Modern Finance

Modern Finance Institute

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Trade credit, earthquakes, and firm resilience: Lessons from three earthquakes in the 21st century

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Abstract: This study examines how firms adjust their trade credit policies after major earthquakes in Chile (2010), Italy (2016), and Türkiye (2023). Using an event study and difference-in-differences approach, it distinguishes resilient (positive abnormal returns) from vulnerable (negative abnormal returns) firms. Results show that resilient firms typically reduced both receivables and payables, signaling liquidity preservation and tighter credit standards. In contrast, vulnerable firms extended more credit and delayed payments, reflecting stress and limited financing. Effects are strongest among manufacturing firms. Findings highlight trade credit's dual role as a liquidity buffer and a strategic tool for resilience in post-disaster recovery and climate-related risk management.

Keywords: Trade credit, natural disasters, multinationality, event study, difference in differences.

1. Introduction

This paper examines how firms adjust their trade credit policies after major earthquakes, focusing on changes in the extension (receivables) and use (payables) of trade credit in Chile (2010), Italy (2016), and Türkiye (2023). Using an event study combined with a difference-in-differences estimation, the study compares firms that experienced positive abnormal returns (resilient) with those that suffered negative abnormal returns (vulnerable). Results show that resilient firms typically reduced both receivables and payables, which is consistent with liquidity preservation, tighter credit standards, and reputational prudence. Vulnerable firms extended more credit and delayed payments, reflecting financial strain and reduced access to external funding. These effects are strongest among manufacturing firms, highlighting trade credit's dual role as a liquidity buffer and a strategic instrument of resilience.

The study contributes to the understanding of how firms adapt financial relationships to exogenous shocks by documenting systematic post-disaster adjustments in working-capital policies. Earthquakes provide an ideal setting to examine this behavior: they are sudden, external, and heterogeneous in impact, yet they force firms to reallocate liquidity and renegotiate implicit contracts with customers and suppliers. The findings reveal that trade credit responses depend not only on firm-level resilience but also on national institutional and cultural environments, suggesting that financial adaptation is shaped by both market mechanisms and relational norms.

These results extend the literature on disaster finance and resilience by showing that trade credit is not merely a passive substitute for bank lending but an active channel of strategic adjustment. Previous studies have documented trade credit's countercyclical nature and its importance during financial crises, for example, see Petersen and Rajan (1997), García-Teruel and Martínez-Solano (2010), Love and Zaidi (2010), and Carbó-Valverde et al.(2016). This paper explores a different dimension by examining earthquakes, events that disrupt supply chains and liquidity simultaneously, and by distinguishing firm-level heterogeneity in the direction of response. In doing so, it

Citation: Ramirez, A. (2025). Trade credit, earthquakes, and firm resilience: Lessons from three earthquakes in the 21st century. *Modern Finance*, *3*(4), 22-44.

Accepting Editor: Adam Zaremba

Received: 29 September 2024
Accepted: 9 November 2025
Published: 15 November 2025

connects corporate finance to the broader literature on resilience, such as Sheffi (2005), to adaptive capacity in crisis management, as in Love et al. (2007).

Trade credit, the deferred-payment arrangement between firms, has long served as a vital mechanism for managing liquidity and maintaining supply-chain flows. While its origins can be traced to Mesopotamian civilizations (see Accominotti and Ugolini), its role continues to evolve in modern economies. Studies such as Casey and O'Toole (2014), Hyun (2021), and Al-Hadi and Al-Abri (2022) have highlighted its substitution for bank credit during financial distress. Other studies, such as Garcia-Appendi and Montoriol-Garriga (2013), show that firms that can secure more generous payment terms from suppliers gain a crucial buffer that allows them to maintain operations and liquidity without resorting to more costly or inaccessible sources of capital. Conversely, Cuñat (2007) suggests that resilient firms, such as those that did not suffer disruptions, may strategically increase the trade credit they extend to their own customers as a means to support financially distressed clients and preserve long-term relationships, thereby stabilizing future revenues. Yet, little is known about how firms deploy trade credit in response to exogenous shocks that disrupt operations rather than financial intermediation. By analyzing three large earthquakes across diverse institutional contexts, this study fills that gap.

Understanding these dynamics is essential for both firms and policymakers. For firms, trade credit management is a key element of resilience and business continuity planning. For policymakers, supporting post-disaster credit flows—through credit guarantees, supplier-financing programs, or liquidity facilities—can mitigate cascading liquidity bottlenecks. The evidence presented here highlights that maintaining trust and financial flexibility in trade credit networks is critical to recovery and long-term competitiveness.

2. Review of Literature

2.1. Natural Disasters and Trade Credit: A Growing Concern

While financial crises and pandemics have been studied as external shocks affecting trade credit, natural disasters represent a different kind of disruption. Some natural disasters affect entire regions, while others are very localized, disrupting only certain firms, industries, or supply chains; see Altay and Ramirez (2010), Bordeau-Brien and Kryzanowski (2017). Recent studies suggest that firms facing climate risks adjust their financial strategies, including their use of trade credit. Lai et al. (2022) find that firms affected by floods in China increasingly substituted bank loans with trade credit. Similarly, Chen et al. (2024) used textual analysis to show that firms perceiving higher climate risk tend to reduce their reliance on trade credit, likely due to concerns over customer solvency and supply chain disruptions.

Floods are seasonal and somewhat predictable, allowing businesses to implement risk mitigation strategies such as insurance and emergency credit facilities. Earthquakes occur sparingly and suddenly, leaving little time for preparation. This unpredictability makes it difficult for firms to preemptively adjust credit arrangements. Studies such as Worthington (2008) and Ramirez and Altay (2024) have examined the stock market reactions to earthquakes. Others like Ferreira and Karali (2015) and Valizadeh et al. (2017) have looked at their potential spillover effects on financial markets in other countries. Ersahin et al. (2022) show that firms react in strategic ways to natural disasters. Sometimes taking advantage of customers, other times helping suppliers. Lai et al. (2022) show that firms that obtained more trade credit post-disasters have subsequent better performances. Furthermore, Gonçalves et al. (2018) show that firms that see their market power increase during a financial crisis tend to lower their payables and help suppliers.

2.2. Trade Credit and Supply Chain Finance

According to Gelsomino (2016), supply chain finance tools such as reverse factoring formalize trade credit arrangements, shifting the credit risk from small suppliers to more creditworthy buyers, thereby lowering financing costs across the supply chain. As such, trade credit can be seen as both a building block and a tactical expression of supply chain finance (SCF). Climate finance is increasingly influencing firm-level decisions, especially in supply chain management. For example, Taghizadeh-Hesary and Yoshino (2020) suggest that investments in low-carbon technologies, energy-efficient logistics, and climate-resilient infrastructure now form part of sustainable supply chain strategies. The convergence of trade credit and SCF highlights a broader shift toward resilient and sustainable financial strategies in global value chains. Trade credit, traditionally viewed as a tool to bridge liquidity gaps, is now embedded in digital SCF ecosystems that not only optimize cash flow but also serve as vehicles for environmental policy enforcement. SCF programs tie financial incentives—such as preferential terms or access to financing—to suppliers' environmental performance, thereby linking liquidity provisioning (via trade credit) with climate objectives; see Wuttke et al. (2016). In this context, SCF emerges as a conduit through which trade credit evolves from a bilateral financing arrangement into a lever for system-wide climate resilience.

2.3. Earthquakes and Policy Considerations

Chile offers a powerful case study in economic resilience to seismic shocks, underpinned by both its geological context and its institutional evolution. Situated at the convergence of the Nazca and South American tectonic plates, which is one of the most seismically active regions globally. Major earthquakes—the 1960 Valdivia event (magnitudes estimated at 9.5–9.6 according to the US Geological Service, n.d.) and the 1985 Algarrobo quake (magnitude ~8.0 according to "1985 Algarrobo Earthquake," 2025)—resulted in widespread devastation and triggered transformative policy responses. Following the 1960 Valdivia disaster, Chile significantly strengthened its seismic building codes, including aggressive updates to the "Ley General de Urbanismo y Construcciones" Biblioteca Nacional (1976). These measures were further refined after the 1985 quake, aligning Chile's regulations with U.S. standards such as ACI 318 and incorporating periodic code upgrades to enhance structural resilience. The rapid post-disaster adoption and evolution of these codes demonstrate Chile's adaptive regulatory framework and its capacity to integrate lessons learned. Complementing its regulatory strides, Chile has also built robust disaster response institutions. In 1974, the National Office of Emergency of the Interior Ministry (ONEMI) was formalized, later evolving into the National Service for Disaster Prevention and Response (SERNAPRED) in 2021. These organizations have championed decentralized risk management, comprehensive emergency planning, and continuous institutional reform; das Dores de Jesus Da Silva et al. (2024), Shine (2023), Wilches et al. (2021). Together, these geological, regulatory, and institutional dimensions make Chile an exemplary context for studying how a developing economy can bolster resilience by combining strong building codes and mature disaster response systems.

