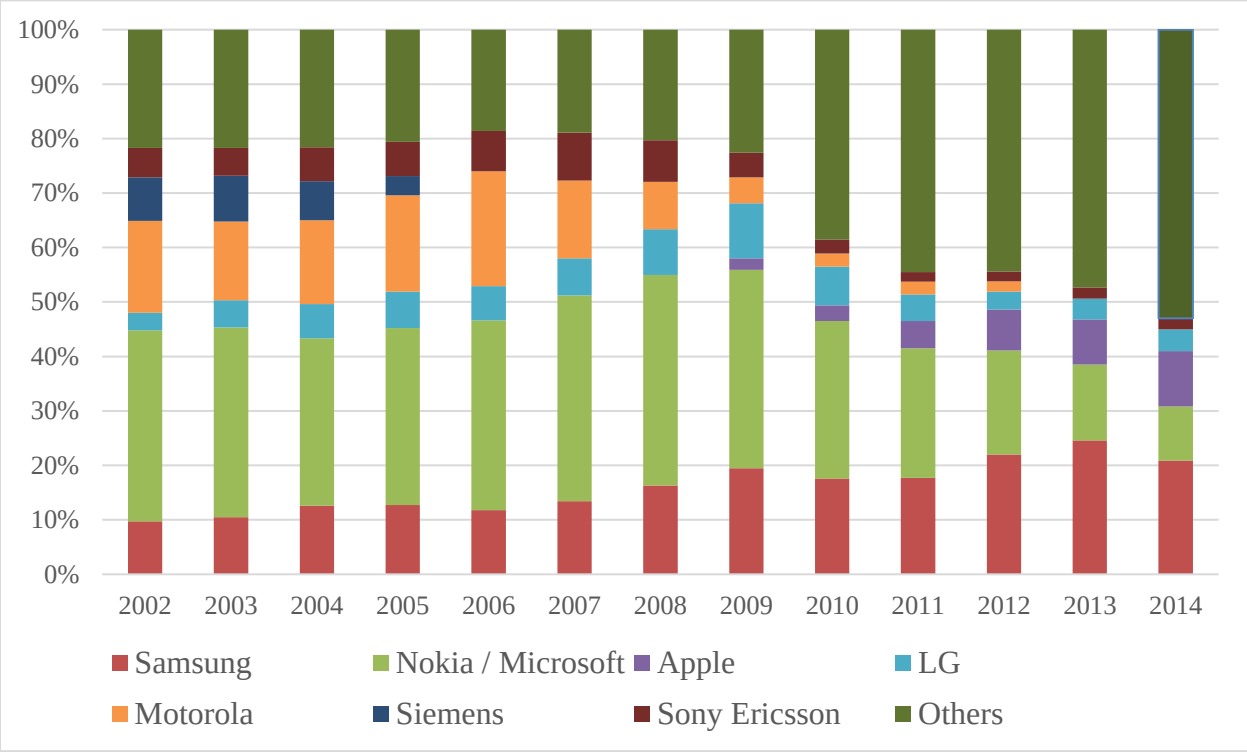
Context: Global Supply Chain Networks in the Mobile Handset Industry, 2002-2014

The purpose of this chapter to give an overview of the empirical context of my dissertation: supply chain networks in the mobile handset industry from 2002 to 2014. Mobile handsets have become very pervasive in people's everyday lives. According to a Pew Research survey (2017), in the United States about 62% of adults owned a cellphone in 2002, the beginning of my observation period. This number increased to 90% in 2014, which is the end of my observation period. The percentage of U.S. adults owning a smartphone skyrocketed from 35% in 2011 to 77% in 2016. As of October 2014, there are more active mobile devices (including tablets and feature phones) in the world than there are people, according to GSMA's real-time tracker (https://www.gsmaintelligence.com/).

Another reason why I focus on this industry is because it represents the dominant features of the current economy. One of Peter Evans's (1995) insights was that a nation state's political-economic structure and strategy can be best understood by vetting a representative product or industry, and that examining how such representative products are made or how such industries grow contributes to understanding the economic, social, and technological characteristics of a nation state. Arguably, the automotive industry was the quintessential industry of the 60s and 70s, followed by the computer and semiconductor industries in the 80s and 90s. In the 21st century, the mobile handset industry is the archetypal industry that embodies the characteristics of late

capitalism: high level of competition, technology-intensiveness, and heavy reliance on global supply chains. As shown in Figure 1, this industry is highly competitive, making it very difficult for a company to maintain competitive advantage for a prolonged period (e.g., the demise of Motorola and Nokia). Industry analysts estimate that most phones have a market life cycle of 9 to 12 months; most users change their cellphones in 24 months (Entner, 2011).

Figure 1. Market Share of Worldwide Mobile Phone Unit Sales, 2002-2014



Notes:
"Others" include mobile phone brands that had market share figures that were smaller than 5% throughout the entire observations period. Examples include Research In Motion (BlackBerry), Xiaomi, and Lenovo.
Source: Gartner

Like most companies in the electronics sector that aim to outsource more than 70 percent of their manufacturing (Doig, Ritter, Speckhals, & Woolson, 2001), most mobile phone brands outsource their manufacturing to vendors in China or other Asian countries. When Apple, headquartered in

Cupertino, Calif., makes an iPhone for $179, $114 of the $179 goes to Japanese, German, and South Korean suppliers, while only about $11 goes to American workers (Rassweiler, 2009). Production of mobile handsets usually spans multiple countries, and to make mobile handsets, one needs both state-of-the-art chipsets as well as sweatshops for assembly. As a result, buyer-supplier relationships tend to endure in this industry. Indeed, a longitudinal analysis on supplier selection in this industry documents that there are high perceived switching costs and strong inertia in customer–supplier matches (Alcacer & Oxley, 2014).

At the same time, the mobile handset industry is no stranger to labor rights violations. For instance, the series of tragic suicides in Shenzhen-based Foxconn, one of Apple's major suppliers, forced Apple to request a third-party investigation (Josephs, 2013). It took nearly eight years for Samsung, another major manufacturer, to acknowledge the association between the unsafe work environment in its own and subsidiaries' factories, and the unending chain of workers who died from leukemia (Robbins, 2015).

DATA

The population of my study consists of all mobile handset manufacturers around the world, as well as their suppliers, for mobile handsets that were released from 2002 to 2014. This period covers both the era of feature phones and the era of smart phones. 2007, the year in which the original iPhone was introduced, sits in the middle of the observation period. Since companies consider the identity of their suppliers to be proprietary information, collecting supply chain information across multiple companies introduces a significant barrier for researchers. For example, the High Performance Manufacturing (HPM) project is an ongoing global research network to collect detailed plant-level information in the automobile, machinery, and electronic industries (Schroeder & Flynn, 2001). However, linking individual participants' survey

responses with other databases is effectively impossible. Another commonly-used source of buyer-supplier relationship data is the Compustat Segment file (e.g., Cohen & Frazzini, 2008). Regulation SFAS No. 131 requires suppliers to disclose any major customer that represents more than 10% of its total reported sales. The Compustat segment data capture this information, but entail two noticeable limitations. First is the sampling bias; since only major customers contributing more than 10% of sales are reported, data are missing for small customers, thus making it difficult to comprehensively capture buyer-supplier relationships. Second is the omission of major international (non-US based) suppliers despite the fact that firms have increasingly relied on global suppliers over the past decade (Wang, Li, & Anupindi, 2015).

As an alternative, to capture fine-grained supplier-manufacturer relationships in the global mobile handset industry, I extracted each component's maker (suppliers) information from individual models' bill-of-materials compiled by Information Handling Services (IHS). This company buys electronic products and breaks them down to trace their component suppliers. Each phone contains hundreds of components. Once the IHS technicians decompose a phone into its components, they extract the lot number assigned to each component and verify the component's supplier name, function, cost, and specification. I obtained all mobile handset teardown reports published by IHS until 2014, which yielded 399 models. On average, a mobile phone in my sample consists of 290 components, with a standard deviation of 130.

Figure 2 shows a snapshot of a bill-of-materials report analyzing Apple iPhone 4. Throughout my dissertation, I call the companies appearing in the second column (e.g., Samsung, Toshiba, Cirrus Logic) the buyer's (Apple in this example) component suppliers. When a buyer's name (mobile phone brand name) is identical to a component suppliers' name, I assume that component was made in-house as opposed to being outsourced. The identity of assemblers such

as Foxconn is unverifiable for each mobile handset as companies only have to disclose the assembler's location at the country level (e.g., "Made in China"). Accordingly, all suppliers shown in my dissertation are component manufacturers.

Figure 2. A Snapshot of Apple iPhone 4's Bill-of-Materials Report

Function	Manufacturer	Part Number	Description	Cost
Memory				$40.40
Includes	Samsung	K9HDG08U5A-LCB0	Flash - NAND, 16GB, MLC	
	Samsung	K4265J1PB-50-F	SDRAM - Mobile DDR, 4Gb, PoP (Assumption - Two Dies, To Be Verified)	
	Toshiba		MCP (To Be Verified)	
Display / Touch Screen				$37.80
Includes	Display Module - 3.5" Diagonal, 16M Color TFT, 960 x 640 Pixels			
	Touchscreen Assembly - Aluminosilicate Glass, Painted, w/ Integral Flex PCB, & Board to Board Connector			
Mechanical / Electro-Mechanical				$19.97
Includes	Includes - PCBs, Enclosure Plastics, Glass & Metals, Etc.			
Baseband / RF / PA (Including GPS)				$16.41
Includes	Qualcomm	MDM6600	Baseband / RF Transceiver - Dual-Mode, CDMA2000 1xEvDO/HSPA+	
	Skyworks	SKY77711-4	PAM - CDMA 1900	
	Skyworks	SKY77710-4	PAM - CDMA 800	
Camera				$13.70
Includes	Camera Module Value Line Item - 5MP CMOS, 1/3.2" Format, OmniVision BSI Image Sensor (Assumed), Auto Focus Lens			
	Camera Module Value Line Item - VGA (To be Verified) CMOS, 1/10" Format, Fixed Lens			
Bluetooth / WLAN				$8.27
Includes	Murata (Module)		Murata Module containing Broadcom BCM4329 WLAN/BT/FM Chip	
Applications Processor				$8.46
Includes	Samsung	APL0398	"A4" Applications Processor - ARM Core, 45nm,	
User Interface				$8.18
Includes	STMicroelectronics	L3G4200D	Gyroscope - 3-Axis, Digital	
	Cirrus Logic	CS42L61	Audio Codec - Ultra Low Power, Stereo, with Headphone	
	Texas Instruments	F761586C	Touchscreen Controller	
	AKM Semiconductor	AKM8975B	Electronic Compass - 3-Axis, with Built-In ADC & 8-Bit	
	STMicroelectronics	LIS331DLH	Accelerometer - MEMS 3-Axis, ±2g/±4g/±8g, Digital Output	
User Interface				$6.50
Includes	Qualcomm	PM8028	Power Management IC	
	Dialog Semiconductor	D1815A	Power Management IC	
	Also includes assorted analog ICs, discrete semiconductors (diodes, transistors) and passive components in			
Battery				$6.00
Includes	Amperex (To Be Verified)		Battery Cell - Li-Ion Polymer, 3.7V, 1420mAh	
Box Contents				$5.66
Includes	USB Charger, Cable, Handsfree Accessory, Etc.			
Total BOM (Materials Only)				$171.35
Estimated Manufacturing Costs				$7.10
Total BOM (Materials Only)				$178.45

Notes:
This is a summarized (e.g., aggregates costs at the component group level, only shows a partial list of suppliers), preliminary version of a bill-of-materials report IHS made public for free. The actual, detailed reports I used in my dissertation are proprietary and cannot be reproduced or published in any form without prior written consent with the company. Image taken from https://telecomreseller.com/2011/02/10/new-iphone-carries-171-85-bill-of-materials-ihs-isuppli-teardown-reveals/.
Source: IHS

One caveat of IHS's proprietary data collection approach is that they do not have access to the original equipment manufacturers' approved vendor lists (AVLs). Teardowns are essentially an autopsy report for a single device, even though some components of that model may have two or more supplier options. To mitigate this measurement error, I cross-referenced the IHS data with a newly available data source, the Bloomberg Supply Chain Function. Bloomberg maps out about 35,000 companies in terms of their suppliers and buyers by showing the most recent snapshot of money flows between companies on both a buyer (revenue) and supplier (cost) basis. Bloomberg collects supply chain information from various sources including public filings (which makes the Compustat segment data a subset of the Bloomberg data), announcements from manufacturers and their suppliers, and other propriety data Bloomberg purchases (Steven, Dong, & Corsi, 2014). Deriving information from a variety of data sources allows Bloomberg to capture more comprehensive supply chain data. For S&P 500 high-tech firms, for example, the total number of suppliers identified by Bloomberg was on average seven times larger than that identified by Compustat (Wang et al., 2015). Currently, Bloomberg only provides a cross-sectional data set with the latest annual relationships. I used the Bloomberg supply chain data as of December 31, 2015.

Altogether, my final sample consists of 46 mobile handset manufacturers and 558 first-tier suppliers that directly sold their components to at least one of those manufacturers. Although my data are not exhaustive and may not capture every significant handset supply contract, industry experts who I spoke to verified that the mobile handsets present in my data account for over 90% of the phones sold in the world. I checked the validity of my data through comparing the list of component suppliers shown in various electronic product review and comparison websites where the specifications of some mobile handsets are publicly shared. I also collected

information on headquarter and factory locations of buyers and suppliers from Compustat, Orbis, Bloomberg, and extensive internet search (e.g., online job advertisements recruiting temporary factory workers).

DESCRIPTIVES

Geographic Distribution of the Production Process

Figures 3-5 show the geographic distribution of mobile phone brands' (buyers) headquarters, their component suppliers' headquarters, and their suppliers' factories, retrospectively. Unlike assemblers that are geographically focused in East Asia (e.g., China and South Korea), the component suppliers are located across the whole of North America, Europe, and Asia. This spatial distribution of suppliers depicts the globally dispersed supply chains in the mobile handset industry, and also serves as a source of variation (e.g., different levels of workers' rights protection across nation states) for explaining supply chain dynamics.

Figure 3. Geographic Distribution of Buyers' Headquarters

Sources: IHS, Bloomberg, Compustat, and firm websites

Figure 4. Geographic Distribution of Suppliers' Headquarters

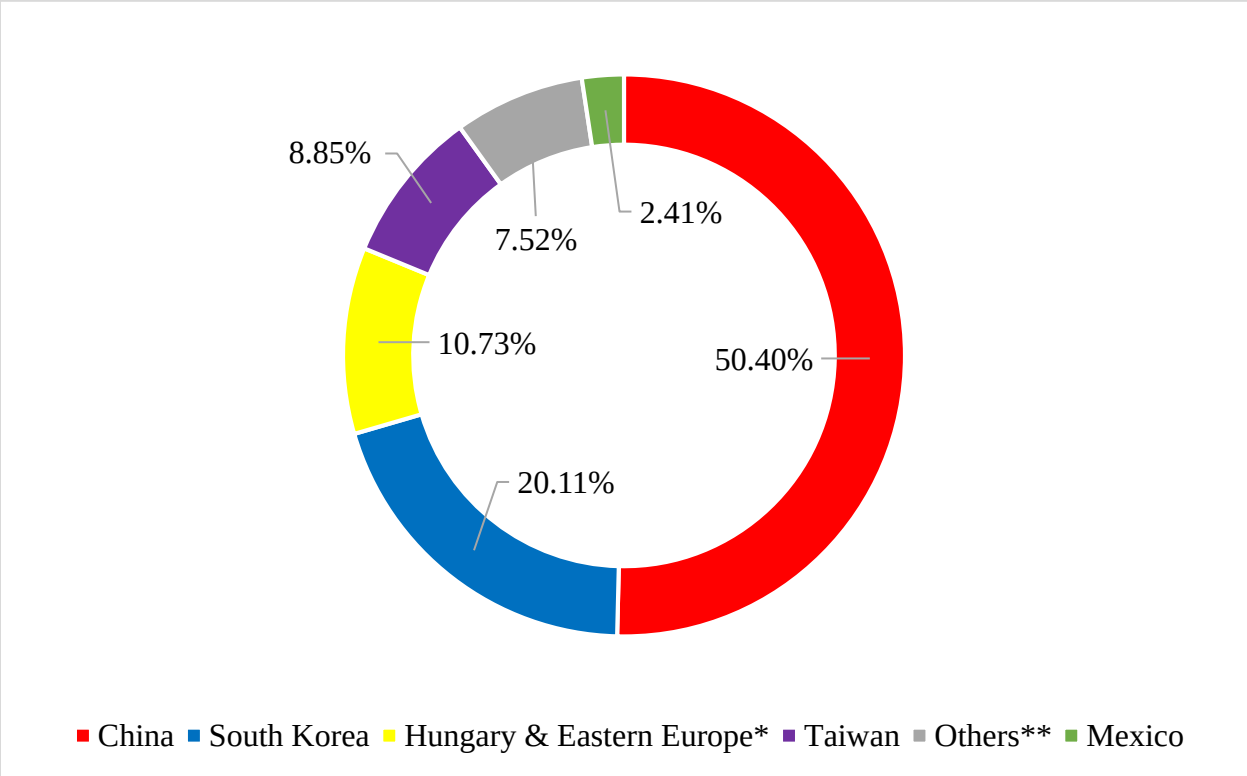
Sources: IHS, Bloomberg, Compustat, and firm websites

Figure 5. Geographic Distribution of Suppliers' Factories

Source: IHS, Bloomberg, Compustat, and firm websites

Once a component manufacturer makes a component, it is sent to an assembly facility where workers engage in assembly and packaging. These tasks require a relatively low skill level, and thus the majority of assembly facilities are located in countries where labor is cheap and abundant. While firms do not provide the identity of their assemblers, each module (e.g., main chipset, camera, etc.) will have the name of the country in which a given module was assembled. Figure 6 shows the location of the assembly locations. Half of the phones were assembled in China, followed by South Korea, Hungary and other Eastern European countries, and Taiwan.

Figure 6. Distribution of Assembly Locations [a]



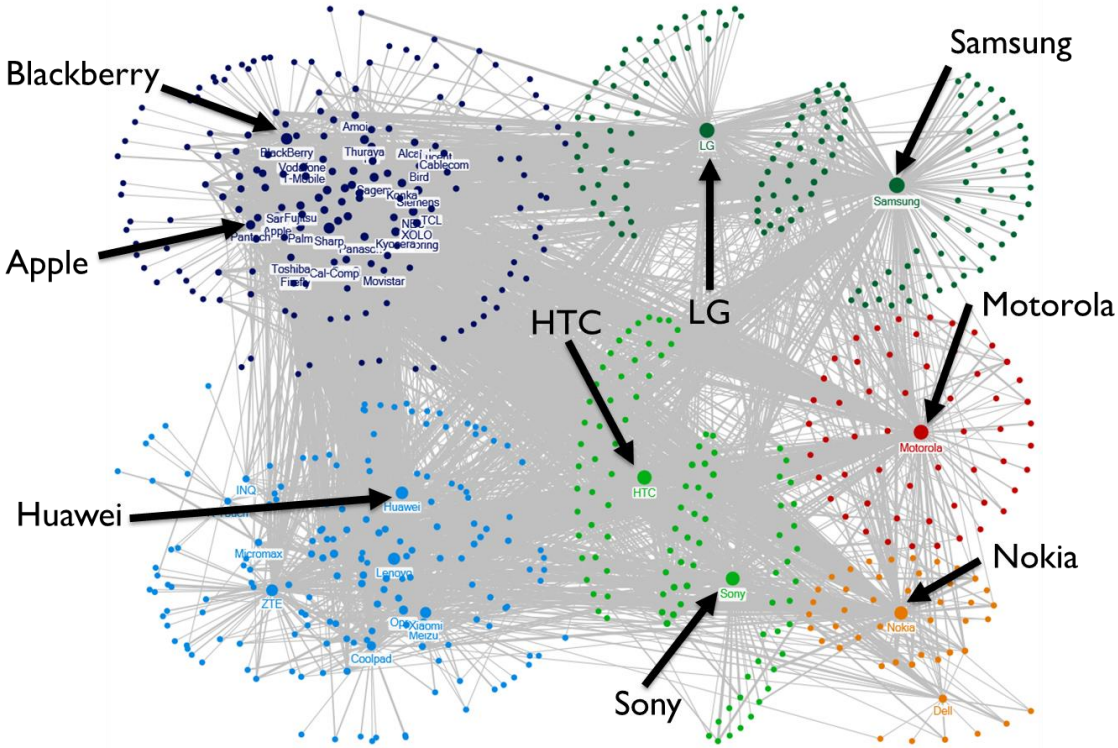
Notes:
[a] 5.36% of the phones in my sample were assembled in two or more countries.
* IHS data had a separate category named "East Europe" as one of assembly locations. Among 10.73% of phones assigned to the "Hungary & Eastern Europe" category, 5.63% were labeled East Europe, 4.83% were labeled Hungary, and 0.27% were labeled Czech Republic.
** Includes the following countries: Malaysia (1.88%), Japan (1.61%), Finland (1.34%), India, Brazil, Germany, Singapore and the United States (all <1%).
Source: IHS

Network Structure

In Figure 7, I present the global structure of the supply chain network, aggregated over all phones released from 2002 to 2014. Nodes with a label represent buyers, and nodes without a label are component suppliers. Node sizes are proportional to node degree, edges are unweighted, and loops (i.e., a component was in-sourced) are removed from the graph. One distinctive characteristic of this network is a clear network community structure. Network communities are densely connected group of actors, with only sparser connections between groups (Newman,

2003b; Newman, 2004). I used a network community detection algorithm proposed by Clauset, Newman, and Moore (2004). This approach focuses on a measure called *modularity*, a quality function that captures how well a given partition of a network compartmentalizes its communities (i.e. how much a network can be 'modularized'). A network's modularity is, up to a multiplicative constant, the number of edges falling within groups minus the expected number in an equivalent network with edges placed at random. Node colors represent community membership, wherein nodes of a same color fall under the same network community. While there are a significant amount of ties across network communities, this figure shows that some pairs of buyers (e.g., Samsung and LG) are more likely to have a common set of suppliers compared to other pairs of buyers (e.g., Samsung and Apple).

Figure 7. Supply Chain Network Structure, 2002-2014



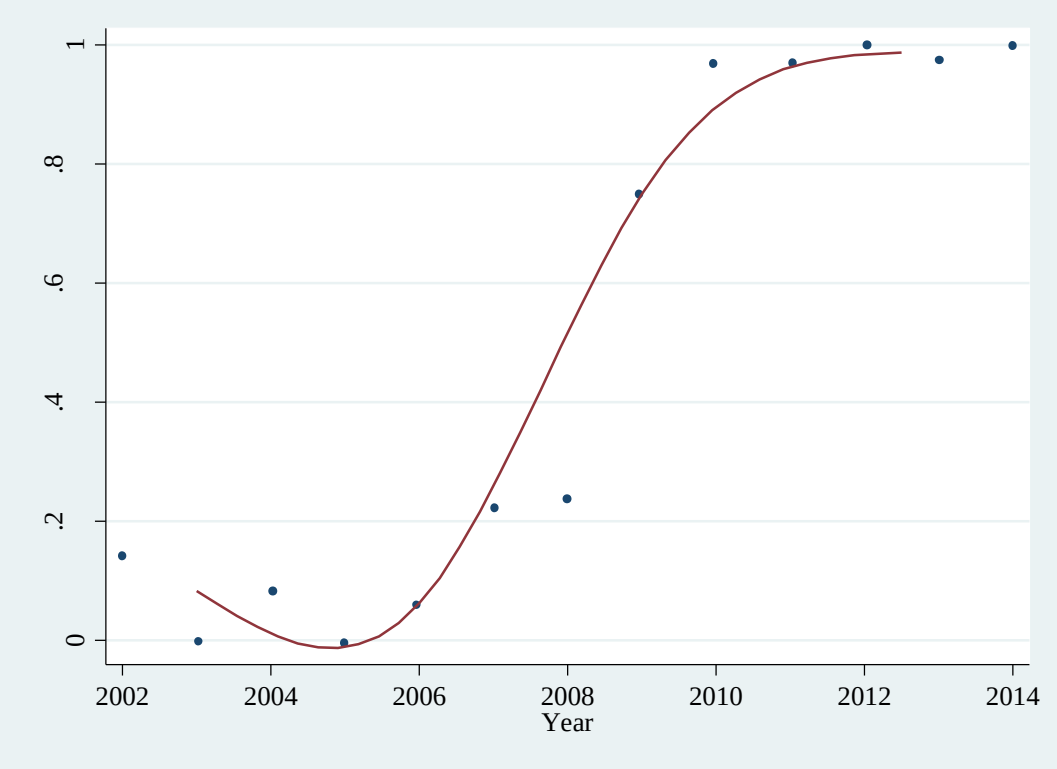
Source: IHS

Technological Change, Insourcing vs. Outsourcing, and Automation

During my observation period (2002-2014), the mobile handset industry witnessed the rise and dominance of smartphones over feature phones. Smartphones are loosely defined as a mobile personal computer that can be used for handheld use. Some common features of smartphones include a touch screen interface, a mobile operating system, and internet access. Arguably the first smartphone to be made and marketed was BellSouth's Simon Personal Communicator which was released in 1994. However, it was the original iPhone, released in 2007, which spearheaded the dominance of smartphones in the mobile handset industry.

Figure 8 shows the growing proportion of smartphones among the mobile handsets in my sample. I used the three aforementioned criteria (i.e., touch screen interface, a mobile operating system, and internet access) to measure if a phone was a smartphone or a feature phone. While my data do not track the population of mobile phones, the trend itself is undeniable. In 2007 and 2008, less than a quarter of released phones were considered smartphones. Three out of four phones released in 2009 were smartphones.

Figure 8. The Rise of Smartphones After 2007

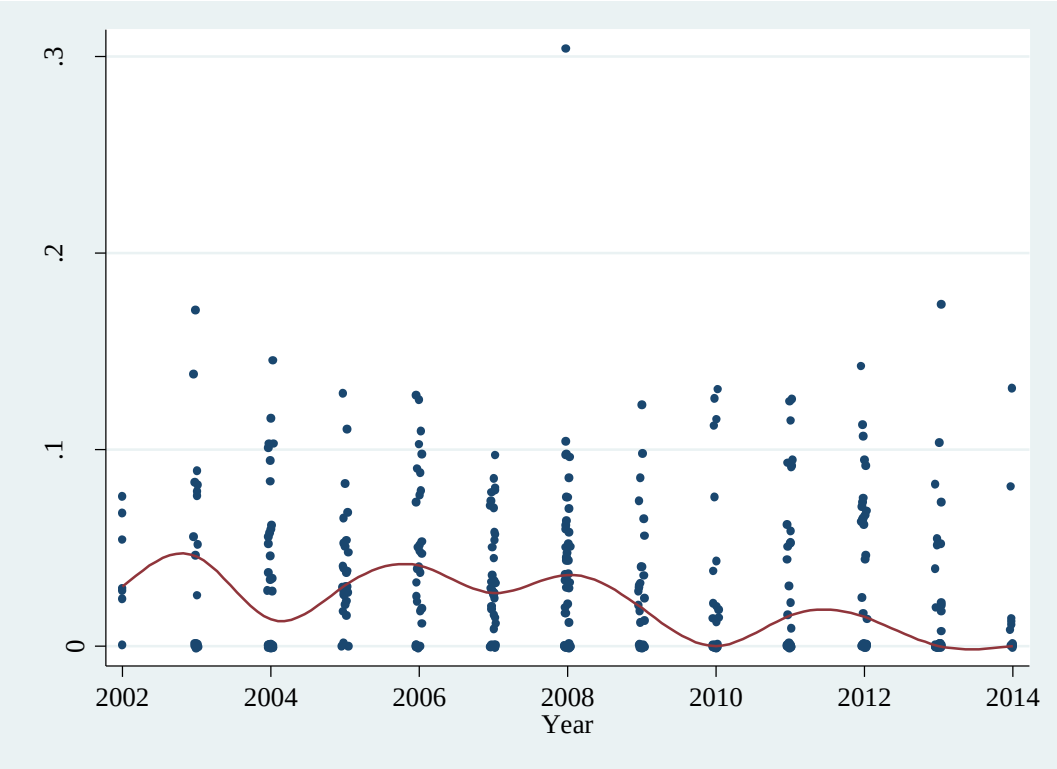


Notes:
The red line denotes the median-spline plot.
The proportion of smartphones is measured as the number of sampled smartphones divided by the total number of sampled phones released in a given year.
Source: IHS

Like most companies in the electronics sector, mobile phone brands typically outsource a lion's share of their production process. For each phone in my sample, I calculated the proportion of components that were insourced, i.e., the component manufacturer name is identical to the buyer's name among all components of which manufacturers were identifiable. As shown in Figure 9, the share of insourced components was already quite low at the beginning of my observation period. On average, only about 3% of components are made by the company named on the final product label. Mobile phone brands are also insourcing fewer components over time, and the correlation between the proportion of insourced components and model release year is negative and statistically significant ($r=-0.16$, $p<0.01$). Taken together, mobile handset

production serves as an exemplary case for so-called “Nikefication,” whereby mobile phone brands (i.e., buyers) tend to concentrate on the design and marketing of their products while contracting out production to vendors in Asia and elsewhere (Davis, 2011).

