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The U.S.–China trade war and Abnormal Fluctuations in Cross-Border Supply Chains

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Research Article

Keywords: Supply chains, Trade War, Exports, Trade Network, Abnormal Fluctuation

Posted Date: October 14th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11146328/v1

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Additional Declarations: No competing interests reported.

Abstract

This paper examines the impact of the U.S.–China trade war on firms' supplier–customer relationship adjustments. Using the FactSet Revere Global Supply Chain Database, we construct an abnormal fluctuation index that distinguishes shock-induced restructuring from routine relationship turnover. The results show that the trade policy significantly increased abnormal fluctuations in cross-border supply chain relationships. Rising transaction costs and heightened uncertainty are two important channels through which the trade war induces abnormal supply chain fluctuations. Firms with stronger innovation capabilities, whose products are more difficult to substitute, are more likely to retain existing customers, whereas firms with customers distributed across a broader range of countries are more likely to switch to lower-cost alternative customers. The findings also highlight substantial heterogeneity in firms' responses to external trade policy shocks. These findings provide a more precise approach to identifying supply chain restructuring and offer new insights into how firms adjust their supply chain relationships in response to trade policy shocks.

JEL Classification: F13, F14, L14

1 Introduction

For decades, trade liberalization brought national economies into ever closer connection. The outbreak of the U.S.–China trade war in 2018, however, marked a significant reversal of this process. The United States imposed several successive rounds of additional tariffs on Chinese exports, substantially increasing firms' cross-border trade costs and trade policy uncertainty. These steep tariffs caused many Chinese suppliers to lose their US customers. Nevertheless, contrary to the intuitive expectation of widespread trade relationship breakdown, Chinese firms did not appear to retreat from overseas markets. Instead, they continued to establish new customer relationships toward other countries and regions (Fig. 1). This pattern raises a broader question: To what extent did U.S. tariff increases reduce Chinese firms' international trade linkages? Faced with rising tariff costs, did firms maintain their existing relationships with US customers, or terminate these relationships and seek new customers in alternative markets?

Existing studies have shown that the U.S.–China trade war significantly affected firms' exports and imports (Jiang et al. 2023), operating performance (Che et al. 2025; Huang et al. 2023), labor markets(Cavalcanti et al. 2026; Javorcik et al. 2025), and social welfare(Hoang and Mix 2026; Ossa 2014). These studies have substantially advanced our understanding of the economic consequences of the trade war across multiple dimensions. Meanwhile, as intermediate inputs have become increasingly important in global trade, a growing body of research has examined the effects of trade war from a supply chain perspective(Artuç and McLaren 2015; Garg et al. 2023; Yang et al. 2025). For firms, particularly those highly dependent on overseas markets, the loss of a major foreign customer can have substantial consequences for their operations(Kopytov et al. 2024). When confronted with a sudden increase in trade costs, firms therefore face a strategic choice, maintain their existing supply chain

relationships and absorb the higher costs, or reconfigure their supply chain networks by seeking new trading partners and more attractive markets.

When examining changes in firms' supplier and customer relationships, two types of adjustment should be considered: proactive adjustments driven by firms' own needs and adjustments forced by external factors. Existing studies on supply chain generally regard changes in cross-border supplier–customer relationships as an important consequence of external shocks (Alessandria et al. 2023; Baldwin et al. 2022; Baslandze and Fuchs 2026; Benguria and Saffie 2024; Bonadio et al. 2021; Freund et al. 2024; Hu et al. 2026; Niu et al. 2025). However, observed changes in supplier–customer relationships may reflect two distinct forces: firms' endogenous adjustments during normal business operations and their responses to exogenous shocks. In practice, even without external shocks, firms routinely adjust their supplier and customer relationships in response to business strategies, project cycles, and changing production needs(Rigo 2024). Therefore, observed changes in supply chain relationships may reflect both routine business adjustments and responses to external shocks. Departing from the existing literature, this study explicitly recognizes such routine adjustments. Rather than attributing all changes in supply chain relationships to external shocks, by focusing on firms' own circumstances, we examine whether U.S. tariff increases triggered supply chain reorganization beyond their normal adjustment patterns.

In this paper, we use the FactSet Revere Global Supply Chain Database to develop a novel measure of abnormal supply chain fluctuation that distinguishes routine relationship turnover from changes exceeding firms' normal adjustment patterns, thereby providing a new empirical approach to identifying supply chain responses to external shocks. The results show that the US–China trade policy significantly increased abnormal fluctuation among Chinese firms, indicating that it pushed their supply chain changes beyond pre-existing patterns rather than merely altering the total number of customer relationships formed or terminated. Rising trade costs and heightened firm-level perceptions of uncertainty as two important drivers of this effect. Given that the trade policy shocks induced abnormal supply chain fluctuations, we further ask which firms were more vulnerable to such disruptions and which were better able to maintain stable relationships. Further analyses show that firms with less substitutable products are more likely to maintain existing customer relationships, whereas firms operating across a wider range of countries are more likely to replace customers in response to external shocks.

This paper contributes by developing a measure of abnormal supply chain fluctuation that uses each firm's usual adjustment frequency as a benchmark. This measure helps distinguish routine relationship adjustments from abnormal fluctuation induced by external shocks. Building on this approach, the paper examines firms' adjustment strategies in response to trade policy shocks along two dimensions: maintaining existing customer relationships and establishing new ones. It thus offers a new perspective on how policy shocks shape supply chain restructuring.

The remainder of the paper is organized as follows. Section 2 presents stylized facts on routine turnover in supply chain relationships. Section 3 develops the theoretical analysis and research hypotheses. Section 4 describes the empirical research design. Section 5 reports the baseline results, robustness checks, and further analyses. Section 6 concludes.

2. Stylized Facts

The additional U.S. tariffs raised the cost of exporting Chinese goods to the United States, potentially making it less profitable for Chinese firms to maintain existing relationships or establish new ones with U.S. customers. Did these relationships indeed contract following the tariff increases? Fig. 1 compares trends in the rate of new customer relationship formation across different groups of firms from 2016 to 2023. Following the U.S. tariff increases, the rate of new relationship formation with U.S. customers among Chinese firms in tariff-exposed industries initially moved in line with that for non-U.S. customers across all industries. After 2020, however, the two trends diverged: the former declined substantially, while the latter remained relatively stable. This divergence suggests a persistent weakening in the formation of new U.S. customer linkages in tariff-exposed industries, while Chinese firms continued to establish new customer relationships in markets outside the United States. These sharply divergent trends suggest that external shocks may reshape the structure of firms' trade networks. One plausible explanation is that external shocks disrupt firms' existing supply chain relationships by raising trade costs, thereby prompting firms to seek new trading partners and reconfigure their global supply chain networks (Bonadio et al. 2021; Carvalho et al. 2021). This raises a question: if Chinese firms were forming fewer new customer relationships in the United States, where were they finding new customers?

To address this question, Fig. 2 further illustrates the evolution of Chinese firms' customer relationship adjustments—including both the formation and termination of customer relationships—across regions from 2010 to 2024. Overall, these changes showed an upward trend across regions over this period, with the most pronounced growth occurring in Asia, Europe, and North America. This suggests that, over the past decade, changes in Chinese suppliers' global production networks have been concentrated in Asia, Europe, and North America, with smaller changes in other regions. Firms continuously established new customer relationships while terminating existing ones, resulting in increasingly frequent adjustments to global supply chain networks.

This raises an important question: why have Chinese suppliers restructured their global production networks on such a large scale? Admittedly, supply chain relationships tend to be highly persistent (Garg et al. 2023). Firms do not readily replace their existing trading partners because adjusting supply chain relationships often entails substantial search, matching, and switching costs(Grossman et al. 2024; Kopytov et al. 2024). Large-scale relationship changes are therefore often interpreted as an important manifestation of firms' responses to external shocks. Nevertheless, supply chain relationships are not entirely fixed. Interfirm cooperation is often tied to specific projects, orders, or stages of production and may naturally turn over as production needs change or projects conclude. Consequently, observed changes in customer relationships may represent either routine adjustments arising from firms' normal

operations or abnormal reorganization induced by the external shocks. Distinguishing between these two types of relationship changes is therefore essential for accurately identifying the effects of the trade policy shock.

We construct a supply chain fluctuation frequency measure to capture both the frequency with which firms adjust their customer networks and the intensity of supply chain reorganization. The measure is defined as the sum of customer relationships formed and terminated in a given year, divided by the firm's total number of customer relationships in that year. Based on the magnitude of this measure, we further classify firms into categories with different levels of relationship fluctuation intensity. As shown in Fig. 3, only 16.94% of firms maintained completely unchanged customer relationships throughout the 2003–2024, whereas the remaining 83.06% exhibit varying degrees of relationship adjustment, which is a widespread phenomenon. Among them. Moreover, approximately 6.15% of firms experienced high-intensity customer relationship reorganization. Since such turnover may arise from both routine business adjustments and external shocks, it cannot, on its own, be interpreted as evidence of shock-induced restructuring. By overlooking the endogenous adjustment of firms' relationship networks, existing studies may therefore overestimate the true effects of external shocks on supply chain reorganization. This calls for a more refined measure of supply chain adjustments that accounts for firms' normal adjustment patterns.

