Testing the Quality Guarantee Theory of Trade Credit

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Abstract

While the theoretical role of deferred payment in trade credit as a product quality assurance mechanism has been established, empirical evidence remains scarce. This study provides the first large-sample causal evidence supporting this function. China's *Pilot Program of Insurance Compensation Mechanism (PPICM) for the First (Set of) Key Technological Equipment* enables equipment manufacturers to insure against quality defects, introducing an exogenous shock to product quality assurance mechanisms. Utilizing this policy initiative, we employ a difference-in-differences design to examine the impact of equipment insurance on trade credit provision. Our findings show that firms reduce trade credit to customers by 18.4% after insuring their equipment against quality defects. The reduction in trade credit is more pronounced among firms with weaker internal quality controls and those with stronger insurance coverage, consistent with equipment insurance substituting trade credit as a product quality guarantee mechanism. Our findings remain robust when we fully absorb unobserved time-varying supplier characteristics. Overall, this study provides empirical validation for the quality guarantee theory of trade credit.

Keywords: Trade credit, Product quality guarantee, Supply chain, Insurance contract

1. Introduction

Firms face significant uncertainties when commercializing early-stage products (Fernandes and Paunov, 2015; Grennan and Town, 2020). Given the limited market exposure of such products, their quality is a major concern for customers, as defects can trigger severe safety incidents or disrupt key production lines. Trade credit, commonly known as a mechanism for providing short-term liquidity, can serve to mitigate buyers' concerns about product quality. By allowing late payment after product delivery, trade credit affords customers the opportunity to evaluate product performance. This mechanism is formalized as the quality guarantee theory of trade credit (Deloof and Jegers, 1996; Lee and Stowe, 1993; Long et al., 1993; Smith, 1987). The case of Boeing provides a salient illustration of this explanation. Boeing experienced a significant increase in accounts receivable following the quality-control issues related to the 737 MAX crisis in 2018.

The quality guarantee theory aligns with several stylized facts about trade credit that are difficult to explain with existing theories. For instance, the literature finds that innovative firms, despite having uncertain cash flows, are major providers of trade credit, and that trade credit is often extended to financially unconstrained customers who are least likely to require liquidity support (Dass et al., 2015; Giannetti et al., 2011; Klapper et al., 2012; Murfin and Njoroge, 2015). Moreover, it offers a partial resolution to the puzzle of why customers tolerate the seemingly excessive costs of trade credit financing (Cuñat, 2007; Petersen and Rajan, 1995, 1994). However, despite its theoretical appeal, empirical support for the quality guarantee role of trade credit remains limited, largely due to challenges in identifying exogenous variations in product quality assurance. To bridge this gap, our study leverages a unique setting in China, where a policy initiative introduces a shock on product-quality insurance for suppliers.

To support the development of the high-end manufacturing industry, China's Ministry of Finance (MOF), Ministry of Industry and Information Technology (MIIT), and China Insurance Regulatory Commission (CIRC) jointly launched the Pilot Program of Insurance Compensation Mechanism (PPICM) for the First (Set of) Key Technological Equipment in February 2015.[1] This initiative targets manufacturers with certified equipment and valid sales contracts, offering government-subsidized insurance covering up to 80% of annual premiums for a maximum of three years.[2] Insurers provide customized policies that cover quality risks associated with first-of-its-kind technological products. In cases where quality defects result in financial losses, suppliers compensate affected customers, with insurance covering a portion of the payout.[3] By transferring a share of product quality risk to insurance providers, the PPICM alleviates the financial burden on both suppliers and customers, thereby enhancing the market viability of innovative equipment.

The PPICM provides a unique empirical setting to examine the role of trade credit as a quality guarantee mechanism. By introducing equipment insurance as a compensation tool, the program offers an alternative approach to mitigating product quality risks. For manufacturers quality risk insurance presents a cost-effective solution for covering liabilities arising from product defects. Typically, the benchmark insurance premium ranges from 2% to 3%, with the government subsidizing the majority of the cost for eligible firms, making the insurance highly attractive. Once products are insured, insurers assume both quality and liability risks in cases of defects, thereby safeguarding customers against potential production or sales disruptions. As a result, customers become less reliant on post-delivery quality inspections before payment. In essence, if trade credit

[1] The First (Set of) Key Technological Equipment refers to equipment, systems and core components with a major breakthrough in varieties, specifications or technical parameters through innovation, and intellectual property rights, but without market performance.
[2] For more details, please see: https://www.pkulaw.com/en_law/ec8090b2ed88fda4bdfb.html (accessed on April 16, 2024).
[3] For instance, Lanke Gaoxin compensated its customer, Yunnan Shihua, over 26 million CNY for product quality issues, with nearly half of the amount reimbursed through insurance claims.

was previously used to mitigate customer concerns about product quality, the availability of insurance diminishes the need for such assurance. Consequently, we hypothesize that supplier firms will extend less trade credit to customers once they secure equipment insurance under the PPICM.

Using a sample of publicly listed firms in China from 2011 to 2022, we employ a difference-in-differences (DID) approach to investigate how equipment insurance under the PPICM program influences trade credit provision of insured firms. The baseline regression reveals that firms extend less trade credit—measured as the ratio of accounts receivable to total assets—after insuring their equipment against quality defects. This finding suggests that equipment insurance substitutes for trade credit's role as a quality guarantee mechanism. Moreover, the effect is economically significant: after controlling for firm characteristics and firm- and year-fixed effects, the documented coefficient translates to an 18.4% reduction in trade credit provision among insured firms. A parallel trends analysis further confirms that the decline in trade credit does not occur prior to the purchase of equipment insurance, supporting a causal interpretation of our findings.

To further substantiate that the observed reduction in trade credit arises from its diminished role as a quality assurance mechanism, we conduct cross-sectional analyses based on suppliers' quality control capabilities and the strength of insurance contract terms. First, we hypothesize that suppliers with weaker quality control are more likely to rely on trade credit as a quality assurance tool because customers demand stronger guarantees when engaging with such firms. Consequently, the introduction of external insurance should lead to a more pronounced reduction in trade credit for these suppliers. We classify firms as having strong or weak quality control based on whether they have established a formal quality management system, maintained an integrity-focused corporate culture, or received quality-related certifications in the past three years. Consistent with

our expectations, firms with weaker quality control experience a significantly larger decline in trade credit after purchasing equipment insurance.

Second, we examine how the strength of insurance coverage influences trade credit provision. Firms with more comprehensive insurance policies—such as those receiving central government subsidies, repeatedly insuring their equipment, or securing multiple contracts in a single subscription year—are better positioned to mitigate quality risks externally. As a result, these firms rely less on trade credit as a quality guarantee tool. Our analysis, which leverages detailed insurance contract data, confirms that the reduction in trade credit is more pronounced among firms with stronger insurance coverage. Collectively, these findings support the notion that the decrease in trade credit is driven by a reduced need for its quality assurance function, as insurance effectively addresses customers' concerns about product quality.