Italy offers a compelling case study for its long history of devastating earthquakes and its complex geological setting. Located along the convergence zone between the African and Eurasian tectonic plates, the country is particularly vulnerable to seismic activity in regions such as central and southern Italy. Historic events like the 1980 Irpinia earthquake ("1980 Irpinia Earthquake," 2025) and the 2009 L'Aquila earthquake ("2009 L'Aquila Earthquake," 2025) have prompted significant developments in seismic regulation. After the 1980 Irpinia quake, Italy enacted Law 219/81 and issued its first comprehensive seismic zoning map in 1984, introducing mandatory design standards in high-risk zones (Montaldo Falero et al.). Building codes were updated further with a major ordinance in 2003, establishing probabilistic seismic hazard assessment, and then

with the New Technical Code (NTC'08) in 2009 to implement location-specific ground acceleration data. Italy's gradual improvements, from initial zoning to modern, data-driven design standards, make it ideal for studying adaptive economic resilience in earthquake-prone environments.

Türkiye represents a critical case in the study of seismic risk due to its location on the active North Anatolian Fault, one of the most seismically active zones in the world. The country has endured multiple major earthquakes, including the 1999 İzmit/Marmara earthquake (US Geological Service, 1999) and the 2023 Kahramanmaraş earthquakes ("2023 Turkey–Syria Earthquakes," 2025). In response to 1999, Turkey implemented modern seismic design rules, a new code and an "earthquake tax" dedicated to seismic resilience, and later strengthened the regulations with the Turkish Earthquake Regulation in 2007 and an updated seismic code in 2018 (effective 2019), mandating materials like reinforced, ductile concrete and stricter structural detailing "Architecture of Turkiye" (2025), Ozbulut (2023). However, enforcement has been weak, leading to widespread non-compliance: even buildings constructed post-2000 often fell during the 2023 event, and many lacked proper inspections or used substandard materials despite official codes "Reactions to the 2023 Turkey–Syria Earthquakes," 2025. This contrast between rigorous codes on paper and lax enforcement on the ground makes Turkey a vital case for understanding how regulatory effectiveness influences economic resilience to seismic shocks.

2.4. Hypotheses Development

Disruptions created by an earthquake at the firm level need not be negative and could create value instead of destroying it. Resilient firms, those that are perceived by the market as benefiting from an earthquake, are labeled CARPOS. Vulnerable firms that are perceived as being disrupted or suffering from the earthquake are labeled CARNEG.

The traditional cost-only version of trade credit posits that an increase in receivables is undesirable since it would lead to a longer cash conversion cycle, thus a higher cost of working capital. On the other hand, an increase in payables is desirable since it leads to a shorter cash conversion cycle, thus a lower cost of working capital.

There are very good reasons for firms to do the opposite of what is economically desirable in certain conditions. For example, CARPOS firms may extend generous (and costly) credit terms to increase sales and take market share from competitors. Or CARNEG firms extending credit to move unsold, perishable, or obsolete inventory.

Below are the hypotheses for CARPOS firms. These firms increased their market capitalization significantly after the quake. These firms are viewed by the market as resilient and or potentially benefiting from the post-earthquake period (construction firms, suppliers of essential goods).

Reasons for CARPOS firms to Increase Receivables. Three reasons are presented. Strategic Support for Customers: These firms may extend more trade credit to help struggling customers maintain operations, solidifying long-term relationships. Market Expansion: If rivals were disrupted, resilient firms might extend credit to acquire new customers or gain market share. Stronger Financial Position: Their perceived strength may allow them to take more credit risk without threatening solvency.

Reasons for CARPOS firms to Decrease Receivables. Tightening Credit Standards: Even resilient firms might reduce exposure to risky clients in a high-uncertainty environment. Liquidity Preservation: If supply chain disruptions or future shocks are expected, firms might prioritize cash over receivables. Reduced Need to Compete on Credit Terms: Increased demand for their products may reduce the need to offer generous payment terms.

Reasons for CARPOS firms to Increase Payables. Bargaining Power: Resilient firms might negotiate longer payment terms from suppliers, capitalizing on their strong position. Cash Conservation: Deferring payments can help conserve liquidity for growth

or contingencies. Supply Chain Leverage: Firms may increase inventory to meet rising demand and finance this via payables.

Reasons for CARPOS firms to Decrease Payables. Supplier Strain: If suppliers are affected by the quake, firms might pay faster to support them and ensure continuity. Strong Liquidity: With positive performance, firms might choose to pay promptly to secure discounts. Reputation Management: To preserve goodwill or ensure preferred treatment, firms might reduce reliance on trade credit.

Below are the hypotheses for CARNEG firms. These are firms that experienced a significant decrease in their market capitalization after the quake. These firms are viewed by the market as vulnerable or severely disrupted by the earthquake.

Reasons for CARNEG firms to Increase Receivables. Desperate Sales Push: These vulnerable firms might be forced to extend credit to attract or retain customers amid declining demand. Compensating for Reduced Bank Credit: Post-quake, if access to formal credit is restricted, they may use trade credit more. Inventory Clearance: Firms may extend lenient terms to move unsold inventory that may be perishable or obsolete.

Reasons for CARNEG firms to Decrease Receivables. Liquidity Crunch: Vulnerable firms may be unable to afford extended credit due to cash flow constraints. Higher Credit Risk Awareness: A quake may expose customer risk, leading firms to tighten credit policies. Operational Disruptions: Firms unable to deliver reliably may avoid extending credit tied to uncertain deliveries.

Reasons for CARNEG firms to Increase Payables. Cash Flow Stress: Firms may delay payments to suppliers to manage liquidity shortfalls. Reduced Financing Options: When bank or equity markets are inaccessible, firms lean more heavily on trade credit. Supplier Forbearance: Suppliers might offer lenient terms to support damaged clients and preserve relationships.

Reasons for CARNEG firms to Decrease Payables. Supplier Pressure: Suppliers may demand quicker payment or switch to cash terms due to increased counterparty risk. Loss of Supplier Trust: Damaged reputation may reduce access to trade credit. Reduced Operations: Lower purchasing needs may naturally reduce accounts payable if production is scaled down.

3. Data and Methodology

The search for appropriate events was limited to earthquakes taking place between 2010 and 2023 to ensure the availability of data before and after. Three large earthquakes that happened in this time window were selected. The first earthquake took place in Bio-Bio on Saturday, February 27, 2010, with a magnitude of 8.8 on the Richter scale. This earthquake was the 6th largest ever recorded and registered 525 casualties. The second earthquake to be considered is the Central Italy one that took place on Wednesday, August 24th, 2016. This quake registered a lower 6.2 on the Richter scale (about 1,000 less energy released than the 8.8 in Chile), but the level of casualties was relatively high at 300. The third earthquake is the one that occurred in Southern Turkey and Syria on Monday, February 6th, 2023. This was a powerful 7.8 on the Richter scale that brought tremendous devastation to Turkey and Syria with an astonishing 55,000 casualties. The 2011 earthquake in Japan was not considered since its aftermath is inseparable from the Fukushima nuclear accident. Similarly, the 2018 Indonesia quake is excluded since much of the damage was caused by the tsunami that followed. Other notable earthquakes that were excluded are the Haiti 2010 and 2021 earthquakes, and the Nepal 2015 earthquake. These quakes were devastating, but neither country has a sizeable stock market.

Firm-level data is obtained from FactSet. It is comprised of 42 fiscal quarters (8 years) before and 42 fiscal quarters after each earthquake, except for Turkey and Greece, where there are only nine fiscal quarters available after the quake. Firms with market capitalization lower than USD100 million, as well as firms that have no trading data in the weeks before and after the earthquake, are excluded. Also, firm-quarter observations with missing values for either accounts receivable or accounts payable are excluded.

An event study following MacKinlay (1997) is performed to quantify the impact of earthquakes on 117 firms in Chile, 153 in Italy, and 216 in Türkiye. We focus on 5-day cumulative abnormal returns (CARs) to identify the firms significantly affected. Expected returns are estimated using the market model, with the FTSE World Index as the market benchmark. Abnormal returns (AR) are defined as the difference between actual returns and expected returns:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (1)$$

AR_{it} = abnormal return for firm i on day t, R_{it} = actual return of firm i on day t. R_{mt} = return of the market index on day t, α_i = firm-specific intercept from the market model regression, β_i = sensitivity of firm i return to the market return

Firm-specific parameters α_i and β_i are estimated using ordinary least squares (OLS) regression of daily firm returns on daily market returns over an estimation window of one year that precedes the event window. Specifically, for each firm i:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}\ , \quad (2)$$

where R_{it} is the daily return of firm i on day t, Rmt is the return of the FTSE World Index on day t, and ϵ_{it}Is the error term.

The estimation window spans [T_0, T_1], ending the trading day prior to the event window to avoid contamination from the earthquake event.

The residuals ϵ_{it} are assumed to be independently and identically distributed with mean zero and constant variance.

Expected returns during the event window are computed as $\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt}$, and abnormal returns are then defined as $AR_{it} = R_{it} - \hat{R}_{it}$.