3 Theoretical Analysis

3.1 The U.S.–China trade war and Abnormal Fluctuations in Supply Chain Relationships

The U.S.–China trade war has altered the costs and benefits associated with maintaining existing customer relationships. On the one hand, additional US tariffs on Chinese goods directly increase the tariff-inclusive prices of affected products in the US market and raise cross-border transaction costs. If firms cannot fully absorb the additional tariffs by reducing profit margins, lowering production costs, or raising product prices, the economic returns from existing trading relationships will decline. When the expected returns from maintaining a relationship are insufficient to cover tariff costs, contract adjustment costs, and other relationship-maintenance expenses, firms and their customers are more likely to terminate their cooperation. On the other hand, the trade war is not merely a one-off price shock; it also heightens firms' perceived uncertainty about future trade policy. This policy uncertainty makes it more difficult for firms to accurately anticipate future market-access conditions and transaction costs, thereby weakening their incentives to undertake relationship-specific investments and enter into long-term contracts.

Faced with rising tariff costs and policy uncertainty, firms generally have two options. First, they may maintain their existing customer relationships and absorb the tariff costs by reducing profit margins, renegotiating contractual terms, or raising product prices. Second, they may incur the costs of customer search, product adaptation, and relationship rebuilding to enter new markets and acquire new

customers. When the cost of maintaining existing relationships exceeds the cost of switching, firms are more likely to change their customer relationships. As existing relationships are terminated and firms accelerate their search for new customers, the formation and termination of customer relationships may deviate from their historical levels under normal operating conditions, resulting in abnormal fluctuations in supply chain relationships. Therefore, the abnormal fluctuations induced by the trade war essentially reflect firms' reconstruction of their existing supply chain networks in response to rising tariff costs and policy uncertainty. Accordingly, we propose the following hypothesis:

H1: The U.S.–China trade war significantly increases abnormal fluctuations in firms' supply chain relationships, thereby promoting the reconstruction of their supply chain networks.

3.2 Irreplaceability and the Maintenance of Supply Chain Relationships

Higher tariffs put existing customer relationships under pressure, but do they necessarily lead firms to change trading partners? Some relationships may persist despite rising costs, while others give way to new ones. This raises a further question: what enables some firms to retain their customers when trade tensions disrupt established trading arrangements?

We focus on product irreplaceability as a potential source of this resilience. On the one hand, Supply chain relationships involving products that are difficult to substitute are more persistent. For highly specialized, strongly differentiated, or technologically sophisticated products, customers generally find it difficult to identify fully substitutable suppliers in the short run. Switching suppliers not only entails renewed search and negotiation costs but may also require product quality verification, technical standard alignment, and production process adjustments. Therefore, the greater the irreplaceability of a product, the stronger the incumbent supplier's bargaining power in trade negotiations. Under these circumstances, exporters may not necessarily bear the entire tariff burden. Suppliers may pass part of the tariff costs on to final consumers by raising prices, while greater product competitiveness enables firms to absorb part of the tariff shock. By contrast, when firms produce highly standardized products for which numerous substitutes are available, customers can more readily source comparable products from other countries or suppliers. Suppliers then have less scope to pass tariffs through by raising prices, making existing relationships more likely to terminate in response to increases in relative prices.

On the other hand, the depth of existing relationships increases the cost of terminating them. These exit costs arise mainly from two sources. First, firms accumulate relational capital through repeated cooperation. Long-term relationships foster trust and transaction-specific experience, while strategic partnerships are often accompanied by greater relationship-specific investments. Terminating such relationships would erode the value of these accumulated assets and investments.

Second, firms may become operationally dependent on their existing customer networks. The greater the share of sales accounted for by a customer, the larger the revenue loss resulting from the termination of that relationship. Similarly, the more heavily a firm depends on customers in a particular country, the

higher the cost of rebuilding its customer network after exiting that market. Therefore, firms with deeper cooperative relationships and greater operational dependence are more likely to maintain their existing customer relationships in response to the trade war. Accordingly, we propose the following hypothesis:

H2: In response to the U.S.–China trade war, firms with more irreplaceable products are more likely to maintain those relationships.

4 Empirical strategy

4.1 Data Resource

This study examines the supply chain relationships between Chinese suppliers and their customers from January 2017 to December 2020. We restrict the sample to supplier–customer relationships in which the supplier is a Chinese firm and exclude firms designated as PT, ST and *ST. Other types of inter-firm relationships are excluded from the sample. Based on FactSet Revere Global Supply Chain Database, we construct a measure of abnormal supply chain fluctuations. The database systematically monitors and collects information on inter-firm supply chain relationships through multiple sources, including annual and quarterly reports, investor reports, corporate websites, and news coverage. It records more than two million supplier–customer relationships among approximately 30,000 listed companies across more than 180 countries worldwide from 2003 to the present. More importantly, the database records the start and end dates of each supply chain relationship and tracks these relationships at a daily frequency. This high-frequency data structure provides a foundation for examining adjustments in inter-firm supply chain relationships in response to trade war shocks. The data for firm-level characteristics and other variables are collected from multiple sources, including the Worldscope global financial database, the CSMAR database, and other relevant databases. Worldscope provides financial statement data for companies worldwide, while CSMAR provides detailed financial and firm-level information on Chinese companies. These databases contain information on assets, liabilities, revenue, profits, and cash flows. We match these records to the supply chain sample using firm identifiers to obtain the financial data needed to construct our firm-level variables.

4.2 Measurement of the Variable

4.2.1 Identification of the U.S.–China Trade War Shock

We identify four rounds of tariff shocks using the product lists published by the Office of the United States Trade Representative (USTR) during the U.S.–China trade war. These comprise List 1, implemented on July 6, 2018; List 2, implemented on August 23, 2018; List 3, implemented on September 24, 2018; and List 4A, implemented on September 1, 2019. The lists identify Chinese products subject to additional U.S. tariffs and provide the basis for determining the timing and coverage of the tariff shocks.

Following Jiang et al.(2024), this paper matches the 8-digit HS product codes used in the tariff lists with the 4-digit SIC industry codes used to identify firms' industries, thereby identifying the industries of Chinese listed firms exposed to the U.S. trade policy shock. The matching procedure is conducted as follows. First, based on the four rounds of tariff lists, we extract the first six digits of the HS codes for the affected products. Second, using the HS2017–HS2007 concordance table provided by the United Nations Statistics Division (UNSD) and the HS2007–SIC concordance table provided by the United Nations Commodity Trade Statistics Database (UN Comtrade), we convert the affected product codes into a list of industries exposed to the U.S. trade policy shock at the 4-digit SIC level. During 2018–2019, the United States imposed four rounds of additional tariffs on Chinese imports, covering a total trade value of approximately USD 375 billion.

4.2.2 Construction of the Abnormal supply chain fluctuation Indicator

Based on global supply chain data from FactSet Revere, this paper constructs an indicator of abnormal supply chain fluctuation. The indicator measures whether firms’ cross-border supply chain relationship adjustments deviate from their normal levels. Unlike existing studies that measure supply chain adjustment based on the absolute magnitude of changes in supplier–customer relationships, this paper further considers firms' routine supply chain adjustments during normal operations and distinguishes abnormal fluctuations induced by external policy shocks from normal adjustment patterns. Specifically, this paper measures firms' monthly additions and terminations of supply chain relationships and compares the actual adjustment intensity with firms' historical average adjustment levels, thereby identifying abnormal fluctuations in supply chain relationships that deviate from normal patterns.

(a) Monthly Supply Chain Relationship Size

We first define a firm's monthly supply chain relationship size as the total number of active supplier–customer relationships maintained by the firm in a given month.

(b) Additions and Terminations of Supply Chain Relationships

Changes in cross-border supply chain relationships mainly arise from two types of events: the establishment of new relationships and the termination of existing relationships. Therefore, we separately identify the number of newly established and terminated supplier–customer relationships in each month.

(c) Supply Chain Fluctuation Rate

Since firms differ substantially in their supply chain network size, the absolute number of relationship changes is not directly comparable across firms. Therefore, we normalize relationship changes by the firm's previous-month supply chain relationship size and construct the supply chain adjustment rate:

$$Fluctuation_{f,t} = \frac{\Delta R_{f,t}}{R_{f,t-1}}$$

1

where $R_{f,t-1}$ denotes the total number of supply chain relationships maintained by firm f in the previous month, and $Fluctuation_{f,t}$ denotes the proportion of firm f's supply chain relationship adjustments in month t relative to its total number of supply chain relationships in the previous period.