One potential concern is that selection into insurance contracts following the introduction of the PPICM might be correlated with the extension of trade credit, thereby challenging causal inferences regarding the effect of insurance. We employ three approaches to address this concern. First, we use an instrumental variable approach that exploits the institutional mandate of the PPICM: the eligibility to purchase insurance depends on the certification of the First (Set of) Key Technological Equipment, which is determined by objective technical parameters. Thus, this certification is closely related to the probability of purchasing insurance while not being directly linked to trade credit extension, qualified as a valid instrumental variable. Using a two-stage least squares (2SLS) procedure, we obtain results that are consistent with our baseline findings.

Second, to mitigate concerns that certification itself, rather than insurance, might drive differences in trade credit, we restrict our analysis to firms with certified equipment. This restriction ensures greater comparability between insured and non-insured firms with respect to

technical characteristics. Our results show that, among firms with certified equipment, those with insurance extend significantly less trade credit than those without, suggesting that the observed decline in trade credit provision is not driven solely by certification.

Third, to further address selection bias stemming from potential differences between insured and non-insured suppliers, we conduct a within-supplier analysis using supplier-customer pair-level data. This data allows us to compare trade credit extended to customers purchasing insured (covered) versus non-insured (non-covered) products from the same insurance-adopting supplier. By controlling for supplier-year fixed effects, we absorb all time-varying supplier characteristics, effectively isolating the effect of equipment insurance from unobserved supplier traits. Our results reveal that insured suppliers extend significantly less trade credit to customers purchasing covered products compared to non-covered ones, further reinforcing the substitution effect between insurance and trade credit as quality guarantee mechanisms.

Finally, we conduct additional tests to ensure the robustness of our findings. Using a stacked DID approach and the method proposed by Callaway and Sant'Anna (2021), we confirm that our results remain robust even when accounting for heterogeneous treatment effects. Our findings are also consistent across alternative sample selections, including simple matching procedures, propensity score matching (PSM), and entropy balancing approaches. Furthermore, our results are robust to alternative measures of trade credit provision and restricting our sample to shorter time windows to control for potential confounding events.

Our paper makes several important contributions to the literature. First, this study provides the first large-sample empirical evidence supporting the quality guarantee theory of trade credit, advancing research on the multifaceted roles of trade credit. Prior work has primarily focused on its financial and transactional functions (Carbó-Valverde et al., 2016; Ersahin et al., 2024; Garcia-

Appendini and Montoriol-Garriga, 2013; Giannetti et al., 2011; Petersen and Rajan, 1997). Despite the early theoretical discussions on the quality guarantee role of trade credit (Lee and Stowe, 1993; Smith, 1987), it has not been thoroughly examined using large-sample evidence and comprehensive empirical methodologies. Leveraging a unique policy experiment in China, we demonstrate that equipment insurance significantly reduces suppliers' reliance on trade credit, thus validating the quality guarantee role of trade credit.

Second, our study contributes to the literature on relationship-specific investment (RSI) by highlighting alternative solutions to quality-related challenges (Grossman and Hart, 1986; Hart and Moore, 1990; Klein et al., 1978; Williamson, 1985). High-end equipment, a key form of RSI, is crucial for long-term supplier-customer relationships but faces strict quality requirements and inspections. The difficulty in defining quality metrics can lead to underinvestment in quality-enhancing RSIs, especially for innovative technologies (Dyer, 1996; Masten, 1984). Prior research has explored contractual, relational, and hybrid governance mechanisms to address this issue (e.g., Baker et al., 2002; Cachon and Lariviere, 2005). By examining the interaction between trade credit and equipment insurance, we reveal the role of quality guarantee mechanisms in supporting quality-related RSIs, thereby facilitating product commercialization, innovation, and supply chain stability.

Finally, our study contributes to the literature on financial intermediaries by shifting the focus to insurance companies. While existing research has predominantly examined the roles of banks, auditors, analysts, media, and underwriters (e.g., Allee and Wangerin, 2018; Gustafson et al., 2021; Hansen and Torregrosa, 1992; Miller, 2006; Yu, 2008), we highlight an underexplored dimension: the risk-sharing function of insurers in product markets. We show that product insurance can serve as a substitute for trade credit, providing quality guarantees and facilitating equipment transactions.

Additionally, we offer valuable insights for policymakers in designing innovative insurance policies to mitigate quality risks and promote technological advancement.

2. Literature Review

Trade credit constitutes the most important source of external finance for firms globally, particularly in emerging economies with underdeveloped financial markets (Fisman and Love, 2003; Levine et al., 2018). While its financing role is well-documented, trade credit imposes significant costs on suppliers. Late payments exacerbate liquidity risks and financial constraints, especially for small firms with limited access to external financing (Barrot, 2016; Greway et al., 2024). During economic crises, trade credit amplifies systemic risks by propagating financial distress through supply chains, as firms default on payment obligations (Boissay and Gropp, 2013; Jacobson and von Schedvin, 2015; Kiyotaki and Moore, 1997). Furthermore, the provision of trade credit can also impose real costs on financially constrained suppliers, such as crowding out investment and employment opportunities, which in turn restricts suppliers' growth (Barrot and Nanda, 2020; Murfin and Njoroge, 2015).

Given the high opportunity cost of trade credit provision, extant literature has proposed several explanations on why suppliers provide trade credit to customers. On the one hand, suppliers utilize the advantage in capital access to transfer credits to customers as an intermediary. Previous literature suggests that suppliers have advantages over banks and other financial institutions in terms of information acquisition (Biais and Gollier, 1997; Smith, 1987), ability of collection and control (Burkart and Ellingsen, 2004; Cuñat, 2007; Giannetti et al., 2011), and asset liquidation (Maksimovic and Frank, 2005; Mian and Smith, Jr., 1992). When customers have limited access to financial markets, unconstrained suppliers can redistribute liquidity to support constrained customers to sustain supply chain stability (Carbó-Valverde et al., 2016; Ersahin et al., 2024;

Garcia-Appendini and Montoriol-Garriga, 2013). On the other hand, firms provide trade credit for transactional incentives (see Giannetti et al., 2011 for a review). Trade credit can separate exchange of goods and transferring of cash, which permits a reduction of precautionary cash holdings of customer and enables suppliers to have a correct expectation of cash inflows, thus reducing the costs in the transaction (Ferris, 1981). Besides, suppliers with monopoly power engage in price discrimination through trade credit (Brennan et al., 1988; Petersen and Rajan, 1997). Firms can also utilize trade credit as a competitive tool to capture customers (Fisman and Raturi, 2004; Giannetti et al., 2021).

