



Recovering from geopolitical risk: An event study of Huawei's semiconductor supply chain

Ying Kei Tse^{a,*}, Kyra Dong^a, Ruiqing Sun^b, Robert Mason^a

^a Cardiff Business School, Cardiff University, Cardiff, UK

^b Business School, Central University of Finance and Economics, Beijing, China

ARTICLE INFO

Keywords:

Semiconductor supply chain
Sanction
Supply disruption
Resilient practice
Propagation effect

ABSTRACT

Amidst the ongoing globalisation of supply chains, geopolitical issues have emerged as a significant source of supply chain risk for firms. This has recently been illustrated in the trade sanctions adopted by the US against the Chinese semiconductor industry, particularly in the accessing of semiconductor chips. A notable event here, that we focus on in this paper, involves how the leading telecommunications company Huawei has been impacted by this and most interestingly how they have been able to respond, by being able to successfully launch new chip-based products during the US semiconductor chip technology blockade, despite the sanctions ban. This has been achieved with the support of key supplier, SMIC, who has become a major 7 nm chip supplier for Huawei. Employing the event study research method, this study initially examines the stock market's response to Huawei's new product release with these new SMIC-sourced semiconductor chips. It also appraises the propagation effects on Huawei's and SMIC's supply chain partners. This exposes the differential impact on the supply chain members of Huawei (focal firm) and SMIC (main supplier). The results reveal predominantly positive responses from Huawei's suppliers and customers, as well as SMIC's suppliers and customers, to these incidents, with Huawei's suppliers' and SMIC's suppliers' and customers' share prices responding positively to the release of Huawei's new product, exhibiting substantial median stock market reaction of 1.53%, 1.62%, and 2.52% on Day 0, respectively, it shows, in contrast, that Huawei's customers did not exhibit a positive share price reaction to the development of this newly sourced product. It is noteworthy that SMIC's supply of chips to Huawei has had a significantly positive impact on both Huawei and SMIC's suppliers and customers. With the impact varying across different roles within the supply chains, this study provides useful insights for understanding the propagation effect of good news in the supply chain resulting from firms' proactive action in response to imposed sanctions for a key supply component.

1. Introduction

In recent years, supply chains, international and domestic and across all industries, have been impacted by significant events which have had positive and negative implications for their ongoing operational effectiveness. For instance, the emergence of COVID-19 in late 2019 and early 2020 resulted in disruptions in production across various regions of China at that time, leading to delays in both inbound and outbound deliveries to and from the country. This not only affected global supply chains but also had repercussions on the stock prices of numerous multinational corporations (Queiroz et al., 2022; Chen et al., 2023). Not only that, geopolitical issues such as nationalism, governmental trade practices, and concerns regarding national security have developed into

an emerging source of risk within supply chains, intensifying vulnerabilities and resulting in disruptions (Liefert et al., 2019). A prominent example of geopolitical risk is the US government's actions and sanctions concerning Huawei's semiconductor equipment sales (Kaska et al., 2019; Caldara and Iacoviello, 2022), notably leading to disruptions in Huawei's chip sourcing. The heightened levels of geopolitical risk can influence how firms formulate and implement strategies (Roscoe et al., 2022), consequently leading to reduced stock returns (Caldara and Iacoviello, 2022). Hence, to navigate the highly competitive and dynamic market, firms must continuously adapt to the evolving environment, for example, by establishing a resilient practice to effectively handle disruptions and swiftly recover (Xin et al., 2010). This way is vital in aiding companies in overcoming the challenges posed by supply

* Corresponding author.

E-mail addresses: TseM1@cardiff.ac.uk (Y.K. Tse), Dongs14@cardiff.ac.uk (K. Dong), sunruiqing96@gmail.com (R. Sun), Masonrj@cardiff.ac.uk (R. Mason).

<https://doi.org/10.1016/j.ijpe.2024.109347>

Received 16 March 2024; Received in revised form 19 July 2024; Accepted 22 July 2024

Available online 22 July 2024

0925-5273/© 2024 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).

chain disruptions.

To overcome the disruption caused by sanctions,¹ Huawei needed to adopt a variety of resilient practices to maintain a sustainable supply of semiconductor chips for its products. The strategy centred on enhancing self-sufficiency in chip production through amplified in-house R&D, bolstering domestic substitution, attracting high-quality domestic suppliers, and fostering the establishment of resilient and self-sufficient supply capabilities (Huawei, 2021). Nevertheless, Huawei was still widely anticipated to face challenges in developing and producing new semiconductor chip-based products. However, a surprising turn of events unfolded on August 29, 2023, when Huawei announced the launch of the new product via its official social media platform Weibo (Huawei, 2023) (Event 1). After the news release, the public exhibited not only surprise and joy but also a rapid surge in Huawei's retailers' demand for Huawei's new products. Subsequently, a Bloomberg report on September 4, 2023, following an investigation and teardown analysis by an information platform for the semiconductor industry, TechInsights, revealed the use of 7 nm chips produced by Semiconductor Manufacturing International Corporation (SMIC) in Huawei's phone, causing a significant stir in the semiconductor industry (Bloomberg, 2023) (Event 2). TechInsights' disassembly analysis also unveiled the mystery surrounding Huawei's 7 nm chips. The chip supplier for Huawei's new phone is China's largest microchip maker, SMIC. In 2020, SMIC was placed on the US trade restriction list limiting the company's access to advanced US technology. Despite this, Huawei is actively seeking cooperation with SMIC, considering it as a domestic alternative supplier. This move aims not only to reduce Huawei's dependence on foreign chips but also to support the development of the domestic semiconductor industry by partnering with SMIC. Although there have been media reports suggesting earlier cooperation between Huawei and SMIC for the independent design of 7 nm chips, Huawei did not formally emphasise this in the announcement (Nikkei Asia, 2023). Therefore, without TechInsights' disclosure, the public might still not know who Huawei's 7 nm chip suppliers were, nor would it have been possible to have such precise information about Huawei's chip suppliers.

This study focuses on two significant news events: Huawei's new product release (Event 1) and another subsequent event - SMIC was exposed as the 7 nm chip supplier for Huawei's new product (Event 2). Huawei's new product unveiling garnered attention from SMIC for the following reasons: (1) Huawei's new product launch (Event 1) marks a significant milestone for the company. Despite enduring years of sanctions and pressure from the US government, Huawei's chip supply chain has been severely disrupted. Huawei did adopt a resilience practices i.e. seeking domestic alternative suppliers (SMIC) have enabled it to effectively mitigate these disruptions and successfully introduce products equipped with cutting-edge chip technology; (2) Although Huawei's new product announcement (Event 1) did not explicitly disclose its chip

suppliers, Bloomberg (2023) reported that Huawei's new products utilize 7 nm chips, with SMIC being exposed as the supplier of these chips (Event 2). Huawei and SMIC encounter challenges in manufacturing chips with advanced technology due to stringent US sanctions on chip and chip technology. Despite these obstacles, they have successfully developed new products utilising state-of-the-art chip technology (7 nm chips). Moreover, approximately 90% of the components used in Huawei's new products are sourced from China (Bloomberg, 2023). This highlights Huawei's capability to circumvent US sanctions through independent research and development, thus mitigating chip supply disruptions; (3) By actively sustaining the supply from the domestic alternative supplier (SMIC), Huawei adeptly evaded sanctions and technological blockades, facilitating the uninterrupted production of high-tech products and alleviating chip supply disruptions. This success not only discloses Huawei's adept management of supply disruptions and its superior strategic procurement practices but also underscores the importance of adopting resilient practices in response to supply disruptions. Concurrently, SMIC's successful breakthrough in technological barriers alongside Huawei amidst sanctions and its production of 7 nm chips with advanced chip technology undeniably underscores the significance of SMIC's role in the industry. Huawei's case is selected in this study to exemplify the importance of resilient practices in managing supply chain disruptions due to geopolitical risks. Several factors contribute to this choice: (i) Prolonged trade tensions and sanctions between Huawei and the US add realism and timeliness to the case. It provides a compelling example where geopolitical risks have significantly impacted Huawei's supply chain operations, yet resilient practices facilitated effective management and product launches. This real-world success underscores the practical significance of resilient practices in supply chain management; (ii) Huawei's prominent global technology leadership position enhances the case's relevance, offering valuable insights for companies navigating complex supply chain environments; (iii) Abundant data associated with Huawei supports its analysis, with extensive media coverage providing insights into supply chain disruptions, resilience practices, and product launches. This data and information abundance ensures thorough examination, ensuring study feasibility and depth.