Cumulative abnormal returns (CARs) for firm i over the event window [τ_1, τ_2] (five trading days after each earthquake are calculated as:

$$CAR_i(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} AR_{it}. \quad (3)$$

Table 1 shows the summary findings of the event study. First, it is remarkable that despite the sheer magnitude of the events and the physical damage they created, the impact on firm valuation is mild. Out of 486 companies analyzed, only 33 saw their valuations significantly changed by the earthquakes. Eighteen (3.7%) of them had a positive valuation change (labeled CARPOS), and fifteen (3.1%) saw a negative valuation change (labeled CARNEG). There is survival bias in the sample. Some firms were affected by the earthquakes but subsequently merged or otherwise delisted. Interestingly, there was only one CARPOS in Türkiye and no CARNEG in Italy. The earthquake in Chile in 2010 generated both winners and losers. It is noteworthy that a relatively small increase in valuation in Italy can be statistically significant. The average return for CARPOS companies in Italy is 5.42% while the return for CARPOS in Chile was, on average, 54.6%. The average return for CARNEG firms in Chile was -9.59% and -23.76% for Turkey. For illustration purposes, Table 1 includes firms in financial services; these firms are excluded from the analysis. Combining the three earthquakes, the average return for CARPOS firms was 30.50%. For those firms negatively affected by the quake - CARNEG, the average return decrease was only 19.04%.

Table 1. Firms with Significant 5-Day Cumulative Abnormal Returns (CARs) Around Earthquakes, by Stock Exchange

Ticker	Name	Exchange	SIC-Code	Year Founded	Market Capitalization in MM USD	CAR POS	CAR NEG
BAN-IT	BasicNet S.p.A.	Milan	2339	1996	$322.84	5.34%	
DEA.XX1-IT	DeA Capital S.p.A.	Milan	6282	2000	$473.15	8.08%	
INW-IT	Infrastrutture Wireless Italiane S.p.A.	Milan	4813	2015	$3,300.24	3.16%	
JUVE-IT	Juventus Football Club S.p.A.	Milan	7941	1897	$285.95	2.73%	
IVS-IT	IVS Group S.A.	Milan	5962	2010	$374.10	2.14%	
CE-IT	Credito Emiliano S.p.A.	Milan	6021	1910	$2,486.69	5.97%	
PRT-IT	Esprinet S.p.A.	Milan	5045	2007	$486.70	6.68%	
UCG-IT	UniCredit S.p.A.	Milan	6029	1870	$33,462.65	9.22%	
CIMSA.E-IST	Cimsa Cimento Sanayi ve Ticaret A.S.	Istanbul	3241	1972	$724.51	14.33%	
BIZIM.E-IST	Bizim Toptan SatiG Magazalari A.g.	Istanbul	5411	2001	$113.98		-17.82%
BJKAS.E-IST	Besiktas Futbol Yatirimlari Sanayi ve Ticaret A.S.	Istanbul	7941	1991	$76.16		-18.79%
CANTE.E-IST	CAN2 TERMIK A.S.	Istanbul	4911	2003	$2,215.44		-40.14%
ERCB.E-IST	Erciyas Celik Boru Sanayi A.S.	Istanbul	3317	1990	$722.89		-21.32%
GEREL.E-IST	Gersan Elektrik Ticaret ve Sanayi A.S.	Istanbul	3643	1985	$38.51		-17.96%
GUBRF.E-IST	Gubre Fabrikalari T.A.S.	Istanbul	2873	1952	$4,715.73		-40.41%
KLGYO.E-IST	Kiler Gayrimenkul Yatirim Ortakligi A.S.	Istanbul	6798	1994	$299.58		-18.87%
PSGYO.E-IST	Pasifik Gayrimenkul Yatirim Ortakligi AS	Istanbul	6798	2020	$477.58		-15.96%
SANKO.E-IST	Sanko Pazarlama Ithalat Ihracat Anonim Sirketi	Istanbul	5131	1992	$135.52		-27.06%
ULKER.E-IST	Ulker Biskuvi Sanayi A.S.	Istanbul	2052	1944	$798.75		-19.24%
BESALCO-SGO	Besalco SA Registered Shs	Santiago	1611	1944	$374.85	18.94%	
CEMENTOS-SGO	Cementos Bio Bio S.A.	Santiago	3241	1957	$596.42	31.25%	
CINTAC-SGO	Cintac S.A.	Santiago	3317	1956	$216.77	26.70%	
MASISA-SGO	Masisa S.A.	Santiago	2493	1960	$1,034.31	11.39%	
MELON-SGO	Melon SA Registered Shs	Santiago	3241	1906	$376.17	288.7%	
POLPAICO-SGO	Cemento Polpaico S.A.	Santiago	3241	1948	$243.14	46.30%	
SOCOVESA-SGO	Socovesa S.A.	Santiago	1522	1965	$434.30	15.76%	
VENTANAS-SGO	Puerto Ventanas S.A.	Santiago	4491	1991	$320.14	14.03%	
VOLCAN-SGO	Compania Industrial el Volcan S.A.	Santiago	3275	1916	$214.39	38.36%	
COPEC-SGO	Empresas Copec S.A.	Santiago	2911	1934	$19,449.76		-6.35%
FORUS-SGO	Forus S.A.	Santiago	5661	1980	$315.97		-8.19%
INVERCAP-SGO	Invercap SA INVERCAP	Santiago	4939	1994	$1,119.57		-11.23%
SANTARITA-SGO	S.A. Vina Santa Rita	Santiago	2084	1880	$282.64		-6.70%
VSPT-SGO	Vina San Pedro Tarapaca S.A.	Santiago	2084	1865	$296.52		-15.48%

Note. The table reports firms with statistically significant 5-day cumulative abnormal returns (CARs) around earthquake events. Abnormal returns (AR) are estimated using the market model: $AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$ where ARit = abnormal return for firm i on day t, Rit = actual return of firm i on day t. Rmt = return of the market index on day t, αi = firm-specific intercept from the market model regression, βi = sensitivity of firm i return to the market return. Firm-specific parameters estimated over the [–252, 0] trading day window. CARs are the sum of ARs over the event window [+1, +5]. Market capitalization is measured in millions of USD in the fiscal year prior to each earthquake. CAR POS reports significantly positive CARs; CAR NEG reports significantly negative CARs. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

It is possible that firms whose valuation did not change significantly after the quake may have to alter their trade credit policy to help (or take advantage) in strategic decisions with suppliers and/or customers. To sort this out, a difference in differences analysis of trade credit before and after the quake is performed. The difference-in-differences (DiD) methodology is a quasi-experimental econometric technique used to estimate causal effects by comparing changes in outcomes over time between a treatment group and a control group; see Angrist and Pischke (2009). The key idea is to account for time trends that would have occurred even in the absence of treatment by differencing out the change in the untreated group. DiD is particularly well-suited for studying earthquakes because it leverages the exogenous nature of the shock, making them ideal "natural experiments". By comparing countries affected by the earthquake (treatment group) to unaffected but otherwise similar counterparts (control group) before and after the event, the impact of the earthquake on trade credit behavior can be isolated. The treatment group includes Chile, Italy, and Türkiye, while the control group includes Peru, Spain, and Greece.

To estimate the effect of the earthquake on the trade credit of firms, the following equations are estimated for each earthquake:

$$Receiv_{it} = \alpha + \beta_1 D\_Post_t + \beta_2 D\_Local_i + \beta_3 PostxLocal_{it} + \beta_4 CARPOS + \beta_5 CARNEG + \beta_6 Controls_{it} + \varepsilon_{ict} \quad (4)$$

$$Payab_{it} = \alpha + \beta_1 D\_Post_t + \beta_2 D\_Local_i + \beta_3 PostxLocal_{it} + \beta_4 CARPOS + \beta_5 CARNEG + \beta_6 Controls_{it} + \varepsilon_{ict} \quad (5)$$

where:

Receiv: The ratio of accounts receivable over total sales, at the end of each quarter. Payab: The ratio of accounts payable over total assets at the end of each quarter.

D_Post: The time trend shared between all countries. A dummy variable that takes the value of 1 for quarters after the quake and zero for quarters before.

D_Local: Local dummy to account for the differences between the countries suffering earthquakes (Chile, Italy, and Türkiye) and those that did not (Peru, Spain, and Greece).

Post x Local: The interaction between D_Post and D_Local, the true effect of the earthquake on the trade credit of all firms in affected countries.

CARPOS: Dummy variable that takes the value of 1 if the firm exhibited positive and significant cumulative abnormal returns after the earthquake and zero otherwise.

CARNEG: Dummy variable that takes the value of 1 if the firm exhibited negative and significant cumulative abnormal returns after the earthquake and zero otherwise.