Trade credit, in particular, can serve as guarantee when customers face quality-related risks. The quality uncertainty emerges from the nature of the transacted product information asymmetries inherent in buyer-supplier relationships. By offering deferred payment terms, suppliers signal product reliability, while customers gain protection against defective goods (Deloof and Jegers, 1996; Lee and Stowe, 1993; Long et al., 1993; Smith, 1987). This role is particularly vital for small firms, high-risk industries, and complex products, where trust and quality assurance are critical to sustaining transactions. Despite these developments, critical gaps persist. First, while the quality guarantee role of trade credit is theorized, empirical identification remains scarce due to endogenous quality measures. Second, the interaction between trade credit and alternative risk-sharing instruments—such as insurance—remains underexplored, particularly in technology-intensive industries where quality risks are acute.

3. Institutional Background

The high-end manufacturing industry is a subset of the manufacturing industry that focuses on products and equipment comprising of advanced technologies, including aerospace, high-speed railways, nuclear power, large-scale hydraulic equipment, semiconductors, and new energy,

among others. These industries contribute significantly to economic growth and job creation in both the manufacturing sector and ancillary industries. However, the development of the high-end manufacturing industry is accompanied by various uncertainties in both innovation and commercialization stages. Due to the inherent technological complexity of high-end equipment, its actual performance may deviate from the quality benchmarks established during research and development. Such discrepancies heighten operational risks, particularly in the early stages of commercialization, where quality failures can result in substantial economic losses for both manufacturers and end-users.

To mitigate these risks and facilitate market entry for high-tech equipment, China's three ministries, MOF, MIIT, and CIRC, jointly issued a notice on carrying out the PPICM for the First (Set of) Key Technological Equipment in February 2015. The policy seeks to mitigate product quality risks associated with the initial market introduction and operation of the high-end equipment. Specifically, the PPICM involves four types of stakeholders. The *producer* and the *user* are the two sides of the transaction for the First (Set of) Key Technological Equipment. The *insurance company* provides customized comprehensive insurance for the First (Set of) Key Technological Equipment to cover quality and liability risks. And the *government* offers subsidies for insurance premiums to eligible producers to enhance risk coverage and promote the market adoption of high-end equipment.

The PPICM is implemented in accordance with the following procedures. First, the government formulates and releases the catalogue of the First (Set of) Key Technological Equipment (Catalogue) each year. The Catalogue specifies the product name, key technical parameters, and the field of the First (Set of) Key Technological Equipment. High-end products and equipment included in the Catalogue are characterized by high technology content, energy

efficiency, environmental friendliness, and have not yet entered the market. An eligible producer with equipment products achieving or exceeding the key technical parameters in the latest Catalogue can apply for the certification of the First (Set of) Key Technological Equipment. Then the local government announces the list of certified equipment after conducting verifications and screenings.

Second, an eligible producer with certified equipment products can independently purchase customized comprehensive insurance for the sold First (Set of) Key Technological Equipment and the users shall be the insurance beneficiaries[4]. The insurance company decides whether to underwrite the insurance, and if so, whether to underwrite it independently or as part of a coinsurance body. The customized comprehensive insurance is designed by the insurance company based on the model clauses uniformly formulated by the Insurance Association of China (IAC) and the specific risks of the key technological equipment[5]. Specifically, the comprehensive insurance covers both the quality risk and the liability risk due to quality defects of products. The insurance company should, according to the insurance contract, settle the claims when users request to repair, replacement, and return of the insured products due to quality defects or when users experience property loss and personal injury risk arising from quality defects of insured products. The benchmark insurance premium rate is usually set at 2%-3%.

Third, the insured producer of the key technological equipment shall submit insurance premium subsidy applications to the MIIT via the local authority or central-state-owned group

[4] Some local governments carry out the certification of the First (Set of) Key Technological Equipment on the products of enterprises according to the central or local Catalogues each year. The certification goes through the process of enterprise application, expert review and government publicity.

[5] The insurance contract typically includes clauses related to insurance liabilities and exclusions, insurance period, premium, liability limits and deductibles, claims settlement, and obligations of the insurer, applicant, and insured. Based on general model clauses for equipment insurance designed by IAC (see https://www.iachina.cn/art/2019/12/5/art_94_103991.html), insurance companies design customized insurance contract for applicants with different First (Set of) Key Technological Equipment. We provide a part of the model clauses for equipment insurance of vessels designed by an insurance company in Appendix C. For the complete version, please see: https://www.cpic.com.cn/upload/resources/file/2021/08/23/59552.pdf.

companies within the stipulated time. Applications are reviewed by industry associations and experts, with final recommendations made by the MIIT. The MOF arranges and grants subsidies to the recommended producers up to 80% of the actual annual insurance premium and the subsidies are available for up to three years.

The high-end equipment insurance is the second major category of insurance supported by the central government through premium subsidies, following agricultural insurance. The insurances and premium subsidies have grown rapidly since the PPICM implemented. By 2021, the central government had allocated a total of 10.3 billion CNY in fiscal funds to subsidize the insurance premiums for approximately 250 billion CNY worth of First (Set of) Key Technological Equipment[6]. And more than 400 firms received insurance subsidies at least once between 2015 and 2021. Besides, some local governments also conduct local PPICM and grant subsidies to the local eligible applicants that do not receive central subsidies[7]. Hebei provincial government, for example, provided a total of approximately 170 million CNY in provincial fiscal premium subsidies for over 1,534 units (sets) of the First (Set of) Key Technological Equipment, with a combined value about 7 billion CNY before 2020[8].

4. Data, Sample, and Research Design

4.1 Sample and data

Our initial sample includes all firms listed in China's A-share market between 2011 and 2022. We obtain data on firms' financial characteristics from the China Stock Market & Accounting

[6] The data is from the China Financial and Economic News and forwarded by MOF. Please see: https://www.mof.gov.cn/zhengwuxinxi/caijingshidian/zgcjb/202203/t20220317_3795917.htm (accessed on July 27, 2024).
[7] Based on our manual data collection, regions including Anhui, Beijing, Chongqing, Gansu, Hebei, Henan, Heilongjiang, Jilin, Jiangsu, Jiangxi, Liaoning, Inner Mongolia, Ningxia, Shandong, Sichuan, and Zhejiang had implemented local PPICM before 2022.
[8] The data is from the Insurance Association of Hebei. Please see: http://he.people.com.cn/n2/2020/0727/c192235-34186933.html (accessed on December 28, 2024)

Research database (CSMAR). Following prior research, firms listed in the financial industry are excluded (China Securities Regulatory Commission (CSRC) code J). We also exclude firm-year observations that are specially treated by CSRC. We further exclude observations whose fundamental data needed to calculate trade credit provision and other variables are missing.