(d) Firm Average Supply Chain Fluctuation Rate

To define what constitutes an abnormal fluctuation, we first calculate each firm's average level of supply chain adjustments over the sample period. The average adjustment rate of firm f during the observation period is defined as follows:

$$\bar{V_f} = \frac{1}{T}\sum_{t=1}^{T} Fluctuation_{f,t}$$

2

where T denotes the number of months in which firm f is observed during the sample period, and $\bar{V_f}$ denotes the firm's average level of supply chain relationship adjustment. This measure captures the firm-specific baseline level of supply chain adjustments under normal conditions. A lower supply chain relationship fluctuation rate indicates greater stability, suggesting that the firm maintains relatively persistent and stable transaction relationships with its upstream and downstream partners. Conversely, a higher fluctuation rate indicates more frequent adjustments to supply chain relationships and, therefore, a relatively less stable supply chain network.

(e) Identification of Abnormal Supply Chain Fluctuations

For each Chinese supplier in the sample, we calculate its average supply chain fluctuation rate over the sample period. The abnormal fluctuation indicator is set equal to one when the supplier's adjustment rate in a given month exceeds its own sample-period average, indicating that the supplier experiences an abnormal supply chain fluctuation in that month; otherwise, it is set equal to zero. We use a binary indicator rather than a continuous measure because our focus is on whether tariff increases raise the probability of adjustments exceeding a firm's own average level, rather than on the magnitude of those adjustments. In the subsequent empirical analysis, this indicator serves as the core dependent variable for examining the effect of the U.S.–China trade war on firms' abnormal supply chain fluctuations.

$$Abnormal_{f,t} = \begin{cases} 1 & Fluctuation_{f,t} > V_f \\ 0 & otherwise \end{cases} \quad (3)$$

4.2.3 Other Variables

(a) Perceived Economic Policy Uncertainty

We employ firm-level perceived economic policy uncertainty as a mechanism variable through which the U.S.–China trade war affects abnormal supply chain fluctuations. Specifically, we use the firm-level economic policy uncertainty (FEPU) index to measure the degree of economic policy uncertainty perceived by individual firms. Developed by Nie et al. (2020), this index extends the national-level economic policy uncertainty (EPU) index proposed by Baker et al. (2016) by applying text-analysis methods to firm-level disclosures.

Specifically, the construction of the index begins by extracting text from the Management Discussion and Analysis (MD&A) sections of listed firms' annual reports and compiling a dictionary comprising three categories of keywords related to "economy," "policy," and "uncertainty." A sentence is classified as reflecting economic policy uncertainty when it contains keywords from all three categories. The number of words (sentences) related to economic policy uncertainty is then calculated and divided by the total number of words in the MD&A section to construct the firm-level economic policy uncertainty index (FEPU). A higher FEPU value indicates that a firm discusses economic policy-related uncertainty more frequently and therefore perceives a higher level of economic policy uncertainty.

(b) Transaction Costs

We argue that rising transaction costs constitute a key channel through which the U.S.–China trade war induces abnormal supply chain fluctuations. Firms incur various costs in market transactions, including the costs of searching for trading partners, negotiating and concluding contracts, monitoring contractual performance, and maintaining business relationships(Coase 1937). Accordingly, we use transaction-related costs as a mechanism variable to examine this channel.

Because transaction costs are not directly observable, existing studies generally use financial indicators that capture firms' expenditures on market transactions and resource coordination as proxies. Following the related literature(Hobbs 1996), We use the selling expense growth rate and the total operating cost growth rate as proxies for firms' transaction costs. Selling expenses primarily include expenditures on marketing, customer acquisition, business communication, distribution-channel maintenance, and after-sales services. Total operating costs capture the broader costs associated with supply chain adjustments, resource reallocation, and the coordination of contractual performance. The relevant

financial data are obtained from the CSMAR database and matched to firms in the FactSet supply chain sample using firm identifiers.

(c) Control Variables

We also control for a set of initial characteristics of Chinese and foreign firms, measured in 2017, including firm size (Size), leverage (Lev), return on assets (ROA), total asset turnover (ATO), operating revenue growth (Growth), and the cash ratio (Cash_ratio). Data on these control variables are obtained from the Worldscope database and matched to firms in the FactSet supply chain database using firm identifiers. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

4.3 Model Specification

We employ a staggered difference-in-differences (DID) model to systematically examine policy-induced abnormal fluctuations in the supply chain relationships of Chinese firms. The model is specified as follows:

$$Fluctuation_{ijt} = \beta_0 + \beta_1 Post_t \times Impact_{ij} + \beta_2 Post_t \times X_i + \lambda_t + \varphi_{ij} + \epsilon_{ijt}$$

4

where i, j, and t denote the Chinese supplier, foreign customer, and year–month period, respectively. The dependent variable, $Abnormal_{ijt}$ captures abnormal fluctuations in the supply chain relationship between Chinese supplier i and foreign customer j,in period t.

$Impact_{ij}$ is the treatment-group indicator, which equals one if supplier i operates in an industry covered by at least one of the four rounds of additional US tariffs, and zero otherwise. $Post_t$ is a relationship-specific post-treatment indicator, which equals one in the period when the supply chain relationship between supplier i and customer j is first exposed to the US tariff shock and in all subsequent periods, and zero otherwise. The coefficient of primary interest is β_1, which captures the effect of the US trade policy shock on abnormal fluctuations in cross-border supply chain relationships.

In addition, we interact the initial characteristics of Chinese supplier, measured in 2017, X_i with $Post_t$, thereby allowing firms with different initial characteristics to respond differently to the trade policy shock. The model also includes year–month fixed effects, λ_t, and supplier–customer relationship fixed effects, φ_{ij}, which control for common time shocks and time-invariant heterogeneity at the supplier–customer relationship level, respectively.

4.4 Summary statistics

Table 1
Summary statistics

Abnormal	Obs	Mean	Std. Dev.	Min	Max
	474869	**0.123**	**0.328**	**0.000**	**1.000**
Impact	506749	0.568	0.495	0.000	1.000
Size	460500	6.159	1.266	2.698	9.879
Lev	459153	60.812	99.504	0.000	673.123
ROA	438456	4.388	4.837	-17.254	16.804
ATO	459826	0.048	0.053	-0.130	0.208
Growth	407337	-0.142	1.657	-8.620	5.836
FCI	438578	0.333	0.222	0.007	0.914
Cash_ratio	458376	33.959	19.125	4.240	86.948
N	506749				

Table 1 reports the summary statistics for the main variables. Our sample contains a total of 506,749 observations at the supplier firm-customer firm-time level. The mean value of supply chain abnormal fluctuation is 0.123, indicating that approximately 12.3% of the observations experience supply chain relationship adjustments beyond their normal levels. Firm size (Size), leverage rate (Lev), return on assets (ROA), total asset turnover (ATO), operating revenue growth (Growth), and the cash ratio (Cash_ratio) all exhibit variation across the sample. These summary statistics provide a basis for further investigating the relationship between trade policy shocks and abnormal supply chain fluctuation. The number of observations varies slightly across variables, mainly because some firms have missing financial data.

5 Results

5.1 Baseline regression result

This section presents the main results on the impact of the US–China trade policy shock on abnormal fluctuations in cross-border supply chains. The baseline regression results reported in Table 2 show that the additional tariffs imposed by the United States increased abnormal fluctuations in the overseas supply chains of Chinese suppliers. Specifically, Column (1) reports the baseline estimates. After controlling for time fixed effects, supplier industry-by-year fixed effects, and firms' initial characteristics, the estimated coefficient on Post x Impact is significantly positive, indicating that the probability of abnormal fluctuations in relationships between affected Chinese suppliers and their customers increased significantly following the U.S. tariff shock.

The results show that the trade policy shock increased the frequency with which Chinese suppliers switched customers, making them more likely to enter periods of supply chain restructuring and resulting in abnormal fluctuations. These findings suggest that the trade policy shock affected not only trade through higher tariffs but also the organization and adjustment of global supply chains, prompting some suppliers to adjust their trading networks in response to the shock.

Columns (2)–(4) introduce progressively more stringent fixed effects. Column (2) further includes supplier–customer pair fixed effects to control for time-invariant characteristics of individual supplier–customer relationships and thereby reduce potential bias arising from unobserved heterogeneity. Columns (3) and (4) additionally include Chinese supplier-by-year fixed effects and customer-by-year fixed effects, respectively, to control for time-varying firm-level characteristics of both Chinese suppliers and foreign customers, including strategic adjustments, operating efficiency, and market share. The inclusion of these additional fixed effects does not materially affect the results, confirming the robustness of the baseline findings.