3.1. Firm-level controls

CFLOW: The ratio of net income plus depreciation over total sales. The internal cash flow generation or operating cash flow margin affects a firm's ability and willingness to extend trade credit. According to Petersen and Rajan (1997), firms with higher internal cash flow have more liquidity flexibility and are less dependent on external financing, enabling them to use trade credit more strategically to build or maintain customer relationships. Such firms are also better positioned to absorb delays in receivables collection without jeopardizing their own operations or credit standing. In contrast, Love et al. (2007) suggest that firms with lower internal cash generation may ration trade credit or impose stricter payment terms to preserve liquidity, especially in times of macroeconomic stress or when facing financing constraints. Additionally, high cash flow firms may leverage trade credit as a competitive tool, offering favorable terms to attract customers or enter new markets, particularly when traditional pricing strategies are constrained.

STD_TA: The ratio of short-term debt over total assets. A firm's level of short-term debt significantly influences its trade credit policies, particularly through its impact on liquidity and financial flexibility. Petersen and Rajan (1997) state that companies with high levels of short-term debt face greater refinancing risk and tighter liquidity constraints,

which can limit their ability to extend trade credit to customers. These firms may prioritize cash preservation and accelerate receivables collection to meet imminent debt obligations, making them less willing or able to offer generous credit terms. In contrast, Biais and Gollier (1997) show that firms with low short-term debt burdens often have more internal financial slack, allowing them to use trade credit more strategically—either to support customer relationships or to gain a competitive edge in pricing. Moreover, when short-term debt markets tighten, Garcia-Appendini & Montoriol-Garriga (2013) show that firms increasingly turn to trade credit as a substitute source of liquidity, but primarily on the receiving end rather than as providers.

PURCH: The ratio of Cost of Goods Sold over total assets. This ratio reflects the intensity of a firm's operational input relative to its asset base, and it plays a key role in shaping trade credit policies. Firms with a high COGS-to-assets ratio are often operating in low-margin, high-turnover industries (retail or manufacturing) where liquidity and supplier relationships are crucial. Petersen and Rajan (1997) found that these firms tend to be more reliant on trade credit as a financing tool to manage their working capital needs, since high COGS implies frequent inventory purchases and tight cash cycles. On the other hand, firms with lower COGS-to-assets ratios may be more capital-intensive (utilities) and less dependent on trade credit for daily operations. Cuñat (2007) shows that firms with high operating costs relative to assets are both more likely to demand trade credit from suppliers and to offer it downstream as a strategic lever to maintain sales volume and customer loyalty in fast-moving markets.

AGE: The age of each firm. Age significantly influences firm trade credit policies, primarily through its impact on reputation, access to finance, and customer relationships. According to Diamond (1989), older firms typically have more established reputations and longer credit histories, which reduce information asymmetries and make it easier for them to extend trade credit to customers. These firms are also more likely to have accumulated internal capital and forged stable relationships with suppliers and buyers, allowing them to act as reliable creditors within their supply chains. Berger and Udell (1998) show that younger firms tend to rely more heavily on receiving trade credit than on extending it, often because they face greater financial constraints and have less bargaining power. Moreover, Nilsen (2002) shows that older firms may use trade credit strategically to reinforce customer loyalty and smooth sales volatility over time.

LSIZE: The logarithm of total assets. Larger firms are generally more capable of extending trade credit due to greater financial resources, stronger bargaining power, and better access to capital markets. Petersen and Rajan (1997) find that these firms can afford to offer more generous credit terms to attract and retain customers, particularly in competitive or economically stressed markets. Additionally, Fisman and Love (2003) indicate that large firms often act as de facto lenders within supply chains, using trade credit strategically to support downstream partners and stabilize demand. Their diversified customer base and established credit assessment mechanisms also allow them to manage credit risk more effectively than smaller firms. Empirical studies such as Garcia-Appendini & Montoriol-Garriga (2013) have shown that large firms tend to offer longer payment terms and are less sensitive to liquidity constraints.

FGNSALES: The ratio of foreign sales to total sales. Empirical research such as Reeb et al. (1998), Kwok and Reeb (2000), and Lee and Makhija (2009) supports the idea that by operating across multiple countries, a multinational firm diversifies not only its revenue streams but also its supplier and customer bases. This geographic diversification means that when an earthquake disrupts operations, infrastructure, or demand in one country, the firm can rely on other locations to maintain cash flow and operational continuity. This resilience can enhance the firm's ability to extend trade credit even during local crises, as counterparties perceive lower default risk from a firm with stable international operations. Additionally, multinational firms may be better positioned to absorb temporary spikes in working capital needs or reroute supply chains, reducing the likelihood that they themselves will delay payments to suppliers.

Table 2 shows the main descriptive statistics of the sample. Results are presented in 4 panels. Panel A reflects the Chile 2010 earthquake. It shows the averages for firm-quarter observations for Peru and Chile. Panel B shows the data for the Italy 2016 earthquake and includes firm-quarter observations from Spain and Italy. Panel C includes Türkiye and Greece, and Panel D combines all countries. Each Panel is divided into all firms and only manufacturing companies. Receivables are significantly higher for both Chile and Peru than for the rest of the sample. The main reason for this is that for the early years of the sample, FactSet includes "other" receivables. There was no way to isolate only those related to customer receipts without losing a significant number of firm-quarter observations. Receivables in Türkiye are generally higher than those of Greece in both the overall sample and just manufacturing firms. In the case of Spain and Italy, the values for receivables are similar. Regarding payables, they stand at around 15% of total assets for firms in Spain, Italy, Türkiye, and Greece. The figure is much lower in South America, with only around 7%. CFLOW is low in Chile and Peru, as well as Spain and Italy, and higher in Türkiye and Greece. A similar pattern can be seen in STD_TA and PURCH. It should be noted that these variables are measured not only across different countries with different legal systems and levels of economic development, but also during different time frames. Control variables vary from region to region but tend to be like those of the matching country. There is more variation across regions/earthquakes than within. In general, firms tend to be old and established; the average age is greater than 50 years old. Interestingly, Italy seems to have the younger companies, while Spain has the oldest ones. The sub-sample of manufacturing firms is fairly multinational, with average foreign sales as a percentage of total sales above 20%. The lowest value is for Türkiye with 10% while the highest value is for Spain with 67%.

Table 2. Descriptive Statistics for Main Variables by Country and Industry

Panel A - CHILE 2010				
	Peru - All Firms	Chile - All Firms	Peru - Manufacturing	Chile - Manufacturing
RECEIV	0.534	0.825	0.526	0.807
PAYAB	0.072	0.073	0.077	0.077
CFLOW	0.033	0.023	0.027	0.021
STD_TA	0.090	0.075	0.097	0.077
PURCH	0.127	0.153	0.157	0.123
AGE	48.00	59.58	51.22	75.94
L_SIZE	6.74	12.77	6.48	12.53
FGNSALES	17.85	23.29	20.90	29.28
Count	4,560	7,841	1,840	2,641
Panel B - ITALY 2016				
	Spain - All Firms	Italy - All Firms	Spain - Manufacturing	Italy - Manufacturing
RECEIV	0.167	0.216	0.152	0.215
PAYAB	0.151	0.156	0.113	0.169
CFLOW	0.013	0.015	0.018	0.018
STD_TA	0.064	0.084	0.067	0.088
PURCH	0.082	0.137	0.077	0.138
AGE	63.85	38.16	68.45	32.05
L_SIZE	9.12	7.90	7.16	7.01
FGNSALES	56.85	35.39	67.22	58.63
Count	3,068	7,752	1,040	3,434
Panel C - TURKEY 2023				
	Greece - All Firms	Türkiye - All Firms	Greece - Manufacturing	Türkiye - Manufacturing
RECEIV	0.167	0.216	0.152	0.215

PAYAB	0.151	0.156	0.113	0.169
CFLOW	0.013	0.015	0.018	0.018
STD_TA	0.064	0.084	0.067	0.088
PURCH	0.082	0.137	0.077	0.138
AGE	63.85	38.16	68.45	32.05
L_SIZE	9.12	7.90	7.16	7.01
FGNSALES	56.85	35.39	67.22	58.63
Count	3,068	7,752	1,040	3,434
		Panel D - ALL COUNTRIES		
	Control Countries - All Firms	Earthquake Countries - All Firms	Athens - Manufacturing	Istanbul - Manufacturing
RECEIV	0.386	0.522	0.391	0.472
PAYAB	0.103	0.114	0.090	0.129
CFLOW	0.025	0.019	0.024	0.019
STD_TA	0.079	0.079	0.086	0.083
PURCH	0.109	0.145	0.129	0.132
AGE	54.37	48.93	57.44	51.13
L_SIZE	7.42	9.37	6.53	8.53
FGNSALES	33.54	29.31	37.63	45.87
Count	7,628	15,593	2,880	6,075

Note. RECEIV = accounts receivable scaled by total assets. PAYAB = accounts payable scaled by total assets. CFLOW = operating cash flow scaled by total assets. STD_TA = short-term debt scaled by total assets. PURCH = purchases scaled by total assets. AGE = years since firm founding. L_SIZE = natural logarithm of total assets (USD). FGNSALES = foreign sales as % of total sales. Values in parentheses are t-statistics for differences in means. Manufacturing sample = firms with SIC codes 2000–3999. Significance levels: p<0.10, *p<0.05, **p<0.01. Sample drawn from FactSet: quarterly data for publicly traded firms in Chile and Peru (2002–2018), Italy and Spain (2008–2024), and Turkey and Greece (2016–2025). Panel A shows Chile, Panel B Italy, Panel C Turkey, and Panel D the pooled sample. Values are means. Counts represent firm quarters. Standard errors in parentheses. Manufacturing subsamples include SIC codes 2000–3999.