Recent research has predominantly concentrated on two primary directions. Firstly, some existing literature centres on studying the propagation effects of supply chain disruptions originating from the focal firm, cascading into its upstream and downstream supply chain partners. For instance, [Baghersad and Zobel \(2021\)](#) investigated the financial performance and stock market reactions of over 300 companies affected by supply chain disruptions spanning from 2005 to 2014. Additionally, [Jacobs et al. \(2022\)](#) delved deeper into the repercussions of trade actions targeting specific companies, i.e., the U.S. government's ban on ZTE, on the stock market, and consequently on its supply chain partners. Their study adopted a comprehensive supply-chain-centric perspective, encompassing not only the focal firms (ZTE) but also ZTE's suppliers and customers in various countries. The research highlighted the negative impact of the U.S. government's trade ban on ZTE, which subsequently propagated to ZTE's supply chain partners, namely suppliers and customers in diverse countries. Secondly, some scholars have directed their focus on assessing the effects of positive news related to the focal firm on its financial performance. For example, [Warren and Sorescu \(2017\)](#) evaluated the impact of 4865 new product announcements made by 826 US-listed firms on their market capitalisation. Similarly, other studies explored stock market responses to announcements concerning global green car innovation ([Ba et al., 2013](#)). Yet, the current understanding does not encompass whether positive developments within the focal firm engender an impact on its supply chain members. To more comprehensively address these research inquiries, our study centres on recent events—Huawei's new product launches (Event 1) and a local supplier - SMIC was exposure as a chip supplier in Huawei's new products (Event 2). Consequently, the following research question is proposed.

¹ In May 2019, the US government added Huawei to its sanctions list due to concerns regarding security risks and its potential impact on global communications networks. Subsequently, the US government announced the inclusion of Huawei and 70 suppliers and customer companies (including SMIC) on the export control entity list, mandating that any semiconductor products containing US technology (such as 7 nm chips) sold to Huawei and these companies must be approved. Therefore, in the face of sanctions, Chinese companies face difficulties in chip technology development and chip manufacturing, and disruptions in chip supply. As a chip manufacturer, SMIC also faced challenges in manufacturing 7 nm chips. Additionally, SMIC has been exposed by several media outlets for manufacturing 7 nm chips using N+2 technology (Financial Times, 2023). "N" represents the current manufacturing technology, whereas "N+2" signifies a technological advancement of two generations beyond the current standard. This advancement typically entails smaller manufacturing nodes and greater integration, thereby enhancing the performance and efficiency of the chip. Consequently, the Chinese semiconductor industry can achieve technological advancements without the need for extreme ultraviolet (EUV) lithography tools.

RQ: How did the announcements of Huawei's new product and supply source affect the financial performance of supply chain partner companies of Huawei and SMIC?

To refine our understanding of the research question in this paper, we will utilise an event study research methodology to investigate the effects of Huawei's new product launch (Event 1) and SMIC's exposure as a 7 nm chips supplier to Huawei (Event 2) on Huawei and SMIC's suppliers and customers, respectively. First, we chose August 29, 2023 (Event 1) and September 4, 2023 (Event 2) as our event dates for these two events respectively, following the event study methodology commonly used by operations and supply chain management researchers (Ding et al., 2011; Papadakis, 2006; Steinker and Hoberg, 2013). Second, our study solely concentrates on Chinese supply chain data, since their Chinese supply chain members are those directly or indirectly influenced by the US sanctions. Given the US sanctions against China, Huawei and SMIC face significant challenges in accessing advanced chips and chip manufacturing technology. Consequently, Chinese companies are anticipated to be the most affected by these restrictions. Financial performance evaluation will involve analysing the abnormal reactions of the stock market. Our study demonstrates predominantly positive responses among Huawei's suppliers and customers, as well as SMIC's suppliers and customers, to these events. Particularly, Huawei's suppliers, as well as SMIC's suppliers and customers positively responded to the release of Huawei's new product (Event 1), exhibiting substantial median stock market reactions of 1.53%, 1.62%, and 2.52% on Day 0, respectively. In contrast, the stock market reaction of Huawei's customers did not display a positive reaction to Event 1. Notably, the supply of chips from SMIC to Huawei (Event 2) had a notably positive impact on both Huawei and SMIC's suppliers and customers. Furthermore, SMIC's suppliers and customers exhibited more positive reactions than Huawei's suppliers and customers. Our findings imply that Huawei's new product launch and SMIC's chip supply generate favourable propagation effects among their supply chain partners, but they have different magnitudes of impact in different roles of the supply chain.

The novelty of this study lies in its departure from prior research. It pioneers an examination of the stock market reaction to positive news and extends its inquiry to ascertain whether these impacts propagate throughout supply chain partners. Furthermore, the study highlights the critical role of resilient practices in addressing supply disruptions attributed to geopolitical risks. Specifically, it delves into how companies can enhance their resilience practices, particularly in light of supply chain disruptions stemming from geopolitical risk, to ensure the continuity and stability of their operations. This contribution is multifaceted. First, while extensive research has explored the impact of positive news on a firm's financial performance, this study builds on this by further investigating the potential impact of focal firms' positive news on their supply chain partners, addressing a key gap in the literature. Secondly, the significance of the chosen news (Event 1) in this research emphasises that the focal firm has successfully overcome technological blockades through its resilience practices. This not only enriches and guides subsequent academic research but also enhances the awareness of practitioners and stakeholders. We highlight the possibility that both positive and negative news from firms can trigger propagation effects. Thus, it emphasises the importance for firms to consider their upstream and downstream partners in their strategic deployment and implementation, advocating a broader perspective that incorporates the entire supply chain.

The rest of the paper is organised as follows: Section 2 furnishes a comprehensive literature review, while Section 3 delineates the formulated research hypotheses. Section 4 delineates the methodology used for estimating stock market reactions and testing our hypotheses. Sections 5 and 6 present the empirical results and deliberate on the implications and limitations of this study, respectively.

2. Literature review

2.1. Geopolitical risk in the supply chain

Geopolitical risks in particular have become more prevalent in supply networks in recent years, and this has had a big impact on supply chain operations (Jacobs et al., 2022). Geopolitical risk encompasses the threat, realisation, and escalation of geopolitical events such as wars, terrorism, and tensions between different countries, leading to the disruption of normal and harmonious international relations (Caldara and Iacoviello, 2022). Geopolitical risks have a negative economic impact on investment and employment, as well as the possibility of a larger financial catastrophe (Caldara and Iacoviello, 2022). The high risk and uncertainty brought about by these events have threatened the stability of the global supply chain of multinational corporations (Charpin et al., 2021; Cui et al., 2023). These threats manifest in various aspects: (i) Geopolitical risks often result in the imposition of trade restrictions and tariffs. These measures can disrupt established supply chains, affecting the cross-border flow of goods and materials and, consequently, impacting companies' supply networks; (ii) Regions experiencing political instability are prone to social unrest and changes in government policies. Such conditions disrupt transportation systems, create uncertainty in the business environment, and lead to delays or interruptions in the production and supply of goods; (iii) Geopolitical risks may impact the availability of critical resources. Sanctions or trade restrictions, for instance, can limit access to vital raw materials, subsequently affecting manufacturing processes and causing disruptions in raw material supply chain networks. Numerous studies have explored the ramifications of geopolitical risks in supply chains.

It is noteworthy that the ongoing globalisation of supply chains is intensifying the impact of geopolitical risks on them. Scholars have conducted considerable research on the impact of geopolitical risk on company innovation (Jia et al., 2022), stock value (Pringpong et al., 2023), and firm value (Jiang et al., 2022). For instance, Hendry et al. (2018) explored how UK food supply chain members responded to constitutional changes throughout the Brexit period and established resilience, in the current US-China trade war (Jacobs et al., 2022; Yu et al., 2019), which is being focussed on in this paper, US trade penalties against the Chinese semiconductor industry (Nikian et al., 2023) have disrupted supply chain firms. From the above discussion, it is evident that the uncertainty of geopolitical risks has exerted a significant impact on the global supply chain, consequently influencing the financial performance of companies.