Table 2
Baseline Results

Post x Impact	**(1)**	**(2)**	**(3)**	**(4)**
	0.159* **	**0.218*** **	**0.237*** **	**0.202*** **
	(0.005)	(0.014)	(0.017)	(0.022)
Post x ATO	-0.019	-0.922***	-1.124***	-1.588***
	(0.035)	(0.114)	(0.137)	(0.188)
Post x Growth	0.001*	0.006***	0.007***	0.007***
	(0.000)	(0.001)	(0.001)	(0.002)
Post x Size	-0.005***	-0.008***	-0.007***	-0.001
	(0.001)	(0.002)	(0.003)	(0.003)
Post x ROA	0.000	0.009***	0.011***	0.015***
	(0.000)	(0.001)	(0.002)	(0.002)
Post x Leverage	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Post x FCI	0.007*	0.019*	0.022*	0.006
	(0.004)	(0.010)	(0.012)	(0.015)
Post x Cash Ratio	-0.000	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.069***	0.060***	0.054***	0.052***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	353,897	353,362	352,360	352,330
R-squared	0.034	0.057	0.066	0.075
Year FE	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES
Relation-Pair FE	NO	YES	YES	YES
Client-Year FE	NO	NO	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Post x Impact	(1)	(2)	(3)	(4)
	0.159* **	**0.218*** **	**0.237*** **	**0.202*** **
Supplier-Year FE	NO	NO	NO	YES
Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.				

5.2 Robustness Tests

5.2.1 Event Study

To further assess the validity of the identifying assumptions underlying the staggered difference-in-differences model and examine the dynamic effects of the U.S.–China trade policy shock on abnormal fluctuations in cross-border supply chains, we conduct an event-study analysis focusing on the first round of the trade policy in July 2018. Specifically, we retain only firms affected by the first round of tariff increases and firms in the control group that were never affected by the trade policy, and define July 2018 as the event date to construct relative event time. We then trim the event-time window by grouping all observations more than six months before the policy shock into period (t=-6) and all observations more than six months after the shock into period (t = 6). Because the Trump administration announced the tariffs before their implementation, potentially prompting firms to adjust in advance, we use the third month before implementation (t = -3), rather than the preceding month, as the reference period. We subsequently construct a set of event-time indicator variables for the periods before and after the tariff shock and estimate the dynamic effects while controlling for firm-level characteristics, year fixed effects, and supplier industry-by-year fixed effects. Standard errors are clustered at the supplier–customer pair level.

Figure 4 reports the event-study estimates. Overall, A closer examination of the dynamic effects shows that the estimated coefficients turn positive immediately after the implementation of the trade policy and remain relatively large and positive over the subsequent periods. Moreover, the estimated coefficients are positive and statistically significant in several post-treatment periods, suggesting that the tariff increases raised the probability of abnormal fluctuations in Chinese suppliers' cross-border supply chains. The estimated coefficients for the pre-treatment periods are generally small. Although a few pre-treatment coefficients are statistically significant, their magnitudes are substantially smaller than those observed after the policy implementation and do not exhibit a persistent trend. Their economic significance is therefore limited. Taken together, the results suggest that there were no economically meaningful systematic differences between the treatment and control groups prior to the policy shock. This indicates that the baseline findings are unlikely to be driven by differential pre-trends and supports the credibility of the identification strategy.

5.2.2 Sensitivity Analysis

To further address identification concerns arising from the statistical significance of a few pre-treatment coefficients in the event-study analysis, we follow Rambachan and Roth (2023) and conduct a sensitivity analysis to examine whether the baseline findings remain valid when allowing for some degree of deviation from the parallel trends assumption between the treatment and control groups. Figure 4 reports the results of the sensitivity analysis. The horizontal axis represents the degree of deviation from parallel trends that is allowed, while the vertical axis shows the estimated effect of the trade policy on abnormal supply chain fluctuations together with its confidence interval.

The results show that, under the baseline specification, the effect of the trade war on abnormal supply chain fluctuations is significantly positive. As the allowed degree of deviation gradually increases, the estimated confidence interval becomes wider. However, under low to moderate deviations from parallel trends, the estimated effect remains positive and the confidence interval does not include zero. This suggests that the main findings do not rely on a strictly imposed parallel trends assumption. Overall, the sensitivity analysis shows that, the U.S.–China trade war significantly increased the probability of abnormal fluctuations in the cross-border supply chains of Chinese suppliers remains robust even when allowing for a certain degree of deviation from parallel trends.

5.2.3 Placebo Test

To further rule out the possibility that the estimated effects are driven by other contemporaneous macroeconomic factors or potentially omitted variables, we conduct a placebo test as an additional robustness check. Specifically, we artificially move the timing of the trade war shock forward by one year and assume that July 2017 is the placebo policy implementation date. We then re-estimate the difference-in-differences model while keeping all other model specifications unchanged.

Table 3 reports the results of the placebo test. The estimated coefficient on the placebo policy variable Placebo Post×Impact is -0.004 and is statistically insignificant, indicating that no significant change in abnormal supply chain fluctuations is observed for treated firms prior to the actual outbreak of the trade war. This suggests that the policy effect identified in the baseline regressions is unlikely to be driven by pre-existing differential trends or other contemporaneous shocks, but instead reflects the impact of the 2018 U.S.–China trade war. These results provide further support for the robustness of the baseline findings.

Table 3
Placebo Test

	(1)
	Placebo (2017m7)
Placebo Post x Impact	-0.004
	(0.004)
Observations	3.54e + 05
R-squared	0.030
Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.	

5.2.4 Lagged Dependent Variable

Given that supply chain adjustment behavior may exhibit a certain degree of persistence, we further re-estimate the model using the abnormal supply chain fluctuation measure lagged by one month as the dependent variable, in order to mitigate potential estimation bias arising from short-term dynamic adjustments. Columns (1)–(2) of Table 4 report the results. The estimated coefficient on the core explanatory variable Post×Impact remains significantly positive when the one-period-lagged measure of abnormal supply chain fluctuation is used. This indicates that the positive effect of the trade policy shock on abnormal supply chain fluctuations is not driven solely by short-term volatility, and the baseline findings remain robust.

5.2.5 Excluding the Impact of the COVID-19 Pandemic

Since the global outbreak of COVID-19 after 2020 may have imposed additional shocks on cross-border supply chain adjustment and thereby interfered with the identification of the trade war effect, we further exclude observations from November 2019 onward and re-estimate the model using only the pre-pandemic sample. Columns (3)–(4) of Table 4 report the results. The estimated coefficient on the core explanatory variable remains significantly positive, indicating that the baseline findings are not driven by the COVID-19 shock. The positive effect of the trade policy shock on abnormal fluctuations in the cross-border supply chains of Chinese suppliers therefore remains robust.

5.2.6 Alternative Measure of the Dependent Variable

The baseline regressions use a binary indicator of abnormal supply chain fluctuation as the dependent variable. Given that a binary measure may discard some information on the magnitude of supply chain adjustments, we further use the supply chain adjustment rate—defined as the number of customer relationships newly established or terminated in a given month relative to the number of customer relationships in the previous period—as a continuous dependent variable and re-estimate the model.

Columns (5)–(6) of Table 4 report the results. The estimated effect of the trade war on the supply chain adjustment rate remains significantly positive, consistent with the baseline findings. This indicates that the main conclusions are not sensitive to the specific measurement of the dependent variable.

Table 4
Robustness Checks Using Alternative Specifications

	(1)	(2)	(3)
	Lag	**No COVID**	**Continuous**
Post x Impact	0.054***	0.175***	0.230***
	(0.014)	(0.020)	(0.026)
Constant	0.032***	0.045***	0.063***
	(0.001)	(0.001)	(0.001)
Observations	253,866	176,402	271,631
R-squared	0.066	0.069	0.077
Year FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
Relation-Pair FE	YES	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2.7 Probit and logit Model

Because the dependent variable in our staggered DID analysis is binary, we also estimate Probit and Logit specifications to assess whether the main findings are robust to alternative functional forms. Table 5 reports the results. The results show that, under both the Probit and Logit models, the estimated coefficient on the core explanatory variable Post×Impact remains significantly positive and is consistent with the baseline results in both sign and statistical significance. This indicates that the trade policy shock significantly increased the probability of abnormal fluctuations in the cross-border supply chains of Chinese suppliers. Therefore, the main findings are not sensitive to the functional form of the model and remain robust when nonlinear binary choice models are employed.