Figure 9. Proportion of In-sourced Components, 2002-2014

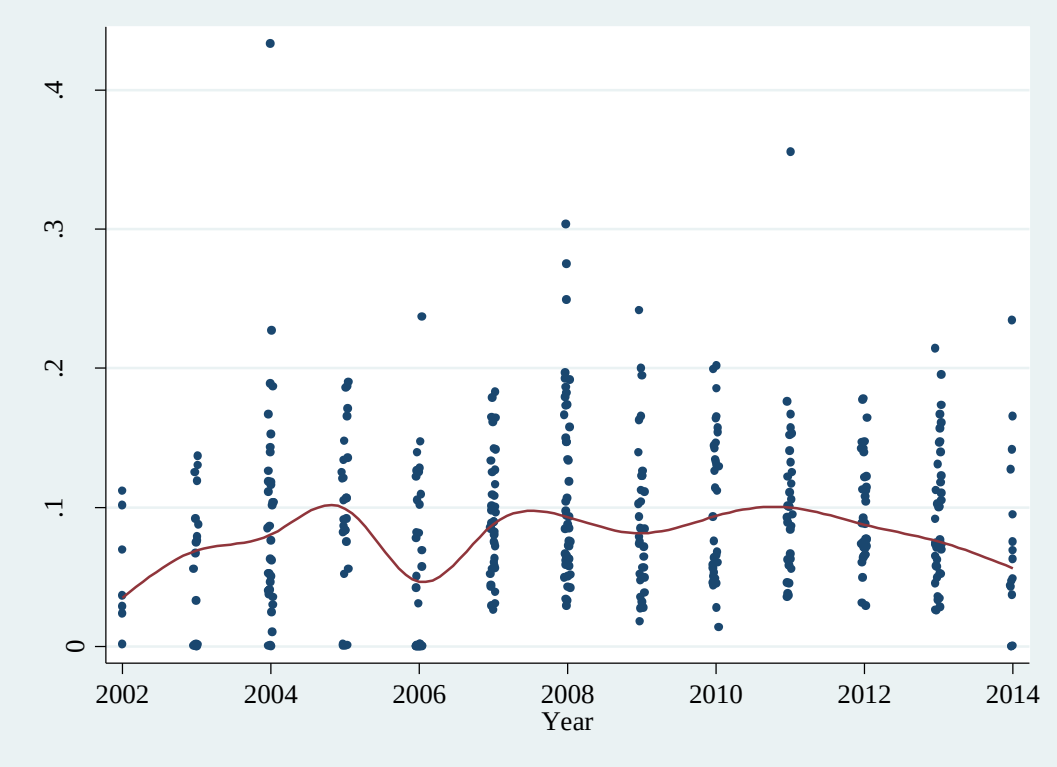


Notes:
The red line denotes the median-spline plot.
The proportion of in-sourced components is measured as the number of components of which component manufacturer names are identical to the brands’ (i.e., buyers’) name divided by the number of total components of which manufacturers are identifiable in a given product.
Source: IHS

Mobile handset production requires both state-of-the-art chipsets as well as cheap labor for assembly. The production of certain parts can be easily standardized, relying on automation and machinery, while there are other components that have a manufacturing process that is inherently

difficult and/or costly to automate. For each component inserted in a mobile handset, IHS determines its insert method, namely by hand or by machine. Using this information, for each phone I calculated the proportion of components that were manually inserted as opposed to inserted by machine. As shown in Figure 10, nine out of ten components are inserted by machine, and this trend is rather stable even after the rise of smartphones.

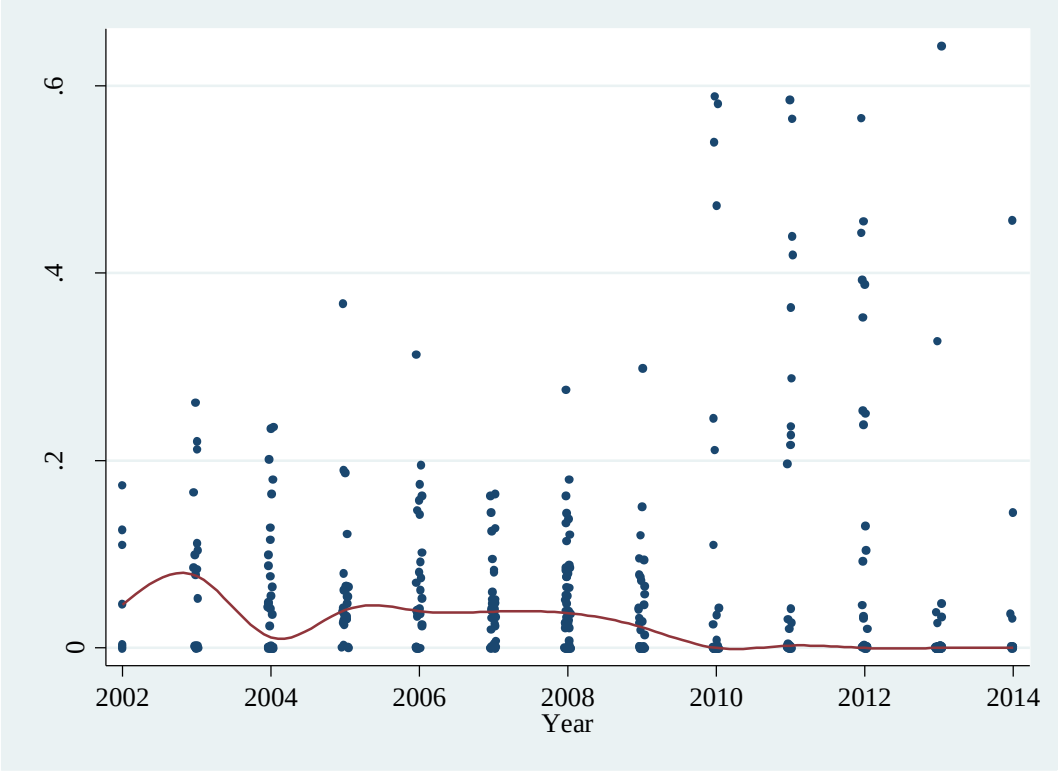
Figure 10. Proportion of Manually Inserted Components, 2002-2014



Notes:
The red line denotes the median-spline plot.
The proportion of manually inserted components is measured as the number of components that were inserted manually (i.e., not via a machine) divided by the number of total components of which manufacturers are identifiable in a given product.
Source: IHS

Similarly, weighting each component by its cost to account for each component's relative importance does not drastically alter this trend. In Figure 11, I calculated the proportion of production cost incurred by in-sourcing out of a product's total production cost. Although there are more outliers in which in-sourcing accounts for more than half of a model's production cost, there is no statistically significant correlation between the release year and the proportion of in-sourced components' cost ($p>0.1$). On average, in-sourcing only accounted for 6% of a model's total production cost throughout the observation period.

Figure 11. Proportion of Manually Inserted Components' Cost out of Total Production Cost, 2002-2014

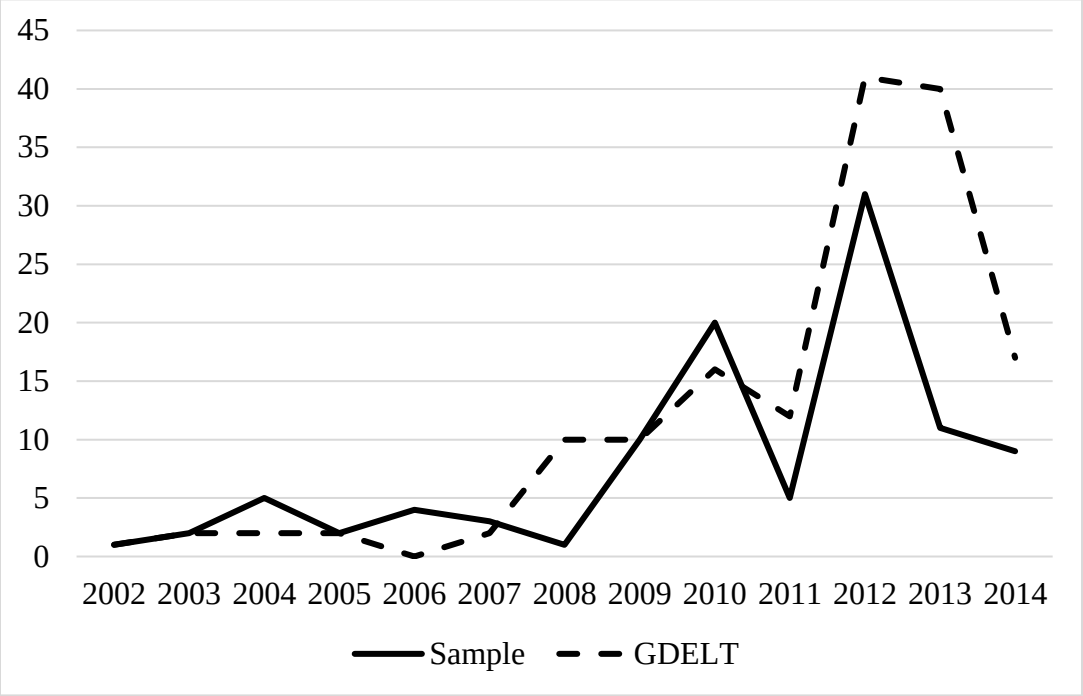


Notes:
The red line denotes the median-spline plot.
The proportion of manually inserted components' cost is measured as the sum of manufacturing cost of all components that were inserted manually (i.e., not via a machine) divided by the total manufacturing cost of a given product.
Source: IHS

Labor Protests

Finally, another important feature that pertains to the mobile handset industry is the rise of labor protests. Because of the need for cheap labor for assembly, a significant portion of workers face potentially unsafe working conditions and low wage, which can lead to labor protests. However, the number of reported labor protests is surprisingly low and remained relatively stable until 2010. Figure 12 (in solid line) shows the number of unique labor protests targeting sampled firms, including buyers (e.g., Samsung and LG). I collected labor protests data from a variety sources, including all publications indexed by Factiva, two crowd-mapped data sets on labor strikes in China (China Labour Bulletin; China Strike), and MediaGaon (a media portal that archives over 50 Korean news outlets). In addition, two Chinese-speaking research assistants searched the occurrence of protest events for China- and Taiwan-based suppliers through internet search. As a point of comparison, I also show (in dash) the number of all labor protests shown in the GDELT (Global Database of Events, Language, and Tone; http://gdeltproject.org/) database (Leetaru & Schrodt, 2013). GDELT does not name the source and target of a protest, but instead codes them by the type of actors such as government, business, labor, etc. I included all protests events initiated by the labor and targeting businesses. Labor protests from all countries and all industries were included. Again, the number of labor protests reported in the press is surprisingly low, but also reflects how central and representative the mobile handset industry is when it comes to reported labor protests. On average, the mobile handset industry experienced 8 labor protests per year during the 2002-2014 period. Across all nations and industries, there were 12 labor protests per year.

Figure 12. Number of Labor Protests, 2002-2014



Source: Factiva, China Labour Bulletin, China Strike, MediaGaon, and GDELT

SUMMARY

In summary, a descriptive analysis of the history of the mobile handset industry reveals four things. First, the production network is globally dispersed, spanning both developed and developing economies. However, the majority of assembly work is occurring in Asia. Second, the global supply chain network features a strong network community structure whereby some pairs of buyers are more likely to have a common set of suppliers compared to other pairs of buyers. Third, the mobile handset industry experienced a massive technological shift from feature phones to smartphones. However, the level of reliance on suppliers as well as the level of use of machines were relatively stable even after smartphones became the dominant design.

Finally, while the overall frequency is low, the industry has often been a target of labor protests, signifying prevalent labor issues in their supply chains.

CHAPTER THREE

When Do Mobile Phone Brands Disengage from Protested Suppliers?

INTRODUCTION

Products are now routinely produced and sold having never been touched by employees of the company named on the label, and firms increasingly outsource their manufacturing to an expansive global network of suppliers (Davis, 2016). At the same time, outsourcing business operations does not mean outsourcing responsibilities or risks. Companies are expected to be accountable for sustainability issues at every stage throughout their supply chain (UN Global Compact & BSR, 2015). However, the opacity of global supply chains makes it extremely difficult for companies to be accountable for the sustainability practices of their suppliers. This reflects a "responsibility paradox" (Davis, Whitman, & Zald, 2013), where the demands for corporate sustainability are increasing even though companies' ability to deliver is shrinking.

The main culprit behind this responsibility paradox is firms' inability to completely trace their production processes (Kim & Davis, 2016). Gaining full knowledge on a company's supply chain is nearly akin to the finding the Holy Grail; it is simply too challenging to contact hundreds of suppliers that one has never heard of. After the Rana Plaza collapsed in 2013 and killed over a thousand garment workers in Bangladesh, some global clothing brands were surprised to find out that unauthorized sub-contractors were producing their goods. Similarly, even after being given more than three years to vet their supply chains and clean their products from the use of conflict

materials, the majority of companies admitted they were unable to determine the source of the raw minerals contained in their products, citing "the complexity and size of our supply chain" as the primary reason for their failure.

A lion's share of buyer-supplier relationships is opaque to and hidden from the public. However, occasionally these ties become visible. Particularly, the deluge of information and communication technologies (ICTs), led by the widespread use of mobile devices and social media, has greatly facilitated individuals' ability to learn and spread information about events occurring all over the world. For example, we now know the majority of iPhones are assembled by Foxconn because of The New York Times' series on supply chain worker abuse overseas and the ensuing social media buzz about the suicides. Furthermore, ICTs provide a platform through which the public can easily mobilize and exert pressure on companies to behave in a more accountable and socially responsible fashion (Luo et al., 2016).

In this chapter, I examine the manner and mechanisms by which mobile phone companies respond to social movements targeting their suppliers by disengaging with those suppliers. I argue that user-generated social media content such as tweets, blogs, and discussion forum posts can help make the buyer-supplier relationship more visible to the public, pushing firms to drop protested suppliers from their future supplier base. Furthermore, the geographic diversity of social media users influences the degree to which social media content influences buyer-supplier relationships. In addition, I explore how the likelihood of buyers' disengagement from protested suppliers is influenced by buyers' involvement in social supply management initiatives, the standardization of their manufacturing processes, as well as the regulatory environment in which suppliers are operating. Finally, to check the robustness of these findings, I compare buyers' responses when their suppliers are affected by social movements with their responses when their

suppliers are affected by natural disasters, the latter of which represents a destructive exogenous shock.

In exploring these questions, I aim to make several theoretical contributions. First, I seek to extend research on network partner selection, which suggests that illegitimate or controversial activities play an important role in affecting the dissolution and replacement of ties with controversial partners (Jensen, 2006; Jensen & Roy, 2008; Sullivan, Haunschild, & Page, 2007). Building on this existing research, my study highlights the important distinction between actual and perceived relationships with controversial partners. Recent work has found that even in the absence of an actual relationship with a partner, social and geographical proximity to that partner may create the façade of a perceived relationship (Greve, Kim, & Teh, 2016; Huang & Li, 2009; Jonsson, Greve, & Fujiwara-Greve, 2009). Complementing this work, my study examines what happens when an actual relationship with a partner is present, but the perceived relationship with a partner is absent.

Second, I intend to add to the growing research on the role of social media in facilitating social movements. The ready accessibility of social media allows people to join a protest and to mobilize free-floating individuals without large, centralized organizations (Calhoun, 2013; Earl & Kimport, 2011). For example, the Arab Spring protests were enabled by ready access to Facebook for organizing and to YouTube for sharing tactics and documenting grievances. What remains unclear, however, is whether social media can really yield desirable social movement outcomes, since the majority of social media users are "unaffiliated participants" engaging in only low-risk behaviors (Mercea, 2012). Against this backdrop, this study presents a model of interplay between traditional movement tactics (e.g., sit-in, strike) and internet activism (e.g.,

posting blogs) where these unaffiliated participants boost the efficacy of traditional protests by making the inter-firm relationship with the protest-target visible.

Finally, I aim to contribute to studies of sustainable supply chain management by exploring how social risks and workers' rights can influence the dynamics of supply chains. The concept of sustainability consists of "three pillars": environment, economy, and social equity — the social aspect of sustainability is understudied compared to the rest (see Gold, Seuring, & Beske, 2010 for a review). Compared to the growing research on designing green supply chain networks that minimize gas emissions or waste, there is significantly less research on designing supply chain networks that minimize social risks and protect workers' rights. Despite the negative financial and reputational damages that suppliers' questionable working condition may cause to buyers (Rock, 2003), and the rising efforts to monitor labor conditions along supply chains (Short, Toffel, & Hugill, 2016), to date we have mostly anecdotal evidence about whether firms actively "weed out" suppliers that do not comply with human and labor rights standards. My study attempts to investigate whether firms' commitment to reducing social risk along their supply chain actually affects their decisions to select as well as ditch suppliers.

ORGANIZATIONAL FACTORS AFFECTING SUPPLIER DISENGAGEMENT

Supplier selection and termination – and outsourcing decisions in general – are primarily motivated by the minimization of production costs and the avoidance of unexpected deviation from a predetermined production schedule. Other factors include the availability of alternative suppliers and transaction-specific know-how, both of which increase search and switching costs (Monteverde & Teece, 1982). Relatedly, buyers' dependence on their suppliers as well as their market position help us understand how firms seek to seal off their core technologies from environmental influences, manage external control, and deal with potential damage to their

public image for keeping or dropping relationships with problematic suppliers (Pfeffer & Salancik, 1978; Salancik, 1979; Thompson, 1967). In that sense, buyers should ditch disrupted suppliers when the costs of searching for and switching to alternative suppliers of the same input are relatively manageable.

Insights from extant organizational studies on stigma and partner selection suggest that buyers would consider walking away from a protested supplier. In particular, when the buyer-supplier relationship can be revealed to stakeholders, an imminent concern for social evaluation arises. Stigma may be transferred to those interacting with stigmatized actors, especially when this interaction entails a meaningful relationship (Goffman, 1963). These companions and partners can evoke the same social disapproval and negative treatment due to their association with stigmatized actors. Transferred stigma and its negative consequences may cause firms to avoid relationships with stigmatized suppliers. Indeed, firms often seek to disassociate themselves from socially questionable business partners, even those of a high status (Jensen, 2006), in part to preserve the cognitive legitimacy they possess. For example, when PETA's exposé revealed the inhumane treatment of lambs at Ovis 21, a large network of farms that supplies to Stella McCartney and Patagonia, it took less than three business days for both companies to cut ties with it (Hendriksz, 2015).

In addition to stigma concerns, there are immediate financial considerations. Supply chain disruptions are notoriously detrimental to buyers' financial performance, both in the short- and long-run (Hendricks & Singhal, 2003, 2005). Protests against a firm are also harmful for financial performance (King & Soule, 2007). For example, Rock's (2003) research on the garment industry found that each news article about firms' sweatshop practices translated into an average loss of $70 million in market capitalization. Taken together, provided the availability of

alternative suppliers and manageable switch costs, there is compelling reason for buyers to disengage from a supplier when the supplier faces a disruption or bad press.

Again, previous research suggests that suppliers with poor labor conditions will face stiff penalty from their buyers. The possibility of disruption in the production process as well as the negative press coverage results in a significant financial loss to the buyer. Buyers are more likely to end their relationships with suppliers that harm their business or that damage their trust (Hibbard, Kumar, & Stern, 2001). Especially when the costs of searching for and switching to alternative suppliers of the same input are relatively manageable (e.g., a disrupted supplier produces less specific components and alternative suppliers are available in the industry), it is reasonable to expect firms to consider turning to other providers of the same input and prevent further financial loss and production disruption (Barrot & Sauvagnat, 2016; Walter, Müller, Helfert, & Ritter, 2003).

Social Media, Link Visibility, and Audience Diversity

The attention-based view of the firm (Ocasio, 1997) provides a useful framework in terms of explaining the impact of stakeholder's attention on buyer-supplier relationships after supplier wrongdoing. The theory's core argument is that firm behavior is the result of how an organization channels and distributes the attention of its decision-makers. What decision-makers do depends on what issues and answers they focus their attention on; what issues and answers decision-makers focus on, and what they do, depends on the particular context or situation in which they find themselves. Therefore, an extension of this theory can be made by positing that the attention of decision-makers in a firm is partially determined by outsiders' or public attention that shapes the particular situation in which the firm finds itself.

In this vein, the buyer's decision of whether or not to disengage from protested suppliers may be explained by the volume of outsider attention given to the event. The attention that stakeholders give to a labor protest shapes how the public thinks about the firm, its values, and its belief. In turn, whether an event receives attention would depend on whether stakeholders hold the industry accountable for the event (Hoffman & Ocasio, 2001). In particular, social movements targeting a firm typically attempt to change -- normally in a negative fashion -- how the public views the targeted firm, so that they can ultimately gain the attention of firm leaders (King, 2008; Maguire & Hardy, 2009). For example, boycotted firms are more likely to increase their prosocial claims activity after a boycott is announced when the boycott event receives more media attention (McDonnell & King, 2013).

One key factor that magnifies the effect of stakeholders' attention on firms taking responsibility for their suppliers' labor protest is the extent to which the link between a buyer and a supplier is visible to stakeholders. The majority of buyer-supplier relationships are invisible to outsiders. Suppliers often sell their products to multiple buyers, and not every buyer gets the same level of public scrutiny for questionable labor conditions of its supplier. Attention is inherently a scarce resource, requiring an individual to focus on a limited amount of issues while being inattentive to the rest (Kahneman, 1973). Supply chain management is not the only factor people use to evaluate a firm, partially because information about a firm's supplier is considered less salient than information about the firm itself. In the stock market, for example, investors who have limited attention tend to overlook rather than to incorporate news about economically related firms, such as their buyers and suppliers (Cohen & Frazzini, 2008). Likewise, despite the abundance of actual buyer-supplier relationships, only a subset of relationships are visible to and perceived by most people.

Link visibility influences stakeholders' ability to associate an event taking place at the supplier's site with the buyer. Individuals are less punitive for the same event when it occurred to a supplier rather than its buyers to the extent that they perceive that the buyer has less foreknowledge and/or control over its suppliers (Paharia, Kassam, Greene, & Bazerman, 2009). Therefore, when the perceived associations between a firm and its suppliers are weak, the firm has an incentive to contract out potential "dirty work" and ship them away to suppliers that operate in developing countries, thereby avoiding public scrutiny from the home country on their production process (Surroca, Tribó, & Zahra, 2013). Conversely, when outsiders imply a strong association between a buyer and its supplier, they are likely to be more punitive towards a buyer for not taking action for its supplier's wrongdoing.

The perceived strong association between a given firm and its supplier also means that the association becomes a more salient issue or category when evaluating the firm. The salience or strength of the association, in turn, limits the dilution of the resulting negative social evaluation (Vergne, 2012). Co-mentions, references to more than one firm in the same article, are shown to be a way to observe the association between firms (Kennedy, 2008). Therefore, I argue that the likelihood of a buyer disengaging from a protested supplier, in part, corresponds to the prevalence of the information that *jointly* mentions the buyer and the supplier, highlighting the linkage between the two. Through these co-mentions, stakeholders build a high level of perceived connectedness between the two, which in turn lead them to attribute direct accountability and responsibility to the buyer for its supplier's wrongdoing. Hence, I predict the following:

> *Hypothesis 1: The buyer is more likely to disengage from a protested supplier when the linkage between that buyer and supplier is highly visible (i.e., more social media posts mention a buyer and a supplier in the same article).*

When is a tweet more likely to gain attention and turn into a buzz? When are social media users more likely to digitally participate in a labor protest taking place in China? Most readers of news articles or social media articles about a labor protest do not have "a dog in the fight". In the context of labor protests, most social media posts are written by consumers rather than the actual factory workers who are physically participating in the protests. These social media users normally have few personal connections amongst themselves, let alone with the factory workers. Most importantly, the cost of social media users tweeting about a protest is significantly lower than the cost of factory workers going on a strike. As much as the factory workers who are taking a substantial amount of risk by protesting can utilize social media to organize themselves and spread the word, most users who are contributing to the buzz about a protest are "unaffiliated participants" engaging in low-risk behavior (Mercea, 2012).

How does the group structure (or lack thereof) of social media users posting or tweeting about a protest influence the buying firm's decision to engage with or disengage from a problematic supplier? Granovetter's (1978) threshold model of collective behavior posits that each individual has a certain threshold at which they will change their behavior (e.g., participate in a protest), which is determined by the individual's assessment of the costs and benefits of doing so. He further argues that this cost and benefit assessment is in part dependent on how many others are taking action: the cost to an individual of joining a certain collective action declines as the size of the collective action increases. Finally, when there are enough people to reach "critical mass", i.e., enough people who choose to make contributions to the collective action while the majority do little or nothing, a social movement can have an exponential growth in terms of its impact (Oliver, Marwell, & Teixeira, 1985).

Research on critical mass consistently documents that the diversity or heterogeneity in the population lowers the bar to reach this critical mass since with a high level of diversity or heterogeneity, fewer contributors may be needed to provide a good to larger groups, making collective action less risky, costly, and complex (Oliver & Marwell, 1988). Furthermore, the diversity within the population yields different, non-redundant sets of knowledge and tactics. The richness of their repertoire expands the movement's organizing capacity (Dutta, 2016) as well as its appeal to different constituencies (Olzak & Ryo, 2007). For example, the attention from social media may be more powerful when the attention is coming from a variety of geographical regions, and when it is communicated in various languages. Therefore, controlling for the volume of social media posts mentioning a supplier, I argue that the geographic diversity of the social media users who are paying attention to a given buyer-supplier relationship may be critical in predicting the effectiveness of supplier-targeting social movements.

> *Hypothesis 2: The buyer is more likely to disengage from a protested supplier when the social media posts mentioning a supplier originate from many geographies.*

Technological Standardization

Historically, the use of machine tools has been used to increase managerial control, allowing factories to rely less on workers' tacit knowledge and manual skills (Noble, 1979). The use of machinery and equipment contributes to suppliers' competitiveness and sustainability. As factories increase their reliance on automation and machinery, production technologies typically become progressively standardized. Particularly, new technologies allow the automation of enterprise business processes, providing greater traceability and reliability in terms of the production process as well as outcome (Chen, 2014; Qiu, 2007).

However, technological standardization may hinder the durability of buyer-supplier relationships. Suppliers that manufacture standardized items offer little competitive advantage over their competitors, making them "arms-length" suppliers. In turn, under the "arm's length" model, buyers typically maintain multiple suppliers, and avoid long term commitments and regular price reviews (Dyer, Cho, & Chu, 1998; Power, 2005). Technological standardization means that multiple suppliers of equivalent components conform to the same technological standard, and buyers of these components invest significant resources in learning to absorb and use the standardized production technology (Tassey, 2000). When multiple suppliers adopt the same technological standard, they become more interchangeable and replaceable from the perspective of the buyer. Buyers can easily switch between suppliers who conform to the same standard without incurring significant switching or learning costs. Standardization also means less reliance on tacit, firm-specific knowledge that may reside within any one worker or group of workers (Lecuona & Reitzig, 2014). Therefore, when a supplier experiences a labor protest, the buyer can disengage from that supplier without losing the particular insights and knowledge that are tightly intertwined with the experience of working with the protested supplier.