We use the following steps to identify the purchase of equipment insurance for the firms in our sample. First, we manually collect detailed information on the equipment insurance, including the insured producer, the product name of high-end equipment, the user, and the insurance company, from the premium subsidy lists published on the official websites and media[9]. Specifically, we obtain national premium subsidy lists from MIIT and provincial lists from local departments of industry and information technology or finance bureaus, respectively. It is worthy noting that, since insured eligible producers typically meet the criteria for subsidy applications, most of them can receive premium subsidies once they apply. Rational managers should therefore apply for these subsidies to reduce insurance costs. Next, we match the names of the insured producers precisely with the names of listed firms or their holding subsidiaries. A firm is defined as insured producer if it insured its high-end equipment against quality defect during the sample period. For each insured firm, we identify the year in which the firm is required to insure its equipment before applying premium subsidies from the government and use this year as the year of the onset of insurance. Finanly, we require an insured (non-insured) firm with at least one observation before and after the insurance subscription year (the PPICM), respectively. This procedure yields a sample of 25,921 firm-year observations and 2,427 unique firms from 2011 to 2022. Particularly, the final sample consists of 2,040 firm-year observations from 206 insured firms.

[9] There exists missing data on the identities of the user and the insurance company.

4.2 Empirical design

To investigate how equipment insurance affects trade credit provision, we specify the following generalized difference-in-difference (DID) model:

$$TC_{it} = \alpha + \beta_1 InsuredPost_{it} + \beta_2 Insured_i + \gamma X_{it-1} + Fixed\ Effects + \varepsilon_{it} \quad (1)$$

where *i* represents firm and *t* represents year. The dependent variable, trade credit provision (*TC*), is defined as the ratio of accounts receivable scaled by total assets (Petersen and Rajan, 1997). *Insured* is a dummy variable that equals 1 if a firm maintains insurances on its First (Set of) Key Technology Equipment during the sample period, and zero otherwise. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the insured firm maintains the equipment insurance, and zero otherwise.

We include a vector of control variables, *X*, that have been shown to affect trade credit provision in previous literature (e.g., Barrot, 2016; Dass et al., 2015; Giannetti et al., 2011). Specifically, we control for firm size (*Size*), financial leverage ratio (*Levb*), growth opportunities (*MB*), profitability (*ROA*), the ratio of fixed assets to total assets (*Fixta*), operating cash flow (*OCF*), the fraction of shares held by the largest shareholder (*Top1*), the equity nature (*SOE*), and the firm age (*Lnage*). Appendix A provides detailed descriptions of these variables. To alleviate the concerns of omitted variable bias, we also include industry and year fixed effects to account for time-invariant industry-specific characteristics and time trends that drive our results. We further include firm fixed effects throughout our empirical analyses to control for unobservable time-invariant firm characteristics that may affect trade credit provision. The coefficient β_1 captures the impact of the equipment insurance on trade credit provision of the insured firms.

4.3 Summary statistics

Table 1 summarizes the descriptive statistics for the main variables. To address potential influences caused by outliers, we winsorize continuous variables at the 1% and the 99% levels, respectively. The dependent variable, *TC*, has a sample average of 0.114 and a standard deviation of 0.102. Observations from the insured firms represent 7.9% of the total sample. In addition, the observations have a mean firm size of 22.31, a mean leverage of 45.2%, a mean fixed assets of 21.6%, a mean market-to-book ratio of 3.65, a mean ROA of 2.6%, a mean operating cash flow of 4.1%, a mean proportion of the largest shareholder of 32.7%, a mean state-owned enterprise of 40.7%, and a mean firm age of 13.32.

[Insert Table 1 Here]

5. Empirical Results

5.1 Baseline results: the insurance effect on trade credit provision

Table 2 presents the empirical results for our baseline analysis which examines the effect of the equipment insurance on trade credit provision. Column (1) reports the estimation results of the DID regression model as specified in Equation (1) when we include the industry and year fixed effects. Column (2) reports the results when we include the control variables. The estimated coefficients on *Insured* are positive and statistically significant at the 1% level in both columns, suggesting that insured firms provide more trade credit to their customers than those non-insured firms. These results are consistent with the quality guarantee role of trade credit as the insured firms are almost the producers of high-end equipment products and customers greatly concern about the product quality because of sophisticated technological content and substantial capital requirements. More importantly, the estimated coefficients on *InsuredPost* are both negative and

significant at the 1% level, suggesting that compared to non-insured firms, insured firms provide less trade credit after insuring their equipment products. We further include firm fixed effects in Columns (3) and (4) to control for unobservable time-invariant firm characteristics that may affect the trade credit provision. The estimated coefficients on *InsuredPost* remain significantly negative at the 1% level. The effect of *InsuredPost* is also economically sizable. For example, the estimated coefficient on *InsuredPost* is -0.021 (*t*=-5.21) in Column (4), suggesting that the insured firms provide 18.4% (=-0.021/0.114) less trade credit after insuring their equipment compared to the control group without equipment insurance.

With respect to the control variables, the signs of the coefficients are largely consistent with those in prior literature (e.g., Wu et al., 2014). Trade credit provision is negatively associated with size, growth opportunities, tangibility and operating cash flow, and positively associated with leverage and profitability.

[Insert Table 2 Here]

We further conduct a parallel trends test to verify the validity of our DID approach, which necessitates that there should be no significant difference in the trend of trade credit provision between insured firms and non-insured firms before insurance. Specifically, based on the baseline model, we decompose the independent variable *InsuredPost* into indicators for years surrounding the equipment insurance to illustrates the dynamic insurance effects on trade credit provision. We use the year immediately before equipment insurance as the benchmark year and estimate the following dynamic model:

$$TC_{it} = \alpha + \sum_k \beta_k Insured_{it}^k + \gamma X_{it-1} + Fixed\ Effects + \varepsilon_{it} \quad (2)$$

where *k* is the indicator for the year surrounding the equipment insurance. We include five or more years before, four years before, three years before, and two years before ($Insured^{-5}$, $Insured^{-4}$,

Insured^{-3}, *Insured*$^{-2}$) as well as the year of, one year after, two years after, three years after, four years after, and five or more years after (*Insured*^{0}, *Insured*$^{+1}$, *Insured*$^{+2}$, *Insured*$^{+3}$, *Insured*$^{+4}$, *Insured*$^{+5}$) the onset of the equipment insurance.

We report the empirical results for the dynamic model in Table 3 and plot the estimated coefficients and corresponding confidence intervals of *Insured*^{k} in Figure 1. All the coefficients for the variables indicating the pre-insurance periods (*Insured*$^{-5}$, *Insured*$^{-4}$, *Insured*$^{-3}$, and *Insured*$^{-2}$) are statistically insignificant, suggesting there is no significant difference in the level of trade credit provision (*TC*) between the insured firms and the non-insured group prior to the equipment insurance. Hence, our DID analysis satisfies the parallel trends assumption. Instead, the indicators in the post-insurance periods (*Insure*^{0}, *Insured*$^{+1}$, *Insured*$^{+2}$, *Insured*$^{+3}$, *Insured*$^{+4}$, and *Insured*$^{+5}$) are all negative and statistically significant at the 1% level, suggesting the insured firms provide less trade credit to their customers relative to the non-insured control group only in the post-insurance period when they insured their equipment products.