2.2. Event study in operations and supply chain management

Originally applied in accounting and finance, the event study method has now found application across various business disciplines, including management, information systems, marketing, operations and supply chain management (OSCM) (MacKinlay, 1997). In the marketing literature, for instance, researchers have utilised event study methods to scrutinise the financial impact of marketing events such as new product launches, chief marketing officer (CMO) appointments, brand acquisitions, and disposals (Ullah et al., 2021). Information systems researchers have focused on events like IT outsourcing, IT investments, IT excellence awards, software vulnerabilities, and security breaches (Konchitchki and O'Leary, 2011). As event research methods have evolved, the applications have gained widespread recognition. Literature reviews in other business disciplines tend to emphasise research design issues and the economic interpretation of research findings. Like in other fields, OSCM has witnessed the rise of event studies as a viable research method.

Over the past few decades, there has been a growing recognition of the strategic importance of OSCM in creating shareholder value. OSCM plays a crucial role in shareholder value creation through revenue growth, reduced operating costs, and efficient capital utilisation

(Christopher and Ryals, 1999). Numerous empirical studies, utilising the event study approach, analyse the relationship between OSCM and shareholder value. The event study method, grounded in the efficient market hypothesis (EMH) (Fama, 1970), presupposes that market information is almost entirely reflected in stock prices. This method enables researchers to quantify the impact of specific events on a firm's shareholder value by monitoring abnormal stock price changes (MacKinlay, 1997).

With the growing popularity of the OSCM literature, short-term event research methods have been employed by researchers to investigate various OSCM topics, such as supply chain disruptions (Papadakis, 2006), environmental management (Jacobs, 2014), and quality management (Lin and Su, 2013). Other studies, such as Hendricks and Singhal (2003) investigated the impact of supply chain glitches leading to production or delivery delays on the wealth of a company's shareholders. Through the analysis of 519 fault announcement samples, the results indicated that supply chain fault announcements produced a smaller negative market reaction for larger companies, while companies with higher growth prospects managed a larger negative market reaction.

In contrast to those previous studies (Merzifonluoglu, 2015; Hansen et al., 2017; Mandal, 2020), our focus is not only on the in-depth analyses of the impact of positive news on firms but also on whether it will have a propagation effect on their suppliers and customers. Noh (2019) suggested that a firm's announcement of environmental awards will have a positive impact on the stock market. Similarly, Xin et al. (2010) provided a comprehensive examination of the impact of radical innovation in firms' new product development on their financial performance, using a sample of US manufacturing firms. The results indicated that corporate new product development has a positive impact on corporate financial performance. While empirical research has extensively examined the impact of positive news on a company's financial performance, it remains unclear whether this effect extends to the company's suppliers and customers. Therefore, our study aims to contribute to filling this gap in the research.

2.3. Resilience practices in supply chain management

We have drawn upon insights from the literature concerning resilience practices in supply chain management. Supply chain resilience encompasses preparedness, effective response to disruptions, and recovery from disruptions (Ali et al., 2017). It is considered a primary strategy for navigating change, disruptions, or disturbances. Previous research has primarily focused on high-profile external catastrophic events like earthquakes, fuel crises, social unrest, and terrorism (Partanen et al., 2020). In examining the food supply chain, Tukamuhabwa et al. (2017) emphasised ensuring continuous food supply by anticipating disruptions, implementing strategies to minimise their impact, facilitating swift recovery, and enabling cumulative learning post-disruption. These patterns and response strategies constitute the focal points of prior research on building resilience in supply chains (Ali et al., 2017). Within complex global supply chains, sudden disruptions can impact one or a group of suppliers without warning. To manage supply disruptions effectively, ensuring profitability and operational efficiency, organisations must exhibit resilience to foreseeable and recoverable supply risks. Instances of the disruption to automakers' supply chains following the 2011 earthquake in Japan, wherein 12% of the company's engines originated from a single plant in the earthquake zone, highlight the need for effective resilience practices (Merzifonluoglu, 2015). Companies should optimise their supply base as well, plan for uncertain environmental conditions, foster learning, maintain supplier relationships, and actively cooperate in emergencies (Talluri and Narasimhan, 2004). Developing a robust relationship between suppliers and focal firms, promoting diversified supplier development, technology sharing, reinforcing coordination and communication, and implementing strategic sourcing practices contribute positively to companies'

resilience (Tukamuhabwa et al., 2017).

Furthermore, to enhance supply chain resilience, companies will establish cooperation with suppliers to create synergies (Wu and Choi, 2005). Buyer-supplier collaboration is a strategic partnership between a buyer and its suppliers, fostering a close, mutually beneficial relationship where both parties work together to achieve common goals, enhance efficiency, and improve overall supply chain performance (Jääskeläinen, 2021). This collaboration is vital as it addresses the risk of uncertainty related to supply chain disruptions, market changes, and other factors (Hosseini et al., 2019; Wang et al., 2016). It enables joint efforts for developing new products, refining processes, and introducing innovative technologies while facilitating the effective flow of information. Simultaneously, when companies need to secure vital material sources or when supplier companies encounter challenges in accessing crucial innovative technologies, some companies will contemplate establishing supplier development programs with key suppliers (Hosseini et al., 2019), particularly in the high-tech industry. Supplier development involves collaborative efforts with key suppliers to enhance performance and delivery capabilities and foster innovation (Liu et al., 2022). This close partnership enables the supply chain to swiftly adapt to uncertainty, ensuring continuous operation, improving resilience, and reducing risk (Hosseini et al., 2019). Building on this foundation, companies can proactively develop domestic supply chains to address geopolitical risks. The objective is to diminish companies' reliance on international supply chains and alleviate uncertainty arising from geopolitical turmoil and international tensions (Niu et al., 2019). Establishing a resilient domestic supply chain involves firms seeking domestic suppliers for raw materials, parts, and other essential resources. This approach reduces reliance on supply chains from countries potentially affected by geopolitical conflicts, insulating enterprises from associated risks and enhancing supply chain stability (Gulley et al., 2019). A robust domestic supply chain fosters deeper collaboration with domestic suppliers, establishing a stable supply chain network, and enhancing resilience to geopolitical risks and supply chain flexibility (Crane et al., 2019).

2.4. The influence of propagation effect on supply chain partners' financial performance

According to Ojha et al. (2018), risks can spread via interconnected supply chain networks. Some articles provide evidence of the repercussions of various supply chain risks. Hertz et al. (2008), for example, currently reported a supply chain ripple effect that causes negative market reactions for both suppliers and customers of bankrupt firms. Jacobs and Singhal (2020) investigated how stock markets react negatively to Tier 1 suppliers and customers in the context of the Volkswagen emissions crisis.

Moving beyond these examples, the most recent case of geopolitical supply chain risk, namely US trade sanctions, is examined in the study by (Jacobs et al., 2022). Their research investigated the impact of the US ban on ZTE on both ZTE and its suppliers and customers. The study's results indicated that the ban significantly affects not only the market value of ZTE's US Tier 1 suppliers but also that of Tier 2 suppliers. Most existing studies have primarily focused on exploring the impact of supply chain disruptions resulting from risky events on firms' stock prices or financial performance. As a result, adverse news from one partner in the supply chain may propagate to other partners within the same supply chain, leading to changes in their revenues or costs.

In summary, the prevailing body of research predominantly centres on the propagation effect of negative news on a firm's supply chain partners, with limited attention devoted to examining the propagation effect of positive news among such partners. Consequently, to address this research gap more comprehensively, this study primarily endeavours to investigate whether positive news from firms engenders propagation effects among their supply chain partners, thereby contributing to the literature in this domain.

3. Hypothesis development

Past studies have demonstrated that the stock market typically responds positively to announcements of environmental innovations by automobile manufacturers, directly impacting the company's market value (Ba et al., 2013; Kim et al., 2015) illustrated that the introduction of a branded mobile application can enhance a company's market value, as investors adjust their expectations for the company's future cash flows and the company signals a strategic interest in engaging with customers. Consequently, announcements of branded mobile applications positively influence the company's value and contribute to improved financial performance. Furthermore, declarations of IT initiatives can generate stock market value and elicit positive market reactions (Boyd et al., 2019). Other studies suggested that the development of blockchain technology announcements not only fosters innovation in a company's business model but also enhances its financial performance (Klößner et al., 2022). Hence, it is evident that positive news for a firm can have a favourable impact on its financial performance. As previously discussed, we contend that Huawei's confrontations with severe sanctions have heightened their urgency for independent research and development in chip technology. These sanctions, restricting Huawei from sourcing chip technology and equipment from certain high-tech companies in the US and its allies, necessitated an acceleration of the company's internal research, development, and production capabilities in the chip sector. This strategic response aligned with the intention to build corporate resilience through the strategic sourcing strategy to enable the successful launch of new products.