In other words, when a supplier automates its production process through the use of machinery, its work is more highly standardized, and buyers can disengage from that supplier without incurring significant switching and learning costs, or losing tacit, firm-specific knowledge. However, when the supplier's work relies heavily on manual labor, then switching to another supplier entails significant switching and learning costs, as well as the loss of tacit, firm-specific knowledge. Therefore, I posit:

> *Hypothesis 3: A buyer is more likely to disengage from a protested supplier when the supplier's work is highly standardized (i.e., a component is inserted by machine rather than by hand).*

Corporate Social Responsibility and Workers' Rights

The stakeholder theory of corporate social responsibility emphasizes a broad set of social responsibilities for businesses, including responsibility for their suppliers along their supply chains (Freeman, 1984). Sustainable supply chain management represents the management of material and information flows while integrating the 'triple-bottom-line' concept that takes the three dimensions of sustainable development (economic, environmental, and social) into account (Seuring & Müller, 2008). In particular, supplier monitoring programs or training programs often enable buyers to reduce social risks along their supply chains. Common indicators of social risks include poor working conditions, the use of child or forced labor, lack of a living, fair or minimum wage, etc.

Companies voluntarily participate in these CSR programs for various reasons. They may participate in such programs in order to improve their image or strategically appeal to socially concerned customers. Regardless of their motivation, voluntary participation in social supply chain management programs allow companies to have more relevant knowledge and experience, which in turn enables companies to build the capacity to understand and address sustainability issues along their supply chains faster and better (Bansal & Roth, 2000; Carter, 2005; Hart, 1995). At the minimum, these companies are more likely to measure and keep track of information related to their suppliers (Ioannou & Serafeim, 2014).

In addition, the public commitment to CSR can also be a burden, in the sense that a firm has now raised external stakeholders' expectations for it to be a socially responsible company, and this can backfire if it does not deal with unsustainable practices. This argument is in line with recent findings in reputation research that suggests good reputation is more likely to become

a burden, rather than a benefit, when considering support from external stakeholders following a negative event (Zavyalova, Pfarrer, Reger, & Hubbard, 2016). Companies that participate in CSR programs need to be more proactive in addressing supply chain sustainability issues in order to avoid the harsh penalties that typically arise when companies that are known for being socially responsible are targeted by social movements (King & McDonnell, 2015). By refusing to terminate relationships with protested suppliers, or take any other actions that might reduce the stain of association with protested suppliers, buyers may unintentionally convey to stakeholders that they are in fact responsible for the labor protest (Sutton & Callahan, 1987). Such a response may be seen as an evasion of responsibility and a rejection of efforts to ensure fairness across stakeholders, leading to a loss of legitimacy (Lamin & Zaheer, 2012). Therefore, when a supplier experiences a labor protest, buyers that participate in social supply chain management programs are better able and more motivated to reduce social risk along their supply chains and thus more likely to disengage from the protested supplier.

> *Hypothesis 4: A buyer that voluntarily participates in social supply chain management programs is more likely to disengage from a protested supplier.*

Not all workers reside in places where they have the rights to organize and strike. Even in states that see these rights as constitutional, not all strikes are legal. The extent to which workers' rights are protected is associated with the level of political opportunity, or "the probability that social protest actions will lead to success in achieving a desired outcome" (Goldstone & Tilly, 2001: 182). Regulatory environment, as a result, has a big impact on the frequency and salience of protests. In states that protect the right to engage in political activities and freedom of association rights, workers have more access to political opportunity structures. Political opportunity structures motivate people to participate in social movements (Tarrow, 1994) and allow social

movements to have a stronger impact on their targets (King, 2008; Soule, 2012). Therefore, in states where workers' rights are strongly protected, workers are more likely to take advantage of the abundant political opportunities available to them and thus are more likely to actively participate in labor protests to voice their grievances. Conversely, for workers in states where their rights are restricted, there is not much they can do to bring about a change in their circumstances even when they experience work-related grievances.

As a result, labor protests are likely to be ubiquitous or inevitable events in states where workers have a high level of political opportunity, but they are likely to be relatively rare in states where workers have a low level of political opportunity. When the suppliers operate in a state that protects workers' rights, due to the normalization and routinization of protests (Meyer & Tarrow, 1998; Oliver & Maney, 2000), buyers might become desensitized to protests targeting their suppliers and be less motivated to respond to those protests. In contrast, in states where workers' rights are restricted, when suppliers become targets of a labor protest, buyers are likely to interpret the rare event as much more significant and disruptive, and therefore have more incentive to disengage from with those suppliers. Therefore, I predict the following:

> *Hypothesis 5: A buyer is more likely to disengage from a protested supplier to the extent that supplier-side workers' rights are restricted as opposed to protected.*

DATA, MEASURES, AND METHODS

As detailed in Chapter Two, to capture fine-grained buyer-supplier relationships in the global mobile handset industry, I extracted each component's maker (suppliers) information from individual model's bill-of-materials compiled by Information Handling Services (IHS). This company buys electronic products and breaks them down to trace their component suppliers.

Each phone contains hundreds of components. Once the IHS technicians decompose a phone into its components, they extract the lot number assigned to each component and verify the component's supplier name, function, and specification. I obtained all mobile handset teardown reports published by IHS until 2014, which yielded 399 models. On average, a mobile phone in my sample consists of 290 components, with a standard deviation of 130.

Dependent Variable

The dependent variable in this study is *supplier disengagement* at the buyer-supplier dyad level, computed as a binary variable that takes the value of 1 when a buyer has ceased to include a given first-tier supplier from its supply base for at least the next three mobile phone releases, and 0 otherwise. To calculate this variable, I first constructed a matrix where each row represents a model release date – buyer – supplier triad. When a buyer released more than two phones in a given month, I combined their supply chain networks, treating them as buying for a single product. The maximum observed value for the number of new phones released in a given month was four. Then, I tracked whether a buyer had a component supplied by its existing suppliers in its individual products. Given that most phones have a market life cycle of nine to twelve months (Entner, 2011), having a value of 1 in this study's dependent variable translates into a given buyer-supplier dyad not being renewed for at least the next two to three years.

In supplementary analyses, I also used different thresholds to determine whether a tie has dissolved, ranging from the next release to the next ten releases. Although the number of available dyads decreases when imposing a stricter threshold (e.g., mobile phone brands that have not released at least ten mobile handsets will be omitted if the threshold is set at 10), my general findings are robust to the choice of thresholds when operationalizing the dependent variable.

Independent Variables

Labor protest. The key independent variable of this study, *labor protest*, is a binary variable that takes the value of 1 if a supplier was targeted for a labor protest within a 3-month window leading up to a product release, and 0 otherwise. The choice of the 3-month period was chosen to adjust for the conventional minimum notice period for contract termination and mobile handset release cycle (cf. Joseph, Klingebiel, & Wilson, 2016). That is, a buyer is relatively constrained to immediately remove a protested supplier from its production process if a protest occurs within this period. As a result, if a buyer decides to remove a protested supplier, such a decision will more likely to occur when it reaches out to potential suppliers that will be a part of the production process of the subsequent model. I obtained each model's product release date from IHS's executive summary report, measured at the year-month level.

The primary source of protest events comes from all daily published and English-written newspapers indexed by Factiva, using "All publications" as the source category from the platform. Using newspaper data on protest events is one of the most frequently used forms of data in the field of social movements, and newspapers are generally considered to be an accurate source in terms of the veracity of event coverage (Earl, Martin, McCarthy, & Soule, 2004). For all instances where a supplier name and a set of keywords (e.g., protest, labor strike, unrest) co-occurred, a group of research assistants manually verified and entered the company name, event date, and the nature of the event into my database. Given my focus on supplier-targeting labor protests (i.e., not consumers or activists boycotting the buyer), the majority of identified events were caused by factory workers demanding a better severance package, higher wage, or working condition, or objecting to layoffs.

However, only a proportion of all public demonstrations receive any media attention. Some protests are deemed to be more "newsworthy." This newsworthiness is often related to various factors including the news agency reporting on the event, violence at the event, and the size/intensity of the event (see Earl et al., 2004 for a review). In addition, the majority of newspapers indexed by Factiva were written in English, raising another source of potential selection bias from focusing only on English news outlets.

Social movements researchers suggest that activist-based web sources tend to report a greater number of protests compared to newspapers (Almeida & Lichbach, 2003), thus I tried to reduce the sample selection bias by considering both conventional media sources (e.g., newspapers) and activist-based web sources to capture the occurrence of protests. I corroborated my database with two crowd-mapped data sets on labor strikes in China (China Labour Bulletin; China Strike) as well as MediaGaon, a media portal that archives over 50 Korean news outlets. In addition, two Chinese-speaking research assistants searched the occurrence of protest events for China- and Taiwan-based suppliers through internet search. These extensive data collection attempts to maximize the coverage of labor protest occurrence in China, South Korea, and Taiwan. Suppliers based in these three countries together account for three-quarters of the market entrants in the mobile handset industry (Alcacer & Oxley, 2014).

In the final sample, 48% of the labor protests pertained to a demand for a higher wage and better working conditions. Another 46% of the labor protests are related to a firm's decision such as an announcement to close a factory or lay off workers. The remaining 6% of the labor protests resulted in lockouts but were not directly targeted at the management. These protests were aimed at addressing social issues or governmental policies. Controlling for the nature of the protest did not alter the regression results. Across all labor protests, there was only one case that

had a report of a death, which was caused by a worker committing suicide to protest low wages. There was no report of the police opening fire at the protesters in any of the protests in my sample.

Link visibility. To capture the extent to which a given buyer and supplier relationship is visible to stakeholders, I measured the frequency of social media posts that connect the buyer with the protested supplier. Specifically, *link visibility* is the natural logarithm of the number of social media posts that mention a given buyer-supplier dyad together within a 6-month window starting from 9-month prior to a product release to 3-month leading up to a product release. The overall results are very similar even if I include the 3-month period leading up to a product release, during which I measure the presence of labor protests. Here, I show the results excluding the 3-month period to avoid potential confounding between the two measures.

Using Crimson Hexagon's ForSight social media analysis platform, I first gathered social media posts mentioning either a buyer or a supplier, resulting in 2.9 billion social media posts. ForSight indexes a massive amount of past social media posts dating back to 2008, and thus social media data are only available for the post-2008 period. After filtering out 'off-topic' posts (e.g., a tweet mentioning the fruit, not the company Apple) through the platform's BrightView algorithm, 5.7 million posts were assigned to be relevant posts. To adjust for the sheer increase in social media volume since 2008, I took a random sample of 10,000 posts per month when there were more than 10,000 relevant posts in that month. ForSight social media analysis platform currently limits the data that can be exported to 10,000 posts per API call, wherein a user specifies the start date and end date for each export call. I made a separate export call for each month. After, removing posts that were deleted by their author, my current sample yielded 781,991 posts.

In the initial sample that indexes all posts that mention either a buyer or a supplier's name (N= 2.9 billion), the majority of the social media posts were from Twitter (81%), followed by forums (9%), blogs (6%), and public Facebook posts (4%). After removing 'off-topic' posts, the sample size decreased to 5.7 million, and the composition of sources substantially changed: now 79% of the relevant user-generated contents were from blogs, followed by forums (18%), while tweets and public Facebook posts account for 1%, respectively. The substantial reduction of Twitter posts in the final sample is partially due to the fact that most machine-learning algorithms, including BrightView algorithm, use the characteristics of other words appearing in the same document or post. In my empirical context, Twitter's 140-character limit makes it difficult to assign a tweet into a category with certainty, especially when a supplier has a long or generic name. Finally, I created a 47 (buyers) x 405 (suppliers) co-occurrence matrix where each cell represents the logged frequency of social media posts mentioning a buyer and a supplier together during the three months leading up to a product release.

Audience geographic diversity. Given that social media presumes authors' anonymity, measuring the diversity of authors imposes a challenge on researchers. One viable solution is to take advantage of the location in which a social media post is published. About 8% of social media posts in my sample have valid geographic information, either extracted from user profiles or geospatial metadata (geotags) associated with a post. Although plausible, to my knowledge, there is no empirical evidence that social media users' location influences the likelihood of them reporting the location or the precision with which they report it, which will create a non-response bias (Takhteyev, Gruzd, & Wellman, 2012). Another potential source of bias, which my data cannot rule out, stems from limiting my search to social media posts written in English and

excluding certain social media platforms that are popular in non-English-speaking countries (e.g., China's Sina Weibo and Russia's VKontakte).

I calculated *audience geographic diversity* for each supplier-release date as the entropy measure of geographic diversity of the social media posts. After removing all social media posts without authors' geographic information, I calculated the entropy measure of audience geographic diversity:

$$Audience\ geographic\ diversity = \sum P_i \ln(1/P_i)$$

where *Pi* is the proportion of supplier-mentioning social media posts originating from country *I* within a 6-month window starting from 9-month prior to a product release to 3-month leading up to a product release. In supplementary analyses, I replaced this entropy measure with its exponentiated value, thus making it the Shannon diversity measure (Shannon & Weaver, 1949), and found no systematic difference in the results in terms of the sign and significance of coefficients.

Technological standardization. I measured the supplier's level of technological standardization using the information on insert method for an individual component. I defined technological standardization as a binary variable that takes the value of 1 if all of the components supplied by a supplier to a buyer was inserted by machine, and 0 if at least one of the components required insertion by hand. Insertion by machine does not imply a fully automated production process; instead, it means that a worker uses a machine to insert a component into a phone. During the observation period, starting in 2002, less than 30% of the components required insertion by hand, and there was no upward linear trend in terms of the proportion of components being inserted by

machine. I obtained this information from individual mobile phones' bill-of-materials compiled by IHS.

Social supply chain management program. I measured a buyer's commitment to supply chain sustainability by capturing whether the company has implemented any initiatives to reduce social risks in its supply chain, where social risks include poor working conditions, the use of child or forced labor, lack of a living, fair or minimum wage, etc. Subsequently, I defined social supply chain management (SCM) program as a binary variable that takes the value of 1 when a buyer has explicitly and publicly disclosed any such efforts at the time of a product release, and 0 otherwise. I obtained this information from Bloomberg Environment, Social and Governance (ESG) database. Bloomberg collects ESG information from company-sourced fillings including sustainability or CSR reports, annual reports, company websites, as well as a proprietary Bloomberg survey that requests corporate data directly from the companies. In contrast to other data providers, Bloomberg does not estimate or derive from mathematical models any of the ESG data, making it a preferable choice when comparing before and after a company has adopted social supply chain management programs (Ioannou & Serafeim, 2014).

Workers' rights. To examine whether a labor protest targeting a supplier was legal in its regulatory environment, I computed *workers' rights*, using data from the Cingranelli-Richards (CIRI) Human Rights Data Project (Cingranelli, Richards, & Clay, 2014). According to a human rights and labor rights perspective, workers should have freedom of association at their workplaces and the right to bargain collectively with their employers. CIRI workers' rights score indicates the extent to which workers enjoy these and other internationally recognized rights at work, including a prohibition on the use of any form of forced or compulsory labor; a minimum

age for the employment of children; and acceptable conditions of work with respect to minimum wages, hours of work, and occupational safety and health.

This variable thus measures the extent to which supplier-side workers' rights were legally protected at the time of a product release, and takes one out of three values. A score of 0 indicates that workers' rights were severely restricted; a score of 1 indicates that workers' rights were somewhat restricted; and a score of 2 indicates that workers' rights were fully protected. When a supplier had factories across multiple countries, I took the average CIRI workers' rights score, weighted by the number of factories in each country, and then recoded it to the nearest integer (between 0, 1, and 2). CIRI scores are assigned at the country-year level, and are available up to 2011. I used the 2011 information for the 2011–2014 period.

Natural disaster. To check whether a buyer-supplier dyad is affected in the aftermath of an exogenous and costly shock, I created a binary variable that takes the value of 1 if a supplier's factory is affected by a natural disaster within a 1-year window leading up to a product release, and 0 otherwise. I obtained the natural disaster data from Centre for Research on the Epidemiology of Disasters (2014). Over 800 recorded natural disasters occurred between 2002 and 2014. To focus on disasters that caused a significant level of damage and also to match the relative frequency of disasters with that of labor protests, my current analyses only include natural disasters that caused more than 100 human fatalities and USD 1 million of economic damage. Using each supplier's headquarter and factory addresses, I checked whether each individual address was located in the region in which the disaster occurred. To define the boundary of regions, I used the ISO 3166-2 subdivision codes. These codes uniquely identify the principal subdivisions (e.g., provinces or states) of all countries coded by the International Organization for Standardization.

Control Variables

I included two control variables in the analyses to account for the dependence between a buyer and a supplier and potential switch costs. First, the *percentage of production cost* is the dollar amount a buyer paid a supplier (including labor cost) divided by the production cost for a given mobile phone, and then multiplied by 100. The greater the percentage of purchases made to a supplier, the greater the buyer's dependence on the buyer (Provan & Gassenheimer, 1994). In additional analyses, I replaced this variable with the absolute dollar amount a buyer spent on a supplier for a given model. These two variables were strongly correlated ($r=0.89$, $p<0.01$), and yielded similar regression results. Second, the *number of alternative suppliers* measures the size of the supplier pool a buyer can choose from for a particular component. A large pool of supplier candidates provides a buyer with leverage over its suppliers and also reduces the search and switch costs for choosing a new supplier. Conversely, the limited availability of alternative suppliers constrains the ability of a buyer to reselect another supplier, forcing the buyer to reinvest in extant relationships (Hart & Saunders, 1997). To calculate this variable, I first counted the number of active suppliers in a given year, grouped by component function. Each component was classified into one of five categories: main printed circuit board (PCB), display (e.g., LCD screen), camera, battery, and supporting items (e.g., accessories). To adjust for the positively skewed distribution of this variable, I took its natural logarithm and assigned the value to its corresponding supplier-release date. For example, in 2012, there were 23 suppliers available for the mobile phone camera; this variable takes the value of $\ln(23)=3.14$.

Previous research suggests co-mentions in the newspapers are a good proxy to show that covered companies are embedded in a market network, which also reflects how people are defining and interpreting the market concept as a whole (Kennedy, 2008; Navis & Glynn, 2010).

To control for the legitimizing effect of co-mentions in newspapers, *co-mention in newspapers* was measured in the same way as one of my key independent variable *link visibility*, with one notable difference. While *link visibility* uses user-generated social media data as its source, this variable takes the natural logarithm of the number of newspaper articles mentioning a buyer and a supplier together in the same article during a 6-month window. All newspapers that are included in Lexis-Nexis's "major newspapers" group were used to create the buyer-supplier co-occurrence matrix. Lexis-Nexis defines major newspapers to be listed in the top 50 circulation in Editor & Publisher Year Book for United States newspapers. For the newspapers published outside the United States, they must be written in English language and listed as a national newspaper in Benn's World Media Directory or one of the top 5% in circulation for the country. The list of newspapers that were included in this group source and also appeared in my data is shown in Table 7 in the Appendix at the end of this chapter.

Link visibility (co-mentioning a buyer and a supplier) is a subset of social media posts mentioning a given supplier. Unlike buyers (e.g., Apple, Samsung) that normally receive media attention, both in social media and newspapers, suppliers are typically unknown to lay people. At the same time, some mobile handset suppliers such as Texas Instruments or Seiko Epson Corporation receive a significant amount of attention. Therefore, I controlled for *supplier node visibility* which takes the natural logarithm of value of the number of social media posts that mention a given supplier within a 6-month window starting from 9-month prior to a product release to 3-month leading up to a product release.

Finally, I created a binary variable *smartphone* that takes the value of 1 if a supplier provided components for a smartphone, and 0 for a feature phone. This variable accounts for the possibility that the transition from feature phones to smartphones serves as a technological

discontinuity. Such a technological breakthrough may push firms to allocate excessive focus on short-term over long-term activities (Vuori & Huy, 2016), and may reduce a buyer's dependence on its existing suppliers in the face of a new dominant design (Tushman & Anderson, 1986).

Estimation

This study's unit of analysis is a buyer–supplier dyad, and each dyad is repeated as many times as the number of times a buyer purchased components from a buyer to produce a different mobile phone since 2002. Reliable, comprehensive social media data were only available in the post-2008 period. Therefore I restricted my analyses to the post-2008 period when testing Hypotheses 1 and 2, and used all observations when testing Hypotheses 3, 4, and 5.

Given that the dependent variable in this study, *supplier disengagement,* is a binary variable, I used a conditional logistic regression with dyadic fixed effects for buyer-supplier pairings to test my hypotheses. The use of dyadic fixed effects controls for any time-invariant, unobserved effects between a buyer-supplier dyad. In additional analyses, I also re-ran all models using a conditional logistic regression with dyadic fixed effects for buyer-year pairings, thus only using the variance within a buyer's multiple suppliers in a given year for estimation. I found little systematic difference in the results. In all models, I computed robust standard errors adjusted for clustering at the buyer–supplier parings.

RESULTS

Table 1 provides descriptive statistics and zero-order correlations for all variables included in the analyses. Most correlations shown in Table 1 are low in magnitude, except for among three variables using social media data (*link visibility, audience geographic diversity*, and *supplier node visibility*) and newspaper data (*co-mention in newspapers*). I further checked for

multicollinearity by computing the variance inflation factors (VIFs) and condition numbers. VIFs and condition numbers in all models without interaction terms were smaller than 4. In supplementary analyses, I removed highly correlated variables one at a time and found consistent results for my key predictors. These results suggest that multicollinearity was not likely to be a significant issue in my models.

Table 1. Descriptive Statistics and Correlations

Panel A: Using post-2008 observations

		Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Supplier disengagement	0.20	0.40												
(2)	Labor protest	0.01	0.10	-0.02											
(3)	Natural disaster	0.01	0.10	-0.05	-0.01										
(4)	Link visibility [a]	1.83	2.16	-0.07	0.08	0.07									
(5)	Audience geographic diversity [a]	1.74	1.58	-0.07	0.00	0.07	0.44								
(6)	Technological standardization	0.86	0.35	-0.06	0.04	0.01	-0.07	-0.06							
(7)	Social SCM program	0.43	0.49	-0.14	0.03	0.08	0.05	0.31	0.04						
(8)	Workers' rights	0.92	0.79	-0.02	-0.04	-0.03	-0.03	-0.07	0.21	0.02					
(9)	Percentage of production cost	1.16	2.71	0.04	-0.04	0.01	0.03	-0.05	-0.29	-0.03	-0.10				
(10)	Number of alternative suppliers	4.66	0.51	-0.08	-0.03	0.07	-0.08	-0.03	0.17	0.02	0.09	-0.05			
(11)	Co-mention in newspapers	0.71	1.28	0.00	0.11	0.10	0.69	0.30	-0.04	-0.04	0.06	-0.03	-0.13		
(12)	Supplier node visibility [a]	3.83	2.47	-0.06	0.04	0.05	0.80	0.48	-0.11	0.03	-0.06	0.14	-0.19	0.66	
(13)	Smartphone	0.89	0.31	-0.15	0.03	0.04	0.14	0.14	-0.02	0.16	-0.08	-0.04	-0.05	-0.03	0.09

Panel B: Using all observations

		Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Supplier disengagement	0.19	0.39									
(2)	Labor protest	0.01	0.08	-0.03								
(3)	Natural disaster	0.01	0.08	-0.02	-0.01							
(4)	Technological standardization	0.89	0.32	-0.05	0.02	0.02						
(5)	Social SCM program	0.36	0.48	-0.16	0.05	0.02	-0.04					
(6)	Workers' rights	1.03	0.82	0.00	-0.04	-0.02	0.18	-0.03				
(7)	Percentage of production cost	1.67	3.71	0.01	0.01	0.02	-0.12	-0.08	-0.08			
(8)	Number of alternative suppliers	4.61	0.55	-0.14	-0.02	0.03	0.12	0.14	0.09	0.02		
(9)	Co-mention in newspapers	0.85	1.41	-0.01	0.10	0.08	0.01	-0.03	0.04	0.27	-0.09	
(10)	Smartphone	0.58	0.49	-0.20	0.06	0.01	0.03	0.30	-0.08	-0.08	0.18	-0.06

Note:

[a] Data only available for the post-2008 period.

Tables 2, 3, 4 show the results of the conditional logistic regression on supplier disengagement. Models shown in Tables 2 and 3 only use the post-2008 observations, where social media data are available. Models in Table 4 use all observations from 2002 to 2014. Model 1 in all three tables presents the results of the baseline model. Throughout all models, both availability of alternative suppliers and the buyer's dependence on a particular supplier do not show any systematic pattern with the likelihood of supplier disengagement. Compared to feature phones, I find that for smartphone models, buyers are less likely to disengage from protested suppliers. This can be partially explained by the fact that smartphones are newer, and thus buyers are less likely to disengage from protested suppliers compared to when older feature phones are involved. I find a marginally significant, negative main effect of supplier node visibility, suggesting that suppliers that have a greater presence in the social media are less likely to be removed from their extant partners' supplier base.

Results of Model 2 in both tables show no significant main effect of supplier-targeting labor protests. In some models with an interaction term, the coefficient estimate of the labor protests becomes statistically significant as if suppliers being targeted for labor protests help them continue to supply for their extant partners. It is plausible to imagine buyers may prefer a manageable amount of labor protests occurring at their suppliers' factories if those protests are an inevitable consequence of cost-saving efforts and the disruption to the production process is temporary and bearable. However, I do not find empirical support to show that protests against low wage are meaningfully different from protests for other causes in terms of their impact on a buyer's decision to disengage from a protested supplier. In addition, the combined effect of labor protests (due to its main effect as well as interaction effect) yields little increase in the likelihood of a buyer to disengage from a protested supplier.

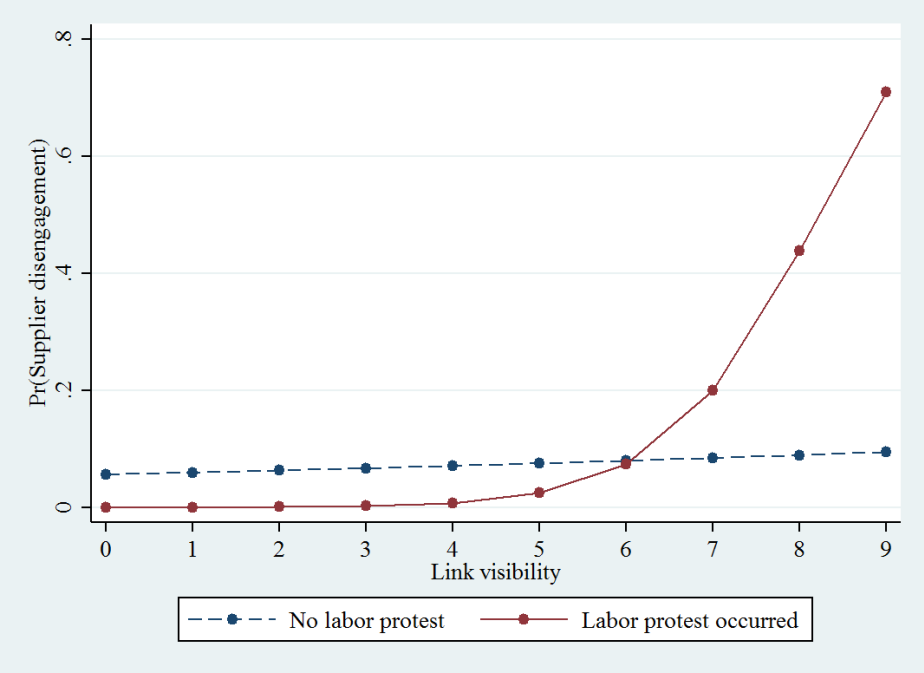
In Model 3 (Table 2), I find a negative and statistically significant interaction between labor protest and link visibility, finding support for Hypothesis 1. Figure 13 illustrates the interaction effect, holding other variables at the mean values. Link visibility increases the likelihood of supplier disengagement when a supplier was a target of labor protests, even after controlling for the supplier node visibility. Figure 13 also reveals that buyers only decide to disengage from protested suppliers when their relationships are highly visible in social media. In my sample, about a quarter of the dyads (23.31%) are not jointly mentioned in the social media throughout the observation period. Companies rarely disengage from suppliers if the labor protest was unnoticed in social media even it was reported in newspapers. In fact, co-mentions in newspapers, which follows the same operationalization with link visibility (in the social media) do not significantly increase the likelihood of supplier disengagement.