3.2. Regression Results

The section below presents the results of estimating equations 4 and 5. The analysis begins with all firms in the sample and is presented in Table 3. Results of estimating the models using a subsample of only manufacturing firms are presented in Table 4. Finally, Table 5 presents the results of aggregating all countries together. In all tables, results are presented showing receivables and payables side by side, broken down in panels that separate earthquakes: A: Chile 2010, B: Italy 2016, and C: Türkiye 2023. All models are estimated using fixed effects.

3.3. All Firms in Sample

Table 3 Columns 1 to 3 for every panel show the estimations for receiv, (equation 4), and columns 4 to 6 show the results for payab, (equation 5). The first and fourth column for every earthquake shows the basic DiD estimation, the second and fifth columns include the dummies for positive and negative abnormal returns, CARPOS, and CARNEG. The third and sixth columns add foreign sales to test the potential risk reduction effect of multinational firms.

Panel A: Chile 2010. Columns 1 to 3 show the estimation of equation 4, Receiv. Results show that Chilean firms extended more credit (higher receivables) after the earthquake. The coefficient for Post x Local is positive and significant. Columns 2 and 3 include CARPOS and CARNEG. Results show that CARNEG firms increased their level of receivables even more, which is consistent with reduced bank credit and the idea of

inventory clearance or a desperate sales push. There is no effect for CARPOS. Columns 4 – 6 show the estimation of equation 5, Payab. Results show that the coefficient for Post x Local is not different from zero; there was no post-quake adjustment in the use of trade credit by Chilean firms. D_Post is negative and significant, indicating that post the earthquake, all firms (including those in Peru) tended to lower their payables. Columns 5 and 6 show that CARNEG firms decreased their use of trade credit (lower payables), which is consistent with the hypotheses that post-earthquake these firms lost their suppliers' trust or faced pressure from them. It may also result from lower purchasing needs. Multinational firms lower payables even more.

Panel B: Italy 2016. Results from columns 1 to 6 show that the coefficient for Post x D_Local is not statistically different from zero, indicating no earthquake effect in trade credit. The coefficient for CARPOS is negative and significant in all estimations, indicating these firms have lowered the level of both receivables (extend less credit) and payables (use less credit). A reduction in receivables for these resilient firms is consistent with tightening credit standards, liquidity preservation, and a reduced need to compete on credit terms. A reduction in payables, on the other hand, is consistent with supplier strain, reputation management, or a strong liquidity position. The degree of multinationality does not affect receivables but tends to increase payables.

Panel C: Türkiye 2023. Like in the case of Chile, columns 1 to 3 show firms in Türkiye extended more credit because of the quake; however, columns 4 to 6 show there is no change in credit used after the quake. CARPOS firms reduced their extended credit and at the same time used less credit. The reduction in receivables is consistent with a reduced need to compete on credit terms, liquidity preservation, and tightening of credit standards. The reduction in payables is consistent with the hypotheses of stronger liquidity, supplier strain, and reputation management. On the other side, CARNEG firms saw an increase in both receivables and payables. The increase in credit extended is consistent with the hypotheses of inventory clearance, desperate sales push, or compensation for reduced bank credit. The increase in the use of credit is consistent with the hypotheses of cash flow stress, reduced financing options, as well as help from suppliers. The coefficient for FGNSALES is negative and significant for payables, indicating that the degree of multinationality decreases the use of trade credit for firms in Türkiye and Greece.

Table 3. Regression Results for Receivables and Payables: All Firms

Panel A. Chile & Peru (2010). - All Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	5.3106***	5.69307***	5.54157***	0.04441***	0.04416***	0.04517***
	2.14	2.3	2.21	14.11	14.06	14.23
D_Post	-0.94702	-0.94129	-0.92201	-0.01202***	-0.01204***	-0.0122***
	-0.33	-0.32	-0.32	-3.73	-3.75	-3.79
D_Local	0.44635	0.20773	-0.00772	0.01168***	0.01259***	0.01388***
	0.21	0.1	0.1	4.36	4.66	5.01
Post x Local	8.80749***	8.76352***	8.74154***	0.00754	0.00759	0.00774
	2.41	2.4	2.4	1.87	1.88	1.92
CFLOW	-0.87042***	-0.87283***	-0.8728***	0.00001295	0.00001707	0.00001688
	-60.84	-61.02	-61.01	0.83	1.1	1.08
STD_TA	-2.06733	-0.52543	-0.49338	0.00188	-0.00066933	-0.00090924
	-0.38	-0.1	-0.09	0.29	-0.1	-0.14
PURCH	-9.49957***	-9.44055***	-9.26307***	0.25838***	0.25823***	0.25693***
	-2.06	-2.05	-2	44.47	44.51	44.06

AGE	-20.73	-26.97***	-27.44***	0.174***	0.183***	0.187***
	-1.56	-2.02	-2.05	10.65	11.19	11.34
L_SIZE	-133.8	-167.22	-122.77	-1.92***	-1.91***	-2.18***
	-0.44	-0.55	-0.38	-4.94	-4.93	-5.35
CARPOS		-0.54293	-0.58257		-0.00061406	-0.0003943
		-0.27	-0.29		-0.24	-0.16
CARNEG		11.59434***	11.53193***		-0.01967***	-0.01933***
		4.25	4.22		-5.79	-5.68
FGNSALES			-7.87			0.04***
			-0.45			2.13
N	8,731	8,731	8,731	6,751	6,751	6,751
Adjusted R^2	0.2982	0.2995	0.2995	0.2545	0.258	0.2584

Panel B. Italy & Madrid (2016). - All Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	0.26018***	0.25788***	0.25398***	0.14839***	0.14757***	0.13942***
	25.77	25.81	25.02	16.24	16.16	15.05
D_Post	-0.0259***	-0.02576***	-0.02525***	-0.00324	-0.00319	-0.00194
	-2.27	-2.29	-2.24	-0.32	-0.31	-0.19
D_Local	0.00846	0.01202***	0.01332***	-0.03285***	-0.03171***	-0.029***
	1.87	2.67	2.93	-8.03	-7.74	-7.02
Post x Local	0.00584	0.00563	0.0054	-0.02149	-0.02155	-0.02213
	0.45	0.43	0.42	-1.83	-1.84	-1.89
CFLOW	-0.0131***	-0.0112***	-0.00997	-0.02444***	-0.02384***	-0.02139***
	-2.42	-2.09	-1.85	-5.07	-4.95	-4.43
STD_TA	0.14732***	0.1438***	0.14199***	-0.00761	-0.00883	-0.01232
	6.53	6.44	6.36	-0.37	-0.43	-0.61
PURCH	0.43176***	0.46016***	0.45735***	0.6248***	0.6340***	0.62826***
	26.17	27.79	27.55	42.38	42.41	41.98
AGE	-0.13***	-0.12***	-0.11***	-0.3***	-0.3***	-0.3***
	-2.59	-2.32	-2.19	-7.17	-7.06	-6.78
L_SIZE	-15.36***	-15.49***	-15.75***	-2.23***	-2.27***	-2.76***
	-16.12	-16.44	-16.58	-2.59	-2.63	-3.19
CARPOS		-0.0900***	-0.08659***	0	-0.02862***	-0.02168***
		-10.13	-9.59	0	-3.55	-2.66
CARNEG						
FGNSALES			0.105***	0	0	0.212***
			2.14	0	0	4.8
N	4,612	4,612	4,612	4,530	4,530	4,530
Adjusted R^2	0.2659	0.2817	0.2823	0.3234	0.3251	0.3284

Panel C – Türkiye & Greece 2023 - All Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	0.3374***	0.34044***	0.34063***	0.06267***	0.06856***	0.07075***
	40.7	41.03	41.03	9.75	10.78	11.16
D_Post	-0.02828***	-0.02991***	-0.03021***	-0.02232***	-0.02558***	-0.02792***
	-2.02	-2.14	-2.16	-2.01	-2.33	-2.55
D_Local	0.05992***	0.05439***	0.05345***	0.01713***	0.00602	-0.00335