Table 5
Robustness Checks Using Logit and Probit Models

Post x Impact	**(1)**	**(2)**
	0.452* **	**0.851*** **
	(0.022)	(0.040)
Constant	-1.543***	-2.742***
	(0.008)	(0.017)
Observations	353,904	353,904
Year FE	YES	YES
Industry FE	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2.8 Alternative Thresholds for Abnormal Supply Chain Fluctuations

To examine the robustness of the definition of abnormal supply chain fluctuations, we reconstruct the abnormal fluctuation indicator using alternative thresholds. In the baseline specification, a firm is classified as experiencing abnormal supply chain fluctuations when the degree of adjustment in its current supply chain relationships exceeds its historical average. To ensure that the results are not driven by this particular threshold choice, we further use the firm's historical median and 75th percentile, respectively, as alternative thresholds for identifying abnormal fluctuations and re-estimate the model using the reconstructed dependent variables. The median provides a benchmark that is less sensitive to extreme adjustment rates, while the 75th percentile identifies adjustments in the upper tail of each firm's own distribution. These alternative thresholds allow us to assess whether the findings hold when abnormal fluctuations are defined relative to a typical adjustment level or a higher quantile of the distribution.

As reported in Table 6, the estimated coefficient on Post×Impact remains statistically significant regardless of the threshold used to define abnormal supply chain fluctuations. This indicates that the main findings are not sensitive to the specific threshold employed to construct the abnormal fluctuation measure and therefore remain robust.

Table 6
Alternative Definition of Abnormal Fluctuation

Post x Impact	**(1)**	**(2)**	**(3)**	**(4)**
	0.224* **	**0.206*** **	**0.196*** **	**0.194*** **
	(0.014)	(0.014)	(0.015)	(0.014)
Observations	353,362	353,362	353,362	353,362
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES
Relation-Pair FE	YES	YES	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.3 Perceived Uncertainty and Transaction Costs

Why, then, would a tariff shock induce firms to adjust these relationships beyond their normal patterns of customer turnover? We examine transaction costs and perceived policy uncertainty because tariff shocks can undermine two foundations of relationship continuity: the economic benefits of maintaining existing transactions and the predictability of their future returns. Higher transaction costs may make existing relationships less attractive relative to alternative arrangements, while greater perceived policy uncertainty may encourage firms to diversify their customer base even when current transactions remain viable. These two mechanisms therefore help explain how tariff shocks can motivate firms to reconsider established customer relationships and undertake adjustments beyond routine turnover.

This section further explores the mechanisms through which the U.S.–China trade war affects abnormal fluctuations in cross-border supply chains. On the one hand, Transaction cost theory suggests that searching for trading partners, negotiating contracts, and enforcing agreements all involve transaction costs(Coase 1937). The unexpected outbreak of the trade war led to a sharp increase in export tariffs faced by Chinese suppliers, thereby raising the search and negotiation costs associated with transactions with their foreign suppliers and customers. These higher costs may make it more difficult for firms to maintain existing customer relationships and prompt them to seek new customers, resulting in supply chain adjustments that exceed their normal levels.

On the other hand, the trade war substantially increased policy uncertainty. Chinese firms therefore became more pessimistic about the future trade environment and the stability of their supply chains, leading to a higher level of perceived uncertainty. When the transaction costs associated with existing customer relationships continue to rise and firms simultaneously perceive substantial uncertainty regarding the future trade environment, the expected benefits of maintaining existing supply chain relationships decline. Firms consequently have stronger incentives to reallocate customer resources and

search for overseas customers associated with lower risk and uncertainty and greater negotiation efficiency, resulting in more frequent adjustments and abnormal fluctuations in supply chain relationships.

To examine the roles of transaction costs and perceived uncertainty, we follow the revised approach to mechanism analysis proposed by Jiang(2022). Rather than including the mechanism variables directly in the baseline regression, we focus on whether the trade war significantly affects the corresponding mechanism variables, thereby providing evidence on the channels through which the policy shock affects abnormal supply chain fluctuation.

(1) Transaction Costs. We use the growth rates of total operating costs and selling expenses of Chinese listed firms as proxy variables for changes in transaction costs. The growth rate of total operating costs reflects changes in firms' overall operating costs, while the growth rate of selling expenses captures, to some extent, costs associated with customer acquisition, market expansion, and the maintenance of trading relationships. Table 7 reports the mechanism analysis results. Columns (1) and (2) show that the estimated coefficients on Post × Impact are both positive and statistically significant at the 1% level, indicating that the trade policy shock significantly increased firms' total operating costs and selling expenses. These findings support the mechanism through which the trade war promotes supply chain abnormal fluctuation by raising cross-border transaction costs. Higher costs of maintaining existing customer relationships may make it more difficult for suppliers and customers to agree on mutually acceptable trading terms. When renegotiation fails, existing relationships may end, prompting suppliers to seek replacement customers. The resulting relationship losses and formation of new ties may raise customer turnover above firms' normal levels, contributing to abnormal fluctuations in cross-border supply chains.

(2) Perceived Uncertainty. We further examine whether the trade war significantly increases firms' perceived uncertainty. Following the existing literature(Huihua,Nie et al. 2020), we employ firm-level perceived uncertainty measures constructed from the textual analysis of listed firms' annual reports, using both a sentence-based measure (Sentence) and a word-frequency-based measure (Word) as proxies. Columns (3) and (4) of Table 8 report the regression results. The estimated coefficients on the core explanatory variable Post×Impact are significantly positive under both the Sentence and Word measures, indicating that the trade policy significantly increased firms' perceived uncertainty regarding the future business environment.

These findings are consistent with perceived policy uncertainty being a channel through which the trade policy contributes to abnormal supply chain fluctuations. When firms find it more difficult to predict future tariff policies and customer orders, continued reliance on existing customer relationships may expose them to unexpected disruptions. To reduce this exposure, firms may seek alternative customers and diversify their customer base, even when existing relationships remain commercially viable. Such precautionary responses can lead firms to bring forward customer changes or undertake additional adjustments that they would not otherwise make in the course of normal operations. To the extent that

these responses raise customer relationship turnover above firms' usual levels, they contribute to abnormal supply chain fluctuations.

Table 7
Transaction Costs and Perceived Uncertainty

	(1)	(2)	(3)	(4)
	Total cost	**Sale cost**	**Sentence**	**Word**
Post x Impact	0.080***	0.107***	0.415***	0.018**
	(0.017)	(0.022)	(0.143)	(0.008)
Post x ATO	0.452***	0.988***	0.511	-0.054
	(0.148)	(0.169)	(0.793)	(0.046)
Post x Growth	0.014***	0.012***	0.025**	0.002***
	(0.003)	(0.003)	(0.011)	(0.001)
Post x Size	-0.018***	-0.004	-0.058***	-0.003**
	(0.002)	(0.003)	(0.020)	(0.001)
Post x ROA	-0.001	-0.010***	-0.020**	-0.000
	(0.002)	(0.002)	(0.010)	(0.001)
Post x Leverage	-0.000***	-0.000***	0.002***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Post x FCI	0.033**	-0.149***	-0.617***	-0.018***
	(0.014)	(0.018)	(0.097)	(0.006)
Post x Cash Ratio	0.001***	-0.000**	0.004***	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Constant	0.177***	0.107***	1.811***	0.094***
	(0.003)	(0.004)	(0.011)	(0.001)
Observations	324,111	322,586	278,143	275,597
R-squared	0.716	0.606	0.439	0.468
Year FE	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4 Product Non-substitutability and Global Network Diversification

When confronted with trade policy shocks, whether firms adjust their supply chain relationships depends on both their ability to retain existing customers and their ability to find alternative customers. Specifically, Firms offering less substitutable products are better positioned to preserve existing customer relationships, whereas firms with more diversified global trade networks can more readily identify alternative customers. Product non-substitutability and global network diversification may therefore have opposing effects on supply chain relationship adjustments induced by the trade war.

We next examine why firms differ in their customer relationship adjustments in response to tariff shocks. Which firms are better able to establish new customer relationships, and which are more likely to retain existing customers? To address these questions, this section examines firm characteristics that may moderate or intensify the effects of the trade war on abnormal supply chain fluctuations.

5.4.1 Product Non-substitutability

More innovative firms can enhance their product competitiveness through technological upgrading and product differentiation, making their products more difficult for customers to replace(Klette and Kortum 2004). Stronger product non-substitutability increases customer retention and reduces the risk of customer loss following the trade policy shock. Consequently, firms with greater innovation capabilities should be more likely to preserve existing customer relationships and exhibit fewer abnormal supply chain fluctuations.

We use firms' disruptive technological innovation to measure product non-substitutability. Specifically, we identify the knowledge elements contained in each patent based on the first four digits of its International Patent Classification (IPC) code, which represent the patent's technological and knowledge characteristics (Guan and Liu 2016). A patent filed by a firm in year t is classified as a disruptive technology patent if it contains a knowledge element that the firm did not use during the preceding five years. We measure a firm's level of disruptive technological innovation in year t by the total number of patent applications filed in that year that meet the above criterion.