[Insert Table 3 Here]

[Insert Figure 1 Here]

Taken together, these empirical results show that the insured firms provide less trade credit after insuring their high-end equipment products against quality defects, suggesting a substitution relationship between the equipment insurance and trade credit in providing quality guarantee in the product market.

5.2 Cross-sectional tests

We propose that trade credit and equipment insurance serve as mutually substitutive role of quality guarantee in the product market and document a decrease in firms' trade credit provision after insuring their equipment against quality defects. In this section, we perform several cross-

sectional tests to provide implications for the economic mechanism through which equipment insurance affects trade credit provision, which in turn help to confirm the quality guarantee role of trade credit.

We start by investigating how suppliers' quality control capabilities and customers' demand for quality guarantee affects the insurance effect on insured suppliers' trade credit provision. Intuitively, customers should demand more quality guarantee from their suppliers when they concern more about the quality issues. As the equipment insurance is designed to alleviate such concerns, we expect the insurance effect on trade credit provision is more pronounced when the quality concern from customers is higher. To this end, we measure the quality concern of customers based on the quality-control capabilities of the equipment producer. Specifically, we construct three proxies, *Qsystem*, *Qculture* and *Qhonor*, to measure the quality-control level of a firm in a given year[10]. *Qsystem* equals 1 when the firm has set up a formal quality management system over the past three years, and zero otherwise. *Qculture* equals 1 if the firm has maintained an integrity-focused corporate culture in business operations over the past three years, and zero otherwise. And *Qhonor* equals 1 if the firm has received quality-related certifications over the past three years, and zero otherwise. Firms with great quality-control capabilities provide a positive signal of the quality on their products and services, and their customers therefore should concern less for the quality risk. We first examine the effect of these quality-control capabilities on trade credit provision, including the control variables in the baseline model. We report the results in the first columns in Panel A, B and C of Table 4 and the coefficient estimates for the three quality-control capabilities are all significantly negative, indicating firms with quality-control capabilities are required less trade credit from their customers.

[10] We obtain data on the product quality management system, integrity management philosophy, and product quality certification and honor of a firm from the Chinese Research Data Services Platform (CNRDS) database.

Then, we split observations into subsamples with strong and weak quality concern based on these three quality-control capabilities and compare the respective insurance effect in these subsamples. Table 4 reports the regression results. The coefficient estimates for *InsuredPost* are both negative and statistically significant in Columns (2) and (3) in Panel A, while the coefficient difference is significant at the 1% level, suggesting a more pronounced insurance effect in firms without a management system on product quality. Similar findings are shown in Columns (2) and (3) in Panel B and C. Taken together, the results in Table 4 suggest that customers concern more about quality issues for firms without quality-control capabilities and demand more trade credit, and the substitution effect of equipment insurance on trade credit provision to assure product quality is more pronounced among such firms.

[Insert Table 4 Here]

We proceed to investigate how the strength of quality guarantee affects the insurance effect on trade credit provision. Due to the differences in the insurance contracts and premium subsidies, the strength of quality guarantee varies across the equipment insurance. And Firms with higher strength of quality guarantee can provide better risk sharing. We hence expect the insurance effect on trade credit provision to be more pronounced when the equipment insurance provides stronger strength of quality guarantee for customers. To this end, we exploit the detailed data on the equipment insurance to capture the guarantee strength.

Specifically, we first expect a stronger insurance effect on centrally subsidized insured firms compared to locally subsidized ones. Equipment qualified for premium subsidies from the central government is, compared to the locally subsidized ones, required to reach top international or domestic technical levels, which features more complex technologies and higher market values that expose clients to greater potential quality risks. Therefore, with the support of central

government finances, insured firms can provide stronger quality guarantee to their clients. We decompose the independent variable *InsuredPost* into two binary variables *InsuredPost_State* and *InsuredPost_Province* to indicate the source of the premium subsidy. *InsuredPost_State* (*InsuredPost_Province*) equals 1 for observations after the firm maintains equipment insurance subsidized by the central (local) government, and zero otherwise. We then compare the respective insurance effects. The results in Column (1) of Table 5 show that trade credit provision decreases by 25.4% (10.5%) for central (local) subsidized firms after insuring their high-end equipment. The Wald test shows that the difference in the coefficients is significant, suggesting the insurance effect is stronger for centrally subsidized equipment insurance.

Second, we expect the insurance effect to be stronger when firms repeatedly insured their equipment across different years. Firms can either renew insurance for previously insured equipment or purchase new insurance for recently certified equipment that has not been insured before. Regardless of the type of new insurance, repeatedly insured firms need to reobtain the endorsement from both the insurance companies and the government. Thus repeatedly insured firms can provide their customers with stronger risk sharing through longer insurance periods or guaranteeing quality for more equipment products. Empirically, we decompose the independent variable *InsuredPost* into two binary variables *InsuredPost_Repeat* and *InsuredPost_Once* to indicate whether a firm repeatedly purchase equipment insurance during the sample period. *InsuredPost_Repeat* (*InsuredPost_Once*) equals 1 for repeatedly (one-time) insured firms after insuring their equipment, and zero otherwise. We compare the respective insurance effects and report the results in Column (2) of Table 5. Repeatedly (one-time) insured firms experience a 23.7% (9.6%) decline in trade credit provision after purchasing the equipment insurance and the

coefficient difference is statistically significant, suggesting the insurance effect is stronger on repeatedly insured firms.

Third, we expect the insurance effect to be stronger when the insured firms hold more insurance contracts during the first subscription year. Firms with multiple insurance and multiple customers as the insurance beneficiary can provide quality guarantee for more equipment products and customers, thereby substituting a larger amount of trade credit used for quality guarantee. We construct two binary variables, *InsuredPost_Moreins* and *InsuredPost_Oneins*, indicating whether a firm hold multiple insurance contracts during the first subscription year. *InsuredPost_Moreins* (*InsuredPost_Oneins*) equals 1 for observations after a firm subscribes multiple (one) insurance contracts, and zero otherwise. As shown in Column (3) of Table 5, firms subscribing multiple (one) insurance contracts experience a 23.7% (14.9%) decline in trade credit provision after insuring against product defects. This suggests that firms with insurance for more equipment products and more customers against product defects provide less trade credit.

Taken together, the above results suggest that firms can provide customers with stronger strength of quality guarantee through insurance with central premium subsidies, repeat insurance, multiple insurance contracts, insurance related to multiple customers and insurance underwritten by multiple insurance companies, and customers in turn require less trade credit as quality guarantee.