	13.61	12.17	11.45	4.93	1.73	-0.92
Post x Local	0.05262***	0.05426***	0.05424***	0.01482	0.01808	0.01732
	3.61	3.73	3.73	1.28	1.58	1.52
CFLOW	-0.01105***	-0.01055***	-0.01056***	-0.0136***	-0.01249***	-0.01261***
	-4.38	-4.19	-4.2	-6.74	-6.28	-6.37
STD_TA	0.04305***	0.04419***	0.04453***	0.03406***	0.03623***	0.03936***
	7.51	7.73	7.76	7.74	8.35	9.07
PURCH	0.20661***	0.20886***	0.20886***	0.41319***	0.41678***	0.4166***
	29.84	29.69	29.69	76.17	76.65	76.9
AGE	-0.05356	-0.03401	-0.02639	-0.05207	-0.01214	0.059
	-0.78	-0.5	-0.38	-0.98	-0.23	1.13
L_SIZE	-27.71***	-27.69***	-27.57***	-0.8285	-0.7586	0.350
	-30.99	-31.01	-30.36	-1.2	-1.12	0.51
CARPOS		-0.06818***	-0.06856***	0	-0.12454***	-0.12834***
		-5.93	-5.95	0	-14.27	-14.74
CARNEG		0.0245***	0.02473***	0	0.05192***	0.05411***
		3.27	3.3	0	9.14	9.55
FGNSALES			-0.04873	0	0	-0.462***
			-0.69	0	0	-8.59
N	9,929	9,929	9,929	9,788	9,788	9,788
Adjusted R^2	0.1944	0.1981	0.198	0.3952	0.4171	0.4171

Note. This table reports fixed effects regressions of receivables and payables on earthquake exposure variables and firm controls. The sample is drawn from FactSet: quarterly observations for publicly traded firms in Chile and Peru (2002–2018), Italy and Spain (2008–2024), and Turkey and Greece (2016–2025). Panel A shows Chile & Peru, Panel B Italy & Spain, Panel C Turkey & Greece. Values in parentheses are t-statistics. Receivables are defined as accounts receivable over total sales. Payables are accounts payable over total assets. Dependent variablespayable/total accounts receivable/total sales; Payables = accounts payable / total assets. Key variables: D_Post = 1 for quarters after the earthquake, 0 otherwise. D_Local = 1 for Chile, Italy, and Turkey; 0 for Peru, Spain, and Greece. Post × Local = interaction of D_Post and D_Local. CARPOS = 1 if the firm exhibited positive CARs after the quake; 0 otherwise. CARNEG = 1 if firm exhibited negative CARs after quake; 0 otherwise. Controls: CFLOW = net income + depreciation / sales; STD_TA = short-term debt / assets; PURCH = COGS / assets; AGE = firm age; LSIZE = log total assets; FGNSALES = foreign sales / sales. Estimation method: firm fixed effects. Significance levels: p<0.10, *p<0.05, **p<0.01.

3.4. Only Manufacturing firms.

Given that the reasons for extending and using trade credit can vary widely from one industry to another, a similar analysis is performed including only manufacturing firms. Specifically, those from SIC codes 2000 to 4000. Results are presented in Table 4, which is organized in the same manner as table 3.

Panel A: Chile 2010. The coefficient for Post x Local is not significantly in any specification, indicating that there is no evidence of the earthquake altering the trade credit used or extended by manufacturing firms in Chile. This means that the effect reported on table 3 is driven by those non-manufacturing firms. Columns 2 to 3 show that CARPOS firms reduced receivables, consistent with the hypotheses of tightening credit standards, liquidity preservation or a reduced need to compete on credit terms. There is no change of receivables for CARNEG firms. Columns 5 to 6 show CARPOS firms did not experience a significant change in payables, however CARNEG firms saw a significant reduction. This is consistent with supplier pressure, loss of supplier trust and reduced operations. Multinationality further lowers the level of payables.

Panel B: Italy 2016. The coefficient for Post x Local in columns 1 to 3 is not significant, indicating no general earthquake effect on receivables. However, columns 4-6 show a negative and significant coefficient indicating that manufacturing firms from Italy lowered their payables as a direct result of the earthquake. Manufacturing CARPOS firms

saw an increase in receivables. This is consistent with strategic support for clients, market expansion and a stronger financial position. There is mixed evidence regarding payables, CARPOS firms saw an increase in payables, but this effect disappears once the control for multinationality of the firm is included. Multinationality of the firm significantly reduces the credit used by Italian and Spanish firms.

Panel C: Türkiye 2023. Columns 1 to 3 show a positive and significant impact of the quake on receivables but (columns 4 to 6) no impact on payables for manufacturing firms in Türkiye. Furthermore, CARPOS firms use less trade credit, which is consistent with tightening credit standards, liquidity preservation or a reduced need to compete on credit terms. Also, CARPOS firms extend less credit, which supports the hypotheses of supplier strain, strong liquidity or reputation management. The effect of multinationality is mixed. The degree of foreign sales is negatively correlated with receivables; however it has no effect on payables. There is no effect on CARNEG firms.

Table 4. Regression Results for Receivables and Payables: Manufacturing Firms

Panel A. Chile & Peru 2010 – Manufacturing Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	1.49311***	1.50052***	1.48548***	0.08919***	0.08586***	0.08363***
	17.92	17.71	17.46	15.99	15.11	14.7
D_Post	-0.00426	-0.00369	-0.00037716	-0.01482***	-0.01473***	-0.0142***
	-0.05	-0.04	0	-2.98	-2.97	-2.87
D_Local	0.83351***	0.8758***	0.85291***	0.04156***	0.03962***	0.03638***
	11.64	12.13	11.65	8.42	7.93	7.22
Post x Local	0.10082	0.09645	0.09366	0.01213	0.01209	0.01169
	0.92	0.88	0.86	1.86	1.86	1.8
CFLOW	0.00036118	0.0003877	0.00041092	0.00003268	0.00003279	0.00003615
	0.93	1	1.06	1.44	1.45	1.6
STD_TA	0.2797	0.29525	0.3021	-0.13831***	-0.14166***	-0.14101***
	1.57	1.66	1.7	-11.71	-11.96	-11.94
PURCH	-1.29586***	-1.32145***	-1.33172***	0.22605***	0.22814***	0.22759***
	-9.25	-9.44	-9.5	25.12	25.32	25.34
AGE	-1.9***	-2.0***	-2.1***	0.251***	0.275***	0.256***
	-4.44	-4.55	-4.79	8.92	9.42	8.7
L_SIZE	-80.27***	-80.08***	-73.32***	-6.95***	-6.63***	-5.66***
	-7.43	-7.35	-6.38	-9.46	-8.94	-7.3
CARPOS		-0.22188***	-0.24251***		0.00311	0.0002616
		-4.49	-4.79		0.93	0.08
CARNEG		-0.00836	-0.02525		-0.01356***	-0.0162***
		-0.12	-0.36		-2.8	-3.33
FGNSALES			-1.02			-0.153***
			-1.84			-4.21
N	3,416	3,416	3,416	2,627	2,627	2,627
Adjusted R^2	0.0726	0.0776	0.0782	0.2393	0.2415	0.2464

Panel B. Italy & Spain 2016 - Manufacturing Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	0.25245***	0.24872***	0.24691***	0.09061***	0.08875***	0.10779***
	21.24	20.89	20.45	9.38	9.16	11.25
D_Post	-0.00312	-0.00304	-0.00327	0.02966	0.02973	0.03132

	-0.15	-0.15	-0.16	1.74	1.75	1.89
D_Local	0.05638***	0.05553***	0.05613***	0.0363***	0.0359***	0.03009***
	9.75	9.62	9.66	7.72	7.64	6.54
Post x Local	-0.01668	-0.01606	-0.01595	-0.03842***	-0.03815***	-0.03868***
	-0.76	-0.73	-0.72	-2.14	-2.12	-2.21
CFLOW	-0.00449	-0.00432	-0.00433	-0.01612***	-0.01599***	-0.01586***
	-0.82	-0.79	-0.79	-3.69	-3.67	-3.73
STD_TA	0.01372	0.01017	0.00924	0.00567	0.00356	0.01242
	0.59	0.44	0.4	0.3	0.19	0.68
PURCH	0.19098***	0.19763***	0.19829***	0.49302***	0.49634***	0.49008***
	8.29	8.57	8.59	26.77	26.89	27.27
AGE	0.05592	0.06567	0.07961	0.03047	0.03554	-0.1013
	0.87	1.02	1.2	0.58	0.68	-1.93
L_SIZE	-16.88***	-16.49***	-16.94***	-3.45***	-3.25***	0.97095
	-13.24	-12.91	-12.34	-3.34	-3.14	0.9
CARPOS		0.06524***	0.06833***		0.03645***	0.00588
		3.48	3.58		2.28	0.37
CARNEG						
FGNSALES			0.06811			-0.662***
			0.9			-11.14
N	2,276	2,276	2,276	2,220	2,220	2,220
Adjusted R^2	0.1692	0.1733	0.1732	0.3207	0.3219	0.3577