Additionally, due to contractual links between customers and suppliers, the financial repercussions of a major event may reverberate through the supply chain. This is analogous to the adverse impact of risk events with a propagation effect on supply chain partners (Jacobs and Singhal, 2020). The propagation effect in the supply chain results from the interconnected and interdependent nature of its various components, with the focal company's customers and suppliers. Disruptions or changes at one point in the supply chain, such as to the focal firm, can lead to a ripple effect that influences other nodes in the supply chain. For example, (Fang et al., 2015) explored that in the high-tech industry, a company's new product development influences its upstream and downstream partners. Specifically, the collaborative development of new products during the new product development process yields higher returns for the company, subsequently improving the financial performance of both upstream and downstream partners. Combined with the research background of this paper, China faces sanctions from the US, preventing Chinese companies from obtaining advanced chip supply and manufacturing technology. Under such circumstances, Huawei's successful release of new products equipped with advanced chip technology shows that Huawei has effectively navigated this disruption through resilient practices. Such positive news was expected to have a favourable impact on the company's finances (Klößner et al., 2022; Hosseini et al., 2019; Fang et al., 2015). Moreover, the Huawei incident signifies a significant advancement in China's chip technology. Huawei's proactive approach to seeking domestic suppliers to address supply disruptions contributes to its success and demonstrates supplier diversification (Ali et al., 2017). Furthermore, the disclosure of information regarding the 7 nm chips in Huawei's new products not only showcases the success of Huawei's resilience practice but also underscores its effective navigation of technological barriers. This revelation has provided the public with an accurate insight into Huawei's new product, consequently garnering a substantial consumer base swiftly. Such developments have not only positively influenced Huawei's suppliers but have also directly impacted its customers. As highlighted by Fang et al. (2015), positive news, including new product development, tends to enhance the financial performance of supply chain partners. Therefore, this paper posits the following hypothesis.

H1. The new product release under sanction will have a direct positive impact on the financial performance of the company's suppliers and customers.

Based on the two events elucidated in this article, our focus now shifts to the subsequent event (i.e. Event 2)—the announcement of SMIC as a chip supplier for Huawei's latest product. This revelation generated considerable attention. Against the backdrop of prevailing sanctions, Huawei actively pursued domestic suppliers to furnish advanced chip manufacturing technology and demonstrated its commitment to responding to chip supply disruptions through resilient practices (Ali et al., 2017; Merzifonluoglu, 2015). In the case of Event 2, SMIC's role as the chip supplier for Huawei's new product signified a breakthrough in chip technology despite being under US sanctions. This further indicates the achievement of China's chip technology in overcoming technical bottlenecks. According to Xin et al. (2010), products resulting from innovative technological breakthroughs contribute to enhanced company profitability. Technologically innovative products often face less competition upon launch, yielding higher profits for the introducing company (Warren et al., 2017). Technological breakthroughs represent the creation of implicit, complex, and specific knowledge that is challenging for competitors to replicate (Boyd et al., 2019). Therefore, the stock market reaction to SMIC, a company that has mastered cutting-edge chip technology, is expected to be more positive. The technological breakthroughs at SMIC will also have positive propagation effects on customers and suppliers for the following reasons: (1) SMIC's technological breakthroughs have established a strong brand image. SMIC's customer companies enhance their brand value and market competitiveness through cooperation with SMIC. This partnership increases the market and investor recognition of the quality of their products, thereby attracting more investors (Jaaskelainen, 2021), which ultimately has a positive financial impact on the customer companies; (2) Technological breakthroughs within a company tend to attract significant market attention, improve product quality, and thus enhance the company's competitiveness in the industry (Klößner et al., 2022). As mentioned earlier, SMIC's technological advancements, including the production of chips using cutting-edge technology, have garnered widespread media and market attention (Bloomberg, 2023). For supplier companies, the public or customers of supplier companies believe that supplier companies of SMIC may be potential contributors to the breakthrough of chip technology. That will enhance the competitiveness of supplier companies' products and have a positive impact. For instance, potential customers and partners are more likely to notice these supplier companies and have greater confidence in the quality and good technological level of their products, thereby increasing their willingness to engage in long-term contracts and enhancing supply chain collaboration. Therefore, this paper posits the following hypothesis.

H2. The technological breakthrough of SMIC under the sanction has a positive impact on the financial performance of SMIC's suppliers and customers.

4. Sample and methodology

We have identified and selected two key events as the focal point of our research. The events selection process is shown in Fig. 1. The criteria guiding our selection are succinctly outlined below. Initially, we conducted an exhaustive search across Ringdata, and LexisNexis news databases to compile news articles about Huawei's new product launches and 7 nm chip suppliers. The search encompassed keywords such as "Huawei new product launch," "Huawei chip supply," or "Huawei 60 Mate Pro." The search date was August 29, 2023, aligning with Huawei's official announcement of the new product release date. Additionally, during this exploration, we identified September 4, 2023, as the date when SMIC was officially disclosed as Huawei's chip supplier in Bloomberg's news, leading to the determination of the date for Event 2. To assess the impact of these two incidents, we scrutinised the list of

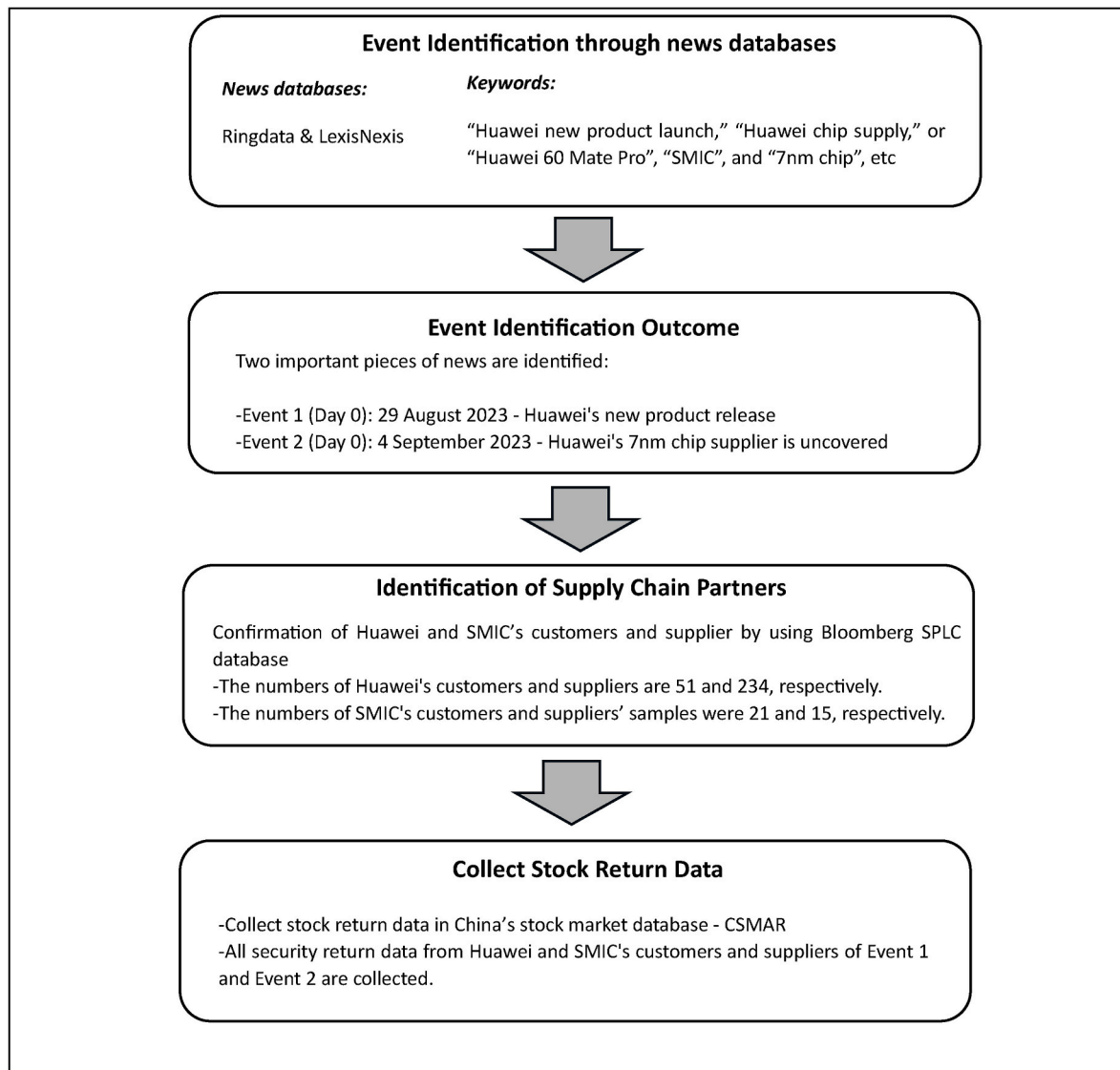


Fig. 1. Data collection process.

suppliers and customers linked to Huawei and SMIC in the Bloomberg SPLC based on the respective dates of the incidents. Stock return data was sourced from the China Stock Market & Accounting Research Database (CSMAR), renowned for providing comprehensive firm-level data on Chinese public firms.