Table 8 reports the results for product non-substitutability. Columns (1)–(3) show that the coefficients on the triple interaction terms are significantly negative, regardless of whether disruptive technological innovation is identified using all patents or invention patents only. These results indicate that firms with stronger innovation capabilities and less substitutable products experience fewer abnormal supply chain fluctuations following the trade policy shock. Greater product competitiveness and customer retention allow these firms to preserve existing customer relationships without frequently reconfiguring their customer networks.

Table 8
Product Non-substitutability

	(1)	(2)
	Patent	**Invention**
Post	0.173***	0.169***
	(0.004)	(0.004)
Post x Impact	-0.038***	-0.038***
	(0.008)	(0.008)
Post x Impact x Patent	-0.004	
	(0.003)	
Post x Impact x Invention		-0.007**
		(0.003)
Observations	247,405	247,405
R-squared	0.066	0.066
Year FE	YES	YES
Industry-Year FE	YES	YES
Relation-Pair FE	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4.2 Global Trade Network Diversification

The geographic configuration of a firm's global trade network affects the ease with which it can find alternative customers. Firms whose customer networks span more countries and are more geographically dispersed tend to possess greater international operating experience and broader overseas customer resources. When trade policy shocks affect a particular market, these firms can more readily use their existing networks to identify new trading partners and redirect their trade relationships toward other countries and regions. They are therefore more likely to adjust their customer relationships.

By contrast, firms whose customer relationships are concentrated in a small number of countries depend more heavily on particular markets and have fewer alternatives. When confronted with a trade policy shock, these firms face greater difficulty in finding new customers and redirecting their trade relationships, resulting in more limited supply chain adjustment.

To test this hypothesis, we measure the diversification of firms' global customer networks in terms of network breadth and geographic concentration. Country Breadth is defined as the number of countries

covered by a firm's customer network, while Country HHI measures the geographic concentration of its customer relationships(Hirschman 1964):

$$HHI_{it} = \sum_j s_{ijt}^2$$

Where s_{ijt} denotes the share of firm i's customer relationships accounted for by country j

in year t. A higher Country HHI indicates that customer relationships are concentrated in fewer countries, whereas a lower value indicates a more geographically dispersed customer network.

Table 9 reports the results for global trade network diversification. The coefficient on the triple interaction term involving Country Breadth is significantly positive, while that involving Country HHI is significantly negative. These findings indicate that firms whose customer networks cover more countries and are more geographically dispersed are better able to replace customers following trade policy shocks and consequently exhibit greater abnormal supply chain fluctuation. Conversely, firms whose customer relationships are concentrated in fewer countries have a more limited ability to reconfigure their supply chain relationships.

Table 9
Product Non-substitutability

	(1)	**(2)**
	Country Breadth	**Country HHI**
Post	0.184***	0.135***
	(0.003)	(0.005)
Post x Impact	-0.053***	-0.001
	(0.006)	(0.008)
Post x Impact x Country Breadth	0.004***	
	(0.001)	
Post x Impact x Country HHI		-0.069***
		(0.012)
Observations	349,600	349,600
R-squared	0.069	0.056
Year FE	YES	YES
Relation-Pair FE	YES	YES

Notes: Standard errors clustered at the supplier–customer pair level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6 Conclusion

This paper provides novel and robust evidence that the U.S.–China trade war significantly increased abnormal fluctuations in the supply chain relationships of Chinese firms. Using the FactSet Revere Global Supply Chain Database, we construct a measure that distinguishes routine relationship turnover arising from firms' normal operations that exceeds their typical adjustment patterns. Our findings show that the trade policy caused firms' supply chain adjustments to deviate from their pre-existing patterns, resulting in abnormal fluctuations in their customer networks.

Further analysis identifies two important mechanisms underlying this effect. First, the additional tariffs increased firms' trade transaction costs, making it more difficult to negotiate mutually acceptable terms within existing supply chain relationships and creating stronger incentives to seek alternative trading partners. Second, the trade policy shock heightened firms' perceptions of uncertainty, prompting them to reassess their existing customer networks and adjust their supply chain relationships more frequently. Rising trade costs and heightened uncertainty perceptions therefore jointly contributed to the abnormal reorganization of firms' supply chains.

These findings suggest that trade policy shocks can push firms' supplier–customer relationship adjustments beyond their normal patterns. Trade tensions can affect whether firms maintain existing customer relationships or replace them with new ones. While this paper examines whether supply chain adjustments exceed firms' normal patterns, future research could investigate how these responses evolve over the short, medium, and long term. In particular, it could examine whether firms restore their original customer networks or establish lasting relationships in alternative markets. This distinction matters because temporary disruptions may primarily impose transitional adjustment costs, whereas persistent shifts may reshape firms' market dependence and exposure to future trade policy shocks, with longer-term implications for their operating performance.

Declarations

Acknowledgement: The authors would like to thank colleagues in Political Science and International Relations at Victoria University of Wellington and participants at the New Zealand Association of Economists (NZAE) Conference for their helpful comments and discussions. Wanying Tang is especially grateful to Professor Xiaoming Huang for his guidance and support during her visiting period at Victoria University of Wellington.

Funding Wanying Tang acknowledges financial support from the China Scholarship Council (CSC) through the State Scholarship Fund. This research was also supported by the Postgraduate Innovative Research Fund of University of International Business and Economics (Grant No. 202549).

Competing Interests The authors declare that they have no competing interests.

Data Availability The data that support the findings of this study are available from FactSet Revere, Worldscope, CSMAR. Restrictions apply to the availability of some of these data, which were used under licence for the current study and are therefore not publicly available. Data may be accessed from the respective providers subject to their licensing and access conditions.

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Figures

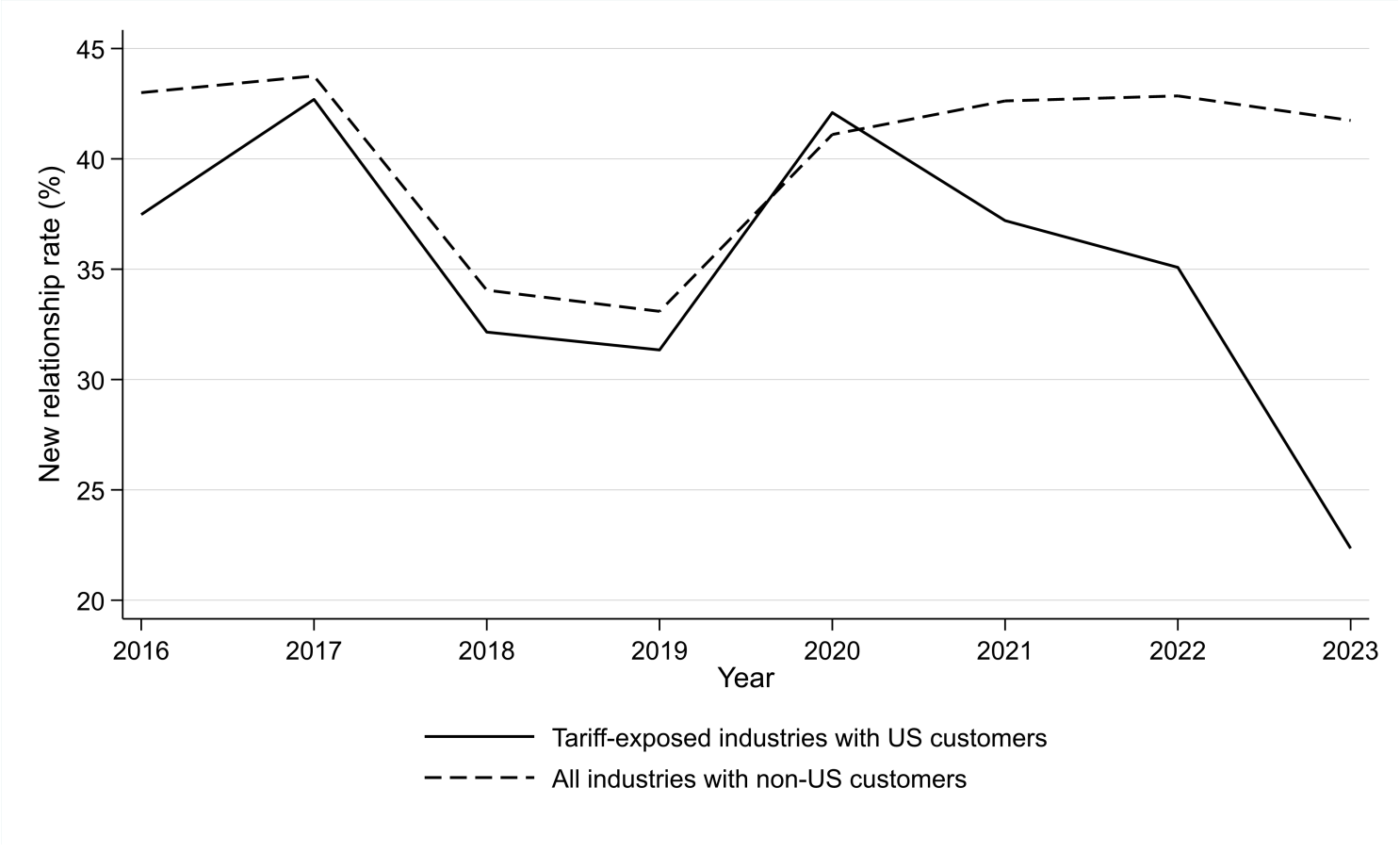


Figure 1

This figure shows changes in the relationships between Chinese firms affected by the trade war and their U.S. customers from 2016 to 2023, compared with relationships with customers in other countries across all industries. The two groups followed similar trends before the 2020 but diverged substantially afterward, as new relationship formation with US customers in tariff-exposed industries declined sharply

relative to that with non-US customers across all industries. From 2020 onward, the rate at which Chinese firms added new customers diverged substantially across regions