[Insert Table 5 Here]

5.3 Endogeneity tests

One potential concern is that selection into insurance contracts following the introduction of the PPICM might be correlated with the extension of trade credit, thereby challenging causal

inferences regarding the effect of insurance. In this section, we try to address potential endogeneity concerns by conducting three tests.

First, we adopt an instrumental variable approach using a 2SLS procedure. The institutional mandate of the PPICM requires that, before insuring the equipment, the insured company must complete the certification of the First (Set of) Key Technological Equipment initiated by the government. It should be emphasized that the certified equipment is required to achieve or exceed advanced technical parameters specified in the Catalogue but have no market performance. Therefore, we employ *CertedPost*, a dummy variable indicates whether a firm certified its equipment, as our instrumental variable. The rationale is that the insurance company can only underwrite certified equipment according to the PPICM and the certification is closely related to the probability of purchasing insurance while not being directly linked to trade credit extension. To implement the first-stage regression, we manually collect data on the list of the eligible firm with certified equipment and match the producer's name precisely with the names of listed firms or their holding subsidiaries. We then define a binary variable, *CertedPost*, equals 1 for observations after the firm acquires the certification of the First (Set of) Key Technological Equipment. We then compute the fitted probability of holding the equipment insurance from the regression with the instrumental variable and all the control variables in the baseline model. In the second stage, we regress trade credit provision, *TC*, on the fitted value of equipment insurance position (*Fitted InsuredPost*) from the first-stage regression and all control variables in the baseline model.

The regression results of the two-stage procedure are reported in Table 6. Column (1) shows that the coefficient on *CertedPost* is positive and significant, consistent with our expectation that firms are more likely to insure their equipment if their equipment is certified as the First (Set of)

Key Technological Equipment. Column (2) shows that the coefficient on the instrumented *InsuredPost* remains negative and statistically significant. The Kleibergen-Paap rk LM statistic for the model is 165.96 (p-value < 0.001), which rejects the null hypothesis that the model is underidentified. The Cragg-Donald Wald F statistic is 12558.23, which is much larger than the value of Stock-Yogo 10% maximal IV size, suggesting that weak instrument problem is not a concern.

[Insert Table 6 Here]

Second, we use a sub-sample comprising only firms with certified equipment to further mitigate the concern that certification itself, rather than insurance, might drive differences in trade credit. To mitigate this concern, we limit the sample to firms with certified equipment during the sample period to ensure greater comparability between insured and non-insured firms with respect to technical characteristics and other characteristics. Then we re-estimate the baseline model based on this sub-sample and report the results in Table 7. It shows that the estimated coefficient on *InsuredPost* remains statistically negative despite a marginal decrease from 0.021 to 0.014. This suggests that insured firms, compared to non-insured firms with certified equipment, entend less trade credit to their customers after insuring their equipment.

[Insert Table 7 Here]

Third, we use detailed supplier-customer pair data to address concerns that our results may be driven by unobserved differences between insured and non-insured suppliers. Insured suppliers offer both insurance-covered and non-covered products, which allows us to compare trade credit extended to customers purchasing covered versus non-covered products within the same supplier-year. To this end, we collect detailed information on customers' identities of the insured equipment from the premium subsidy lists published on the official websites and media. We also hand-collect

a sample that captures pairwise trade credit relationships between individual suppliers and customers from the notes in financial reports. We then merge the pair of the insured supplier and the guaranteed customer (i.e., user of insured equipment) with the detailed amount of trade credit between the two counterparties during [-4, +4] window surrounding the insurance subscription year. We also include data on the amount of trade credit between the insured supplier and the non-guaranteed customer (i.e., user of non-insured product) for the same period. The paired sample consists 1,866 pair-year observations, including 115 observations from 34 pairs of insured supplier–guaranteed customer and 1,751 observations from 752 pairs of insured supplier–non-guaranteed customer. Figure 2 displays the time-series trend of average ratio of trade credit scaled by the supplier's assets surrounding the purchase of the equipment insurance. The trade credit between the insured supplier and non-guaranteed customer remains stable surrounding the purchase of equipment insurance. In contrast, the average trade credit provision from insured suppliers to guaranteed customers before insuring is much higher than that to non-guaranteed customers. While it decreases sharply right after suppliers insured their equipment products. We further use the paired sample and examine the insurance effect on trade credit provision based on the following model:

$$TCPair_{pt} = \alpha + \beta_1 InsuredpairPost_{pt} + Fixed\ Effects + \varepsilon_{pt} \quad (3)$$

where *p* represents the supplier-customer pair and *t* represents year. The dependent variable, trade credit provision (*TCPair*), is the ratio of trade credit between the supplier and the customer scaled by the supplier's total assets. *InsuredpairPost* is a dummy variable that equals 1 for pair-year observations after the insured supplier purchase insurance for the equipment sold to the customer, and zero otherwise. We include supplier-customer pair fixed effects to capture time invariant characteristics of the supplier and customer as well as bilateral supplier-buyer relationships. We

also include year fixed effects to control time trends.

Table 8 presents the empirical results. As shown in Column (1), the coefficient estimate for *InsuredpairPost* is significantly negative, suggesting insured suppliers extend significantly less trade credit to customers buying covered products compared to those buying non-covered ones. We further include supplier-year fixed effects to control time-variant characteristics of the insured supplier in Column (2). The estimated coefficient on *InsuredpairPost* remains significantly negative.

[Insert Figure 2 Here]

[Insert Table 8 Here]

5.4 Robustness tests

We conduct a battery of tests to check the robustness of the causal relationship between the equipment insurance and trade credit provision.

First, there might be potential biases in staggered implementation of the DID approach due to heterogenous treatment effect as suggested in recent literature (e.g., Baker et al., 2022; Callaway and Sant'Anna, 2021). We tackle these potential biases by using a stacked DID regression. Specifically, for each treated cohort based on the insurance subscription year, we create a dataset that includes a group of insured firms and a group of control firms that never insured their equipment during the sample period. We retain the data over the [–3,+3] treatment window and stack all of these datasets together. We then estimate a stacked DID regression with two-way fixed effect (i.e., Cohort*Firm and Cohort*Year fixed effects). As show in Table 9, the independent variable of interest, *InsuredPost*, remains significantly negative at the 1% level and the scale of the coefficient estimate only decreases slightly when using the stacked regression. Besides, we also estimate the average treatment effect of the equipment insurance on trade credit provision

based on the method proposed by Callaway, and Sant'Anna (2021). We continue to find a negative and statistically significant effect (-0.020, *t*=-4.44) of the equipment insurance on trade credit provision of the insured group and the magnitude of the estimate remains almost unchanged relative to the baseline results. And as shown in Figure 3, the dynamic effects based on Callaway, and Sant'Anna (2021) also satisfies the parallel trends. Overall, these results suggest that our baseline results still hold even when we control for heterogenous treatment effects.