4.1. Data

To examine the propagation effect of Huawei's new product release, this study utilised the Bloomberg Supplier Chain and Product Linkage Database (SPLC) to discern the suppliers and customers associated with Huawei and SMIC. Bloomberg SPLC has been widely used in OSCM studies recently. Compared with FactSet Reverse, another database that provides supply chain information data of public and private firms, Bloomberg SPLC was claimed to have more precise and comprehensive supply chain-level data. Consequently, Bloomberg SPLC has gained prominence in academic research as a valuable source for studying supply chain relationships (Osadchiy et al., 2015). Furthermore, to assess the financial implications, the sample of suppliers and customers was confined to companies listed on the Chinese stock market (as shown in Table 1). This was primarily because Huawei and SMIC are Chinese companies. Given the context of US sanctions against China, Huawei and

SMIC encountered obstacles in accessing advanced chip technology and chip manufacturing capabilities. Consequently, Chinese companies were expected to be the most affected.

4.2. Event study method

This paper employed the event study method to assess the stock market reaction to the focal firm's good news on supply chain members. Based on the EMH, the event study method allows researchers to determine the causal effect of an event by examining the abnormal returns of firms (Hendricks and Singhal, 2003; Swift et al., 2019; Jacobs and Singhal, 2020). According to the EMH, in an efficient market, stock prices consistently fully incorporate available information. Consequently, as financial markets react to new information, event studies facilitate the quantification of the financial impact of a specific event by examining abnormal stock returns over a relatively brief period (Jacobs and Singhal, 2020). The cumulative abnormal returns (CARs) is a core component of the event study method, calculated by summarising the abnormal returns (ARs) within a defined event window. ARs represent the deviation between the actual stock returns and the expected returns, typically calculated using a market model (MacKinlay, 1997). CARs reflect the market's immediate reaction to new information, embodying

Table 1
The demographic details of Huawei and SMIC's supply chain partners in China.

Panel A: Huawei's Customer		
Sample Industry Description	Number	% of Huawei's Supplier
Technology	20	39%
Electronics	16	31%
Manufacturing	7	14%
Others	9	16%
Total	51	100%
Panel B: Huawei's Supplier		
Sample Industry Description	Number	% of Huawei's Customer
Technology	90	38%
Electronics	41	18%
Manufacturing	40	17%
IT Services	33	14%
Others	30	13%
Total	234	100%
Panel C: SMIC's Customer		
Sample Industry Description	Number	% of Huawei's Supplier
Electronics	8	53%
Technology	4	27%
Others	3	20%
Total	15	100%
Panel D: SMIC's Supplier		
Sample Industry Description	Number	% of Huawei's Customer
Technology	7	33%
Electronics	7	33%
Manufacturing	4	19%
Others	3	14%
Total	21	100%

investors' reassessment of a company's future cash flows and risk profile in light of the event. Positive CARs indicate that investors expect the event to enhance the company's financial performance (Noh, 2019), while negative CARs suggest an adverse impact (Ali et al., 2017). By aggregating CARs over multiple days before and after an event (the event window), CARs provide a composite indicator that captures both the initial market reaction and any delayed responses. This comprehensive view is crucial for understanding the overall impact of events on a company's valuation (Christopher and Ryals, 1999).

The event date in this study was designated as the first public date of each news. Specifically, in both events, the news was released when the stock market was open. Therefore, August 29, 2023, was specified as the event date for Event 1, and September 4, 2023, was specified as the event date for Event 2. In event studies, the stock market reaction on the day of the event and the day before is usually estimated and attributed to the event of interest (Hendricks and Singhal, 2003). However, other studies have demonstrated that using one- or two-day event periods is also common (Jacobs and Singhal, 2020). Unlike these studies, given the significance of the positive news and the continuous release of related information, we further estimate the stock market reaction on the day of the initial announcement (Day 0) and the subsequent five trading days. Thus, we use a six-day event period (Day 0 to Day 5) as our main focus.

We adopted an estimation window of 200 days when calculating the abnormal return, which started on Day -210 days and ended on Day -11. A market model was chosen and OLS regression was used to estimate the parameters in the market model. According to the market model, the security return of a specific firm could be partially explained by the overall market performance. Therefore,

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where R_{it} was the stock return of firm i on Day t , α_i and β_i were firm-related specific parameters. R_{mt} was the market return on Day t . We used the Shanghai and Shenzhen A-share market index as the market return here. ε_{it} was the error term. On the event day that a certain event happened, the estimated stock return of firm i was calculated as:

$$E(R_{it}) = \hat{\alpha}_i + \hat{\beta}_i R_{mt}$$

where $\hat{\alpha}_i$ and $\hat{\beta}_i$ were the estimated intercept and slope from OLS regression over the estimation window. Therefore, the abnormal return (AR) of firm i on Day t was:

$$AR_{it} = R_{it} - E(R_{it})$$

We also reported cumulative abnormal return (CAR) in the results. CAR was calculated as:

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} \bar{A}_t$$

where \bar{A}_t was:

$$\bar{A}_t = \frac{\sum_{i=1}^N AR_{it}}{N}$$

Additionally, the mean (median) of ARs and the percentage of negative ARs were also reported in our results. T-tests, Wilcoxon signed-rank tests, and binomial sign tests were used here.

5. Results

Table 2 presents the abnormal returns (ARs) daily from Day 0 to Day 2. Cumulative abnormal returns (CARs) were also reported from Day 0 through Day 3 (Day 4, Day 5). As depicted in Table 2, Huawei's suppliers exhibited positive and statistically significant ARs on day 0, with a mean (median) AR of 2.00% (1.53%), both significant at the 1% level. Over 83% of the suppliers experience a positive AR, significantly different from 50% at the 1% level. The positive and significant ARs continued on Day 1 and Day 2, with median ARs of 1.34% and 0.15%, respectively. Cumulative abnormal returns (CARs) for Huawei's suppliers also displayed positive significance, indicating a stable positive trend in Huawei suppliers' response to Event 1. Panel B in Table 2 presents the stock market reaction of SMIC's suppliers to Event 1. Similar to Huawei, the results in panel B indicated a positive reaction from SMIC's suppliers toward the news of the product launch. For Day 0, the mean and median ARs are 1.90% and 1.62%, respectively, both significant at the 1% level. Over 85% of the suppliers experienced a positive AR, significantly different from 50% at the 1% level. The ARs over the next two days remained consistent with those observed on Day 0. The CARs for Days [0,5] were positively significant. The mean and median CARs for Days [0,5] are 6.24% and 4.91%, respectively, were both significant at the 1% level. All firms experienced a positive CAR, significantly different from 50% at the 1% level. The above results suggested that both Huawei and SMIC's suppliers had reacted positively to Event 1.

As illustrated in Table 3, Panel A details the stock market reaction of Huawei's customers to Event 1. The AR results during the initial three days did not exhibit statistical significance. The results for CARs were the same. Moving Panel B, delineates the stock market reaction of SMIC's customers to Event 1. Overall, SMIC's customers exhibited a positive and significant response to Event 1. Specifically, the mean and median ARs for day 0 are 3.37% and 2.52%, respectively, with both mean and median ARs statistically significant at the 1% level. Over 93% of customer firms exhibited a positive reaction to the launch of new phones. The results on day 1 and day 2 are analogous to those observed on day 0. Notably, the mean (median) CARs for Days [0,5] for SMIC's customers was 8.64% (7.38%), significant at the 1% level. While Huawei's customers displayed no significant response to Event 1.

In Event 2, Bloomberg disclosed the previously obscure chip supply relationship between SMIC and Huawei. Table 4 presents the stock market reaction results of Huawei and SMIC's suppliers to Event 2. Panel A shows that the overall impact of Event 2 on Huawei's suppliers was positive and significant. At first, ARs on Day 0 were not significant.