Table 2. Conditional Fixed-Effects Logit Regression on Supplier Disengagement

	Model 1	Model 2	Model 3	Model 4
Percentage of production cost	0.021	0.021	0.021	0.021
	(0.042)	(0.042)	(0.042)	(0.042)
Number of alternative suppliers	-0.247	-0.243	-0.243	-0.243
	(0.241)	(0.245)	(0.247)	(0.245)
Co-mention in newspapers	0.147	0.174	0.174	0.172
	(0.217)	(0.217)	(0.217)	(0.216)
Supplier node visibility	-0.230+	-0.229+	-0.225+	-0.229+
	(0.126)	(0.126)	(0.127)	(0.126)
Smartphone	-0.743**	-0.729**	-0.731**	-0.727**
	(0.279)	(0.280)	(0.280)	(0.279)
Buyer-supplier fixed effects	Included	Included	Included	Included
Link visibility	0.067	0.069	0.062	0.068
	(0.097)	(0.096)	(0.098)	(0.096)
Audience geographic diversity	-0.181*	-0.188*	-0.182*	-0.186*
	(0.081)	(0.084)	(0.082)	(0.083)
Labor protest		-0.945	-6.541*	5.860*
		(0.794)	(2.941)	(2.466)
Labor protest x Link visibility			1.077*	
			(0.543)	
Labor protest x Audience geographic diversity				-6.709**
				(0.298)
Observations	985	985	985	985
Wald chi^2	29.30	32.34	35.81	744.3

Notes:
Robust standard errors in parentheses, clustered by buyer-supplier dyads. Observations are limited to the post-2008 period, when social media data become available.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)

Figure 13. The Effect of Link Visibility with or without Labor Protests



The current measure of link visibility does not include social media posts published after a protest event has occurred. However, the results are remarkably similar even when I use social media co-mentions that were posted after the protest event and before the product release. In Table 3, I re-ran all models shown in Table 2 using a different time window to measure link visibility. Now the variable measures the natural logarithm of the number of social media posts that mention a given buyer-supplier dyad together within a 6-month window leading up to a product release. The overall results are very similar even when I include the 3-month period leading up to a product release, during which I measure the presence of labor protests. When I limit the window to a 3-month period leading up to a product release and thus have a complete overlap with the window I use to measure the occurrence of labor protests, the interaction term between labor protest and link visibility is positive and statistically significant at the $\alpha=0.05$ level.

Therefore, these findings suggest that the link visibility driven by social media can shed light on supply chain dynamics in the aftermath of social movements.

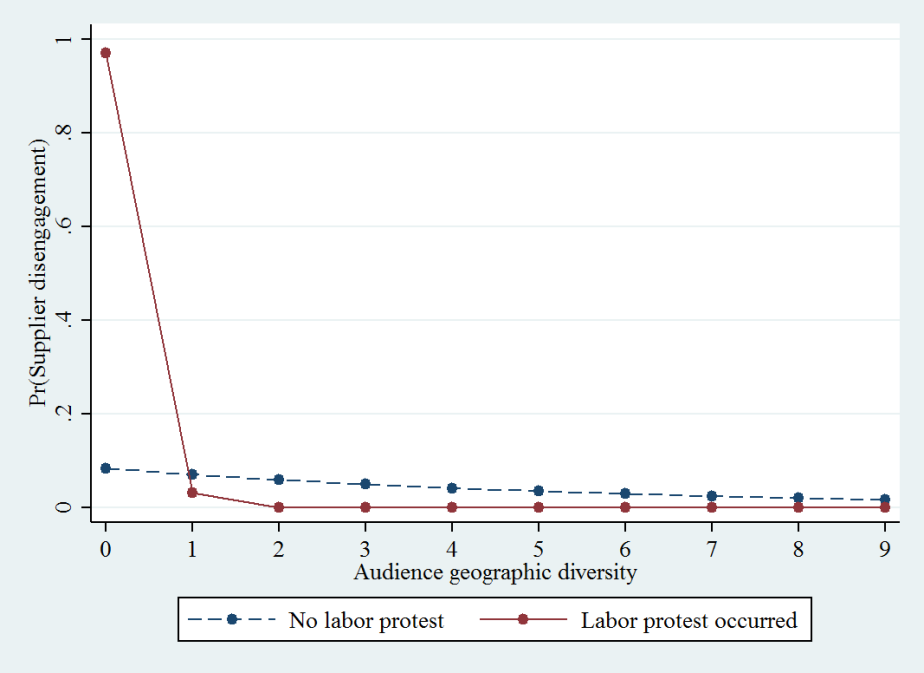
Table 3. Conditional Fixed-Effects Logit Regression on Supplier Disengagement

	Model 1	Model 2	Model 3	Model 4
Percentage of production cost	0.022	0.021	0.022	0.021
	(0.043)	(0.043)	(0.043)	(0.043)
Number of alternative suppliers	-0.252	-0.248	-0.245	-0.248
	(0.248)	(0.253)	(0.254)	(0.252)
Co-mention in newspapers	0.137	0.155	0.131	0.151
	(0.219)	(0.221)	(0.221)	(0.221)
Supplier node visibility	-0.212	-0.213	-0.207	-0.212
	(0.149)	(0.149)	(0.149)	(0.149)
Smartphone	-0.709*	-0.696*	-0.701*	-0.695*
	(0.277)	(0.278)	(0.279)	(0.278)
Buyer-supplier fixed effects	Included	Included	Included	Included
Link visibility [a]	0.037	0.041	0.033	0.040
	(0.181)	(0.181)	(0.181)	(0.181)
Audience geographic diversity	-0.176*	-0.182*	-0.176*	-0.180*
	(0.082)	(0.084)	(0.082)	(0.084)
Labor protest		-0.912	-6.718*	6.029
		(0.786)	(3.242)	(3.688)
Labor protest x Link visibility [a]			1.085+	
			(0.571)	
Labor protest x Audience geographic diversity				-6.837**
				(0.307)
Observations	985	985	985	985
Wald chi2	27.79	30.79	34.89	690.8

Notes:
Robust standard errors in parentheses, clustered by buyer-supplier dyads. Observations are limited to the post-2008 period, when social media data become available.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)
[a] Link visibility is measured using a 6-month window leading up to a product release.

Contrary to Hypothesis 2 where I predicted that a buyer is more likely to disengage from a protested supplier when social media posts originate from geographically diverse locations, the result in Model 4 (Tables 2 and 3) suggests the opposite: as social media posts mentioning a supplier originates from many geographies, a buyer is substantially less likely to disengage from the protested supplier. One plausible explanation is that firms pay more attention to social media posts written by users in rich, developed countries. However, this pattern is consistent even when I remove all social media posts coming from the United States, which accounts for more than half of social media volume. Another plausible explanation is that the digital transition has allowed people to rapidly gather virtually and participate in the online debate without needing to be all present in-person in one physical location, making social media forums a global, geography-free space (Silverstone, 2006; Weichert, 2016). As anyone who wants to be involved in the online discussion can publish, interact, and debate within an imaginary but nonetheless real communication space, the diversity of the people engaging in social media – especially their geographic location – may have insignificant impact compared to their collective volume. As shown in Figure 14, the significant interaction between audience geographic diversity and labor protests is mainly driven by instances where all social media posts originated from a single country (even it is not the United States) compared to coming from multiple countries.

Figure 14. The Effect of Audience Geographic Diversity with or without Labor Protests



In subsequent analyses, I found that the sheer volume of supplier-mentioning social media posts, ignoring geotag information, also substantially reduces the likelihood of supplier disengagement: a buyer is reluctant to disengage from a protested supplier when the supplier has a high social media profile. However, the buyer becomes prone to disengaging from that supplier as its linkage with the protested supplier gains attention on social media.

Table 4. Conditional Fixed-Effects Logit Regression on Supplier Disengagement

	Model 1	Model 2	Model 3	Model 4	Model 5
Percentage of production cost	0.022	0.021	0.021	0.022	0.023
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Number of alternative suppliers	-0.084	-0.086	-0.086	-0.085	-0.085
	(0.118)	(0.118)	(0.118)	(0.118)	(0.118)
Co-mention in newspapers	-0.142	-0.137	-0.138	-0.135	-0.134
	(0.138)	(0.139)	(0.139)	(0.139)	(0.139)
Smartphone	-0.873**	-0.870**	-0.871**	-0.868**	-0.870**
	(0.160)	(0.160)	(0.160)	(0.160)	(0.160)
Buyer-supplier fixed effects	Included	Included	Included	Included	Included
Technological standardization	-0.051	-0.045	-0.053	-0.031	-0.055
	(0.294)	(0.292)	(0.292)	(0.294)	(0.291)
Social SCM program	-1.565**	-1.562**	-1.562**	-1.558**	-1.557**
	(0.206)	(0.206)	(0.206)	(0.205)	(0.206)
Workers' rights	0.180	0.167	0.169	0.177	0.177
	(0.198)	(0.198)	(0.198)	(0.198)	(0.198)
Labor protest		-0.687	-10.731**	-0.116	-0.136
		(1.064)	(1.017)	(1.137)	(1.184)
Labor protest x Technological standardization			10.151**		
			(1.450)		
Labor protest x Social SCM program				-12.789**	
				(1.274)	
Labor protest x Workers' rights					-11.557**
					(1.266)
Observations	2,898	2,898	2,898	2,898	2,898
Wald chi^2	143.5	144.2	251.6	824.6	885

Notes:
Robust standard errors in parentheses, clustered by buyer-supplier dyads.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)

In Model 3 (Table 4), I find a significant interaction between labor protests and suppliers' technological standardization. It is plausible to argue that the supplier's technological standardization should make that supplier a more reliable partner and more replaceable. However, now labor protests have a negative, significant main effect, essentially balancing out this positive interaction.

As indicated by the negative and statistically significant main effect of social SCM program in Model 4 (Table 4), buyers that implemented a social supply chain management program tend to refrain from disengaging from protested suppliers regardless of the occurrence of labor protests. Moreover, when a supplier is targeted for a labor protest, the likelihood of supplier disengagement decreases by 22 percentage points, contrary to Hypothesis 4. This result suggests that the efforts to reduce social risk along one's supply chain are more likely to be manifested as engaging with protested suppliers (e.g., conducting supplier audits) rather than removing them from its supply chain.

Finally, the result in Model 5 (Table 4) shows that buyers are more likely to disengage from a protested supplier when the supplier operates in a regulatory environment in which workers' rights to protest are not protected. Specifically, when supplier-side workers have a low level of freedom of association (i.e., workers' rights have a value of 0) at their workplaces and the right to bargain collectively with their employers, the probability of supplier disengagement decreases by 15 percentage points compared to when they have an average or a high level of rights (i.e., workers' rights have a value of 1 or 2). On the other hand, there is no significant difference in the probability of supplier disengagement between protested suppliers that operate in a region with an average level of workers' rights and those operate in a region where workers' rights are fully protected. Taken together, these results suggest that buyers particularly react to

labor protests taking place in regions where such an event is least likely to occur, supporting Hypothesis 5.

Supplementary Analyses: Labor Protest vs. Natural Disaster

The results shown in Tables 2 and 3 underscore the circumstances under which supplier-targeting labor protests impact supply chain dynamics. Two factors that may result in a biased or inconsistent estimate are (1) the sample selection bias of protest events and (2) the endogenous nature of labor protests. Only a proportion of all public demonstrations receive any media attention. Some protests are deemed to be more "newsworthy." Moreover, the occurrence of labor protests is partially driven by the extent of grievances and available resources to the workers as well as other environmental conditions that allow protests to occur. Labor protests, as a result, arise from the endogenous characteristics of a supplier. In additional analyses (results available upon request), I find that labor protests are more likely to occur when a supplier is frequently mentioned in the social media and (2) its buyer has a larger market share in the mobile handset industry.[1] It is plausible that the likelihood of media coverage on protest events is biased towards highly visible suppliers. Workers consider the potential benefit of labor protest to be greater when the market favors the product that contains their employer's components, and thus they are more likely to demand a larger share of the profit. The latter scenario especially raises the possibility of reverse causality, wherein a supplier-targeting labor protest is caused by the supplier's relationship with its buyer.

One econometrically plausible option to deal with the selection bias of protest events is to employ a Heckman two-step model, thus extracting the effects of selection before estimating the theoretically relevant coefficients in the second stage. However, prior research suggests that the

[1] I obtained proprietary data on mobile handset market shares from IHS for the 2011−2014 period.

uncorrected coefficient is in fact more conservative than the corrected coefficient, indicating the sample selection bias of protest events will result in false negatives as opposed to false positives (Hug & Wisler, 1998). In addition, the fixed-effects approach controls for all, both observed and unobserved, time-invariant differences between buyer−supplier dyads. Therefore, the possibility that one supplier might be more likely to experience labor protests than other suppliers does not affect my main analysis.

Alternatively, I conducted supplementary analyses by replacing labor protests, which are endogenous to the suppliers' characteristics, with natural disasters, which represent destructive exogenous shocks. It is unreasonable to expect natural disasters to be caused by certain buyer−supplier relationships. Labor protests may exert a significant effect on buyer−supplier dyads before as well as after the events take place. On the other hand, natural disasters should only influence buyer−supplier relationships after the event (Tilcsik & Marquis, 2013). Furthermore, only including natural disasters with some level of damage (i.e., at least 100 fatalities and USD 1 million of economic damage) also reduces the likelihood of a disaster event going unnoticed by the media (Gaddy & Tanjong, 1986).

The intuition behind comparing labor protests with natural disasters is that if supplier disengagement was primarily driven by cost, then we should expect to see a similar pattern when the moderator is something that directly impacts day-to-day operations and firm profitability (e.g., technological standardization). On the other hand, factors pertaining to the attention given to a buyer−supplier dyad or a supplier (e.g., link visibility and audience geographic diversity) should be irrelevant to or deter supplier disengagement. For example, natural disasters are unplanned (and unwanted) events that have no significant relationship with supplier-side workers' rights protection. If a supplier's factory was severely damaged by a natural disaster, a buyer is

forced to find a new supplier. This decision should be independent of the extent to which the buyer-supplier relationship is visible in the social media.

Accordingly, I re-ran the analyses for Hypotheses 1−5, using the same set of fixed effects and controls used in Tables 2-4, but replacing labor protests with natural disasters. As reported in Table 5, the analysis revealed similar patterns between labor protests and natural disasters when the moderator is a supplier achieving technological standardization (Hypothesis 3) or a supplier's implementation of social SCM programs (Hypothesis 4). On the other hand, I found no significant interaction between natural disasters and link visibility (Hypothesis 1) as well as between natural disasters and workers' rights (Hypothesis 5). The interaction term between natural disasters and audience geographic diversity was opposite of the interaction between labor protests and audience geographic diversity (Hypothesis 2) but this term was only marginally significant. Taken together, these findings suggest that supplier disengagement in the aftermath of social movements is at least partially caused by the perceived relationship between a buyer and a supplier, above and beyond the operational and financial risks invoked by social movements.

Table 5. Conditional Fixed-Effects Logit Regression on Supplier Disengagement

	Model 1	Model 2	Model 3	Model 4	Model 5
Percentage of production cost	0.021	0.021	0.023	0.024	0.023
	(0.042)	(0.042)	(0.023)	(0.024)	(0.023)
Number of alternative suppliers	-0.240	-0.240	-0.086	-0.086	-0.084
	(0.240)	(0.240)	(0.118)	(0.118)	(0.118)
Co-mention in newspapers	0.157	0.157	-0.135	-0.133	-0.135
	(0.216)	(0.216)	(0.139)	(0.139)	(0.139)
Smartphone	-0.743**	-0.743**	-0.873**	-0.873**	-0.874**
	(0.279)	(0.279)	(0.160)	(0.160)	(0.160)
Supplier node visibility [a]	-0.223+	-0.223+			
	(0.126)	(0.126)			
Buyer-supplier fixed effects	Included	Included	Included	Included	Included
Link visibility [a]	0.065	0.065			
	(0.096)	(0.096)			
Audience geographic diversity [a]	-0.177*	-0.177*			
	(0.081)	(0.081)			
Technological standardization			-0.051	-0.050	-0.051
			(0.294)	(0.293)	(0.294)
Social SCM program			-1.563**	-1.552**	-1.559**
			(0.207)	(0.207)	(0.206)
Workers' rights			0.188	0.187	0.187
			(0.198)	(0.198)	(0.198)
Natural disaster	-14.376**	-16.064**	-7.444**	-0.558	-1.540
	(0.952)	(1.202)	(1.053)	(0.748)	(2.052)
Natural disaster x Link visibility	0.289				
	(0.186)				
Natural disaster x Audience geographic diversity		0.628+			
		(0.346)			
Natural disaster x Technological standardization			6.707**		
			(1.252)		
Natural disaster x Social SCM program				-12.133**	
				(0.897)	
Natural disaster x Workers' rights					0.601
					(1.737)
Observations	985	985	2,898	2,898	2,898
Wald chi2	570.3	703.1	243.3	640.4	149.6

Notes:
[a] Data only available for the post-2008 period.
Robust standard errors in parentheses, clustered by buyer-supplier dyads.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)

Supplementary Analyses: Other Forms of Firms' Responses to Supply Chain Labor Conflicts

One notable limitation of the current study is the nature of my dependent variable, which only captures whether or not a tie exists or not at a given time. My dependent variable does not differentiate how, if at all, a buyer is managing its supplier when the latter continues to be a component supplier. Studying supplier disengagement has several advantages. First, tie dissolution is costly and consequential to organizations involved in the process (Zhelyazkov & Gulati, 2016). Second, tie dissolution, supplier disengagement in particular, is well aligned with broader theoretical questions about organizational boundaries, make-or-buy decisions, supplier switching costs, and supply chain management (Monteverde & Teece, 1982). Third, tie dissolution can be observed and measured in a systematic fashion across many organizations and across a long period of time, which is a substantial challenge in my empirical context.

However, supplier disengagement is only one of various ways firms may respond to supply chain labor conflicts. For example, research on organizational stigma suggests a long list of possible organizational reactions including concealing, defining, denying, accepting responsibility, and withdrawing (Sutton & Callahan, 1987). Also, one can borrow from research on employee job dissatisfaction where actors have an option among voice, exit, loyalty, and neglect (Hirschman, 1970; Withey & Cooper, 1989).

While exploring all of these options are beyond the scope of this chapter, there are new data sources and methods that can be used for future research. For example, third-party supplier audit reports, often conducted at the factory level, provides an opportunity to measure if buyers are actually engaging with their suppliers. Furthermore, they allow researchers to understand how successfully such initiatives are being implemented on the ground in great detail

(Distelhorst, Hainmueller, & Locke, 2017; Locke, Qin, & Brause, 2007; Short et al., 2016). Another possibility is to use press releases to see if companies are responding to their suppliers' issue and whether their responses pertain to concrete, technical actions as opposed to ceremonial actions (Zavyalova, Pfarrer, Reger, & Shapiro, 2012).

As an exploratory analysis, I downloaded all press releases from PR Newswire and Business Wire that mention at least one of the 47 mobile handset manufacturers (buyers) from 2001 to 2014. This query yielded 199,327 press releases and about 16% (n=32,566) of them were released by the buyers in my sample. About a fifth (n=6,626; 20.35%) of press releases published by the buyers in my sample pertain supplier or supply chain issues. I used a type of unsupervised topic modeling called Latent Dirichlet Allocation (LDA), which is used to identify hidden thematic structure in large collections of documents. For a corpus of documents, LDA produces a set of "topics," groups of words that are associated with a single theme. In LDA, the number of topics is specified in advance by the researcher, and the output presents a list of topics wherein each topic is formally defined as a distribution over a vocabulary. Then it analyzes the corpus to estimate simultaneously the topics and how the documents exhibit them (Blei, 2012; Blei, Ng, & Jordan, 2003). The corpus I used for LDA consists of 6,626 press releases initiated by a buyer that mentions the word(s) "supplier" or "supply chain". I removed common English stop words (e.g., the, this, is, are) and short vocabularies (i.e., 4 or fewer characters), and singularized all vocabularies in plural form (e.g., the word "businesses" becomes "business"). Since there is no statistical test for the optimal number of topics or for the quality of a solution (DiMaggio, Nag, & Blei, 2013), I re-ran the algorithm with 10, 30, 50, and 100 topics, but found little systematic differences from increasing the number of topics.

Table 8 in the Appendix displays the 30-topic solution. Topic order has no meaning. Within each topic, the 20 words with highest probability are presented. LDA results indicate that the majority of these releases pertain to new product announcement or earnings. Unfortunately, companies' press releases rarely cover social movements targeting their suppliers. As shown in Table 6, even when companies initiate a press release to comment on their relationships with suppliers, the majority of them concern promoting supplier engagement such as increasing interactions with their supplier base. Companies hardly discuss supplier disengagement or termination in their press releases. Supplier-targeting protests are almost never the reason behind a company issuing a press release.

Table 6. Frequency of Press Releases Covering Supplier Engagement and Disengagement

Type	Frequency	Percentage
All press releases mentioning a buyer	199,327	100%
All press releases mentioning a buyer, and mention supplier or supply chain, and mention protest	34	0.02%
All press releases initiated by a buyer	32,566	100%
All press releases initiated by a buyer, and mention supplier or supply chain	6,626	20.35%
All press releases initiated by a buyer, and mention supplier or supply chain, and mention supplier engagement	258	0.79%
All press releases initiated by a buyer, and mention supplier or supply chain, and mention supplier disengagement	47	0.14%
All press releases initiated by a buyer, and mention supplier or supply chain, and mention protest	1	> 0.01%

Source: PR Newswire (n=95,257) and Business Wire (n=104,070)

DISCUSSION

Modern firms are increasingly expected to be accountable for the sustainability practices of their suppliers. Therefore, when suppliers become targets of labor protests, buyers also bear some responsibility and are expected to respond. In recent years, the public scrutiny on buyer-supplier relationships has grown due to the advent of social media. This heightened scrutiny forces buyers to be even more accountable for the sustainability of their suppliers. In my study of mobile handset manufacturers and their first-tier suppliers from 2002 to 2014, I found that supplier-targeting labor protests lead buyers to disengage from protested suppliers when those buyer-supplier relationships are highly visible on social media. The volume and audiences' geographic concentration of supplier-mentioning social media posts substantially reduces the likelihood of supplier disengagement, possibly suggesting that the geographic diversity of social media posts contributes to disagreement and polarization which weakens the power of social media to act as a unified collective, sending a mixed signal to buyers on whether or not to disengage from protested suppliers (Dutta, 2016).

Somewhat surprisingly, companies that participate in social supply chain management programs are found to be reluctant to switch away from protested suppliers. Instead, the participation in these programs seem to encourage companies to engage with protested suppliers and help suppliers to build their capacity to deal with sustainability issues. One implication of the findings related to companies' involvement in social supply chain management programs is that firms' endeavors to achieve supply chain sustainability may unintentionally and disproportionally raise standards for entrants but not for incumbents, allowing troubled suppliers to remain central players in the industry. As the notion of supply chain sustainability becomes more popular in the field, most firms, both those with high and low involvement in CSR

programs, will expend great effort when screening and selecting new suppliers. However, the pruning out of protested suppliers is primarily driven by companies with low involvement in CSR program. As a result, the global network may become very strict for entrants but seemingly forgiving to incumbents.

Finally, the extent to which workers' rights are protected also influences buyer-supplier network dynamics. The results show that buyers are more likely to cease their relationships with protested suppliers when the suppliers operate in a poor regulatory environment where workers have a low level of freedom of association at their workplaces and restrictions to their right to bargain collectively with their employers. This suggests that buyers are more likely to disengage from protested suppliers in places where protests are not allowed; protests occurring in such environments are likely perceived as more disruptive and costly.

This study makes several theoretical contributions. First, this work contributes to the literature on how illegitimate or controversial activities are spread through inter-organizational relationships (Briscoe, Gupta, & Anner, 2015; Davis, 1991). I explore how firms proactively prune their networks to remove nodes that were targeted for labor protests, which may halt the diffusion of questionable practices in their production network. Existing work also suggests status and legitimacy concerns play an important role in affecting the dissolution and replacement of ties with controversial partners (Jensen, 2006; Jensen & Roy, 2008; Sullivan et al., 2007). My study builds on this work by highlighting the important distinction between actual and perceived relationships with controversial partners. I propose this distinction meaningfully impacts whether firms disengage from controversial partners. Although there is some work comparing the different effects of actual and perceived relationships on individuals' network dynamics (Kilduff & Krackhardt, 1994), I build on this individual-level work by exploring this

distinction at the firm-level, among buyers and suppliers. Lastly, my work builds on prior work about how perceived relationships may exist in the absence of actual relationships (Greve et al., 2016; Huang & Li, 2009; Jonsson et al., 2009). Co-mentions of firms in social media posts proxy the cognitive social structure, or the perceived image of a company's interfirm relationships. Contrasting such perceived relationships with actual relationships collected from unique bill-of-materials, I show that actual relationships can actually be masked by the absence of perceived relationships. Specifically, my study investigates how the illegal or illegitimate behaviors of network partners may go unchecked because actual relationships between buyers and suppliers are not visible or perceived by the public.

Second, this work contributes to the emerging literature on the influence of social media on social movements. On the one end, there are people calling for Twitter to be nominated for the Nobel Peace Prize due to its role in bringing about the Arab Spring. On the other end, represented by Malcolm Gladwell's (2010) attention-grabbing title "Why the revolution will not be tweeted," there are people who downplay the efficacy of social media at achieving the goal of the protesters. My work suggests that buzzes, retweets, and likes fueled by social media can yield desirable social movement outcomes. Even though most social media users are free-floating agents who engage in low-commitment behaviors (Mercea, 2012), have little or no personal relationship with the actual protesters (cf. McAdam & Paulsen, 1993), and do not live in the same region or country as the actual protesters (Morozov, 2012), their online activity helps to shine a spotlight on buyers' relationships with protested suppliers. Without scrutiny from social media, buyers will be less compelled to respond to supplier-targeting labor protests by disengaging from protested suppliers.

Finally, my work contributes to research on sustainable supply chain management. This study examines how companies manage their supply chains to deal with social risks such as labor protests, complementing the abundant research on how companies manage their supply chains to deal with environmental risks (Beamon, 1999; Sarkis, 2003; Srivastava, 2007). This study documents how social supply chain management programs influence companies' decisions relating to their supplier selection and retention. Richard Locke's (Locke, 2013; Locke et al., 2007) research on Nike's supply chains reveal two things. First, private auditing and monitoring systems incur substantial costs, but are unable to deliver a stable, significant improvement in the working conditions in the supply chains such as the protection of freedom of association or the reduction of excessive working hours. Second, real improvement in labor conditions can be achieved by a capacity building approach wherein suppliers are not seen as immoral agents but rather as willing partners who lack certain organizational skills for effective code of conduct enforcement.

My results suggest that buyers that are involved in social supply chain management programs are more likely to maintain relationships with protested suppliers, rather than ending those relationships. Indeed, when buyers keep their relationships with protested suppliers, they can positively influence suppliers through two approaches – compliance with requirements and capacity building (Ciliberti, Pontrandolfo, & Scozzi, 2008). The first approach involves buyers setting standards for suppliers and incentivizing compliance via a strict monitoring program. The second approach involves building up the supplier's own capacity of addressing sustainability issues. Consistent with Locke's argument, my research shows that a firm's focus on long-term relationships with suppliers indeed results in continuing engagement with its suppliers even

when they are targeted for social movements, reducing the tendency to cut-and-run at the slightest sign of trouble.