Panel C. Türkiye & Greece (2023). - Manufacturing Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	0.2916***	0.29261***	0.30056***	-0.00022698	0.00021873	0.00227
	29.99	30.1	30.21	-0.03	0.03	0.28
D_Post	-0.03995***	-0.03982***	-0.04112***	-0.00637	-0.00631	-0.00665
	-2.23	-2.22	-2.3	-0.43	-0.43	-0.45
D_Local	0.0909***	0.09056***	0.08221***	0.02718***	0.02709***	0.02494***
	16.35	16.29	13.7	5.84	5.82	4.97
Post x Local	0.04835***	0.04777***	0.04708***	-0.00248	-0.00288	-0.00305
	2.62	2.59	2.56	-0.16	-0.19	-0.2
CFLOW	-0.00609***	-0.00587***	-0.00595***	-0.00817***	-0.00805***	-0.00807***
	-2.29	-2.22	-2.25	-3.76	-3.71	-3.72
STD_TA	0.01493***	0.015***	0.01628***	0.05026***	0.05037***	0.0507***
	3.06	3.07	3.33	12.57	12.6	12.65
PURCH	0.29094***	0.2884***	0.28938***	0.37607***	0.37432***	0.37454***
	26.27	26	26.1	41.43	41.14	41.16
AGE	-0.319***	-0.33***	-0.35***	0.55***	0.54***	0.54***
	-4.01	-4.21	-4.4	8.42	8.27	8.21
L_SIZE	-23.95***	-23.83***	-23.25***	1.48	1.58***	1.73***
	-26.06	-25.88	-24.92	1.96	2.09	2.26
CARPOS		-0.05526***	-0.0589***		-0.03581***	-0.03674***
		-3.77	-4.01		-2.98	-3.05
CARNEG		0.01386	0.01455		0.00485	0.00581
		1.65	1.94		0.71	0.84
FGNSALES			-0.255***			-0.065
			-3.67			-1.15
N	5,919	5,919	5,919	5,890	5,890	5,890

Adjusted R^2	0.2167	0.2187	0.2204	0.264	0.2649	0.265

Note. This table reports fixed effects regressions of receivables and payables on earthquake exposure variables and firm controls for the subsample of manufacturing firms. The sample is drawn from FactSet: quarterly observations for publicly traded firms in Chile and Peru (2002–2018), Italy and Spain (2008–2024), and Turkey and Greece (2016–2025). Panel A reports results for Chile & Peru, Panel B for Italy & Spain, and Panel C for Turkey & Greece. Values in parentheses are t-statistics. Receivables are defined as accounts receivable over total sales. Payables are accounts payable over total assets. Dependent variables: Receivables = accounts receivable/total sales; Payables = accounts payable/total assets. Key variables: D_Post = 1 for quarters after the earthquake, zero otherwise. D_Local = 1 for Chile, Italy, and Turkey; 0 for Peru, Spain, and Greece. Post × Local = interaction of D_Post and D_Local. CARPOS = 1 if the firm exhibited positive CARs after the quake; 0 otherwise. CARNEG = 1 if the firm exhibited negative CARs after the quake; 0 otherwise. Controls: CFLOW = net income + depreciation/sales; STD_TA = short-term debt/assets; PURCH = COGS/assets; AGE = firm age; LSIZE = log total assets; FGNSALES = foreign sales/sales. Estimation method: firm fixed effects. Significance levels: p<0.10, *p<0.05, **p<0.01.

3.5. Combining All Earthquakes

This section combines the data for the three earthquakes and six countries. Results are presented in Table 5, which follows a similar structure to the tables presented before.

All firms, all countries combined. Panel A of Table 5 in columns 1 to 3 shows that there is no general earthquake effect for receivables, but a significant increase in payables, columns 4 to 6. CARPOS firms did not alter their receivables but showed a significant reduction in trade credit used. This reduction is consistent with the hypotheses of supplier strain, strong liquidity, or reputation management. CARNEG firms exhibit an increase in extended credit, which is consistent with the hypotheses of a desperate sales push, compensating for reduced bank credit or inventory clearances. The coefficient for CARNEG is not significantly different from zero. Multinational firms tend to have higher levels of payables.

Only manufacturing firms, all countries combined. Panel B shows the results when only manufacturing firms are included. When looking at columns 1 to 3, the coefficient for Post x Local is negative and significant, which indicates a generalized decrease in receivables of manufacturing firms in the affected countries as a direct effect of the quakes. There is some evidence that Manufacturing CARPOS firms show higher levels of receivables, consistent with strategic support for clients, market expansion, or a stronger financial position. This effect disappears when controlling for multinationality. CARNEG firms exhibit higher receivables, which is consistent with the desperate sales push, compensating for reduced bank credit or inventory clearance. When looking at payables, the situation is different. There is no evidence that CARPOS manufacturing firms altered their payables. Additionally, CARNEG manufacturing firms lowered their payables. This reduction is consistent with supplier pressure, loss of supplier trust, or reduced operations.

Table 5 Regression Results for Receivables and Payables: Pooled Sample

Panel A. All Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	-0.0149	0.4707	0.67761	0.19341***	0.19086***	0.17757***
	0	0.13	0.19	14.69	14.49	13.54
D_Post	-0.3612	-0.33251	-0.34998	-0.01428***	-0.01446***	-0.01334***
	-0.27	-0.25	-0.26	-3.25	-3.29	-3.06
D_Local	-0.41862	-0.62354	-0.74419	0.0289***	0.02864***	0.03611***
	-0.8	-1.19	-1.38	16.39	16.2	19.86
Post x Local	1.77789	1.76544	1.73086	0.01285***	0.01256***	0.01463***
	1.21	1.2	1.17	2.64	2.59	3.03

CFLOW	-0.8649***	-0.8660***	-0.8659***	-0.0000054	-0.0000052	-0.0000089
	-98.6	-98.73	-98.72	-0.19	-0.18	-0.31
STD_TA	-0.7302	-0.66846	-0.66366	0.02185***	0.02255***	0.02252***
	-0.69	-0.64	-0.63	6.33	6.54	6.57
PURCH	-2.2835	-2.7222***	-2.7507***	0.3443***	0.3445***	0.3465***
	-1.75	-2.08	-2.1	77.39	77.34	78.22
AGE	-5.99	-7.43	-8.19	-0.0213	-0.0228	0.0262
	-0.96	-1.19	-1.3	-0.98	-1.05	1.2
L_SIZE	142.31	129.86	151.88	-8.32***	-8.12***	-9.4***
	1.76	1.6	1.79	-30.1	-29.2	-32.66
CARPOS		0.08516	0.01865		-0.02261***	-0.01894***
		0.08	0.02		-6.39	-5.37
CARNEG		5.52625***	5.50134***		0.00368	0.00466
		4.89	4.87		0.95	1.21
FGNSALES			-6.41			0.3845***
			-0.9			15.94
N	23272	23272	23272	21069	21069	21069
Adjusted R^2	0.2997	0.3004	0.3004	0.4494	0.4504	0.457

Panel B. Manufacturing Firms Dependent variables: Receivables (columns 1–3) and Payables (columns 4–6)

	(1) Receiv.	(2) Receiv.	(3) Receiv.	(4) Payab.	(5) Payab.	(6) Payab.
INTERCEPT	0.00268***	0.0028***	0.36053***	0.078***	0.07662***	0.0624***
	30.85	31.76	37.75	14.78	14.31	11.02
D_Post	0.00033518***	0.00033116***	-0.0333***	-0.01445***	-0.01448***	-0.01366***
	3.03	3	-2.44	-2.22	-2.22	-2.1
D_Local	-0.00073732***	-0.0007485***	0.06147***	0.0473***	0.04772***	0.0514***
	-19.2	-19.49	14.13	20.15	20.27	21.43
Post x Local	-0.00044912***	-0.0004182***	0.03326***	0.01561***	0.01556***	0.01698***
	-3.76	-3.51	2.35	2.22	2.21	2.42
CFLOW	-4.822E-07	-5.755E-07	-0.0033	0.0000171	0.0000180	0.0000134
	-0.76	-0.91	-1.47	0.48	0.49	0.36
STD_TA	0.000761***	0.000750***	0.02378***	0.0325***	0.0326***	0.033***
	12.96	12.81	5.41	9.42	9.45	9.57
PURCH	0.000193	0.000254***	0.2723***	0.3299***	0.3297***	0.3330***
	1.75	2.3	29.17	49.96	49.83	50.35
AGE	0.000004***	0.000004***	-0.00002	0.00005***	0.00006***	0.00012***
	9.47	9.14	-0.46	1.98	2.29	4.2
L_SIZE	-0.0002405***	-0.0002536***	-0.02172***	-0.0064***	-0.0063***	-0.0070***
	-41.66	-42.52	-28.75	-17.98	-17.12	-18.52
CARPOS		0.0006069***	-0.0054		-0.000500	0.00323
		8.18	-0.46		-0.1	0.67
CARNEG		0.000183***	0.01668***		-0.0110***	-0.0114***
		2.36	2.15		-2.26	-2.34
FGNSALES			-0.000457***			0.00021***
			-10.4			7.57
N	11611	11611	11611	10737	10737	10737
Adjusted R^2	0.1502	0.1739	0.1938	0.2881	0.2883	0.292

Note. This table reports fixed effects regressions of receivables and payables on earthquake exposure variables and firm controls, pooling firms from Chile, Peru, Italy, Spain, Turkey, and Greece. Panel A includes all firms, while Panel B includes only manufacturing firms. Values in parentheses are t-

statistics. Receivables are defined as accounts receivable over total sales. Payables are defined as accounts payable over total assets. Dependent variables: Receivables = accounts receivable/total sales; Payables = accounts payable / total assets. Key variables: D_Post = 1 for quarters after the earthquake, zero otherwise. D_Local = 1 for Chile, Italy, and Turkey; 0 for Peru, Spain, and Greece. Post × Local = interaction of D_Post and D_Local. CARPOS = 1 if the firm exhibited positive CARs after the quake; 0 otherwise. CARNEG = 1 if the firm exhibited negative CARs after the quake; 0 otherwise. Controls: CFLOW = net income + depreciation/sales; STD_TA = short-term debt/assets; PURCH = COGS/assets; AGE = firm age; LSIZE = log total assets; FGNSALES = foreign sales/sales. Estimation method: firm fixed effects. Significance levels: $p<0.10$, *$p<0.05$, **$p<0.01$.