Table 2
ARs and CARs for the sample of Huawei and SMIC's suppliers of Event 1.

Panel A: ARs and CARs of Huawei's Suppliers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	234	2.00%	(+10.91)***	1.53%	(+10.55)***	38	16.24%	(-10.33)***
1	234	1.15%	(+8.43)***	1.34%	(+8.33)***	57	24.36%	(-7.84)***
2	234	0.35%	(+1.97)*	0.15%	(+1.86)*	103	44.02%	(-1.83)*
[0,5]	234	4.18%	(+9.43)***	3.56%	(+9.11)***	57	24.36%	(-7.84)***
Panel B: ARs and CARs of SMIC's Suppliers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	21	1.90%	(+3.36)***	1.62%	(+3.35)***	3	14.29%	(-3.27)***
1	21	2.04%	(+3.69)***	2.08%	(+3.32)***	2	9.52%	(-3.71)***
2	21	2.17%	(+3.92)***	1.51%	(+2.08)***	5	23.81%	(-2.40)**
[0,5]	21	6.24%	(+4.49)***	4.91%	(+4.54)***	0	0.00%	(-4.58)***

Note: Two-tailed tests; *p < 0.10; **p < 0.05; ***p < 0.01.

^a Calculated from Wilcoxon signed-rank tests.

^b Calculated from binomial sign tests.

Table 3
ARs and CARs for the sample of Huawei and SMIC's customers of Event 1.

Panel A: ARs and CARs of Huawei's Customers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	51	0.58%	(+1.76)*	0.62%	(+1.41)	21	41.18%	(-1.26)
1	51	0.00%	(+0.82)	0.00%	(+0.82)	22	43.14%	(-0.98)
2	51	-0.22%	(-0.69)	-0.01%	(-0.39)	26	50.98%	(+0.14)
[0,5]	51	0.56%	(+0.70)	-0.53%	(-0.34)	26	50.98%	(+0.14)
Panel B: ARs and CARs of SMIC's Customers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	15	3.37%	(+4.32)***	2.52%	(+3.07)***	1	6.67%	(-3.36)***
1	15	3.15%	(+4.05)***	3.10%	(+3.41)***	0	0.00%	(-3.87)***
2	15	2.37%	(+3.04)***	1.61%	(+3.18)***	1	6.67%	(-3.36)***
[0,5]	15	8.64%	(+4.37)***	7.38%	(+4.67)***	0	0.00%	(-3.87)***

Note: Two-tailed tests; *p < 0.10; **p < 0.05; ***p < 0.01.

^a Calculated from Wilcoxon signed-rank tests.

^b Calculated from binomial sign tests.

Table 4
ARs and CARs for the sample of Huawei and SMIC's suppliers of Event 2.

Panel A: ARs and CARs of Huawei's Suppliers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	234	0.30%	(+1.64)	-0.06%	(+0.48)	12	52.56%	(+0.78)
1	234	0.58%	(+3.23)***	0.53%	(+3.49)***	98	41.88%	(-2.48)**
2	234	1.28%	(+7.21)***	0.87%	(+7.42)***	73	31.20%	(-5.75)***
[0,5]	234	2.66%	(+6.11)***	2.16%	(+5.44)***	75	32.05%	(-5.49)***
Panel B: ARs and CARs of SMIC's Suppliers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	21	-0.25%	(-0.44)	-0.37%	(-1.09)	13	61.90%	(+1.09)
1	21	1.07%	(+1.94)*	1.11%	(+2.59)***	5	23.81%	(-2.04)**
2	21	3.37%	(+6.12)***	2.61%	(+3.77)***	1	4.76%	(-4.15)***
[0,5]	21	3.03%	(+2.20)**	2.80%	(+1.88)*	4	19.05%	(-2.84)***

Note: Two-tailed tests; *p < 0.10; **p < 0.05; ***p < 0.01.

^a Calculated from Wilcoxon signed-rank tests.

^b Calculated from binomial sign tests.

However, ARs became positively significant on Day 1 and Day 2. Additionally, the mean and median CARs for Days [0,5] were summarised as 2.66% and 2.16%. The results suggested that suppliers of Huawei reacted positively to this event.

Panel B provides the stock market reaction of SMIC's suppliers to Event 2. Similarly, on day 0, ARs did not exhibit significant changes. Significance gradually emerged from Day 1, with particularly noteworthy results on Day 2, where the mean and median ARs were 3.37% and 2.61%. Statistical tests affirmed that both mean and median ARs were significant at the 1% level. While neither Huawei nor SMIC suppliers manifested a significant response to Event 2 on day 0, a

noteworthy shift occurred over time. This provides clear evidence that SMIC's suppliers reacted positively to Bloomberg's disclosure.

Table 5 outlines the stock market reaction of customers of Huawei and SMIC to Event 2. In panel A, Huawei's customers did not exhibit a significant stock market reaction on Day 0 and Day 1. A positive reaction emerged on Day 2, with mean and median ARs of 0.83% and 0.58%, respectively, both significant at the 1% level. Over 64% of Huawei's customers experience positive ARs on Day 2. The mean and median CARs for Days [0,5] were 2.12% and 0.30%, significant at 1% and 10% level, respectively. In short, Huawei's customers' response to the event was positive. In Panel B, the significant response of SMIC's customers

Table 5
ARs and CARs for the sample of Huawei and SMIC's customers of Event 2.

Panel A: ARs and CARs of Huawei's Customers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	51	0.46%	(+1.43)	0.10%	(+0.34)	23	45.10%	(-0.70)
1	51	-0.10%	(-0.30)	-0.21%	(-1.28)	30	58.82%	(+1.26)
2	51	0.83%	(+2.62) ***	0.58%	(+2.32) ***	18	35.29%	(-2.10) **
[0,5]	51	2.12%	(+2.69) ***	0.30%	(+1.68) *	23	45.10%	(-0.70)
Panel B: ARs and CARs of SMIC's Customers								
Event day	N	Mean	t	Median	Z ^a	#Negative	%Negative	Z ^b
0	15	0.01%	(+0.02)	0.04%	(+0.34)	7	46.67%	(-0.26)
1	15	1.04%	(+1.34)	1.29%	(+1.87) *	3	20.00%	(-2.32) **
2	15	2.32%	(+3.00) ***	2.63%	(+3.41) ***	0	0.00%	(-3.87) ***
[0,5]	15	2.77%	(+1.43)	1.83%	(+2.28) **	2	13.33%	(-2.84) ***

Note: Two-tailed tests; *p < 0.10; **p < 0.05; ***p < 0.01.

^a Calculated from Wilcoxon signed-rank tests.

^b Calculated from binomial sign tests.

also commenced on Day 2, with mean and median ARs of 2.32% and 2.63%, respectively. The statistical tests confirm that both mean and median ARs were significant at the 1% level. Table 5 suggests an interesting finding that the stock market reaction of SMIC customers is more pronounced than that of Huawei's customers. This is evident as the mean ARs of SMIC's customers on Day 2 (mean = 2.32%) were higher than the mean ARs of Huawei's customers (mean = 0.83%).

6. Discussion and conclusion

In this study, Event 1 primarily examined whether the stock market reaction to Huawei's new product release propagated among Huawei's supply chain partners. Huawei's successful release of new products indicated that, despite US sanction, the company had effectively identified domestic suppliers to provide components for its new products. Through strategic collaborations with these suppliers, Huawei strengthened its supply chain resilience, enabling it to navigate and overcome the challenges posed by the sanctions. In Event 2, our focus shifted to SMIC, the chip supplier for Huawei's new products, to assess the event's impact on SMIC and explore whether this impact propagated within SMIC's supply chain. Specifically, the results of the Event 1 study revealed a notable positive response from Huawei's suppliers to the launch of the new mobile phone. However, the market reaction from Huawei's customers to Event 1 was not readily apparent. Although we also explored the impact on SMIC during Event 1, this may appear unnecessary since Event 1 was published without mentioning SMIC. However, this approach allowed us to compare and emphasise the positive impact of Event 2 (SMIC's technological breakthrough) on SMIC when we obtained the results for Event 2. The results of Event 2 indicated that while both Huawei's and SMIC's customers and suppliers displayed positive responses, the degree of positivity varied. SMIC's supply chain partners exhibited a more pronounced positive reaction than Huawei's supply chain partners. In general, event studies usually examine the impact of a single event, especially those involving major news (Ba et al., 2013; Boyd et al., 2019). While some studies do incorporate subsequent events, this approach has not been widely adopted (Jacobs et al., 2020). However, from a study design perspective, it is reasonable to consider subsequent events because a single unexpected event often triggers follow-up events. For example, bad news may be followed by reports of new evidence or a company's response. Our research, while focusing on good news, falls into the latter category: new evidence (Event 2 confirms Huawei's remarkable resilience). We believe that combining a major event (Event 1) with subsequent events (Event 2) provides a clearer picture of the overall impact and explores whether subsequent evidence has a lasting effect. In this study, our results show that Event 1 and Event 2 have a continuous positive impact on the company and its supply chain members, with varying degrees of propagation effects among the supply chain members.