[Insert Table 9 Here]

[Insert Figure 3 Here]

Second, we use alternative matched samples to mitigate the systematic differences in attributes beyond the insurance status between the insured group and the non-insured group. We start by a simple matching procedure to construct a matched control group. Specifically, for each insured firm, we search for firms in the non-insured group operated in the same industry and province as the insured firm and keep three of them with the closest magnitude in revenue in the year before the insurance. After non-replacement matching, we obtain a matched sample consisting of 5,758 firm-year observations from 188 insured firms and 362 non-insured firms. We re-estimate the baseline model using the simple matched sample and report the results in Column (1) of Table 10. We continue to find a significantly negative coefficient on *InsuredPost*. We then adopt a propensity score matching (PSM) procedure to further address the concern. Specifically, we run a logit regression with firm characteristics included in the baseline model and industry fixed effects based on the pre-PPICM sample to calculate the propensity score. We then set the caliper of the matching to 0.05 and match each insured firm with one control firm with the closest propensity score prior to the implementation of PPICM. This produces 304 unique pairs of

matched firms[11]. We re-estimate the insurance effect and report the results in Column (2). The coefficient estimate for *InsuredPost* remains negative and statistically negative. Additionally, we perform entropy balancing analyses to match insured and non-insured observations. Following Hainmueller (2012), we produce a balanced sample by reweighting the observations in the non-insured group to match the characteristics between insured and non-insured groups on the first, second, and third moments. As shown in Column (3), the coefficient estimate for *InsuredPost* after employing entropy balancing remains negative and statistically significant. The above results suggest that our results are not driven by other differences beyond the insurance between insured and non-insured firms.

[Insert Table 10 Here]

Third, we employ two alternative proxies for trade credit provision that are frequently used in the previous literature to address possible measurement bias. Specifically, we use *ARS*, measured as the ratio of accounts receivable scaled by total sales, and *LnAR*, measured as the natural logarithm of accounts receivable plus 1, to re-estimate the baseline model, respectively (Giannetti et al., 2011; Greway et al., 2024). The empirical results as shown in Columns (1) and (2) of Table 11 are consistent with prior analyses.

Finally, we use observations over a shorter event window to mitigate the possible impact of confounding events. Specifically, we examine the insurance effect on trade credit provision over a seven-year window (i.e., [-3,+3]) around the onset of the equipment insurance of the insured group. We report the results in Column (3) of Table 11. The coefficient estimate for *InsuredPost* remains negative and statistically significant.

[11] To ensure the comparability between insured firms and non-insured firms, we compare the summary statistics of pre-PPICM characteristics between the insured group and the non-insured group before and after the match. As shown in Table A2 in Appendix B, after propensity score matching, none of the univariate comparison between insured and non-insured firms before the implementation of PPICM is statistically significant.

[Insert Table 11 Here]

6. Conclusions

Trade credit can function as a quality guarantee, helping to mitigate consumer concerns about quality risks, particularly during the early commercialization stages of innovative products. However, its dual role in both the product and financial markets makes it challenging to isolate its quality guarantee function.

This study exploits a unique insurance policy in China designed to protect manufacturers of high-end technological equipment against quality defects, specifically targeting products without prior market performance. We examine the impact of this insurance on trade credit provision and find robust evidence that insured firms extend less trade credit to their customers after insuring their equipment. The effect is more pronounced among firms with weaker internal quality controls and when the insurance offers stronger quality guarantees. Our findings are robust to using an instrumental variable approach, restricting firms to certified suppliers, and controlling for unobserved time-varying supplier characteristics.

Collectively, our findings provide the first large-sample evidence supporting the quality guarantee theory of trade credit, while also highlighting the underexplored role of insurers in mitigating product market risks.

References

Allee, K.D., Wangerin, D.D., 2018. Auditor monitoring and verification in financial contracts: evidence from earnouts and SFAS 141(R). Rev. Account. Stud. 23, 1629–1664. https://doi.org/10.1007/s11142-018-9472-0

Baker, A.C., Larcker, D.F., Wang, C.C.Y., 2022. How much should we trust staggered difference-in-differences estimates? J. Finan. Econ. 144, 370–395. https://doi.org/10.1016/j.jfineco.2022.01.004

Baker, G., Gibbons, R., Murphy, K.J., 2002. Relational Contracts and the Theory of the Firm. Quart. J. Econ. 117, 39–84. https://doi.org/10.1162/003355302753399445

Barrot, J.-N., 2016. Trade Credit and Industry Dynamics: Evidence from Trucking Firms. J. Finance 71, 1975–2016. https://doi.org/10.1111/jofi.12371

Barrot, J.-N., Nanda, R., 2020. The Employment Effects of Faster Payment: Evidence from the Federal Quickpay Reform. J. Finance 75, 3139–3173. https://doi.org/10.1111/jofi.12955

Biais, B., Gollier, C., 1997. Trade Credit and Credit Rationing. Rev. Finan. Stud. 10, 903–937. https://doi.org/10.1093/rfs/10.4.903

Boissay, F., Gropp, R., 2013. Payment Defaults and Interfirm Liquidity Provision. Rev. Financ. 17, 1853–1894. https://doi.org/10.1093/rof/rfs045

Brennan, M.J., Maksimovic, V., Zechner, J., 1988. Vendor Financing. J. Finance 43, 1127–1141. https://doi.org/10.1111/j.1540-6261.1988.tb03960.x

Burkart, M., Ellingsen, T., 2004. In-Kind Finance: A Theory of Trade Credit. Amer. Econ. Rev. 94, 569–590. https://doi.org/10.1257/0002828041464579

Cachon, G.P., Lariviere, M.A., 2005. Supply Chain Coordination with Revenue-Sharing Contracts: Strengths and Limitations. Manage. Sci. 51, 30–44. https://doi.org/10.1287/mnsc.1040.0215

Callaway, B., Sant'Anna, P.H.C., 2021. Difference-in-Differences with multiple time periods. J. Econometrics, Themed Issue: Treatment Effect 1 225, 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001

Carbó-Valverde, S., Rodríguez-Fernández, F., Udell, G.F., 2016. Trade Credit, the Financial Crisis, and SME Access to Finance. J. Money Credit Bank. 48, 113–143. https://doi.org/10.1111/jmcb.12292

Cuñat, V., 2007. Trade Credit: Suppliers as Debt Collectors and Insurance Providers. Rev. Finan. Stud. 20, 491–527. https://doi.org/10.1093/rfs/hhl015

Dass, N., Kale, J.R., Nanda, V., 2015. Trade Credit, Relationship-specific Investment, and Product Market Power. Rev. Financ. 57.