APPENDIX

Table 7. List of Newspapers Included in the Analysis to Measure Buyer-Supplier Newspaper Co-mentions

Title	Frequency	Headquarter Location
The Mercury News	18,877	USA
The Globe and Mail	14,382	CAN
The New York Times	13,618	USA
Los Angeles Times	9,073	USA
The Toronto Star	8,476	CAN
The Daily Telegraph	8,272	GBR
The Guardian	8,001	GBR
Chicago Tribune	7,449	USA
The Australian	7,354	AUS
The Washington Post	7,018	USA
The New Zealand Herald	6,103	NZL
The Straits Times	5,821	SGP
The Irish Times	5,690	IRL
The San Francisco Chronicle	5,377	USA
South China Morning Post	5,363	HKG
The Dallas Morning News	5,348	USA
Australian Financial Review	5,312	AUS
Wall Street Journal Abstracts	5,184	USA
USA Today	5,000	USA
The Star-Ledger	4,802	USA
The Independent	4,745	GBR
The Houston Chronicle	4,452	USA
The Boston Globe	4,450	USA
Information Bank Abstracts	4,384	USA
The Business Times Singapore	4,241	SGP
The Seattle Times	4,151	USA
Herald Sun/Sunday Herald Sun	3,953	AUS
The Courier Mail/The Sunday Mail	3,923	AUS
Sydney Morning Herald	3,799	AUS
Orlando Sentinel	3,634	USA
The New York Post	3,560	USA
New Straits Times	3,472	MYS
The Daily Telegraph	3,447	AUS
Sun-Sentinel	3,344	USA
The Atlanta Journal-Constitution	3,329	USA

Title	Frequency	Headquarter Location
The Advertiser/Sunday Mail	3,201	AUS
Chicago Sun-Times	3,147	USA
The Kansas City Star	3,085	USA
Tampa Bay Times	3,081	USA
Newsday	3,024	USA
The Miami Herald	2,879	USA
The Japan News	2,671	JPN
Grand Rapids Press	2,440	USA
The Boston Herald	2,401	USA
Daily News	2,217	USA
St. Louis Post-Dispatch	2,171	USA
The Observer	2,162	AUS
The Herald	2,087	GBR
Pittsburgh Post-Gazette	2,042	USA
St. Paul Pioneer Press	2,011	USA
The Philadelphia Inquirer	1,951	USA
The Age	1,904	AUS
Sacramento Bee	1,835	USA
The Orange County Register	1,785	USA
The Columbus Dispatch	1,586	USA
Detroit Free Press	1,561	USA
The Press	1,541	NZL
The Denver Post	1,510	USA
The Arizona Republic	1,504	USA
Fort Worth Star-Telegram	1,474	USA
The San Diego Union Tribune	1,378	USA
The Buffalo News	1,377	USA
The Daily Oklahoman	1,351	USA
The Baltimore Sun	1,303	USA
The Courier-Journal	1,296	USA
The Dominion Post	1,292	NZL
The Charlotte Observer	1,212	USA
Canberra Times	1,177	AUS
Hobart Mercury/Sunday Tasmanian	1,165	AUS
The Tampa Tribune	1,149	USA
San Antonio Express News	1,107	USA
The Oregonian	1,064	USA
The Jerusalem Post	1,001	ISR
The Detroit News	984	USA
The Indianapolis Star	968	USA

Title	Frequency	Headquarter Location
The Plain Dealer	930	USA
Star Tribune	860	USA
The Cincinnati Enquirer	853	USA
The Milwaukee Journal Sentinel	825	USA
The Christian Science Monitor	823	USA
The West Australian	756	AUS
Arkansas Democrat-Gazette	700	USA
The Hartford Courant	697	USA
Times – Picayune	632	USA
Northern Territory News	434	AUS
The Philadelphia Daily News	388	USA
Gazeta Mercantil Online	363	BRA
Sunshine Coast Daily	262	AUS
Journal of Commerce	243	USA
The Nelson Mail	181	NZL
The Hartford Courant	157	USA
The Independent - Daily Edition	154	GBR
The Morning Bulletin	133	AUS
The Northern Star and Rural Weekly	132	AUS
The Chronicle	109	AUS
The Queensland Times	107	AUS
The Daily Mercury and Rural Weekly	101	AUS
NewsMail and Rural Weekly	98	AUS
The Observer	89	AUS
The Coffs Coast Advocate	73	AUS
Business Times	72	MYS
Daily Examiner	69	AUS
The Gympie Times	63	AUS
Tweed Daily News	48	AUS
Fraser Coast Chronicle	46	AUS
Warwick Daily News	31	AUS
Sunshine Coast Sunday	27	AUS
Total	**298,954**	

Table 8. 30-Topic Solution, Unsupervised Topic Model, 20 Highest-Ranked Terms per Topic

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6	Topic 7	Topic 8	Topic 9	Topic 10
Fujitsu	Nokia	percent	Siemens	Siemens	income	Siemens	group	mobile	Panasonic
product	mobile	quarter	automation	plant	operating	healthcare	share	Nokia	power
America	service	company	energy	system	financial	solution	million	service	system
computer	phone	million	industry	power	non-GAAP	medical	billion	company	service
information	company	share	software	technology	quarter	system	financial	technology	energy
solution	network	table	company	billion	company	information	market	software	solution
technology	ability	market	project	company	billion	patient	business	product	technology
warranty	device	product	technology	automotive	million	technology	company	solution	turbine
leading	music	year-over-year	power	control	revenue	clinical	income	information	information
drive	product	revenue	product	emission	fiscal	imaging	ended	network	product
trademark	experience	operating	service	world	segment	management	march	platform	company
drives	technology	Lenovo	business	sector	share	customer	profit	internet	America
service	people	segment	solution	solution	expense	health	fiscal	application	provide
services	including	earning	information	information	amazon	diagnostic	revenue	development	customer
communication	available	shipment	management	September	statement	company	consolidated	leading	leading
performance	market	billion	plant	product	including	support	service	mobility	north
products	internet	service	manufacturing	generation	month	billion	result	industry	business
including	solution	financial	division	turbines	consolidated	provide	operating	world	global
scanner	world	result	customer	supplier	measure	workflow	mobile	provide	industry
right	media	fiscal	global	market	percent	world	increased	customer	drive

Topic 11	Topic 12	Topic 13	Topic 14	Topic 15	Topic 16	Topic 17	Topic 18	Topic 19	Topic 20
Lenovo	cisco	Fujitsu	mobile	service	Lenovo	network	Kyocera	digital	security
Panasonic	product	network	network	Alcatel-lucent	market	service	solar	cable	network
display	software	optical	company	customer	product	mobile	energy	video	service
entertainment	information	networking	world	company	company	solution	corporation	television	company
product	trademark	communication	china	solution	business	Alcatel-lucent	power	service	enterprise
company	customer	service	service	global	Siemens	technology	company	broadband	T-Mobile
design	industry	solution	solution	business	global	access	global	system	solution
technology	technology	Ethernet	communication	technology	billion	operator	module	Motorola	customer
video	service	transport	technology	enterprise	technology	communication	ceramic	technology	product
available	business	platform	market	system	customer	provide	ceramics	information	earthquake
consumer	solution	flashwave	Nokia	provider	information	telecom	industrial	satellite	wireless
mobile	company	trademark	global	world	service	services	generating	Siemens	technology
corporation	global	support	leading	provide	solution	customer	group	solution	ultra-broadband
include	network	system	customer	network	group	provider	japan	provide	information
processor	market	Richardson	provide	industry	growth	broadband	material	network	stoneware
electronic	Siemens	customer	information	networking	industry	system	metal	communication	communication
thinkcentre	system	product	supplier	services	Panasonic	information	advanced	set-top	provide
offer	provide	market	product	cisco	system	networks	equipment	company	Alcatel-lucent
world	server	north	system	Alcatel	world	company	headquarters	access	world
screen	management	information	industry	Euronext	manufacturing	world	march	virtual	provider

Topic 21	**Topic 22**	**Topic 23**	**Topic 24**	**Topic 25**	**Topic 26**	**Topic 27**	**Topic 28**	**Topic 29**	**Topic 30**
Toshiba	Motorola	product	Siemens	hearing	mobile	service	Siemens	tablet	statement
Kyocera	product	Fujitsu	technology	Alcatel-lucent	service	solution	imaging	ThinkPad	company
wireless	technology	technology	information	technology	network	network	medical	business	forward-looking
product	service	software	healthcare	Siemens	solution	smart	healthcare	Lenovo	solution
device	system	storage	industry	instruments	Nokia	system	patient	cloud	product
power	company	biometric	student	company	business	communication	diagnostic	solution	projector
company	digital	solution	education	network	company	mobile	clinical	window	including
mobile	solution	design	Lenovo	solution	technology	company	system	technology	information
phone	electronic	America	school	service	customer	provide	information	retail	business
available	information	system	solution	waterproof	operator	information	technology	product	security
information	global	information	company	billion	internet	product	solution	customer	technology
electronic	communication	application	world	instrument	market	market	image	touch	service
devices	design	performance	community	information	oracle	management	Somatom	software	customer
technology	cable	customer	research	td-lte	leading	customer	disease	company	enterprise
semiconductor	market	market	sector	customer	services	technology	billion	computing	market
feature	network	server	program	sector	product	power	table	include	global
components	provide	company	laboratory	world	content	leading	fiscal	store	Amkor
America	broadband	trademark	apple	mobile	information	support	million	device	result
leading	customer	memory	university	product	enable	business	percent	smartphone	release
corporation	leading	global	billion	wearer	system	solutions	radiation	available	system

CHAPTER FOUR

Network Mechanisms of Supply Chain Evolution, 2007-2013

INTRODUCTION

One of the key business trends over the last couple of decades has been the outsourcing of key business activities to suppliers and subcontractors. Supply chains are increasingly becoming longer, more dispersed, and more complex. Such trends have two implications. First, supply chains became less visible not just to investors and consumers, who are not participating in the production process, but also to the companies themselves. Second, companies are also increasingly exposed to high impact low probability discrete events along their supply chains such as natural disasters, social and political instability, and equipment malfunctions and systemic failures (Kleindorfer & Saad, 2005).

In theory, firms deliberately draw a distinction between what activities should be conducted inside the firm boundary versus outside of it (Coase, 1937; Williamson, 1981). Transactions within the firm's boundary can be monitored and controlled by management, while the firm's ability to do this with its suppliers is limited by contracts. Firms seek to seal off their core technologies from environmental influences (Thompson, 1967) and to manage external control (Pfeffer & Salancik, 1978). At the same time, the fit between a firm and the environment is critical for performance and survival (Miles & Snow, 1994). Therefore, the architecture of a

firm's supply chain network -- the nodes, edges, and the resulting structure from these edges -- would not only represent and reflect its strategy but also influence its performance (Ahuja et al., 2012). In a supply chain context, the buyer has some level of agency in terms of orchestrating a particular network architecture. It can identify a potential supplier from a pool of qualified candidates, and it can choose to create, maintain, or terminate relationships with individual suppliers. As an individual firm makes these decision based on its preferences, constraints, and objectives, a global network as an organizational field evolves over time while the field's properties also influence individual field participants.

In most cases, field reproduction, or the persistence of a given network architecture, is the default option, normally preferred by all actors (Bourdieu & Wacquant, 1992). Relationships tend to endure. Firms that had ties between them in the past are more likely to form ties again in the future (Gulati, 1995; Gulati & Gargiulo, 1999). A longitudinal analysis on supplier selection in the mobile handset industry also documents that there are high perceived switching costs and strong inertia in customer–supplier matches (Alcacer & Oxley, 2014).

One factor that can perturb the stability of the social structure is the occurrence of events that are hard to foresee and have disruptive and potentially inimical impact (Meyer, 1982). The occurrence of such events may destabilize a system and invite new logics of action and interaction, altering the relationships within the field (Corbo, Corrado, & Ferriani, 2016; Fligstein & McAdam, 2012; Powell et al., 2005). Such "shocks" to a system "…can destabilize it and result in a tip in the rules of affiliation and the resulting combinatorial possibilities" (Powell et al., 2005:1190). The occurrence of an environmental jolt, i.e., a low probability discrete event impacting all market participants, provides an opportunity to investigate the process by which an organizational field transforms.

In this chapter, I identify the network mechanisms underlying the network formation process in the mobile handset industry, and investigate how the network mechanisms changed due to an environmental jolt. Specifically, I use several events that occurred in 2010 as an environmental jolt. These events include (1) the Foxconn suicides in Shenzhen, China, (2) the proposal of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, and (3) the passage of the California Transparency in Supply Chains Act. These events greatly increased the amount of attention given to supply chain issues, affecting how firms manage their relationships with extant suppliers, as well as how firms choose new suppliers as the potential cost associated with supplier issues increased. The changes spurred by a sudden increase in the visibility of supply chain involve firms (1) spending more time and energy to understand their supply base and (2) disclosing more information about their supply chains. Micro-macro linkages between an individual's behavior in networks and global network properties often yield unintended consequences. The overall results of this study suggest that firms' endeavors to achieve supply chain sustainability may disproportionally raise standard for low-degree actors but not for high-degree actors, allowing them, both high-degree buyers and high-degree suppliers, to remain central players in the industry.

In the section that follows, I briefly describe these events that occurred in 2010 and how firms were affected by the tragedy with a focus on firms' commitment to corporate sustainability.

2010 AS AN ENVIRONMENTAL JOLT IN SUPPLY CHAINS

Hon Hai Precision Industry Company, more commonly known by its trade name Foxconn, was founded in 1974 in Taipei, Taiwan. In 2010, Foxconn was the largest contract electronics manufacturer in the world. Experts predicted that by 2011, Foxconn would take in more than half of the global electronics manufacturing service industry revenue. Foxconn's tremendous

commercial success is juxtaposed against the harsh working conditions of its young factory workers (Chan & Pun, 2010). Within a period of fewer than eight months during 2010, 18 workers attempted suicide at Foxconn facilities in China. The employees ranged in age from 17 to 25. Fourteen of them were successful in their suicide attempt and the remaining four survived with serious injuries (Chan, 2011). An additional 20 suicide attempts were reportedly thwarted by company officials in the same period (Student & Scholars Against Corporate Misbehavior, 2010).

The shocking suicide events at Foxconn sparked a global media frenzy, focusing the world's attention on the poor labor conditions of Foxconn's workers and the dark side of the manufacturing supply chains of China's export industry. The international media labelled the spate of suicides as the "suicide express" (Jones, 2010). *The New York Times* took on a leading role in the US mainstream media response, with its in-depth coverage of the Foxconn suicides, further placing the issue under international scrutiny (Guo, Hsu, Holton, & Jeong, 2012). Academics, too, offered harsh critique of the labor problems at Foxconn and other Foxconn-like manufacturers, and raised concerns about the social responsibilities of these manufacturers' global business partners, including Apple, Cisco Systems, Dell, Hitachi, HP, IBM, Intel, LG, Nokia, Panasonic, Samsung, Sony, and other major electronic firms (Chan & Pun, 2010; Ling, Kee, & Kueng, 2011; Yuan et al., 2010). Apple, one of Foxconn's largest customers, was especially implicated in the suicide scandal as the factories where the suicides occurred produce high-profile Apple products such as the iPod and iPhone (Lucas, Kang, & Li, 2013).

Following the suicide events, Foxconn was initially undaunted by the negative publicity. Foxconn vice president Cheng Tianzong responded to journalists by saying, "…[S]ome major clients are very concerned with the Foxconn employee suicides, but many of them are our long-

term partners. So it doesn't affect Foxconn's orders" (quoted in Zhao (2010)). Indeed, computer companies tend to focus on long-term relationships with their main contractors, although they sometimes shift contracts to those who can offer better quality, lower cost or greater capabilities (Dedrick & Kraemer, 2011). However, soon after the suicide events in 2010, Apple apparently shifted some iPhone and iPad orders to Taiwanese-owned Pegatron to diversify risk and minimize disruption (Chan, Pun, & Selden, 2013). This diversification highlights the power asymmetries between Apple and its manufacturers as they seek to retain their market position as manufacturers of Apple products. At the same time, global electronic companies continue to exert immense pressure on suppliers to compete against each other on price, quality, and delivery.

The Foxconn suicides of 2010 coincided with the proposal of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (so-called "conflict minerals act") in December 2010. This rule was introduced because of concerns that the use of conflict minerals may help finance armed groups in the Congo area. Under the rule, every SEC filing company—both domestic and foreign issuers—that deems that such minerals 1) are necessary to the functionality or production of a product manufactured or 2) are contracted to be manufactured by the company, would be required to conduct a reasonable investigation and determine whether or not the company's products are clear from the use of conflict minerals and potentially subsidizing war. In essence, this investigation required companies to visualize their complete supply chains (Kim & Davis, 2016).

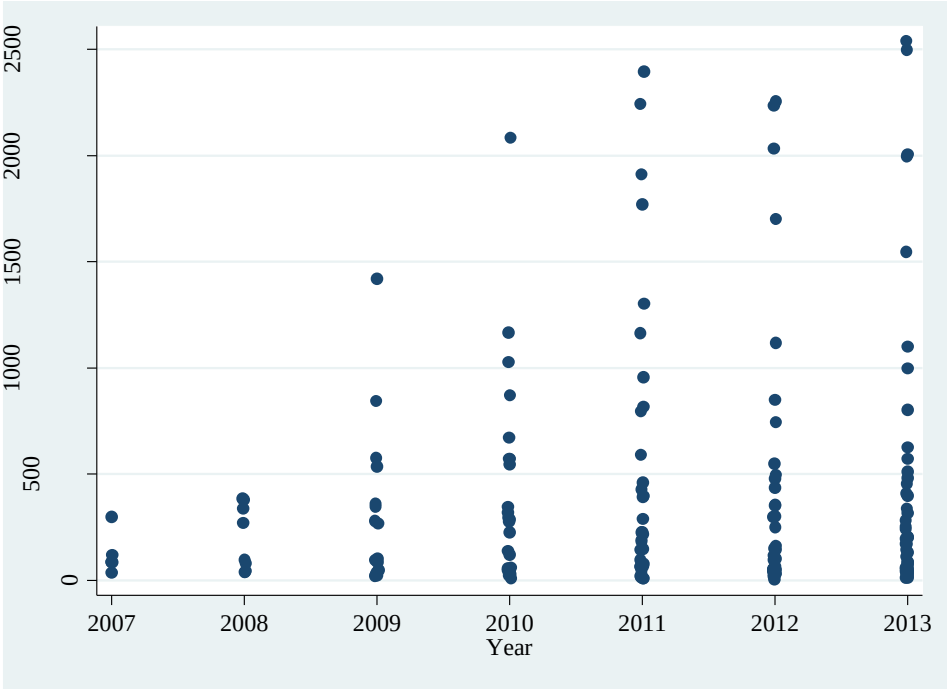
Another closely related event of 2010 is the passage of the California Transparency in Supply Chains Act, which requires all retailers and manufacturers with annual global revenues of more than $100 million that do business in the state of California to disclose information about their efforts to eradicate slavery and human trafficking from their direct supply chains when they

make tangible goods for sale. The main goal of the Act was to improve corporate responsibility practices, refine traceability technologies and create more informed and discerning consumer preferences (Pickles & Zhu, 2013), partially through extending the liability of firms for human rights issue even outside their boundaries (Barrientos, 2013).

These events of 2010 greatly affected how firms manage their relationships with suppliers. These changes were not limited to electronics companies that had deals with Foxconn, operating in the mining industry, or did business in California. In short, these changes involve firms spending more time and energy understanding their supply base and disclosing more information about their supply chains due to the potential cost associated with supplier issues increased. To describe how these events altered the nature of buyer-supplier relationships at the field level, I downloaded the sustainability metrics of all companies that have a global company key (GVKEY) from Bloomberg ESG platform, which resulted in 13,872 unique firms.

In Figure 15, I show the distribution of the supplier audits publicly reported by the sampled companies for a three-year period before and after 2010, respectively. Less than 0.5% of these 13,872 companies reported records of supplier audits in any year between 2007 and 2013. Nonetheless the pattern suggests that companies are increasingly checking the labor conditions of their suppliers.

Figure 15. Number of Supplier Audits Conducted, 2007-2013



Notes:
I removed 8 outliers reported by four companies. These companies include Brasil Foods S.A., Monsanto, Syngenta, and Wal-Mart, all of which reported at least 8,322 (Wal-Mart in 2011) and as many as 37,494 (Monsanto in 2012) supplier audits. The average number of supplier audits conducted drops from 1206 to 416 once I removed these outliers.
Sources: Bloomberg Environment, Social and Governance (ESG) database, extracted on April 29, 2015.

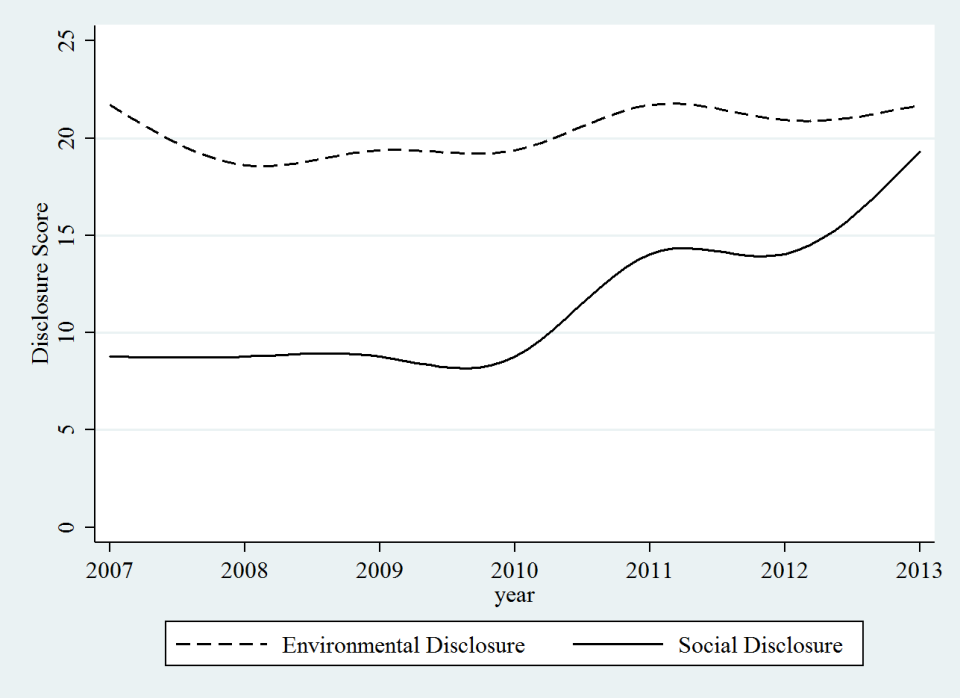
It is plausible to argue that companies are increasingly paying attention to sustainability issues, both social and environmental. However, the comparison between the environmental and social aspects of CSR suggests that it was the latter that was affected by the events of 2010. Bloomberg reports Environmental Disclosure Score (i.e., degree of transparency on environmental metrics) alongside Social Disclosure Score (i.e., degree of transparency on social metrics). Social Disclosure Score primarily pertains to supply chain issues, and its three components are the following: (1) whether a company has implemented any initiatives to reduce the social risks in its supply chain, where social risks include poor working conditions, the use of child or forced labor, lack of a living, fair or minimum wage etc.; (2) whether a supplier's guidelines, which

encompass all Environmental, Social and Governance (ESG) areas, are publicly disclosed; and (3) the total number of supplier audits conducted, wherein audits are concerned specifically with the management of environmental and social risks. About one in five sampled companies (2,709 out of 13,556) had a valid disclosure score.

Figure 16 shows the median-spline plots of environmental disclosure and social disclosure. The increased focus on buyer-supplier relationships after 2010 is particularly remarkable considering that companies' focus on environmental issues did not meaningfully increase during this period. During the three-year period leading up to 2010, the median value of both disclosure metrics were rather stagnant at 10 points for social disclosure and 20 points for environmental disclosure, respectively. Both disclosure scores remained stable despite the Great Recession during this period, and this finding is also consistent with Nollet, Filis, and Mitrokostas (2016) that traced S&P500 firms' corporate social performance during the 2007-2011 period.

However, in the three-year period following 2010, the median social disclosure score doubled, while companies' focus on environmental issue was largely unaffected. Taken together, these patterns suggest that the aforementioned events that occurred in 2010 may function as a jolt in supply chains, which destabilized a system and invited new logics of action and interaction, altering the relationships among the field participants.

Figure 16. Comparison between Environmental and Social Disclosure, 2007-2013



Sources: Bloomberg Environment, Social and Governance (ESG) database, extracted on April 29, 2015.

NETWORK MECHANISMS AND REACTION TO AN ENVIRONMENTAL JOLT

Density and Transitivity

The effect of an environmental jolt on network evolution is contingent upon the nature of the jolt (Madhavan, Koka, & Prescott, 1998). For example, an empirical study of North American firms found that the advent of new technologies such as remarkable increases in internet usage and semiconductor productivity provided significant innovation opportunities which provoke a surge of new ties between firms that were previously not connected to each other (Schilling, 2015). After experiencing such environmental jolts, firms may pursue more open networks as opposed to closed networks in order to access new and diverse resources necessary for continuous innovation (Tatarynowicz, Sytch, & Gulati, 2016).

The central assumption for using 2010 as an environmental jolt is that several events that took place in 2010 resulted in an unexpected, sharp increase in the amount of industry-wide attention given to supply chain issues, increasing the potential cost associated with supply chain issues, which in turn influenced how firms manage their relationships with suppliers. As stated earlier, these changes caused by a sudden increase in the visibility of supply chain involve firms spending more time and energy understanding their supply base and disclosing more information about their supply chains. Events of 2010 substantially increased public awareness about labor issues in global supply chains, as well as the public demand for firms to be more accountable for events occurring along their supply chains. In other words, vetting suppliers became more important, and associating with an unverified supplier put buyers more at the risk of being seen as irresponsible organizations.

I argue that a sudden increase in the level of visibility given to supply chains will make firms reduce their supplier base as opposed to creating ties with suppliers they have not worked with in the past. A threat that has impending negative or harmful consequences for organizations tend to reduce their flexibility and make them more rigid (Staw, Sandelands, & Dutton, 1981). Similar to a regime change, environmental jolts that are perceived as a threat and uncertainty may motivate a preference for a durable and cohesive network structure (Stark & Vedres, 2006). Such a constriction of control leads to simplification and reduction in alternatives considered.

Creating new ties comes at a price. Firms have a limited capacity to inspect potential suppliers and build relationships with them. When a high level of attention is suddenly given to how firms manage their suppliers, the cost induced by the establishment of a tie increases further compared to the past. Exploiting existing partners help firms reduce the field-wide uncertainty, lowering the baseline probability of being penalized by labor issues in their supply chains

(Beckman, Haunschild, & Phillips, 2004). As a result, in the aftermath of an environmental jolt which increases the visibility of the field, firms may turtle up their supply chain network, intensifying pre-existing relationships with trustworthy suppliers. Taken together, I predict the following:

> *Hypothesis 1: Out-degree (i.e., the buyers' tendency to create ties with suppliers) negatively influences tie creation in the post-2010 period.*

Another way firms can respond to the heightened uncertainty following an environmental jolt is to create a cohesive network. Transitive closure, i.e., the tendency for a pair of buyers that share a common supplier to share more suppliers, has several advantages. First, it may reduce the burden of vetting a supplier. For example, in the context of venture syndicates, a prior co-investment relationship between two parties enable them to trust and rely on each other's assessment and monitoring capabilities regarding indirectly connected potential targets (Sorenson & Stuart, 2001). A buyer can also learn about a potential target through its current supplier that is in a structurally equivalent position with the target. This tendency diminishes the uncertainty associated with future partnerships. Second, cohesive networks help buyers obtain a level of accuracy in the information that is being transferred. When a supplier clandestinely seeks to hide, distort, or misrepresent any potentially negative information, closed and cohesive networks are more likely to detect such an instance and levy appropriate sanctions (Coleman, 1988). Finally, transitivity in organizational networks tends to be local, either in terms of geographic or technological proximity (Madhavan, Gnyawali, & He, 2004). In a supply chain context, such a tendency will result in an increase in the sharing of suppliers between two buyers that previously shared suppliers. Following an environmental jolt, the local structure of buyer-

supplier relationships may produce clusters that increase the level of interdependence and collaboration over time. Therefore, I predict the following:

> *Hypothesis 2: Transitivity (i.e., the tendency for two buyers that share a supplier to create ties to have more common suppliers) positively influences tie creation in the post-2010 period.*

Preferential Attachment and Assortativity

Achieving sustainable supply chains requires a high level of commitment from not just buyers, but also suppliers. Many companies ask suppliers to self-assess their sustainability performance as an initial screening step in selecting new suppliers or as part of a risk assessment for identifying which suppliers may require closer attention. Among supply chain management professionals, the selection of new suppliers with relatively high sustainability capabilities and practices is considered a primary lever for achieving supply chain sustainability (UN Global Compact & BSR, 2015:55). From the supplier's perspective, fulfilling such requirements can differentiate them from their competitors, becoming an asset to attract new customers in the market (Kiessling, Isaksson, & Yasar, 2016). However, fulfilling these requirements, like most CSR activities, brings added costs and often hurts the firm's financial performance. Most benefits of CSR revolve around intangible asset creation such as brand image and reputation (Carroll & Shabana, 2010). As a result, it is normally suppliers that are rich in resources that can participate in such activities. In turn, when there is a strong need to partner with sustainable suppliers, I expect previously established suppliers to become more popular.

Even if the true state of labor conditions at a particular supplier is unknown, the number of existing buyers working with that supplier signals its quality. Research on status also suggests that an association with high-status actors enhances the prestige of a firm, while ties with low-

status actors diminishes it (Podolny, 1993). High in-degree suppliers are considered more valuable, and therefore they are desirable partners under high uncertainty. Such a tendency results in a rich-get-richer Matthew effect (Merton, 1968), wherein popular actors become even more popular. The increased visibility caused by the events that occurred in 2010 made established suppliers a safer and more desirable choice. Therefore, following the environmental jolt, I argue that suppliers that were already working with a large number of buyers attract extra new buyers.