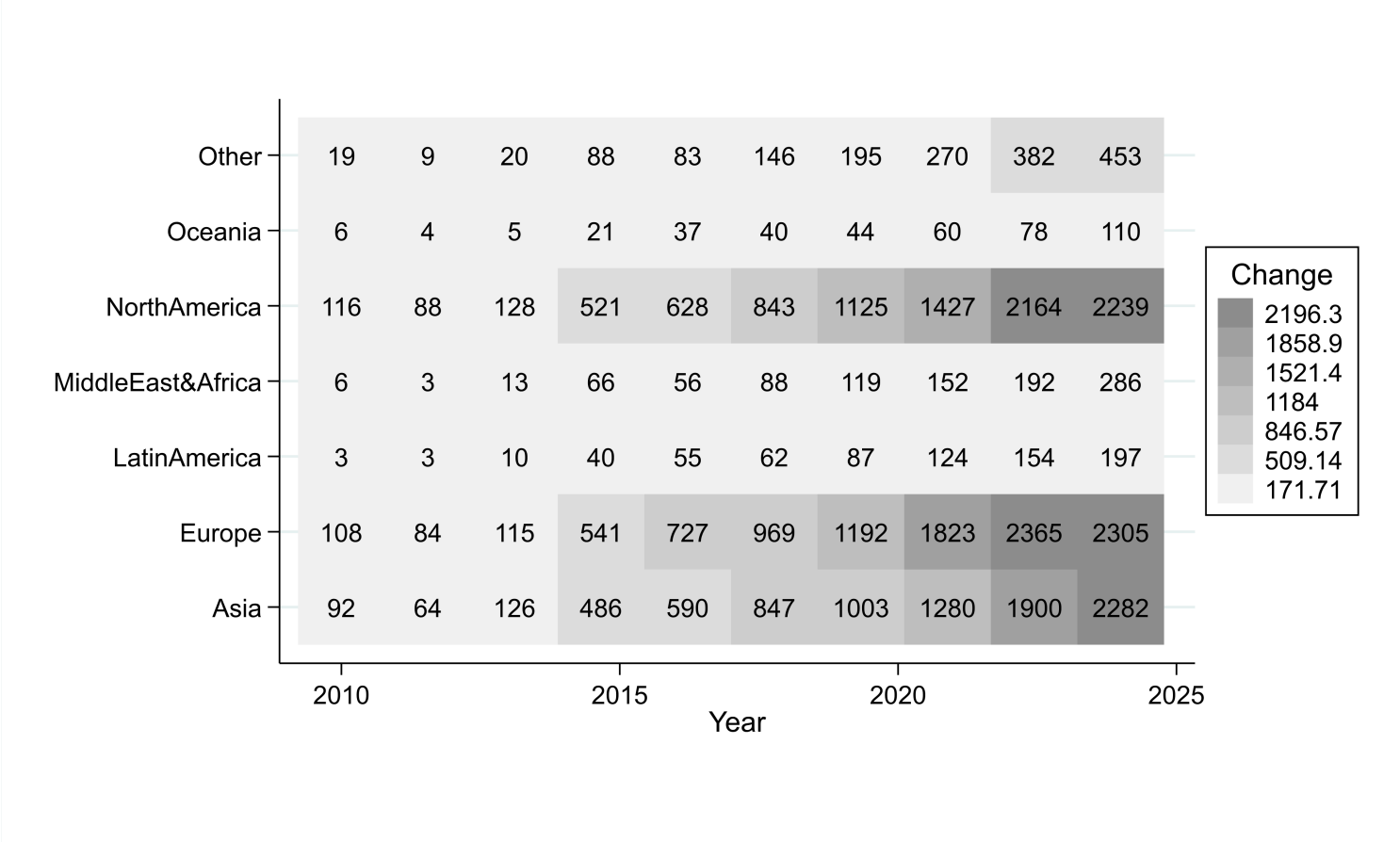


Figure 2

This figure provides an overview of Chinese firms' cross-border customer relationship turnover, showing where relationship changes are concentrated and how their geographic distribution evolves over time. Each cell reports the combined number of newly formed and terminated customer relationships in a given region and year, allowing comparisons across regions and years. Colors range from dark purple (fewer relationship changes) to bright yellow (more relationship changes).

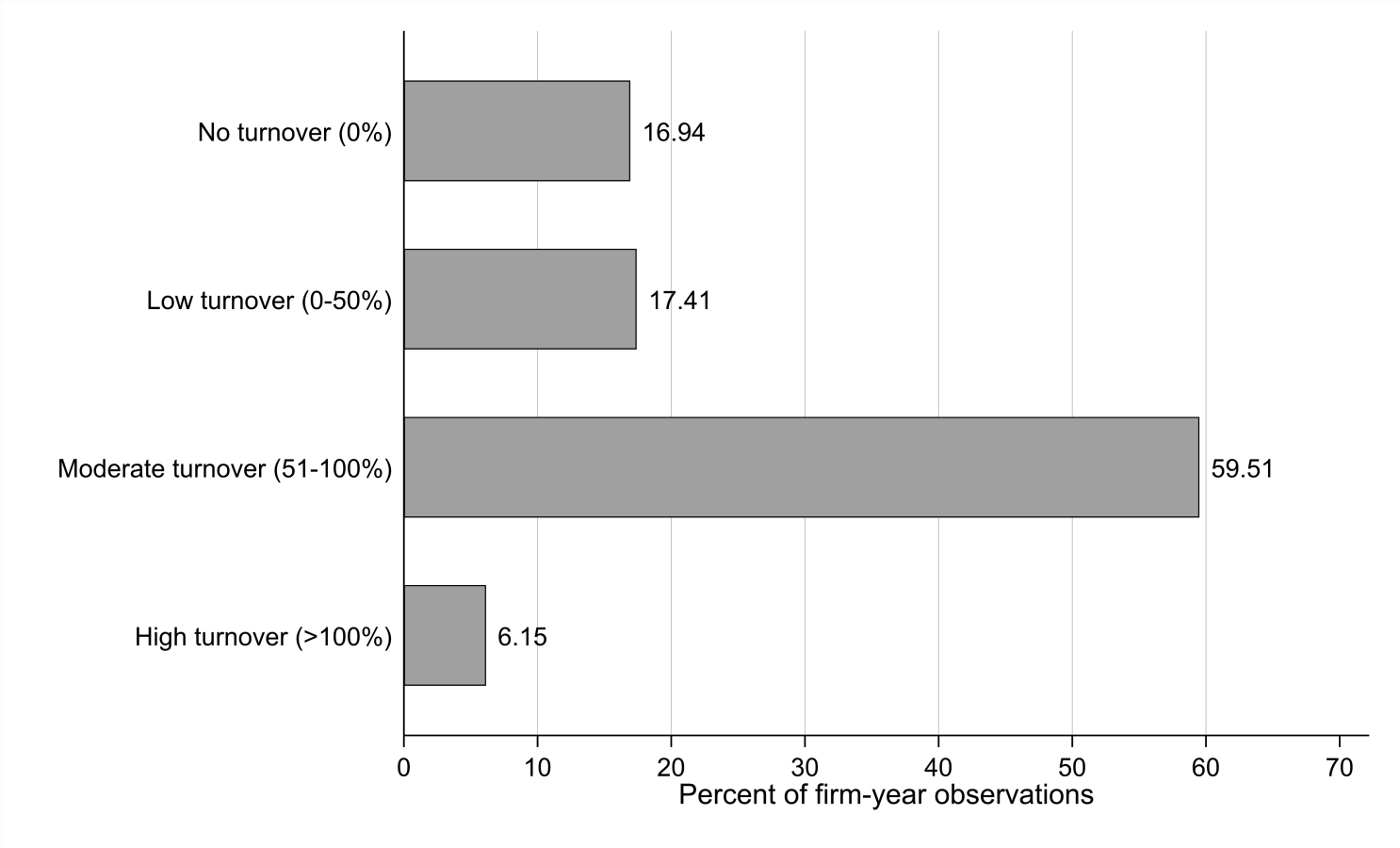


Figure 3

This figure presents the distribution of supplier-year observations by customer relationship turnover rate, constructed using the FactSet Revere Relationship database for the period 2003–2024. The turnover rate is calculated as the sum of newly formed and terminated customer relationships divided by the total number of supplier–customer relationships in a given year. Supplier-year observations are classified into four categories: no turnover (0%), low turnover (0–50%), moderate turnover (51–100%), and high turnover (above 100%). A turnover rate of 0% indicates that no customer relationships were formed or terminated during the year, whereas a positive turnover rate reflects varying degrees of customer relationship adjustment. As shown in the figure, 16.9% of observations exhibit no customer turnover, while 83.1% experience some degree of turnover. In particular, 59.5% of observations fall into the moderate-turnover category, indicating that customer relationship adjustments are common in firms' normal business operations