Upon further examination of the research results, it was perhaps surprising to discover that, although the market reaction of Huawei's customers to Event 1 was not significant, the market reaction to Event 2 was more positive, even surpassing that of Event 1, with the median market reaction being 0.58% and -0.01%. We posit that this outcome may be attributed to the following reasons: (i) In the official news released by Huawei (Event 1), the company solely announced the release of new products, lacking substantive information about the chip or technological breakthroughs; (ii) Huawei's customer companies may have been unaware of the new source of the chips, potentially believing that the chips used in Huawei's new products might be part of the inventory purchased before US sanctions. This uncertainty led to doubts regarding Huawei's resilience practice. As a result, customers did not receive precise information about technological breakthroughs and/or supply resilience, resulting in their insignificant response to Event 1. Subsequently, Bloomberg (2023) published news a few days later (September 4, 2023), providing reliable information that the chip was manufactured by SMIC and supplied to Huawei (Event 2). Through Event 2, it became evident that Huawei has identified a chip supplier (SMIC) capable of ongoing chip supply (BBC, 2023). Moreover, given US sanctions, Chinese companies faced challenges in producing chips with advanced technologies like 7 nm chips. Event 2 further underscored Huawei's and SMIC's success in overcoming technical bottlenecks and navigating US technology sanctions. Consequently, the market reaction of Huawei's customers to Event 2 was more pronounced than that of Event 1.

However, by comparing the results, we observe different impacts of Event 1 and Event 2 on the supply chain partners of Huawei and SMIC on different days. For instance, Event 2 significantly impacts SMIC's suppliers on Day 1 and its customers on Day 2, rather than immediately on Day 0. This suggests that, while the focal firm influences its supply chain partners through the propagation effect (Jacobs and Singhal, 2020), this influence cannot be entirely attributed to the focal firm. Due to simultaneous announcement releases, both the focal firm and its supply chain partners receive the news at the same time. Event studies assess the impact of specific events on firm value or market performance (MacKinlay, 1997), reflecting shareholders' performance expectations. Thus, although these events concern the focal firms, the influence on supply chain partners varies based on the event's characteristics and shareholder focus. Therefore, although the events in this study concern the focal firms (Huawei and SMIC), in many cases, the focal firm is expected to be the first company affected. However, this may not always be the case, as the propagation of effects is not necessarily transmitted through their contractual bonds. Instead, it depends on how sensitive the shareholders of the company's supply chain members are to news about the focal firm, especially if the focal firm is a major customer or supplier. In this case, both Huawei and their supply chain members are equally sensitive to the positive news about resilience, but the market of

different parties may not react at the same time. From this, we can see that the time of influence on supply chain partners is not always consistent. It also depends on the characteristics of the event and whether the focus of the supply chain partners' shareholders is on the focal firm.

In summary, the analysis of Event 1 and Event 2 addressed the research question of propagation effects between Huawei (the focal firm) and SMIC (the main supplier) supply chain partners respectively. This study, in particular, underscored that firm resilience practices can be an effective measure to enable companies to adeptly manage supply disruptions arising from geopolitical issues.

6.1. Implications for research

Through the event study methodology, this research rigorously examines two positive events: Huawei's new product launch (Event 1) and the disclosure of SMIC as Huawei's chip supplier (Event 2). It delves into how the stock market reacts to positive corporate events and the subsequent propagation of this reaction among supply chain partners. The findings reveal that the stock market exhibits a positive reaction to positive news from companies, which then propagates to influence supply chain partners. This study enriches our comprehension of the stock market in reaction to positive news and highlights the propagation effects within supply chain partnerships. Addressing existing research gaps and offering fresh insights, not only advances our understanding of supply chain partnerships but also sets the stage for future investigations in this area. In addition, our study offers valuable insights for the research design of future event studies involving multiple events. It would be better if the estimation window of the second event does not overlap with the event window of the first event. This approach will help maintain the accuracy and reliability of the results for the second event.

Our findings empirically confirm that resilience practices play a pivotal role in mitigating and responding to disruptions arising from geopolitical uncertainty (Kim and Chai, 2017; Charpin et al., 2021). This paper identifies the importance of resilience practices, such as actively seeking domestic alternative suppliers (Wu and Choi, 2005), establishing cooperative relationships with suppliers (Jääskeläinen, 2021), and implementing strategic procurement strategies (Gulley et al., 2019). Consequently, this study contributes to the academic literature on developing resilience practices to overcome geopolitical risks informs corporate strategies and provides references for companies to formulate more accurate geopolitical risk management strategies.

We also aim to contribute to academic research on resilient practices to overcome supply chain disruptions and respond to the call from scholars for more empirical research on the topic (Ali et al., 2017; Tukamuhabwa et al., 2017; Partanen et al., 2019). However, what distinguishes our study from previous research is our exploration of the positive impact that an enterprise can achieve in quickly recovering after a supply chain disruption through its resilience practices (e.g., actively establishing cooperation with domestic suppliers). Consequently, the study provides crucial insights into the strategic implications of resilient practices for companies seeking to navigate and overcome supply chain disruptions through an analysis of events and research findings. Our research also highlights the importance of actively building strategic relationships with supply chain partners to yield better outcomes in resilience practices.

6.2. Implications for practice

In addition to the aforementioned research significance, this study offers practical insights for managers. First, our research may encourage companies to voluntarily implement resilient practices, as such practices help companies recover quickly from uncertainties caused by supply chain disruptions or geopolitical risks (Ali et al., 2017). For example, actively seeking domestic alternative suppliers has proven to be an effective means of addressing supply disruptions amid geopolitical risks

(Fan et al., 2022). As such, the study provides valuable guidance for managers, especially in today's business environment where supply disruptions are frequent and unpredictable due to geopolitical issues. Firms responding to the challenges posed by supply disruptions by building their resilience practices can significantly impact their financial performance (Namdar et al., 2017). Therefore, business managers should not underestimate the importance of flexible practices when formulating corporate strategies.

Secondly, based on the empirical results of this paper, positive news from focal firms can extend its impact through a propagation effect between upstream and downstream partners in the supply chain (Ojha et al., 2018). However, based on the results of Event 1, when the specifics of the technological breakthrough are not clear, the stock market of customer companies may not necessarily react to the event. Therefore, managers should fully consider the importance of upstream and downstream partners in the supply chain when formulating and implementing strategies (Osadchiy et al., 2015). Advocating for a broader perspective is crucial to fully understand the potential impacts across the supply chain. Managers of supplier and customer companies need to monitor the information dynamics of the focal companies and adjust their strategic decisions accordingly (Jiang et al., 2023). For instance, positive news from the focal firm can enhance the competitiveness of its client company, leading to increased market share and overall business value. Similarly, the supplier company will experience an increase in orders, demanding higher equipment and capacity to ensure seamless production progress. This study offers a unique perspective for company managers to make corporate decisions with a broader outlook.

Thirdly, practitioners should endeavour to construct resilient supply chain ecosystems capable of swift adaptation and response to emergencies. Concurrently, it is imperative to enhance the monitoring capabilities across all supply chain nodes, facilitating the timely identification of diverse risks and alterations within the supply chain. Finally, our research holds implications for investors. Investors need timely information about the supply chain network in which the company is situated, encompassing a comprehensive understanding of the information and news related to supply chain partner companies. This is crucial because the financial impact can propagate among supply chain partners.