> *Hypothesis 3: In-degree popularity (i.e., the tendency for suppliers with high in-degrees to attract extra incoming ties due to their high degrees) positively influences tie creation in the post-2010 period.*

Not all suppliers have the resources or capabilities to attract new buyers. Similarly, not all buyers have the means to create ties with popular suppliers. Some buyers may primarily look for low procurement prices when choosing a supplier, while others may take into account other non-financial considerations. High out-degree organizations, which occupy the central position in the entire network, tend to create ties with other highly embedded partners to minimize potential hazards associated with building new ties (Gulati & Gargiulo, 1999). On the other hand, organizations located at the periphery of the network are constrained in their ability to work their way towards the center of the network. What is left for them are other peripheral partners. As a result, in social networks, there is a general tendency for an assortative mixing wherein high-degree actors associate with each other (Newman, 2003a), resulting in a core-periphery structure in the network.

Significant changes in assortativity signals a shift in the resource requirements for success in the interorganizational field (Ahuja et al., 2012:437). I argue that the added cost

associated with pursing supply chain sustainability may reinforce the core-periphery structure. The ability to improve workers' low wages and poor working conditions are most likely to occur for established suppliers and buyers that are willing to pay the price. As predicted in Hypothesis 3, any buyer would prefer to create a tie with a reputed, established supplier. Both buyers and suppliers have limited capacity to build relationships with them, and the upheaval in the field made popular suppliers even more popular. Other things being equal, prominent suppliers will tend to build relationships with prominent buyers, and vice versa. As a result, less popular buyers are typically left with opportunities to build ties only with other less popular suppliers.

In addition, highly visible buyers and suppliers attract a disproportionate amount of attention from consumers and activists, influencing them to engage in the efforts to achieve supply chain sustainability. On the other hand, small and peripheral firms either do not have the resources to do so, and/or are relatively invisible to others. Taken together, I predict that after 2010, the level of assortative mixing increased, resulting in a stronger core-periphery structure in the network.

> *Hypothesis 4: Out-in degree assortativity (i.e., the tendency for high out-degree buyers to create ties with high in-degree suppliers) positively influences tie creation in the post-2010 period.*

DATA AND METHODS

Data

As detailed in Chapter Two, to capture fine-grained buyer-supplier relationships in the global mobile handset industry, I extracted each component's maker (supplier) information from each individual model's bill-of-materials compiled by Information Handling Services (IHS). This company buys electronic products and breaks them down to trace their component suppliers.

Each phone contains hundreds of components. Once the IHS technicians decompose a phone into its components, they extract the lot number assigned to each component and verify the component's supplier name, function, and specification. I obtained all mobile handset teardown reports published by IHS until 2014, which yielded 399 models.

To create longitudinal network data centered around 2010, I restricted my sample to the 2007−2013 period. Limiting sample to this period also reduces the risk of inadvertently attributing observed network changes to the transition from feature phones to smartphones (Schilling, 2015). Only buyers and suppliers that were active (i.e., released a phone for buyers; manufactured a component for a mobile handset for suppliers) since 2007 were kept in the analysis, resulting in a sample that consists of 15 buyers and 189 suppliers. It is possible that companies that were only active in the pre-2010 period or in the post-2010 period operate under different network mechanisms in terms of their directions or magnitudes. As a result, the findings here only apply to companies that experienced and survived the events of 2010. The list of mobile phone brands (i.e., buyers) are shown in Table 9.

Table 9. List of Mobile Phone Brands Included in the Analysis

Alcatel	Apple	Blackberry	HTC	Huawei
Lenovo	LG	Motorola	Nokia	Panasonic
Samsung	Sharp	Sony	Vodafone	ZTE

For each year $_{y}$, I created a 15 x 189 matrix where each row represents a buyer and each column represents a supplier. Each cell of the matrix takes the value of 1 if a component manufactured by a supplier was included in a buyer's product released in year $_{y}$ or year $_{y-1}$, and 0, otherwise.

Since a buyer has some level of agency in terms of orchestrating a particular network architecture, I assume that a buyer sends out a tie, and a supplier receives a tie.

An analysis of a two-mode network requires two sets of nodes, and ties are only established between nodes belonging to different sets. While these are definitional properties of a two-mode network, they create two issues in terms of accurately describing the reality. First, some suppliers in the mobile handset industry are buyers themselves (e.g., Samsung, LG). However, two-mode networks cannot define ties between buyers or between suppliers. Therefore, it fails to capture if and how some suppliers accumulate knowledge and resources to become buyers, eventually directly competing with them in the product market (Wan & Wu, 2017). Second, loops cannot be defined despite their significance (i.e., in-sourcing) in reality. As a result, I removed all loops, and treated an organization that is a buyer as well as a supplier as two distinct entities. For example, ties from Apple as a buyer to Samsung as a supplier are included, and ties from Samsung as a buyer to Samsung as a supplier are excluded.

Methods

Investigating the mechanisms that drive network change over time requires a method that allows for the simultaneous analysis of different effects on network change. Therefore, in this chapter I use a type of stochastic actor-oriented model called Simulation Investigation for Empirical Network Analysis (SIENA). SIENA is designed for statistically estimating models for network evolution by combining panel data and an actor-driven approach (for details, see Conaldi, Lomi, & Tonellato, 2012; Ripley, Snijders, Boda, Voros, & Preciado, 2017; Snijders, van de Bunt, & Steglich, 2010). Specifically, it identifies the model specification that is most likely to generate the observed networks at discrete points in time. This process is done in three steps. First, each actor's objective function that reflects the hypothesized underlying network-formation process,

such as in-degree popularity and out-in degree assortativity effects, is defined. Objective functions are represented as a linear combination of these network effects. Second, network simulation is conducted to maximize actors' objective functions. The initial observation (i.e., network of 2007 in this study) is considered the process starting value. Third, after each iteration, parameter values are updated to make the average of simulated statistics as close as possible to the statistics obtained from the observed network. This iteration continues until a model specification minimizes the divergence between the simulated and observed networks. Due to the required computing resources in the simulation, this method is applicable to networks with approximately 10 to 1,000 nodes, observed in two more waves. The network sample featured in this chapter (7 waves of a two-mode network consisting of 15 buyers and 189 suppliers) meet this criterion.

SIENA, as a class of stochastic actor-oriented models, has three key assumptions. First, actors are seen as having full knowledge about the network and attributes of others. Second, actors are seen as having agency which allows them to change their outgoing ties and attributes. Third, ties are assumed to be states (not events) that are relatively stable, and the network change is calculated as an outcome of a Markov process. In other words, only the current state of the network probabilistically predicts its next state.

In SIENA, network change depends on two functions: rate function and objective function. The former determines the opportunities of relational change, which is based on a Poisson process for each actor. Objective function describes preferences and constraints of actors as choices of tie changes which are determined by a linear combination of effects. The combination of the rate function and objective function defines a continuous-time Markov chain. At any given moment, one probabilistically chosen actor has an opportunity to change an

outgoing tie. This change can be either adding a new tie, dropping an existing tie, or simply doing nothing. SIENA only handles binary networks, and thus increasing or decreasing edge weight is not an admissible option for an actor. The probability of choice among multiple options is modeled by a multinomial logistic regression, specified by an objective function. A description of possible tie change patterns is shown in Table 10.

Table 10. Possible Tie Change Patterns between Two Nodes Observed in Two Time Points

At t_1	At t_2	Meaning
i j	i → j	Create a new tie
i → j	i → j	Maintain an existing tie
i → j	i j	Sever an existing tie
i j	i j	Maintain not having a tie

Source: Adapted from (Ripley et al., 2017: 14)

Dependent Variable

Given that each tie can have four patterns between two time points as shown in Table 2, the rate, or the log-odds ratio between different admissible changes are defined as dependent variables. This study's dependent variable, *tie creation*, captures the propensity for a focal buyer to create a tie with a supplier. Specifically, the measure is operationalized as the log-odds ratio between the summation of (1a) creating a tie which did not exist in the past and (1b) maintaining an existing tie and the summation of (2a) severing an existing tie and (2b) maintaining not having a tie. This measure is identical to "network evaluation" in the SIENA framework.

In subsequent analyses, I also employ an alternative measure of tie creation. The alternative measure uses the log-odds ratio between (1) creating a tie which did not exist in the past and (2) maintaining not having a tie. SIENA researchers commonly call this "network

creation." Severing an existing tie is seen as the opposite of creating a new tie. The difference between two measures of tie creation is the inclusion or exclusion of maintaining an existing tie. The first measure (network evaluation) assumes that the propensity to create a new tie is equal to the propensity to maintain an existing tie. Given the importance of supplier switching costs in the mobile handset industry, it is necessary to test if my results are affected by this assumption. Therefore, in additional analyses I created a new dependent variable, *tie maintenance*, which is defined as the log-odds ratio between (1) maintaining an existing tie and (2) severing an existing tie. This measure is identical to "network endowment" in SIENA framework. I reported these findings in the Appendix Tables 13 and 14.

Effect Parameters

Out-degree effect (density effect). This effect measures the number of outgoing ties. It serves as a baseline parameter (i.e., control variable) that must be included in all models. The effect can be defined as the following:

$$Out - degree = \sum_j x_{ij;all\ different}$$

where x_{ij}=1 if a tie from i to j exists; 0 if a tie from i to j does not exist.

The possible nonlinear effect of out-degree can be tested by modeling *out-degree activity effect*, which reflects tendencies to dispersion in out-degrees of the actors. This effect captures if buyers with high out-degrees send out extra outgoing ties because of their high current out-degrees. A positive value for this parameter suggests that buyers with many suppliers in a given year will continue adding new suppliers in the following year. The use of square roots is recommended to reduce the collinearity between this effect and the out-degree effect. The measure can be formally defined as the following:

$$Out - degree\ activity = \sum_j x_{ij} \times \sqrt{\sum_j x_{ij}}$$

Transitivity effect. In a two-mode network, ties can be only established between nodes belonging to different sets, therefore a triadic closure cannot be defined. Alternatively, transitivity in two-mode networks is expressed by the number of four-cycles (Robins & Alexander, 2004). This reflects the extent to which actors who make one choice in common also make other choices in common. The measure can be defined as the following:

$$Transitivity = \frac{1}{4}\sum_{j,k,h;all\ different} x_{ij}x_{ik}x_{hj}x_{hk}$$

In-degree popularity effect. This effect is measured as the sum of the square roots of the in-degrees of the suppliers to which a buyer is tied, and reflects tendencies to dispersion in in-degrees of the suppliers. The substantive meaning of this effect is the extent to which suppliers with high in-degrees attract extra incoming ties from buyers because of their high current in-degrees. Formally, the effect is expressed as the following:

$$In - degree\ popularity = \sum_j x_{ij} \times \sqrt{\sum_h x_{hj}}$$

Out-in degree assortativity effect. This effect reflects tendencies for buyers with high out-degrees to prefer to be tied to suppliers with high in-degrees. The use of square roots is recommended to reduce the collinearity between this effect and the out-degree effect. The measure is defined as the following:

$$Out - in\ degree\ assortativity = \sum_j x_{ij} \times \sqrt{\sum_j x_{ij}} \times \sqrt{\sum_h x_{hj}}$$

RESULTS

Table 11 shows network summary statistics. The first three rows of the table describe degree-related measures. Each year's bipartite network consists of 15 buyers and 189 suppliers. Density measures the number of observed edges divided by the number of possible edges (15 x 189 = 2,835). During the observation period, each buyer had about 40 ties with suppliers, and the density of the network was relatively stable, ranging from 0.177 to 0.235. Another indication that the network was relatively stable during the 2007-2013 period can be found from the high values of Jaccard index, which is defined as:

$$Jaccard\ Index = \frac{Frequency\ of\ tie\ maintenance}{Frequency\ of\ tie\ creation,\ \ tie\ dissolution,\ \ and\ tie\ maintenance}$$

For example, Jaccard index of 2007 measures the similarity between the 2007 network and 2008 network, and is calculated as the 516 maintained ties divided by the sum of 91 created ties, 83 terminated ties, and 516 maintained ties (516/(91+83+516)=0.748). Jaccard index is a measure of stability, i.e., the similarity between network at time $_t$ and time $_{t+1}$. Jaccard index values greater than 0.3 are recommended as the threshold to estimate the longitudinal data as an evolving network as opposed to a collection of disjointed networks (Snijders et al., 2010). Using this criterion, the high Jaccard index values during the observation period, ranging from .622 to .748, suggest the year-to-year changes in the network is indeed an evolution of the same network.

Table 11. Network Summary Statistics

Year	2007	2008	2009	2010	2011	2012	2013
Density	0.211	0.214	0.188	0.199	0.231	0.235	0.177
Average degree	39.933	40.467	35.533	37.533	43.600	44.333	33.533
Number of edges	599	607	533	563	654	665	503
Jaccard index	0.748	0.629	0.689	0.638	0.711	0.622	
Tie changes							
From 0 to 0	2145	2135	2186	2092	2064	2115	
From 0 to 1	91	93	116	180	117	55	
From 1 to 0	83	167	86	89	106	217	
From 1 to 1	516	440	447	474	548	448	

Notes:
Networks consist of 15 buyers and 189 suppliers. Tie changes measure the composition of the (before vs. after) x (tie absence (=0) vs. tie presence (=1)) frequencies. See Table 2 for details.

Table 12 shows the results of SIENA models for tie creation. In Appendix Tables 13 and 14, I also present the results of SIENA models using an alternative measure of tie creation (i.e., log-odds of creating a new tie over maintaining not having a tie) as well as the propensity to maintain an existing tie (i.e., log-odds of maintaining an existing tie over severing an existing tie). As previously mentioned, my primary dependent variable assumes that the creation and endowment effects are equal. Separating the contribution of an effect into two tie creation and tie endowment functions reduces the model's statistical power, and thus most SIENA studies limit their attention to "network evaluation effects," which is how I measured the study's dependent variable (Ripley et al., 2017).

The results across the three dependent variables are remarkably similar, with the notable difference being the lack of statistical significance for the main effects (but not the interaction effects) of in-degree popularity and out-in degree assortativity in the models shown in the Appendix. Convergence ratio, shown at the bottom of the table, captures the extent to which the simulated values deviate from the observed values. This value needs to be close to 0, and values

smaller than 0.1 indicate excellent convergence (Ripley et al., 2017). Models including the high-order term of buyers' out-degree have a convergence ratio greater than 0.1, primarily due to their correlation with out-degree. Increasing the number of iterations and repeating the simulation after carrying previous estimates gradually decrease the convergence ratio. In this study, I repeated the simulation three times for all models, where each simulation were set to have up to 3,000 iterations for parameter estimation.

Table 12. SIENA Models for Tie Creation (i.e., Network Evaluation in SIENA)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Rate parameter, 2007	13.078**	13.122**	13.680**	13.261**	13.207**	13.049**	13.103**	13.942**	13.365**	13.293**
	(1.064)	(1.026)	(1.084)	(1.106)	(1.079)	(1.032)	(1.032)	(1.214)	(1.104)	(1.105)
Rate parameter, 2008	20.787**	20.956**	22.811**	21.224**	21.313**	20.819**	21.062**	23.747**	21.523**	21.608**
	(1.462)	(1.397)	(1.63)	(1.438)	(1.491)	(1.425)	(1.46)	(1.792)	(1.531)	(1.536)
Rate parameter, 2009	16.094**	16.536**	17.944**	16.262**	16.739**	16.272**	17.026**	19.114**	16.412**	17.277**
	(1.283)	(1.323)	(1.483)	(1.251)	(1.295)	(1.235)	(1.318)	(1.606)	(1.256)	(1.424)
Rate parameter, 2010	22.505**	22.966**	25.124**	22.709**	23.29**	21.256**	23.143**	27.085**	21.694**	23.697**
	(1.522)	(1.575)	(1.846)	(1.605)	(1.683)	(1.404)	(1.661)	(2.052)	(1.47)	(1.729)
Rate parameter, 2011	17.187**	17.246**	18.359**	17.473**	17.571**	17.214**	17.408**	18.873**	17.613**	17.699**
	(1.197)	(1.262)	(1.411)	(1.295)	(1.254)	(1.255)	(1.275)	(1.487)	(1.291)	(1.242)
Rate parameter, 2012	21.591**	21.779**	23.704**	22.171**	22.082**	21.643**	21.916**	24.654**	22.369**	22.432**
	(1.448)	(1.441)	(1.653)	(1.507)	(1.437)	(1.477)	(1.522)	(1.762)	(1.522)	(1.519)
Out-degree	-0.804**	-1.051**	-1.147**	-1.162**	-1.078**	-0.812**	-1.252**	-1.371**	-1.366**	-1.252**
	(0.029)	(0.121)	(0.036)	(0.079)	(0.102)	(0.028)	(0.113)	(0.036)	(0.078)	(0.096)
Out-degree activity		0.031**					0.052**			
		(0.012)					(0.012)			
Transitivity			0.006**					0.008**		
			(0.000)					(0.000)		
In-degree popularity				0.203**					0.303**	
				(0.036)					(0.036)	
Out-in degree assortativity					0.016**					0.025**
					(0.005)					(0.005)
Post-2010 dummy x Out-degree						0.466**				
						(0.077)				
Post-2010 dummy x Out-degree activity							0.024**			
							(0.006)			
Post-2010 dummy x Transitivity								0.002**		
								(0.001)		
Post-2010 dummy x In-degree popularity									0.201**	
									(0.037)	
Post-2010 dummy x Out-in degree assortativity										0.010**
										(0.003)
Maximum convergence ratio	< 0.1	> 0.1	> 0.1	<0.1	> 0.1	< 0.1	> 0.1	> 0.1	< 0.1	> 0.1

Notes:
Standard errors in parentheses.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)

The rate function models the speed by which the dependent variable, *tie creation*, can change. Rate parameters estimate the speed by which each network actor gets an opportunity for changing its score on the dependent variable, including unobserved changes. As a result, some opportunities for change lead to the decision 'no change'. Some of these changes may be cancelled (e.g., making a new choice and then withdrawing it again). As a result, the average observed number of differences per actor will typically be smaller than this estimate. On average, each buyer had about 17 opportunities for change prior to 2010, and 20 opportunities after 2010.

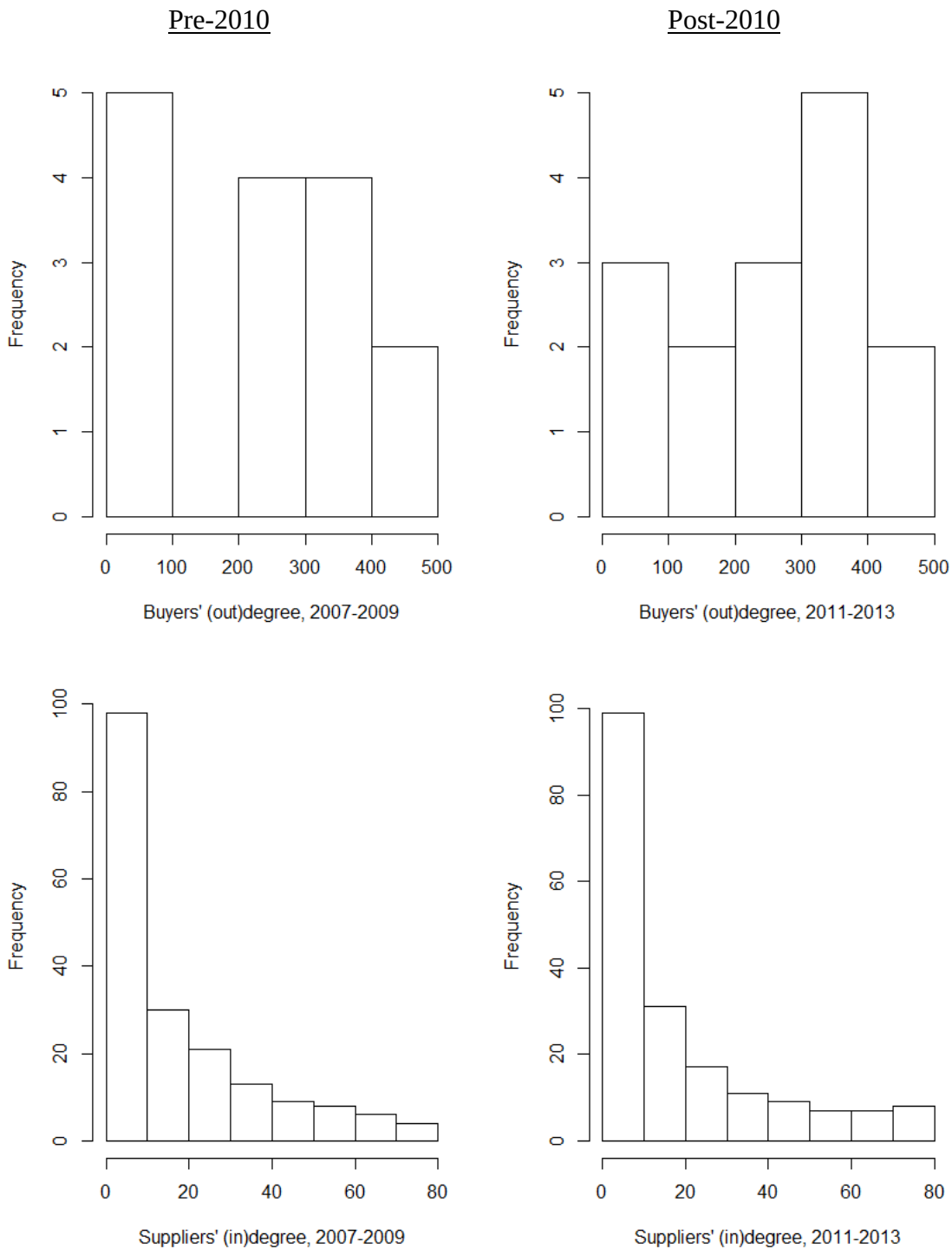
Models 1-5 show the results of the weight estimation of tie creation without time heterogeneity (i.e., interaction between a structural effect and a time period dummy variable). Models 6-10 add an interaction term between a structural effect and a post-2010 period dummy variable. Except for rate parameters, other coefficients can be interpreted as rate of change, or to be precise, as log-odds ratios: the contributions to log-probabilities of increasing the dependent variable by 1 unit when the effect is increased by 1 unit (Ripley et al., 2017). Because these estimates are non-standardized, researchers are normally interested in the sign and statistical significance of parameters. In short, if a parameter is positive and significant, it can be argued that the variable associated with such a parameter drives tie creation. Likewise, if a parameter is negative and significant, the variable associated with such a parameter drives tie creation in the opposite direction, i.e., it is driving tie dissolution. If a parameter value and significance are null, the corresponding effect does not drive tie creation (Lazega, Mounier, Snijders, & Tubaro, 2012).

While I do not have data to proxy each firm's size or production capacity, if large buyers have more suppliers and vice versa, we would most likely have observed positive coefficients for out-degree parameters. However, across all models, out-degree (i.e., density) parameters have negative and statistically significant coefficients, suggesting that buyers are reluctant to create

and maintain ties with random suppliers. This finding is common in networks where there is a cost associated with creating and maintaining random ties. A tie is created and maintained only when its cost is outweighed by other components of the utility function which have positive and statistically significant parameter estimates. Out-degree activity has a positive effect, indicating that high out-degree buyers create and maintain a disproportionately large number of ties with suppliers (Model 2). Transitivity (Model 3), popularity (Model 4), and assortativity (Model 5) effects are all found to be meaningful predictors for understanding supply chain network dynamics.

In Hypothesis 1, I predicted that buyers will constrict their supplier base to a smaller set of suppliers post-2010. Results of Model 6 indicate the opposite. Despite the cost associated with creating and maintaining ties (as indicated in the negative main effect of out-degree), I find that buyers were expanding their supplier base in the post-2010 period. This was especially so for buyers with many existing suppliers rather than few existing suppliers, as indicated by the positive interaction between out-degree activity and the time dummy in Model 7. The upper panel of Figure 17 shows how the out-degree distribution of buyers changed before (left) and after (right) 2010. The comparison between the two graphs clearly indicates a sharp increase in buyers' out-degree.

Figure 17. Degree Distribution of 2007-2009 and 2011-2013



Both out-degree (density) effect and out-degree activity effect pertain to creating and maintaining random ties, i.e., relationships with suppliers regardless of their extant in-degree. Therefore, a positive effect of out-degree and out-degree activity effects raises the possibility that the events that occurred in 2010 served as a structure-loosening event wherein previously low in-degree suppliers became more attractive as a partner than compared to the past (Madhavan et al., 1998). If buyers are indeed creating and maintaining more random ties after the jolt, buyers' tendency to partner with a high in-degree supplier will be as great as their tendency to partner with a low in-degree supplier, eventually reducing the centralization and core–periphery separation of the global network.

However, results from the subsequent models indicate the opposite. Results in Model 8 suggest a small yet significant increase in the importance of transitivity in the post-2010 period. Supporting Hypothesis 2, I find that after 2010, there was a stronger tendency for two buyers that already share a supplier to have more common suppliers in the following year. Similar to transitive triangles, the parameter for 4-cycles (a bipartite network version of transitivity and triadic closure) is an indicator of clustering and strength, which also indicates the presence of core-periphery structures in the global network (Borgatti & Everett, 1999). Results show that the jolt accelerated local clustering, inducing stronger effects of 4-cycles and making the network more cohesive.

Consistent with Hypothesis 3, in Model 9 I find significant empirical support for the preferential attachment mechanism (i.e., in-degree popularity) in the post-2010 period. A positive value for in-degree popularity indicates a supplier's cumulative advantage in which large in-degrees reinforce themselves over time leading to high levels of dispersion in the in-degree distribution in the global network (Snijders et al., 2010). The extent to which buyers, net

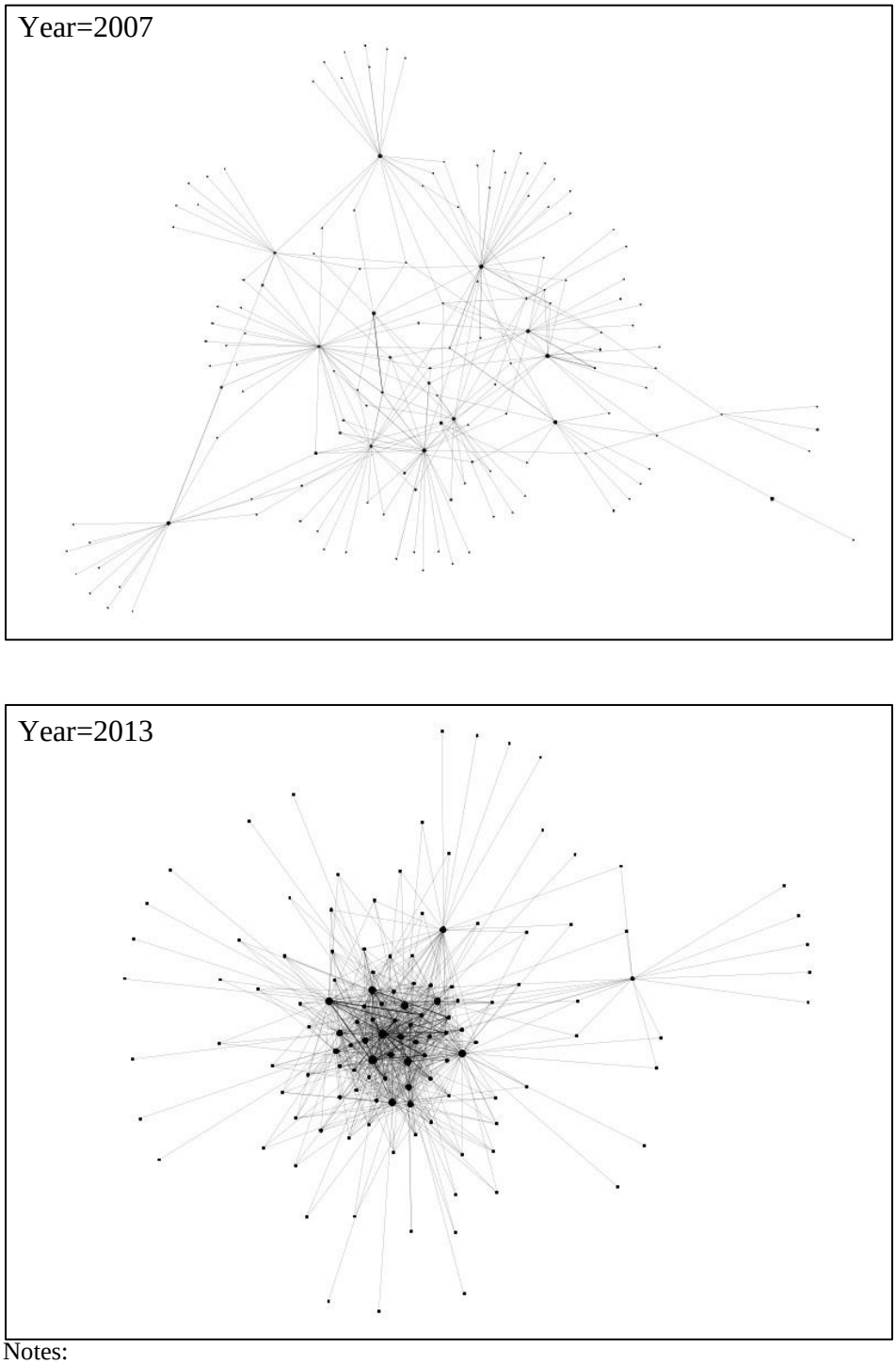
of their own out-degree, tend to choose suppliers that already have many buyers (i.e., high in-degree) significantly increased in the post-2010 period. The lower panel of Figure 3 shows how the in-degree distribution of buyers changed before (left) and after (right) 2010, using a 3-year window. The comparison between the two graphs suggests that the degree distribution did not change much for low-degree suppliers. The main difference comes from the thickened right tail of the distribution: already popular, proven suppliers became even more popular after 2010.