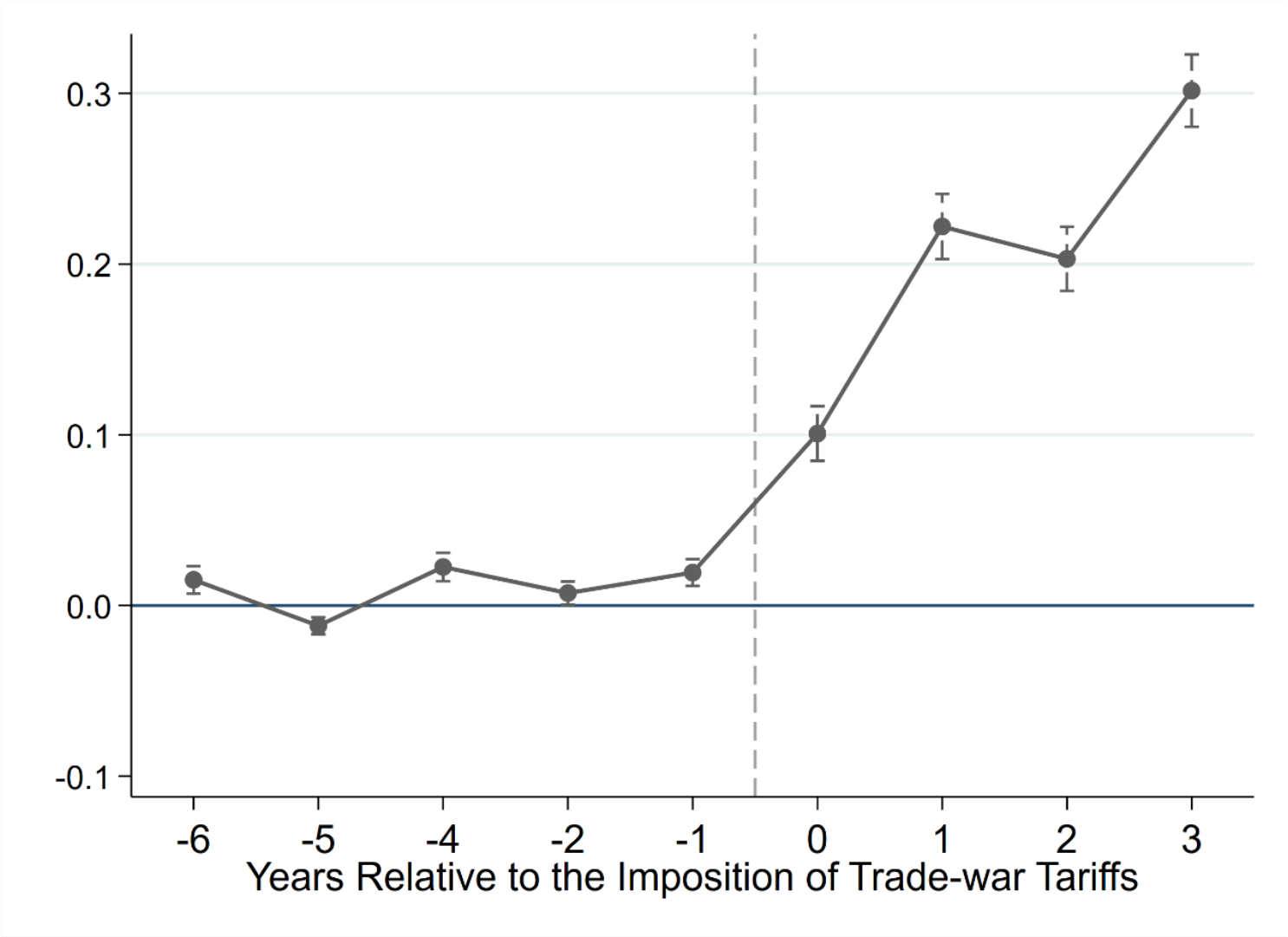


Figure 4

Event Study

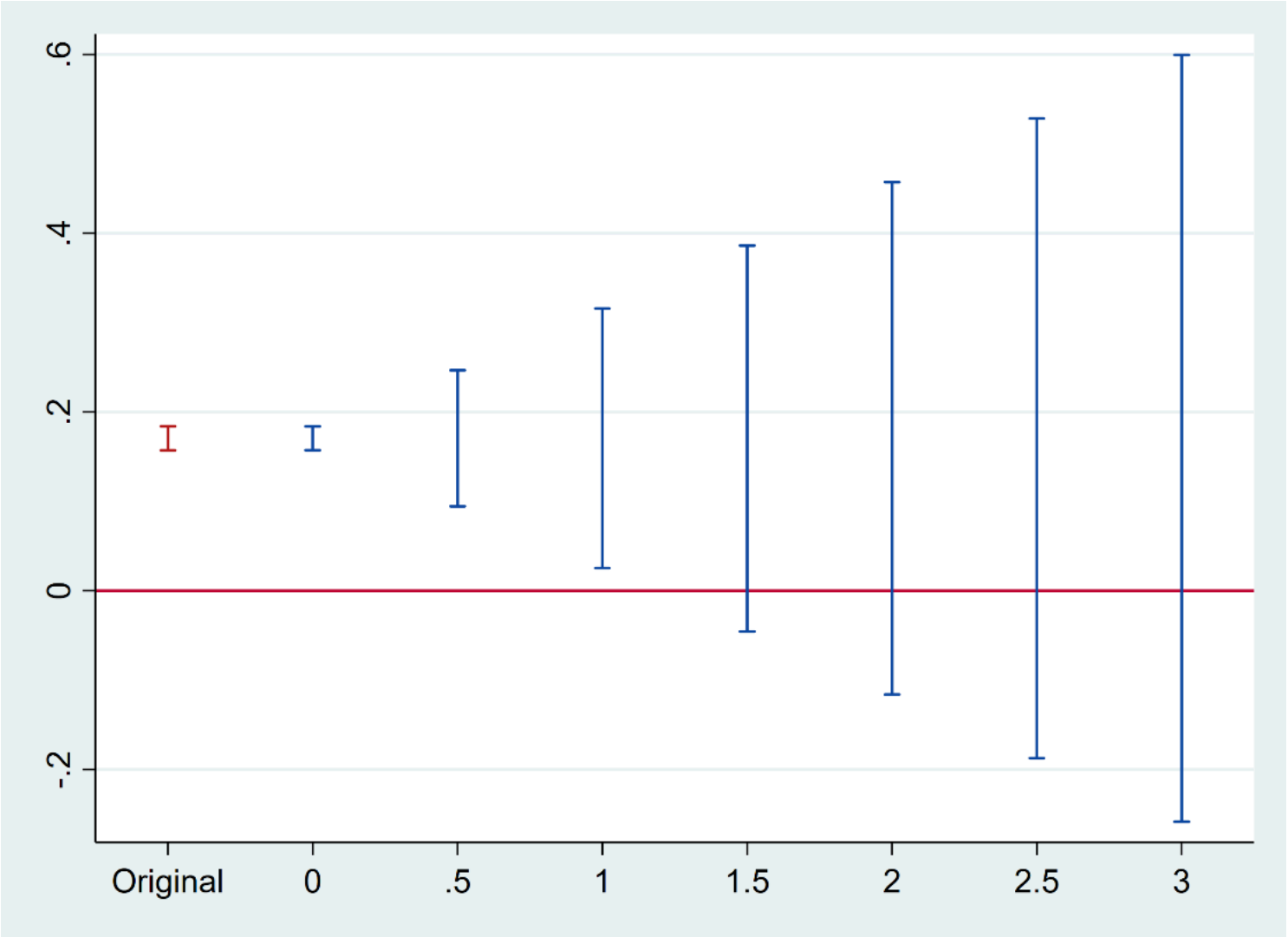


Figure 5

Sensitivity Analysis