3.6. Robustness Checks

To address the heterogeneity in earthquake exposure suggested by the reviewer, we explored several approaches to capture firm-level impact. First, we calculated the distance between each firm's reported domicile and the epicenter of the main shock. However, this variable proved to be a poor proxy, as most publicly traded firms are domiciled in the capital city—where customers as well as financial and regulatory institutions are located—while their production facilities are often dispersed across regions. Second, we tested a measure of labor intensity, defined as the ratio of employees to total assets, under the assumption that firms with higher human-capital intensity might be more vulnerable to operational disruption. This variable was statistically insignificant across specifications. Third, we manually reviewed quarterly reports and CEO letters for Chilean firms following the earthquake to identify qualitative references to physical damage or production interruptions. These narratives were inconsistent and largely anecdotal. Finally, we collected Google News counts for each firm in the weeks before and after the event to approximate public attention or disruption signals; these results were also inconclusive. While country-level statistics exist on fatalities, population affected, and total economic losses, such data cannot be reliably linked to individual firms. Overall, these exercises confirm that the idiosyncratic nature of earthquake damage and the limited availability of granular firm-level data preclude a consistent measure of direct physical exposure. Accordingly, we rely on market-based reactions (CARs) as an unbiased, comprehensive reflection of investors' assessment of firm-specific and systemic effects.

4. Discussion and Implications

In the aftermath of an exogenous shock such as an earthquake, firms may be affected positively, negatively, or may remain largely unscathed. Regardless of direct exposure, firms often must adjust their trade credit policies for strategic reasons. This study addresses these issues through a two-step approach. First, the event study provides an unbiased measure of the earthquake's impact that captures both positive and negative effects. Second, this information is incorporated into a Difference-in-Differences estimation to disentangle firm-level behavioral responses from confounding macroeconomic influences.

Findings underscore the heterogeneity of firm responses. Earthquakes significantly affected only a minority of firms, and the direction and magnitude of effects varied widely. The most notable changes in trade credit behavior occurred among firms experiencing substantial shifts in market valuation. Resilient firms (CARPOS) often reduced both receivables and payables, suggesting a strategic tightening of credit terms, liquidity preservation, or reputational signaling. In contrast, vulnerable firms (CARNEG) tended to expand receivables—likely to sustain sales or offset reduced access to bank credit—and in some cases, also increased payables, reflecting liquidity stress or supplier forbearance. These patterns are not uniform across industries. In manufacturing, where trade credit is central to supply chain resilience, the effects were more pronounced. Interestingly, firm multinationality did not yield consistent results, although it helped capture some dynamics of trade credit adjustments.

Cross-country comparisons reveal that cultural, economic, and institutional factors may shape these responses. According to Hofstede (2005), Chile's moderate collectivism may foster reliance on trusted networks and relational credit extension. Chile's open and export-oriented economy further incentivizes firms to maintain trade credit relationships to preserve foreign markets. Türkiye, characterized by high uncertainty avoidance and collectivism Hoang), exhibits strong trade credit provision as a substitute for constrained bank financing, particularly under persistent inflation. Italy, a developed and individualistic economy with deep financial markets, showed no evidence of CARNEG firms, consistent with its diversified credit channels.

Beyond these cultural explanations, regulatory enforcement and disaster preparedness emerge as additional institutional dimensions influencing firm outcomes. Türkiye, for instance, maintained strict seismic building codes on paper, yet enforcement gaps resulted in widespread non-compliance and infrastructure vulnerability. In contrast, Chile's institutional architecture—including agencies such as SERNAPRED—facilitates systematic risk management and rapid response. Future research could develop or employ proxies for the effectiveness of regulatory enforcement and preparedness (e.g., compliance indices, regional enforcement rates) to quantify how institutional robustness affects post-disaster financial behavior.

Similarly, integrating cultural and managerial variables directly into the econometric framework could enrich the analysis. Measures such as national uncertainty-avoidance scores, trust indices, or firm-level governance characteristics may help explain variation in trade credit adjustments beyond ex-post narrative interpretation. This approach would move the discussion from descriptive cross-country contrasts to an empirically testable framework that captures the interaction between culture, management practices, and financial resilience.

At the sectoral level, the results invite deeper exploration within manufacturing sub-industries. Disaggregating sectors such as construction, textiles, or food processing could reveal distinct supply chains and demand structures that drive heterogeneous trade credit responses. Construction firms, for example, may face direct physical damage and liquidity stress, whereas food-processing firms may experience temporary demand surges or logistics bottlenecks.

From a policy perspective, these findings highlight the importance of supporting trade credit flows in post-disaster recovery. Governments and financial institutions should consider mechanisms such as credit guarantees, supplier-financing programs, or emergency liquidity facilities to sustain credit relationships and prevent cascading liquidity bottlenecks. Such policies can both mitigate systemic disruption and facilitate recovery for firms facing increased demand. For firms, trade credit emerges not as a passive reaction but as a proactive instrument of resilience. Financially stronger or strategically agile firms can leverage trade credit to stabilize relationships, support partners, and gain a competitive advantage in disrupted environments. Companies operating in disaster-prone regions should therefore stress-test their working capital policies and incorporate trade credit management into broader risk and continuity planning.

Future research could extend this two-step methodology to other types of natural disasters (e.g., floods, wildfires) and explore the long-term persistence of post-disaster trade credit adjustments. Moreover, integrating environmental and social performance metrics into trade credit decisions, an emerging trend in sustainable supply chain finance, offers a promising avenue for aligning resilience with sustainability.

Funding: This research received no external funding,

Data Availability Statement: The firm-level financial and accounting data used in this study were obtained from FactSet, a subscription-based commercial database. Earthquake-related information was collected from publicly available sources cited in the reference list. All data were used in accordance with the terms and conditions of their respective providers.

Acknowledgments: The author thanks Davide Sanna for research assistance and Huan Kuang for comments on an earlier version of the paper.

Conflicts of Interest: The author declares no conflict of interest.

AI Use Statement: The author used ChatGPT (OpenAI) for grammar and language refinement. All content was carefully reviewed and verified by the author.

Appendix A

Appendix 1 – Variable definition.

Dependent Variables

RECEIV: Is the ratio of accounts receivable over total sales measured at the end of each quarter.

PAYAB: Is the ratio of accounts payable over total assets measured at the end of each quarter.

Main Explanatory Variables:

D_Post. For each pair of treatment/control countries, it is a dummy variable that takes the value of 1 for the 5 quarters after the earthquake hits and zero otherwise. It measures the time effect. Represents the average change in the control group over time (i.e., how much the outcome changes from pre- to post-treatment for the control group).

D_Local. It is a dummy variable that takes the value of 1 if the firm trades in the Chilean, Italian, or Turkish stock exchanges and zero otherwise. It measures the group effect. Represents the difference in the outcome between the treated and control groups before treatment.

P x T: Is an interaction variable, the product of D_Post times D_Local. Measures the causal effect of the treatment by capturing the extra change in the treated group relative to the control group after the treatment. This coefficient captures the difference in difference.

Control Variables:

CFLOW: Is the ratio of net income plus depreciation over total sales measured at the end of each quarter. It captures the internal cash flow generation of the firm.

STD_TA: Is the ratio of short-term debt over total assets measured at the end of each quarter. It represents each firm's reliance on short-term financing over its asset base.

PURCH: Is the ratio of Cost of Goods sold over total assets measured at the end of each quarter. It indicates the intensity of operational input over its asset base.

AGE: Is the age of each firm in years measured in the year of the earthquake? It is scaled in tables for easier reading.

L_SIZE: Is the logarithm of total assets measured in the year of the earthquake. It captures the relative size of each firm. It is scaled in tables for easier reading.

CARPOS: Dummy variable that takes the value of 1 if the firm exhibited positive and significant cumulative abnormal returns after the earthquake and zero otherwise. This dummy captures firms that were positively affected by the earthquake.

CARNEG: Dummy variable that takes the value of 1 if the firm exhibited positive and significant cumulative abnormal returns after the earthquake and zero otherwise. This dummy captures firms that were negatively affected by the earthquake.

FGNSALES: The ratio of foreign sales to total sales measured at the end of each quarter. This variable captures the multinationality of the firm. It is scaled in tables for easier reading.

All financial data is obtained from FactSet.

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