Finally, Model 10 tests the assortativity mechanism wherein degree-based homophily drives network evolution. Supporting Hypothesis 4, the parameter estimates of the interaction term suggests that there is a stronger tendency for buyers with many suppliers to create and maintain relationships with suppliers that have many buyers. On the same token, in the post-2010 period, buyers with few suppliers were more likely to be connected to suppliers with few buyers. A significant change in the level of assortativity may indicate a shift in the resource requirements for success in the industry (Ahuja et al., 2012). I find that the events that occurred in 2010 increased the importance of the assortativity logic, reinforcing the core-periphery structure. Compared to the pre-2010 period, it became even more difficult for buyers with a narrow supplier base to build ties with high-degree suppliers. At the same time, low-degree suppliers were also stuck with low-degree buyers.

Taken together, SIENA results suggest that the supply chain network in the mobile handset industry became denser post-2010, resulting in more opportunities for suppliers to attract new relationships. However, the level of inequality in terms of suppliers' in-degree also increased, indicating that previously popular suppliers captured most of the new opportunities. Figure 18 shows snapshots of the network at the beginning (2007) and end (2013) of the observation period. In 2007, the network was much more dispersed and modularized. Each buyer

appears as a local hub which has its own supplier base, some of which were being shared with other buyers. The network figure of 2013 depicts a much more centralized network. Previously high-degree suppliers, which were already manufacturing components for multiple buyers, attracted more ties from other buyers. As a result, the network features a strong core-periphery structure. I should note, however, that these changes occurred gradually as opposed to suddenly after 2010. As indicated by the high level of Jaccard index values, which measures stability of a system, what the results show is an evolving network as opposed to a collection of disjointed networks (Snijders et al., 2010).

Figure 18. Supply Chain Network of 2007 (top) and 2013 (bottom)



Notes:
Node sizes are proportional to node degree, and edge widths are proportional to the number components transferred from a supplier to a buyer. Isolates are removed. Both graphs use Yifan Hu's (2005) proportional layout algorithm implemented in Gephi.
Source: IHS

DISCUSSION

As products are now routinely produced and sold having never been touched by employees of the company named on the label (Davis, 2013), disperse supply chains make addressing sustainability issues extremely difficult for both businesses and scholars. Supply chains are increasingly becoming longer, more dispersed, and more complex. As a result, they are becoming less visible. Companies are also increasingly exposed to high impact low probability discrete events along their supply chains. While buyer-supplier relationships are supposed to endure, events that are hard to foresee and have disruptive and potentially inimical impact may the stability of the social structure, and the logics driving field evolution.

In this chapter, I used several events that occurred in 2010, including (1) the Foxconn suicides in Shenzhen, China, (2) the proposal of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, and (3) the passage of the California Transparency in Supply Chains Act, as an environmental jolt that greatly increased the amount of attention given to labor issues in supply chains. Specifically, I investigated how an industry-wide, sudden increase in the visibility of supply chain issues influences network mechanisms driving supply chain network evolution. In my study of mobile handset manufacturers and their first-tier suppliers from 2007 to 2013, I found that the supply chain network became denser after the jolt, resulting in more opportunities for suppliers to attract new relationships. Also, my results indicate that buyers responded to the heightened uncertainty by pursuing a closed, cohesive network. However, the level of network inequality also increased—previously popular suppliers captured most of the new business opportunities. Relatedly, a degree-based homophily became more prevalent after the jolt, wherein high out-degree buyers were creating ties with high in-degree suppliers. As the value of being an established supplier increased in the post-2010 period,

less popular buyers were left with opportunities to build ties only with other less popular suppliers. Thus, a previously dispersed and modularized network became more centralized, featuring a stronger core-periphery structure compared to before 2010.

One interesting finding from the study is the out-degree effect, which had a negative effect in general but had a positive effect post-2010. Both out-degree and out-degree activity effects pertain to creating and maintaining random ties, i.e., relationships with suppliers irrespective to their network attributes. Given the cost associated with creating new ties, most SIENA studies using inter-organizational networks data find a negative effect of out-degree. An increase in tendencies to create random ties often leads to a reduction of the centralization and core–periphery separation of the global network. The poor get richer and highly central actors forgo a central position while more peripheral actors become more central. Instead of an increase in matches between high-degree buyers and low-degree suppliers, one may expect more matches between low-degree buyers and high-degree suppliers. However, results from the subsequent models showed the opposite. One plausible explanation is that buyers responded to the events that occurred in 2010 by having multiple suppliers for a single component. This approach is often viewed as a means of mitigating supply risk, including cost and reliability. However, this option also comes at a cost. Keeping multiple suppliers for a single component increases the level of coordination needed to improve the efficiency of operations and the difficulty of obtaining homogenous inputs (Agrawal & Nahmias, 1997; Milgate, 2001). Moreover, keeping multiple suppliers, or having a larger number of suppliers, makes a firm's supply chain even more complex than before. And increased density, i.e., adding more ties, may lead to a sudden, non-linear change in the property of the aggregate.

Another interesting observation is that I found the exact same patterns (i.e., increase in the tendency of out-degree effect, transitivity effect, popularity effect, and assortativity effect in the post-2010 period) for models predicting tie creation and tie maintenance *separately* (see Appendix Tables 13 and 14). As previously mentioned, in the SIENA framework, these two are assumed to be equal. However, in interorganizational networks, and in the supply chain context, there is often a qualitative difference between creating a new tie and maintain an existing tie (Dahlander & McFarland, 2013). For example, it is reasonable to argue that maintaining a relationship with an extant supplier would cost a buyer less than creating a relationship with a new supplier. Naturally, network mechanisms for tie creation and tie maintenance may differ. For example, if the purpose of using network characteristics (e.g., degree) was to reduce uncertainty about whether the partner is capable or reliable, network characteristics may be more relevant for the formation of a tie but not for its maintenance. Once the relationship has been formed, partners can assess each other's capability and reliability through direct interactions, which reduce the value of network-based information (Shipilov, Rowley, & Aharonson, 2006). My results, however, suggest that network-based information continues to be a relevant criterion for maintaining an existing tie as if direct experience cannot improve the accuracy of judgments of each other's capability and reliability.

With these findings, the present chapter makes several contributions. First, I contribute to the work on network dynamics and field evolution (Fligstein, 1991; Fligstein & McAdam, 2011, 2012; Powell et al., 2005) by explicating a set of network mechanisms which drive network dynamics following an environmental jolt. Extant work primarily focuses on whether actors, under duress, increase their network size to seek flexibility (e.g., Schilling, 2015), or whether they become rigid and decrease the breadth of their network (e.g., Beckman et al., 2004; Romero,

Uzzi, & Kleinberg, 2016). My finding constitutes a notable extension to understanding how the pursuit of flexibility (e.g., out-degree) and the pursuit of stability (e.g., transitivity) *jointly* influence field evolution in the aftermath of industry-wide disruptive events, and their concomitant implications. Second, my work also hints at the unintended consequences of CSR. The simulation results concur with previous findings that the ties between extant, central actors tend to create a barrier that restricts outsider's entry (Hochberg, Ljungqvist, & Lu, 2010). As a result, incumbents pursuing an accountable supply chain may create a barrier to entry for newcomers. For example, there were 34 new suppliers in my sample that entered the mobile handset industry during the 2007-2009 period. There were only 9 new suppliers during the 2011-2013 period. In other words, firms' attempts to attain supply chain sustainability may disproportionally raise standards for low-degree actors but not for high-degree actors, allowing both high-degree buyers and high-degree suppliers to remain central players in the industry. Finally the primary objective of this chapter is to investigate if and how "different mechanisms play greater or lesser roles as networks evolve" (Rivera, Soderstrom, & Uzzi, 2010:108). Hence, this study directly responds to the call for more research on network dynamics (Ahuja et al., 2012; Rivera et al., 2010).

In terms of methodology, this study adds to the growing interest in dynamic models of social network analysis (e.g, Corbo et al., 2016; Ebbers & Wijnberg, 2010). Stochastic actor-oriented models such as SIENA allow researchers to apply a dynamic or evolutionary approach to social network analysis. As an analytical tool, stochastic actor-oriented models are particularly useful in analyzing two-mode network data. Conventional ways of analyzing two-mode network data included (1) projecting the data into a one-mode network data, which suffers from the loss of information occurring from reducing dimensionality; and (2) running direct statistical analysis

of two-mode dyads, which cannot explain for local dependencies from which social networks develop and change (Conaldi et al., 2012; Robins & Alexander, 2004). If the assumptions of stochastic actor-oriented models can hold in researchers' empirical settings, these models offer a powerful alternative to redress limitations found in other approaches.

APPENDIX

Table 13. SIENA Models for Tie Creation (i.e., Network Creation in SIENA)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Rate parameters	Included	Included	Included	Included	Included	Included	Included	Included
Out-degree	-1.176**	-1.532**	-1.348**	-1.383**	-1.269**	-1.716**	-1.506**	-1.564**
	(0.057)	(0.084)	(0.129)	(0.230)	(0.058)	(0.081)	(0.122)	(0.229)
Transitivity		0.009**				0.010**		
		(0.001)				(0.001)		
In-degree popularity			0.091				0.159**	
			(0.067)				(0.063)	
Out-in degree assortativity				0.016				0.024**
				(0.011)				(0.011)
Post-2010 dummy					0.591**			
x Out-degree					(0.151)			
Post-2010 dummy						0.005**		
x Transitivity						(0.001)		
Post-2010 dummy							0.458**	
x In-degree popularity							(0.075)	
Post-2010 dummy								0.034**
x Out-in degree assortativity								(0.001)
Maximum convergence ratio	< 0.1	> 0.1	> 0.1	> 0.1	<0.1	> 0.1	>0.1	> 0.1

Notes:
Standard errors in parentheses.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)
As of SIENA version 4.0, out-degree activity effect in bipartite networks can be only estimated in network evaluation models.

Table 14. SIENA Models for Tie Maintenance (i.e., Network Endowment in SIENA)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Rate parameters	Included	Included	Included	Included	Included	Included	Included	Included
Out-degree	-1.316**	-1.525**	-1.417**	-1.456**	-1.449**	-1.661**	-1.521**	-1.578**
	(0.059)	(0.075)	(0.149)	(0.192)	(0.057)	(0.075)	(0.150)	(0.184)
Transitivity		0.002**				0.002**		
		(0.001)				(0.001)		
In-degree popularity			-0.015				0.007	
			(0.056)				(0.058)	
Out-in degree assortativity				0.002				0.005
				(0.009)				(0.008)
Post-2010 dummy					0.606**			
x Out-degree					(0.149)			
Post-2010 dummy						0.002**		
x Transitivity						(0.001)		
Post-2010 dummy							0.191**	
x In-degree popularity							(0.065)	
Post-2010 dummy								0.022**
x Out-in degree assortativity								(0.006)
Maximum convergence ratio	< 0.1	> 0.1	> 0.1	> 0.1	< 0.1	> 0.1	> 0.1	> 0.1

Notes:
Standard errors in parentheses.
** p<0.01, * p<0.05, + p<0.1 (two-tailed)
As of SIENA version 4.0, out-degree activity effect in bipartite networks can be only estimated in network evaluation models.

CHAPTER FIVE

Conclusion: Summary of Findings and Implications for Future Research

SUMMARY OF FINDINGS

My dissertation explores the interplay between social supply chain sustainability and supply chains dynamics. Building on my earlier work which suggests that widespread outsourcing may have reduced the corporate sector's capacity to account for the practices that yield its products (Kim & Davis, 2016), my dissertation is focused on the question of how network visibility influences organizational accountability and network dynamics. To explore the shifting shape of supply chain networks in this industry, I constructed an original dataset of OEM–component supplier relationships extracted from over 400 mobile phones' bill of materials released from 2002 to 2014.

In my first empirical essay (Chapter Three), I studied the manner and mechanisms by which social movements (e.g., labor protests and strikes) influence buyer-supplier relationships. My results show that supplier-targeting labor protests lead buyers to disengage from protested suppliers when those buyer-supplier relationships are more visible on social media (i.e., blogs, forums, Twitter, and Facebook), while volume and audiences' geographic concentration of supplier-mentioning social media posts substantially reduces the likelihood of supplier disengagement. In addition, buyers' commitment to supply chain sustainability initiatives and supplier-side workers' political opportunity structures influence the likelihood of supplier

disengagement following labor protests. To ensure the robustness of my results, I also compared the consequences of labor protests, which suppliers are partially responsible for, with the consequences of natural disasters, which suppliers have no control over. Furthermore, I conducted an exhaustive search of press releases and newspaper articles, and found that firms rarely acknowledge supply chain labor issues. Overall, my findings suggest that although the identities of companies' supply chains are mostly hidden, social media and social movements can put a spotlight on supply chain issues.

In my second empirical (Chapter Four), I investigated how an industry-wide, sudden increase in the visibility of the supply chains influences the evolution of organizational fields. Environmental jolts, or events that are hard to foresee and have disruptive impact, can perturb the stability of social structure, destabilize a system, invite new logics of action and interaction, and alter the relationships within the field. Empirically, I used several events that took place in 2010, including (1) the Foxconn suicides in Shenzhen, China, (2) the proposal of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, and (3) the passage of the California Transparency in Supply Chains Act, as an environmental jolt in supply chains and conducted a series of stochastic actor-oriented models to identify how the network mechanisms of network evolution changed after a steep increase in the field-level visibility of the supply chain network. Unlike my prediction that firms will constrict their supplier base after the jolt, simulation results indicate that the supply chain network became denser, resulting in more opportunities for suppliers to attract new relationships. However, the level of inequality in terms of suppliers' in-degree also increased: previously popular suppliers captured most of the new opportunities, resulting in a rich-get-richer Matthew effect (Merton, 1968). Also, the logic of transitivity and assortativity became more prevalent post-2010, reflecting firms' preference for

established suppliers. As a result, a previously dispersed and modularized network became more centralized, featuring a strong core-periphery structure. These findings suggest that firms' endeavors to achieve supply chain sustainability in the post-2010 period may have disproportionally raised the standard for low-degree suppliers but not for high-degree suppliers, allowing already popular and established suppliers to remain central players in the network.

FUTURE DIRECTIONS

Against this backdrop, I hope to continue developing my research program on the challenges associated with corporate accountability in supply chains settings. Here I provide a set of promising future research topics that expand my focus towards an ecosystem-based perspective of supply chain networks. I look forward to pursuing these topics in the years to come.

First, extending the scope of research beyond immediate, direct buyer-supplier relationships will allow researchers to explore the impact of social movements that penetrate beyond the target firm and its direct partners. The majority of prior research regarding supply chain disruptions has focused on their effects on firms' direct connections. However, recent findings show that some firm-specific shocks impact the revenue of firms multiple degrees (i.e., paths, tiers) away from their origins (Carvalho, Nirei, Saito, & Tahbaz-Salehi, 2016; Wu, 2016). At the same time, much of labor issues in supply chains involve subcontractors, although even car manufacturers, which rely heavily on their supply chains, have difficulty identifying their fourth- or fifth-tier suppliers. One possible avenue for future research will be exploring how far the impact of firm-targeting social movements can propagate along the supply chain network, and identifying the set of conditions which cause firm managers to respond to issues that were legally and/or physically unrelated to the focal firm (e.g., Dessaint & Matray, *forthcoming;* Tilcsik & Marquis, 2013). Relatedly, this line of research can shed light on if and how supplier-

targeting social movements can create social and community-based value beyond the protest target.

Second, recognizing that firms are embedded in multiple types of relationships, and buyer-supplier relationships being one of them, future research can benefit from investigating the evolutionary dynamics of multiplex networks. Firms belong to multiple network layers of distinct types of relationships such as dependence, collaboration, and conflict. Multiplex networks become consequential when different types of roles and relationships overlap and interact with each other, creating processes that cannot be explained by a single network alone (Gould, 1991; Heaney, 2014; Padgett & Ansell, 1993; Sytch & Tatarynowicz, 2014). Yet these different network layers are correlated with one another rather than being combined at random (Min, Yi, Lee, & Goh, 2014; Szell, Lambiotte, & Thurner, 2010). In other words, one type of relationship most likely influences the dynamics of another type of relationship. Recent methodological advances in stochastic actor-oriented models allow researchers to unravel the relationship dynamics among different sets of relationships (Snijders, Lomi, & Torló, 2013). Will firms that were targeted by social movements build a coalition among themselves and cooperate more in the future (Huitsing, Snijders, Van Duijn, & Veenstra, 2014)? Will the increase in interdependence between two firms due to sharing a supplier stifle possible litigation between them? Or conversely, can litigation between firms explain why some triads consisting of strong collaborative relationships remain open due to their supply chain network dynamics (Granovetter, 1973)? Answering such questions will provide a better understanding of the dynamics of supply chain networks.

Finally, a particularly promising direction for future research is the implications for entrepreneurial opportunities that put improving supply chain visibility at the core of their

business model. In recent years, market researchers witnessed a growing demand from consumers for companies to address social and environmental issues. For example, a study of consumers from nine of the largest countries in the world by gross domestic product (GDP) found that 84 percent of consumers globally report that they seek out responsible products whenever they can (Sustainable Brands, 2015). Four-in-five are willing to consume or purchase fewer products to preserve natural resources or buy a product from an unknown brand if it has strong CSR commitments. The rising demand for supply chain accountability and transparency has resulted in a groundswell of new social innovations from entrepreneurs. The same technology that enables customers to pay for an item by simply swiping the phone over the tag can allow them to link to data about the product's origin, certifications, and trajectory through the chain. Up-and-coming social enterprises use new technologies to create applications and tools that provide rich data about conditions along the supply chain. For instance, LaborVoices (https://www.laborvoices.com/) uses crowd-sourcing technology to instantly poll factory workers based all over the world on the safety and working conditions of the factories in which they work, and large corporations purchase and use the information to identify low-risk, model factories and hedge against problematic factories. The advent of such technology-driven entrepreneurs provides rich research opportunities to investigate how new technologies to provide provenance data to the marketplace can reduce the social risk in the global supply chain networks; and how the symbiotic interdependence between industry incumbents and new entrants determines the trajectory of industry evolution.

REFERENCES

Agrawal, N., & Nahmias, S. 1997. Rationalization of the supplier base in the presence of yield uncertainty. ***Production and Operations Management***, 6(3): 291-308.

Ahuja, G., Soda, G., & Zaheer, A. 2012. The genesis and dynamics of organizational networks. ***Organization Science***, 23(2): 434-448.

Alcacer, J., & Oxley, J. 2014. Learning by supplying. ***Strategic Management Journal***, 35(2): 204-223.

Almeida, P., & Lichbach, M. 2003. To the internet, from the internet: Comparative media coverage of transnational protests. ***Mobilization: An International Quarterly***, 8(3): 249-272.

AT Kearney. 2011. Carbon disclosure project: Supply chain report 2011. London, UK: CDP.

Aven, B. L. 2015. The paradox of corrupt networks: An analysis of organizational crime at enron. ***Organization Science***, 26(4): 980-996.

Baker, W. E., & Faulkner, R. R. 1993. The social organization of conspiracy: Illegal networks in the heavy electrical equipment industry. ***American Sociological Review***, 58(6): 837-860.

Bansal, P., & Roth, K. 2000. Why companies go green: A model of ecological responsiveness. ***Academy of Management Journal***, 43(4): 717-736.

Barrientos, S. W. 2013. 'Labour chains': Analysing the role of labour contractors in global production networks. ***The Journal of Development Studies***, 49(8): 1058-1071.

Barrot, J.-N., & Sauvagnat, J. 2016. Input specificity and the propagation of idiosyncratic shocks in production networks. ***Quarterly Journal of Economics***, 131(3): 1543-1592.

Beamon, B. M. 1999. Measuring supply chain performance. ***International Journal of Operations & Production Management***, 19(3): 275-292.

Beckman, C. M., Haunschild, P. R., & Phillips, D. J. 2004. Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. ***Organization Science***, 15(3): 259-275.

Blei, D. M. 2012. Probabilistic topic models. ***Communications of the ACM***, 55(4): 77-84.

Blei, D. M., Ng, A. Y., & Jordan, M. I. 2003. Latent dirichlet allocation. ***Journal of Machine Learning Research***, 3(Jan): 993-1022.

Borgatti, S. P., & Everett, M. G. 1999. Models of core/periphery structures. ***Social Networks***, 21: 375-395.

Bourdieu, P., & Wacquant, L. J. 1992. ***An invitation to reflexive sociology***. Chicago: University of Chicago Press.

Brammer, S., Hoejmose, S., & Millington, A. 2011. Managing sustainable global supply chain: Framework and best practices. Ontario, London: Network for Business Sustainability.

Brammer, S., & Millington, A. 2006. Firm size, organizational visibility and corporate philanthropy: An empirical analysis. ***Business Ethics: A European Review***, 15(1): 6-18.

Briscoe, F., Gupta, A., & Anner, M. S. 2015. Social activism and practice diffusion: How activist tactics affect non-targeted organizations. ***Administrative Science Quarterly***, 60(2): 300-332.

Calhoun, C. 2013. Occupy wall street in perspective. ***British Journal of Sociology***, 64(1): 26-38.

Carroll, A. B., & Shabana, K. M. 2010. The business case for corporate social responsibility: A review of concepts, research and practice. ***International Journal of Management Reviews***, 12(1): 85-105.

Carter, C. R. 2005. Purchasing social responsibility and firm performance: The key mediating roles of organizational learning and supplier performance. ***International Journal of Physical Distribution & Logistics Management***, 35(3): 177-194.

Carvalho, V. M., Nirei, M., Saito, Y. U., & Tahbaz-Salehi, A. 2016. ***Supply chain disruptions: Evidence from the great east japan earthquake***. Columbia Business School Research Paper No. 17-5, New York: NY.

Centre for Research on the Epidemiology of Disasters. 2014. Em-dat: The international disaster database. Université Catholque de Louvain, Brussels, Belgium. http://www.emdat.be/.

Chan, J. 2011. Islave: Jenny chan explores life and death at one of china's most successful companies, ***New Internationalist***. Retrieved from https://newint.org/features/2011/04/01/islave-foxconn-suicides-workers/. Posted on April 1, 2011. Accessed on April 5, 2017.

Chan, J., & Pun, N. 2010. Suicide as protest for the new generation of chinese migrant workers: Foxconn, global capital, and the state. ***Asia-Pacific Journal: Japan Focus***, 8(37): 1-42.

Chan, J., Pun, N., & Selden, M. 2013. The politics of global production: Apple, foxconn and china's new working class. ***New Technology, Work and Employment***, 28(2): 100-115.

Chen, T. 2014. Strengthening the competitiveness and sustainability of a semiconductor manufacturer with cloud manufacturing. ***Sustainability***, 6(1): 251.

Ciliberti, F., Pontrandolfo, P., & Scozzi, B. 2008. Investigating corporate social responsibility in supply chains: A sme perspective. ***Journal of Cleaner Production***, 16(15): 1579-1588.

Cingranelli, D. L., Richards, D. L., & Clay, K. C. 2014. The ciri human rights dataset (version 2014.04.14). http://www.humanrightsdata.com.

Clauset, A., Newman, M. E. J., & Moore, C. 2004. Finding community structure in very large networks. ***Physical Review E***, 70(6): 066111.

Coase, R. H. 1937. The nature of the firm. ***Economica***, 4(16): 386-405.

Cohen, L., & Frazzini, A. 2008. Economic links and predictable returns. ***Journal of Finance***, 63(4): 1977-2011.

Coleman, J. S. 1988. Free riders and zealots: The role of social networks. ***Sociological Theory***, 6(1): 52-57.

Conaldi, G., Lomi, A., & Tonellato, M. 2012. Dynamic models of affiliation and the network structure of problem solving in an open source software project. ***Organizational Research Methods***, 15(3): 385-412.

Corbo, L., Corrado, R., & Ferriani, S. 2016. A new order of things: Network mechanisms of field evolution in the aftermath of an exogenous shock. ***Organization Studies***, 37(3): 323-348.

Dahlander, L., & McFarland, D. A. 2013. Ties that last: Tie formation and persistence in research collaborations over time. ***Administrative Science Quarterly***, 58(1): 69-110.

Davis, G. F. 1991. Agents without principles? The spread of poison pill through the intercoporate network. ***Administrative Science Quarterly***, 36(4): 583 - 613.

Davis, G. F. 2011. The twilight of the berle and means corporation. ***Seatle University Law Review***, 34(4): 1121-1138.

Davis, G. F. 2013. Can global supply chains be accountable?, ***Yale Global Online***. Retrieved from http://yaleglobal.yale.edu/content/can-global-supply-chains-be-accountable. Posted on May 16, 2013. Accessed on May 18, 2013.

Davis, G. F. 2016. ***The vanishing american corporation: Navigating the hazards of a new economy***. Oakland, CA: Berrett-Koehler Publishers.

Davis, G. F., Whitman, M. V., & Zald, M. N. 2013. Political agency and the responsibility paradox: Multinationals and corporate social responsibility. In B. Maiguashca, & R. Marchett (Eds.), ***Contemporary political agency: Theory and practice***. London, United Kingdom: Routledge.

Dedrick, J., & Kraemer, K. L. 2011. Market making in the personal computer industry. In G. G. Hamilton, M. Petrovic, & B. Senauer (Eds.), ***The market makers: How retailers are reshaping the global economy***: 291-310. Oxford, United Kingdom: Oxford University Press.

Dessaint, O., & Matray, A. *forthcoming*. Do managers overreact to salient risks? Evidence from hurricane strikes. ***Journal of Financial Economics***, Retrieved from http://ssrn.com/abstract=2358186. Posted on November 22, 2013. Accessed on October 28, 2016.

DiMaggio, P., Nag, M., & Blei, D. 2013. Exploiting affinities between topic modeling and the sociological perspective on culture: Application to newspaper coverage of u.S. Government arts funding. ***Poetics***, 41(6): 570-606.

Distelhorst, G., Hainmueller, J., & Locke, R. M. 2017. Does lean improve labor standards? Management and social performance in the nike supply chain. ***Management Science***, 63(3): 707-728.

Doig, S. J., Ritter, R. C., Speckhals, K., & Woolson, D. 2001. Has outsourcing gone too far? ***The McKinsey Quarterly***, Autumn 2001(4): 25-37.

Dutta, S. 2016. Creating in the crucibles of nature's fury: Associational diversity and local social entrepreneurship after natural disasters in california, 1991–2010. ***Administrative Science Quarterly***.

Dyer, J. H., Cho, D. S., & Chu, W. 1998. Strategic supplier segmentation: The next "best practice" in supply chain management. ***California Management Review***, 40(2): 57-77.

Earl, J., & Kimport, K. 2011. ***Digitally enabled social change: Activism in the internet age***. Cambridge, MA: MIT Press.