Limitations and future research

The study has certain limitations. Firstly, our data exclusively comprises listed companies in China. Therefore, further verification is necessary to determine whether propagation effects among supply chain members are present in non-listed companies. Secondly, employing the event study method, we concentrate on the short-term impact of positive news on the stock market. Future research is encouraged to delve into the long-term consequences of such events on supply chain networks, offering valuable insights from a risk and resilience perspective. Finally, we utilise ARs as an indicator to measure the company's financial performance. While this approach is common in contemporary OSCM research, we believe that employing alternative measures of financial performance could yield an interesting and more generalised finding. In addition, it is worth noting that, as Huawei is not a publicly listed company, this study cannot ascertain the impact of this news on Huawei's stock market reaction.

CRediT authorship contribution statement

Ying Kei Tse: Writing – review & editing, Supervision, Resources, Project administration. **Kyra Dong:** Writing – original draft. **Ruiqing Sun:** Methodology. **Robert Mason:** Writing – review & editing.

Data availability

Data will be made available on request.

References

- Ali, A., Mahfouz, A., Arisha, A., 2017. Analysing supply chain resilience: integrating the constructs in a concept mapping framework via a systematic literature review. *Supply Chain Manag.: Int. J.* 22, 16–39.
- Ba, S., Liscic, L.L., Liu, Q., Stallaert, J., 2013. Stock market reaction to green vehicle innovation. *Prod. Oper. Manag.* 22, 976–990.
- Baghersad, M., Zobel, C.W., 2021. Assessing the extended impacts of supply chain disruptions on firms: an empirical study. *Int. J. Prod. Econ.* 231, 107862.
- Boyd, D.E., Kannan, P.K., Slotegraaf, R.J., 2019. Branded apps and their impact on firm value: a design perspective. *J. Market. Res.* 56, 76–88.
- Caldara, D., Iacoviello, M., 2022. Measuring geopolitical risk. *Am. Econ. Rev.* 112, 1194–1225.
- Charpin, R., Powell, E.E., Roth, A.V., 2021. The influence of perceived host country political risk on foreign subunits' supplier development strategies. *J. Oper. Manag.* 67, 329–359.
- Christopher, M., Ryals, L., 1999. Supply chain strategy: its impact on shareholder value. *Int. J. Logist. Manag.* 10, 1–10.
- Cui, L., Yue, S., Nghiem, X.-H., Duan, M., 2023. Exploring the risk and economic vulnerability of global energy supply chain interruption in the context of Russo-Ukrainian war. *Resour. Pol.* 81, 103373.
- Ding, H., Molchanov, A.E., Stork, P.A., 2011. The value of celebrity endorsements: a stock market perspective. *Mark Lett* 22, 147–163.
- Fama, E.F., 1970. Efficient capital markets: a review of theory and empirical work. *J. Finance* 25, 383–417.
- Fan, D., Zhou, Y., Yeung, A.C.L., Lo, C.K.Y., Tang, C., 2022. Impact of the U.S.–China trade war on the operating performance of U.S. firms: the role of outsourcing and supply base complexity. *J. Oper. Manag.* 68, 928–962.
- Fang, E., Lee, J., Yang, Z., 2015. The timing of codevelopment alliances in new product development processes: returns for upstream and downstream partners. *J. Market.* 79, 64–82.
- Hendricks, K.B., Singhal, V.R., 2003. The effect of supply chain glitches on shareholder wealth. *J. Oper. Manag.* 21, 501–522.
- Jacobs, B.W., 2014. Shareholder value effects of voluntary emissions reduction. *Prod. Oper. Manag.* 23, 1859–1874.
- Jacobs, B.W., Singhal, V.R., 2020. Shareholder value effects of the volkswagen emissions scandal on the automotive ecosystem. *Prod. Oper. Manag.* 29, 2230–2251.
- Jacobs, B.W., Singhal, V.R., Zhan, X., 2022. Stock market reaction to global supply chain disruptions from the 2018 US government ban on ZTE. *J. Oper. Manag.* 68, 903–927.
- Jia, S., Yang, L., Zhou, F., 2022. Geopolitical risk and corporate innovation: evidence from China. *J. Multinat. Financ. Manag.* 66, 100772.
- Jiang, Y., Tian, G., Wu, Y., Mo, B., 2022. Impacts of geopolitical risks and economic policy uncertainty on Chinese tourism-listed company stock. *Int. J. Finance Econ.* 27, 320–333.
- Kim, S.J., Wang, R.J.-H., Malthouse, E.C., 2015. The effects of adopting and using a brand's mobile application on customers' subsequent purchase behavior. *J. Interact. Market.* 31, 28–41.
- Klöckner, M., Schmidt, C.G., Wagner, S.M., 2022. When blockchain creates shareholder value: empirical evidence from international firm announcements. *Prod. Oper. Manag.* 31, 46–64.
- Konchitchki, Y., O'Leary, D., 2011. Event study methodologies in information systems research. *Int. J. Account. Inf. Syst.* 12, 99–115.
- Liefert, W.M., Liefert, O., Seeley, R., Lee, T., 2019. The effect of Russia's economic crisis and import ban on its agricultural and food sector. *J. Eurasian Stud.* 10, 119–135.
- Lin, C.-S., Su, C.-T., 2013. The Taiwan national quality award and market value of the firms: an empirical study. *Int. J. Prod. Econ.* 144, 57–67.
- MacKinlay, A.C., 1997. Event studies in economics and finance. *J. Econ. Lit.* 35, 13–39.
- Merzifonluoglu, Y., 2015. Risk averse supply portfolio selection with supply, demand and spot market volatility. *Omega, Decision Making in Enterprise Risk Management* 57, 40–53.
- Namdar, J., Li, X., Sawhney, R., Pradhan, N., 2017. Supply chain resilience for single and multiple sourcing in the presence of disruption risks. *Int. J. Prod. Res.* 56, 1–22.
- Noh, Y., 2019. The effects of corporate green efforts for sustainability: an event study approach. *Sustainability* 11, 4073.
- Osadchyi, N., Gaur, V., Seshadri, S., 2015. Systematic risk in supply chain networks. *Manag. Sci.* 62 (6), 1755–1777.
- Papadakis, I.S., 2006. Financial performance of supply chains after disruptions: an event study. *Supply Chain Manag.: Int. J.* 11, 25–33.
- Partanen, J., Kohtamäki, M., Patel, P.C., Parida, V., 2020. Supply chain ambidexterity and manufacturing SME performance: the moderating roles of network capability and strategic information flow. *Int. J. Prod. Econ.* 221, 107470.
- Pringpong, S., Maneenop, S., Jaroenjitkrum, A., 2023. Geopolitical risk and firm value: evidence from emerging markets. *N. Am. J. Econ. Finance* 68, 101951.
- Queiroz, M.M., Ivanov, D., Dolgui, A., Fosso Wamba, S., 2022. Impacts of epidemic outbreaks on supply chains: mapping a research agenda amid the COVID-19 pandemic through a structured literature review. *Annu. Oper. Res.* 319, 1159–1196.
- Roscoe, S., Aktas, E., Petersen, K.J., Skipworth, H.D., Handfield, R.B., Habib, F., 2022. Redesigning global supply chains during compounding geopolitical disruptions: the role of supply chain logics. *Int. J. Oper. Prod. Manag.* 42, 1407–1434.
- Steinker, S., Hoberg, K., 2013. The impact of inventory dynamics on long-term stock returns – an empirical investigation of U.S. manufacturing companies. *J. Oper. Manag.* 31, 250–261.
- Talluri, S., Narasimhan, R., 2004. A methodology for strategic sourcing. *Eur. J. Oper. Res.* 154, 236–250.
- Tukamuhabwa, B., Stevenson, M., Busby, J., 2017. Supply chain resilience in a developing country context: a case study on the interconnectedness of threats, strategies and outcomes. *Supply Chain Manag.: Int. J.* 22, 486–505.
- Ullah, S., Zaefarian, G., Ahmed, R., Kimani, D., 2021. How to apply the event study methodology in STATA: an overview and a step-by-step guide for authors. *Ind. Market. Manag.* 99, A1–A12.
- Warren, N.L., Sorescu, A., 2017. Interpreting the stock returns to new product announcements: how the past shapes investors' expectations of the future. *J. Market. Res.* 54, 799–815.
- Xin, J.Y., Yeung, A.C.L., Cheng, T.C.E., 2010. First to market: is technological innovation in new product development profitable in health care industries? *Int. J. Prod. Econ.* 127, 129–135.
- Yu, W., Jacobs, M.A., Chavez, R., Yang, J., 2019. Dynamism, disruption orientation, and resilience in the supply chain and the impacts on financial performance: a dynamic capabilities perspective. *Int. J. Prod. Econ.* 218, 352–362.