Earl, J., Martin, A., McCarthy, J. D., & Soule, S. A. 2004. The use of newspaper data in the study of collective action. ***Annual Review of Sociology***, 30: 65-80.

Ebbers, J. J., & Wijnberg, N. M. 2010. Disentangling the effects of reputation and network position on the evolution of alliance networks. ***Strategic Organization***, 8(3): 255-275.

Entner, R. 2011. International comparisons: The handset replacement cycle. Retrieved from http://mobilefuture.org/wp-content/uploads/2013/02/mobile-future.publications.handset-replacement-cycle.pdf. Posted on June 23, 2011. Accessed on December 14, 2013.

Erickson, B. H. 1981. Secret societies and social structure. ***Social Forces***, 60(1): 188-210.

Evans, P. B. 1995. ***Embedded autonomy: States and industrial transformation***. Cambridge, United Kingdom: Cambridge University Press.

Fiss, P. C., & Zajac, E. J. 2006. The symbolic management of strategic change: Sensegiving via framing and decoupling. ***Academy of Management Journal***, 49(6): 1173-1193.

Fligstein, N. J. 1991. The structural transformation of american industry: An institutional account of the causes of diversification in the largest firms, 1919-1979. In W. W. P. a. P. DiMaggio (Ed.), ***The new institutionalism in organizational analysis***: 311-336. Chicago: University of Chicago Press.

Fligstein, N. J., & McAdam, D. 2011. Toward a general theory of strategic action fields. ***Sociological Theory***, 29(1): 1-26.

Fligstein, N. J., & McAdam, D. 2012. ***A theory of fields***. New York, NY: Oxford University Press.

Francis, V. 2008. Supply chain visibility: Lost in translation? ***Supply Chain Management: An International Journal***, 13(3): 180-184.

Freeman, R. E. 1984. ***Strategic management: A stakeholder approach***. Boston, MA: Pitman.

Gaddy, G. D., & Tanjong, E. 1986. Earthquake coverage by the western press. ***Journal of Communication***, 36(2): 105-112.

Gamson, W. A. [1975]1990. The strategy of social protest. ***Homewood, IL: Dorsey***.

Giddens, A. 1984. ***The constitution of society: Outline of the theory of structuration***. Cambridge, United Kingdom: Polity Press.

Gladwell, M. 2010. Small change: Why the revolution will not be tweeted, ***New Yorker***: 42-49. Retrieved from http://www.newyorker.com/magazine/2010/10/04/small-change-malcolm-gladwell. Posted on Oct 4, 2010. Accessed on Oct 15, 2010.

Goffman, E. 1963. ***Stigma: Notes on the management of spoiled identity***. Englewood Cliffs, NJ: Prentice-Hall.

Gold, S., Seuring, S., & Beske, P. 2010. Sustainable supply chain management and inter-organizational resources: A literature review. ***Corporate Social Responsibility and Environmental Management***, 17(4): 230-245.

Goldstone, J. A., & Tilly, C. 2001. Threat (and opportunity): Popular action and state response in the dynamics of contentious action. In R. Aminzade, D. McAdam, E. Perry, W. Sewell, S. Tarrow, & C. Tilly (Eds.), ***Silence and voice in the study of contentious politics***: 179-194. Cambridge, United Kingdom: Cambridge University Press.

Gould, R. V. 1991. Multiple networks and mobilization in the paris commune, 1871. ***American Sociological Review***, 56(6): 716-729.

Granovetter, M. 1973. The strength of weak ties. ***American Journal of Sociology***, 78(6): 1360-1380.

Granovetter, M. 1978. Threshold models of collective behavior. ***American Journal of Sociology***, 83(6): 1420-1443.

Greve, H. R., Kim, J.-Y., & Teh, D. 2016. Ripples of fear: The diffusion of a bank panic. ***American Sociological Review***, 81(2): 396-420.

Gulati, R. 1995. Social structure and alliance formation patterns: A longitudinal analysis. ***Administrative Science Quarterly***, 40(4): 619-652.

Gulati, R., & Gargiulo, M. 1999. Where do interorganizational networks come from? ***American Journal of Sociology***, 104(5): 1439-1493.

Guo, L., Hsu, S.-H., Holton, A., & Jeong, S. H. 2012. A case study of the foxconn suicides. ***International Communication Gazette***, 74(5): 484-503.

Hart, P., & Saunders, C. 1997. Power and trust: Critical factors in the adoption and use of electronic data interchange. ***Organization Science***, 8(1): 23-42.

Hart, S. L. 1995. A natural-resource-based view of the firm. ***Academy of Management Review***, 20(4): 986-1014.

Heaney, M. T. 2014. Multiplex networks and interest group influence reputation: An exponential random graph model. ***Social Networks***, 36(2014): 66-81.
Hendricks, K. B., & Singhal, V. R. 2003. The effect of supply chain glitches on shareholder wealth. ***Journal of Operations Management***, 21(5): 501-522.
Hendricks, K. B., & Singhal, V. R. 2005. An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm. ***Production and Operations Management***, 14(1): 35-52.
Hendriksz, V. 2015. Patagonia cuts ties with wool supplier ovis 21 following peta exposé, ***FashionUnited***. Retrieved from https://fashionunited.uk/news/fashion/patagonia-cuts-ties-with-wool-supplier-ovis-21-following-peta-expose/2015081817379, Posted on August 18, 2015. Accessed on July 14, 2016.
Hibbard, J. D., Kumar, N., & Stern, L. W. 2001. Examining the impact of destructive acts in marketing channel relationships. ***Journal of Marketing Research***, 38(1): 45-61.
Hirschman, A. O. 1970. ***Exit, voice, and loyalty: Responses to decline in firms, organizations, and states***. Cambridge, MA: Harvard University Press.
Hochberg, Y. V., Ljungqvist, A., & Lu, Y. 2010. Networking as a barrier to entry and the competitive supply of venture capital. ***The Journal of Finance***, 65(3): 829-859.
Hoejmose, S. U., Roehrich, J. K., & Grosvold, J. 2014. Is doing more doing better? The relationship between responsible supply chain management and corporate reputation. ***Industrial Marketing Management***, 43(1): 77-90.
Hoffman, A. J., & Ocasio, W. 2001. Not all events are attended equally: Toward a middle-range theory of industry attention to external events. ***Organization Science***, 12(4): 414-434.
Hu, Y. 2005. Efficient, high-quality force-directed graph drawing. ***Mathematica Journal***, 10(1): 37-71.
Huang, R. D., & Li, H. 2009. Does the market dole out collective punishment? An empirical analysis of industry, geography, and arthur andersen's reputation. ***Journal of Banking & Finance***, 33(7): 1255-1265.
Hug, S., & Wisler, D. 1998. Correcting for selection bias in social movement research. ***Mobilization: An International Quarterly***, 3(2): 141-161.
Huitsing, G., Snijders, T. A. B., Van Duijn, M. A. J., & Veenstra, R. 2014. Victims, bullies, and their defenders: A longitudinal study of the coevolution of positive and negative networks. ***Development and Psychopathology***, 26(3): 645-659.
Ioannou, I., & Serafeim, G. 2014. ***The consequences of mandatory corporate sustainability reporting: Evidence from four countries***. Harvard Business School Research Working Paper No. 11-100, Boston, MA.
Jackson, R. 2011. Low-carbon's missing link. ***Accountancy Futures***, 3: 42-43.
Jensen, M. 2006. Should we stay or should we go? Accountability, status anxiety, and client defections. ***Administrative Science Quarterly***, 51(1): 97-128.
Jensen, M., & Roy, A. 2008. Staging exchange partner choices: When do status and reputation matter? ***Academy of Management Journal***, 51(3): 495-516.
Jones, R. 2010. Something rotten at apple's core? Shocking toll of suicides at ipad factory in china revealed, ***Daily Mail***. Retrived from http://www.dailymail.co.uk/news/article-1282481/iPad-factorysuicides-China.html. Posted on May 29, 2010. Accessed on April 5, 2016.

Jonsson, S., Greve, H. R., & Fujiwara-Greve, T. 2009. Undeserved loss: The spread of legitimacy loss to innocent organizations in response to reported corporate deviance. ***Administrative Science Quarterly***, 54(2): 195-228.

Joseph, J., Klingebiel, R., & Wilson, A. J. 2016. Organizational structure and performance feedback: Centralization, aspirations, and termination decisions. ***Organization Science***, 27(5): 1065-1083.

Josephs, H. K. 2013. Productions chains and workplace law violations: The case of apple and foxconn. ***Global Business Law Review***, 3(2): 211-227.

Kahneman, D. 1973. ***Attention and effort***. Englewood Cliffs, NJ: Prentice-Hall.

Kennedy, M. T. 2008. Getting counted: Markets, media, and reality. ***American Sociological Review***, 73(2): 270-295.

Kiessling, T., Isaksson, L., & Yasar, B. 2016. Market orientation and csr: Performance implications. ***Journal of Business Ethics***, 137(2): 269-284.

Kilduff, M., & Krackhardt, D. 1994. Bringing the individual back in: A structural analysis of the internal market for reputation in organizations. ***Academy of Management Journal***, 37(1): 87-108.

Kim, Y. H., & Davis, G. F. 2016. Challenges for global supply chain sustainability: Evidence from conflict minerals reports. ***Academy of Management Journal***, 59(6): 1896-1916.

King, B. G. 2008. A political mediation model of corporate response to social movement activism. ***Administrative Science Quarterly***, 53(3): 395-421.

King, B. G., & McDonnell, M.-H. 2015. Good firms, good targets: The relationship between corporate social responsibility, reputation, and activist targeting. In K. Tsutsui, & A. Lim (Eds.), ***Corporate social responsibility in a globalizing world***: 430-454. New York: Cambridge University Press.

King, B. G., & Soule, S. A. 2007. Social movements as extra-institutional entrepreneurs: The effect of protests on stock price returns. ***Administrative Science Quarterly***, 52(3): 413-442.

Kleindorfer, P. R., & Saad, G. H. 2005. Managing disruption risks in supply chains. ***Production and Operations Management***, 14(1): 53-68.

Krebs, V. 2002. Uncloaking terrorist networks. ***First Monday***, 7(4).

Lamin, A., & Zaheer, S. 2012. Wall street vs. Main street: Firm strategies for defending legitimacy and their impact on different stakeholders. ***Organization Science***, 23(1): 47-66.

Lauchs, M., Keast, R., & Yousefpour, N. 2011. Corrupt police networks: Uncovering hidden relationship patterns, functions and roles. ***Policing and Society***, 21(1): 110-127.

Lazega, E., Mounier, L., Snijders, T., & Tubaro, P. 2012. Norms, status and the dynamics of advice networks: A case study. ***Social Networks***, 34(3): 323-332.

Lecuona, J. R., & Reitzig, M. 2014. Knowledge worth having in 'excess': The value of tacit and firm-specific human resource slack. ***Strategic Management Journal***, 35(7): 954-973.

Leetaru, K., & Schrodt, P. A. 2013. ***Gdelt: Global data on events, location, and tone, 1979–2012***. Paper presented at the ISA Annual Convention.

Lindelauf, R., Borm, P., & Hamers, H. 2009. The influence of secrecy on the communication structure of covert networks. ***Social Networks***, 31(2): 126-137.

Ling, K. C., Kee, H. W., & Kueng, K. C. 2011. The challenges of corporate social responsibility practice: A case study of taiwanese investment in china. ***Journal for the Advancement of Science & Arts***, 22(1): 1-23.

Locke, R. M. 2013. ***The promise and limits of private power: Promoting labor standards in a global economy***. New York, NY: Cambridge University Press.
Locke, R. M., Qin, F., & Brause, A. 2007. Does monitoring improve labor standards? Lessons from nike. ***ILR Review***, 61(1): 3-31.
Lucas, K., Kang, D., & Li, Z. 2013. Workplace dignity in a total institution: Examining the experiences of foxconn's migrant workforce. ***Journal of Business Ethics***, 114(1): 91-106.
Luo, X. R., Zhang, J., & Marquis, C. 2016. Mobilization in the internet age: Internet activism and corporate response. ***Academy of Management Journal***, 59(6): 2045-2068.
Madhavan, R., Gnyawali, D. R., & He, J. 2004. Two's company, three's a crowd? Triads in cooperative-competitive networks. ***Academy of Management Journal***, 47(6): 918-927.
Madhavan, R., Koka, B. R., & Prescott, J. E. 1998. Networks in transition: How industry events (re)shape interfirm relationships. ***Strategic Management Journal***, 19: 439-459.
Maguire, S., & Hardy, C. 2009. Discourse and deinstitutionalization: The decline of ddt. ***Academy of Management Journal***, 52(1): 148-178.
McAdam, D., & Paulsen, R. 1993. Specifying the relationship between social ties and activism. ***American Journal of Sociology***, 99(3): 640-667.
McDonnell, M.-H., & King, B. 2013. Keeping up appearances: Reputational threat and impression management after social movement boycotts. ***Administrative Science Quarterly***, 58(3): 387-419.
Mercea, D. 2012. Digital prefigurative participation: The entwinement of online communication and offline participation in protest events. ***New Media & Society***, 14(1): 153-169.
Merton, R. K. 1968. The matthew effect in science. ***Science***, 159(3810): 56-63.
Meyer, A. D. 1982. Adapting to environmental jolts. ***Administrative Science Quarterly***, 27(4): 515-537.
Meyer, D. S., & Tarrow, S. G. 1998. ***The social movement society: Contentious politics for a new century***. Lanham, MD: Rowman & Littlefield.
Miles, R. E., & Snow, C. C. 1994. ***Fit, failure, and the hall of fame: How companies succeed or fail***. NY: Free Press.
Milgate, M. 2001. Supply chain complexity and delivery performance: An international exploratory study. ***Supply Chain Management: An International Journal***, 6(3): 106-118.
Min, B., Yi, S. D., Lee, K.-M., & Goh, K. I. 2014. Network robustness of multiplex networks with interlayer degree correlations. ***Physical Review E***, 89(4): 042811.
Monteverde, K., & Teece, D. J. 1982. Supplier switching costs and vertical integration in the automobile industry. ***The Bell Journal of Economics***, 13(1): 206-213.
Morozov, E. 2012. ***The net delusion: The dark side of internet freedom***. NY: PublicAffairs.
Navis, C., & Glynn, M. A. 2010. How new market categories emerge: Temporal dynamics of legitimacy, identity, and entrepreneurship in satellite radio, 1990-2005. ***Administrative Science Quarterly***, 55(3): 439-471.
Newman, M. E. J. 2003a. Mixing patterns in networks. ***Physical Review E***, 67(2): 026126.
Newman, M. E. J. 2003b. Properties of highly clustered networks. ***Physical Review E***, 68(2): 026121.
Newman, M. E. J. 2004. Detecting community structure in networks. ***European Physical Journal B-Condensed Matter and Complex Systems***, 38(2): 321-330.

Noble, D. 1979. ***Social choice in machine design: The case of automatically controlled machine tools***. New York: Monthly Review Press.

Nollet, J., Filis, G., & Mitrokostas, E. 2016. Corporate social responsibility and financial performance: A non-linear and disaggregated approach. ***Economic Modelling***, 52, Part B: 400-407.

Ocasio, W. 1997. Towards an attention-based view of the firm. ***Strategic Management Journal***, 18(51): 187-206.

Oliver, P. E., & Maney, G. M. 2000. Political processes and local newspaper coverage of protest events: From selection bias to triadic interactions. ***American Journal of Sociology***, 106(2): 463-505.

Oliver, P. E., & Marwell, G. 1988. The paradox of group size in collective action: A theory of the critical mass. Ii. ***American Sociological Review***, 53(1): 1-8.

Oliver, P. E., Marwell, G., & Teixeira, R. 1985. A theory of the critical mass. I. Interdependence, group heterogeneity, and the production of collective action. ***American Journal of Sociology***, 91(3): 522-556.

Olzak, S., & Ryo, E. 2007. Organizational diversity, vitality and outcomes in the civil rights movement. ***Social Forces***, 85(4): 1561-1591.

Padgett, J. F., & Ansell, C. K. 1993. Robust action and the rise of the medici, 1400-1434. ***American Journal of Sociology***, 98(6): 1259-1319.

Paharia, N., Kassam, K. S., Greene, J. D., & Bazerman, M. H. 2009. Dirty work, clean hands: The moral psychology of indirect agency. ***Organizational Behavior and Human Decision Processes***, 109(2): 134-141.

Pew Research Center. 2017. Mobile fact sheet. Retrieved from http://www.pewinternet.org/fact-sheet/mobile/. Posted on January 12, 2017. Accessed on May 30, 2017.

Pfeffer, J., & Salancik, G. R. 1978. ***The external control of organizations: A resource dependence perspective***. Stanford, CA: Stanford University Press.

Pickles, J., & Zhu, S. 2013. The california transparency in supply chains act, ***Capturing the Gains Working Paper 15***. Retrieved from https://ssrn.com/abstract=2237437. Posted on March 23, 2013. Accessed on August 11, 2017.

Podolny, J. M. 1993. A status-based model of market competition. ***American Journal of Sociology***, 98(4): 829-872.

Powell, W. W., White, D. R., Koput, K. W., & Owen-Smith, J. 2005. Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. ***American Journal of Sociology***, 110(4): 1132-1205.

Power, D. 2005. Supply chain management integration and implementation: A literature review. ***Supply Chain Management: An International Journal***, 10(4): 252-263.

Provan, K. G., & Gassenheimer, J. B. 1994. Supplier commitment in relational contract exchanges with buyers: A study of interorganizational dependence and exercised power. ***Journal of Management Studies***, 31(1): 55-68.

Qiu, R. G. 2007. Rfid-enabled automation in support of factory integration. ***Robotics and Computer-Integrated Manufacturing***, 23(6): 677-683.

Rassweiler, A. 2009. Iphone 3g s carries $178.96 bom and manufacturing cost, isuppli teardown reveals. Retrieved from https://technology.ihs.com/389273/iphone-3g-s-carries-17896-bom-and-manufacturing-cost-isuppli-teardown-reveals. Posted on June 24, 2009. Accessed on July 14, 2013.

Rehbein, K., Waddock, S., & Graves, S. B. 2004. Understanding shareholder activism: Which corporations are targeted? ***Business & Society***, 43(3): 239-267.

Ripley, R. M., Snijders, T. A. B., Boda, Z., Voros, A., & Preciado, P. 2017. ***Manual for siena version 4.0 (version may 12, 2017)***. Oxford, United Kingdom: University of Oxford, Department of Statistics; Nuffield College. http://www.stats.ox.ac.uk/siena/.

Rivera, M. T., Soderstrom, S. B., & Uzzi, B. 2010. Dynamics of dyads in social networks: Assortative, relational, and proximity mechanisms. ***Annual Review of Sociology***, 36: 91-115.

Robbins, A. 2015. Toxic sweatshops: Regulating the import of hazardous electronics. ***City University of New York Law Review***, 18(2): 267-285.

Robins, G., & Alexander, M. 2004. Small worlds among interlocking directors: Network structure and distance in bipartite graphs. ***Computational & Mathematical Organization Theory***, 10(1): 69-94.

Rock, M. T. 2003. Public disclosure of the sweatshop practices of american multinational garment/shoe makers/retailers: Impacts on their stock prices. ***Competition & Change***, 7(1): 23-38.

Romero, D. M., Uzzi, B., & Kleinberg, J. 2016. Social networks under stress, ***Proceedings of the 25th International Conference on World Wide Web***: 9-20. Montreal, Quebec, Canada: International World Wide Web Conferences Steering Committee.

Salancik, G. R. 1979. Interorganizational dependence and responsiveness to affirmative action: The case of women and defense contractors. ***Academy of Management Journal***, 22(2): 375-394.

Sarkis, J. 2003. A strategic decision framework for green supply chain management. ***Journal of Cleaner Production***, 11(4): 397-409.

Schilling, M. A. 2015. Technology shocks, technological collaboration, and innovation outcomes. ***Organization Science***, 26(3): 668-686.

Schroeder, R. G., & Flynn, B. B. (Eds.). 2001. ***High performance manufacturing: Global perspectives***. New York: Wiley.

Seuring, S., & Müller, M. 2008. From a literature review to a conceptual framework for sustainable supply chain management. ***Journal of Cleaner Production***, 16(15): 1699-1710.

Shannon, C. E., & Weaver, W. 1949. ***The mathematical theory of communication***. Urbana, IL: University of Illinois Press.

Shipilov, A. V., Rowley, T. J., & Aharonson, B. S. 2006. When do networks matter? A study of tie formation and decay. In J. A. C. Baum, S. D. Dobrev, & A. V. Witteloostuijn (Eds.), ***Ecology and strategy (advances in strategic management)***, Vol. 23: 481-519. Bingley, UK: Emerald Group Publishing Limited.

Short, J. L., Toffel, M. W., & Hugill, A. R. 2016. Monitoring global supply chains. ***Strategic Management Journal***, 37(9): 1878-1897.

Silverstone, R. 2006. ***Media and morality: On the rise of the mediapolis***. Cambridge, UK: Polity Press.

Snijders, T. A. B., Lomi, A., & Torló, V. J. 2013. A model for the multiplex dynamics of two-mode and one-mode networks, with an application to employment preference, friendship, and advice. ***Social Networks***, 35(2): 265-276.

Snijders, T. A. B., van de Bunt, G. G., & Steglich, C. E. G. 2010. Introduction to stochastic actor-based models for network dynamics. ***Social Networks***, 32(1): 44-60.

Sorenson, O., & Stuart, T. E. 2001. Syndication networks and the spatial distribution of venture capital investments. ***American Journal of Sociology***, 106(6): 1546-1588.
Soule, S. A. 2012. Social movements and markets, industries, and firms. ***Organization Studies***, 33(12): 1715-1733.
Srivastava, S. K. 2007. Green supply-chain management: A state-of-the-art literature review. ***International Journal of Management Reviews***, 9(1): 53-80.
Stark, D., & Vedres, B. 2006. Social times of network spaces: Network sequences and foreign investment in hungary. ***American Journal of Sociology***, 111(5): 1367-1411.
Staw, B. M., Sandelands, L. E., & Dutton, J. E. 1981. Threat rigidity effects in organizational behavior: A multilevel analysis. ***Administrative Science Quarterly***, 26(4): 501-524.
Steven, A. B., Dong, Y., & Corsi, T. 2014. Global sourcing and quality recalls: An empirical study of outsourcing-supplier concentration-product recalls linkages. ***Journal of Operations Management***, 32(5): 241-253.
Student & Scholars Against Corporate Misbehavior. 2010. Workers as machines: Military management in foxconn. Retrived from http://sacom.hk/wp-content/uploads/2010/11/report-on-foxconn-workers-as-machines_sacom.pdf. Posted on October 12, 2010. Accessed on July 14, 2016.
Sullivan, B. N., Haunschild, P., & Page, K. 2007. Organizations non gratae? The impact of unethical corporate acts on interorganizational networks. ***Organization Science***, 18(1): 55-70.
Surroca, J., Tribó, J. A., & Zahra, S. A. 2013. Stakeholder pressure on mnes and the transfer of socially irresponsible practices to subsidiaries. ***Academy of Management Journal***, 56(2): 549-572.
Sustainable Brands. 2015. Study: 81% of consumers say they will make personal sacrifices to address social, environmental issues. Retrieved from http://www.sustainablebrands.com/news_and_views/stakeholder_trends_insights/sustainable_brands/study_81_consumers_say_they_will_make_. Posted on May 27, 2015. Accessed on July 14, 2016.
Sutton, R. I., & Callahan, A. L. 1987. The stigma of bankruptcy: Spoiled organizational image and its management. ***Academy of Management Journal***, 30(3): 405-436.
Sytch, M., & Tatarynowicz, A. 2014. Friends and foes: The dynamics of dual social structures. ***Academy of Management Journal***, 57(2): 585-613.
Szell, M., Lambiotte, R., & Thurner, S. 2010. Multirelational organization of large-scale social networks in an online world. ***Proceedings of the National Academy of Sciences***, 107(31): 13636-13641.
Takhteyev, Y., Gruzd, A., & Wellman, B. 2012. Geography of twitter networks. ***Social Networks***, 34(1): 73-81.
Tarrow, S. 1994. ***Power in movement: Social movements, collective action and mass politics in the modern state***. Cambridge, MA: Cambridge University Press.
Tassey, G. 2000. Standardization in technology-based markets. ***Research Policy***, 29(4–5): 587-602.
Tatarynowicz, A., Sytch, M., & Gulati, R. 2016. Environmental demands and the emergence of social structure: Technological dynamism and interorganizational network forms. ***Administrative Science Quarterly***, 61(1): 52-86.
Thompson, J. D. 1967. ***Organizations in action***. New York: McGraw-Hill.

Tilcsik, A., & Marquis, C. 2013. Punctuated generosity: How mega-events and natural disasters affect corporate philanthropy in us communities. ***Administrative Science Quarterly***, 58(1): 111-148.

Tushman, M. L., & Anderson, P. 1986. Technological discontinuities and organizational environments. ***Administrative Science Quarterly***, 31(3): 439-465.

UN Global Compact, & BSR. 2015. Supply chain sustainability. A practical guide for continuous improvement (second edition). New York: UN Global Compact Office. Retrieved from https://www.unglobalcompact.org/docs/issues_doc/supply_chain/SupplyChainRep_spread.pdf, Accessed on July 14, 2015.

Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddedness. ***Administrative Science Quarterly***, 42(1): 35-67.

Vergne, J.-P. 2012. Stigmatized categories and public disapproval of organizations: A mixed-methods study of the global arms industry, 1996–2007. ***Academy of Management Journal***, 55(5): 1027-1052.

Vuori, T. O., & Huy, Q. N. 2016. Distributed attention and shared emotions in the innovation process: How nokia lost the smartphone battle. ***Administrative Science Quarterly***, 61(1): 9-51.

Walter, A., Müller, T. A., Helfert, G., & Ritter, T. 2003. Functions of industrial supplier relationships and their impact on relationship quality. ***Industrial Marketing Management***, 32(2): 159-169.

Wan, Z., & Wu, B. 2017. When suppliers climb the value chain: A theory of value distribution in vertical relationships. ***Management Science***, 63(2): 477-496.

Wang, Y., Li, J., & Anupindi, R. 2015. ***Risky suppliers or risky supply chains? An empirical analysis of sub-tier supply network structure on firm performance in the high-tech sector***. Ross School of Business Working Paper Series no. 1297, University of Michigan, Ann Arbor, MI.

Weichert, S. 2016. From swarm intelligence to swarm malice: An appeal. ***Social Media + Society***, 2(1).

Williamson, O. E. 1981. The economics of organization: The transaction cost approach. ***American Journal of Sociology***, 87(3): 548-577.

Withey, M. J., & Cooper, W. H. 1989. Predicting exit, voice, loyalty, and neglect. ***Administrative Science Quarterly***, 34(4): 521-539.

Wu, D. 2016. ***Essays on the interface between finance and technology (doctoral dissertation)***. Retrieved from ProQuest. AAI10134936. http://repository.upenn.edu/dissertations/AAI10134936. .

Yuan, S., Yuhua, G., Huilin, L., Ngai, P., Jianzhong, D., Shen, T., Hong, S., Yan, R., & Dunfu, Z. 2010. Appeal by sociologists: Address to the problems of new generations of chinese migrant workers, end to foxconn tragedy now. Retrieved from http://sacom.hk/appeal-by-sociologists-address-to-the-problems-of-new-generations-of-chinese-migrant-workers/. Posted on May 18, 2010. Accessed on April 12, 2016.

Zavyalova, A., Pfarrer, M., Reger, R. K., & Hubbard, T. 2016. Reputation as a benefit and a burden? How stakeholders' organizational identification affects the role of reputation following a negative event. ***Academy of Management Journal***, 59(1): 253-276.

Zavyalova, A., Pfarrer, M. D., Reger, R. K., & Shapiro, D. 2012. Managing the message: The effects of firm actions and industry spillovers on media coverage following wrongdoing. ***Academy of Management Journal***, 55(5): 1079-1101.

Zhao, J. 2010. Suicide occurs after foxconn ceo's visit. Retrieved from https://web.archive.org/web/20120808145800/http://english.caixin.com/2010-05-27/100147763.html. Posted on May 27, 2010. Accessed on April 30, 2017.

Zhelyazkov, P. I., & Gulati, R. 2016. After the break-up: The relational and reputational consequences of withdrawals from venture capital syndicates. ***Academy of Management Journal***, 59(1): 277-301.