Deloof, M., Jegers, M., 1996. Trade Credit, Product Quality, and Intragroup Trade: Some European Evidence. Finan. Manage. 25, 33–43. https://doi.org/10.2307/3665806

Dyer, J.H., 1996. Specialized Supplier Networks as a Source of Competitive Advantage: Evidence from the Auto Industry. Strateg. Manage. J. 17, 271–291. https://doi.org/10.1002/(SICI)1097-0266(199604)17:4<271::AID-SMJ807>3.0.CO;2-Y

Ersahin, N., Giannetti, M., Huang, R., 2024. Trade credit and the stability of supply chains. J. Finan. Econ. 155, 103830. https://doi.org/10.1016/j.jfineco.2024.103830

Fernandes, A.M., Paunov, C., 2015. The Risks of Innovation: Are Innovating Firms Less Likely to Die? Rev. Econ. Statist. 97, 638–653. https://doi.org/10.1162/REST_a_00446

Ferris, J.S., 1981. A Transactions Theory of Trade Credit Use. Quart. J. Econ. 96, 243. https://doi.org/10.2307/1882390

Fisman, R., Love, I., 2003. Trade Credit, Financial Intermediary Development, and Industry Growth. J. Finance 58, 353–374. https://doi.org/10.1111/1540-6261.00527
Fisman, R., Raturi, M., 2004. Does Competition Encourage Credit Provision? Evidence from African Trade Credit Relationships. Rev. Econ. Statist. 86, 345–352. https://doi.org/10.1162/003465304323023859
Garcia-Appendini, E., Montoriol-Garriga, J., 2013. Firms as liquidity providers: Evidence from the 2007–2008 financial crisis. J. Finan. Econ. 109, 272–291. https://doi.org/10.1016/j.jfineco.2013.02.010
Giannetti, M., Burkart, M., Ellingsen, T., 2011. What You Sell Is What You Lend? Explaining Trade Credit Contracts. Rev. Finan. Stud. 24, 1261–1298. https://doi.org/10.1093/rfs/hhn096
Giannetti, M., Serrano-Velarde, N., Tarantino, E., 2021. Cheap Trade Credit and Competition in Downstream Markets. J. Polit. Economy 129, 1744–1796. https://doi.org/10.1086/713731
Grennan, M., Town, R.J., 2020. Regulating Innovation with Uncertain Quality: Information, Risk, and Access in Medical Devices. Amer. Econ. Rev. 110, 120–161. https://doi.org/10.1257/aer.20180946
Greway, J., Mohan, A., Pérez-Cavazos, G., 2024. Payment Practices Transparency and Customer-Supplier Dynamics. J. Acc. Res. 62, 635–674. https://doi.org/10.1111/1475-679X.12521
Grossman, S.J., Hart, O.D., 1986. The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. J. Polit. Economy 94, 691–719. https://doi.org/10.1086/261404
Gustafson, M.T., Ivanov, I.T., Meisenzahl, R.R., 2021. Bank monitoring: Evidence from syndicated loans. J. Finan. Econ. 139, 452–477. https://doi.org/10.1016/j.jfineco.2020.08.017
Hainmueller, J., 2012. Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies. Polit. Anal. 20, 25–46. https://doi.org/10.1093/pan/mpr025
Hansen, R.S., Torregrosa, P., 1992. Underwriter Compensation and Corporate Monitoring. J. Finance 47, 1537–1555. https://doi.org/10.1111/j.1540-6261.1992.tb04669.x
Hart, O., Moore, J., 1990. Property Rights and the Nature of the Firm. J. Polit. Economy 98, 1119–1158. https://doi.org/10.1086/261729
Jacobson, T., von Schedvin, E., 2015. Trade Credit and the Propagation of Corporate Failure: An Empirical Analysis. Econometrica 83, 1315–1371. https://doi.org/10.3982/ECTA12148
Kiyotaki, N., Moore, J., 1997. Credit Chains.
Klapper, L., Laeven, L., Rajan, R., 2012. Trade Credit Contracts. Rev. Finan. Stud. 25, 838–867. https://doi.org/10.1093/rfs/hhr122
Klein, B., Crawford, R.G., Alchian, A.A., 1978. Vertical Integration, Appropriable Rents, and the Competitive Contracting Process. J. Law Econ. 21, 297–326. https://doi.org/10.1086/466922
Lee, Y.W., Stowe, J.D., 1993. Product Risk, Asymmetric Information, and Trade Credit. J. Finan. Quant. Anal. 28, 285–300. https://doi.org/10.2307/2331291
Levine, R., Lin, C., Xie, W., 2018. Corporate Resilience to Banking Crises: The Roles of Trust and Trade Credit. J. Finan. Quant. Anal. 53, 1441–1477. https://doi.org/10.1017/S0022109018000224
Long, M.S., Malitz, I.B., Ravid, S.A., 1993. Trade Credit, Quality Guarantees, and Product Marketability. Finan. Manage. 22, 117–127. https://doi.org/10.2307/3665582
Maksimovic, V., Frank, M.Z., 2005. Trade Credit, Collateral, and Adverse Selection. Working

Paper. https://doi.org/10.2139/ssrn.87868
Masten, S.E., 1984. The Organization of Production: Evidence from the Aerospace Industry. J. Law Econ. 27, 403–417. https://doi.org/10.1086/467071
Mian, S.L., Smith, Jr., C.W., 1992. Accounts Receivable Management Policy: Theory and Evidence. J. Finance 47, 169–200. https://doi.org/10.1111/j.1540-6261.1992.tb03982.x
Miller, G.S., 2006. The Press as a Watchdog for Accounting Fraud. J. Acc. Res. 44, 1001–1033. https://doi.org/10.1111/j.1475-679X.2006.00224.x
Murfin, J., Njoroge, K., 2015. The Implicit Costs of Trade Credit Borrowing by Large Firms. Rev. Finan. Stud. 28, 112–145. https://doi.org/10.1093/rfs/hhu051
Petersen, M.A., Rajan, R.G., 1997. Trade Credit: Theories and Evidence. Rev. Finan. Stud. 10, 661–691. https://doi.org/10.1093/rfs/10.3.661
Petersen, M.A., Rajan, R.G., 1995. The Effect of Credit Market Competition on Lending Relationships. Quart. J. Econ. 110, 407–443. https://doi.org/10.2307/2118445
Petersen, M.A., Rajan, R.G., 1994. The Benefits of Lending Relationships: Evidence from Small Business Data. J. Finance 49, 3–37. https://doi.org/10.1111/j.1540-6261.1994.tb04418.x
Smith, J.K., 1987. Trade Credit and Informational Asymmetry. J. Finance 42, 863–872. https://doi.org/10.1111/j.1540-6261.1987.tb03916.x
Williamson, O.E., 1985. The Economic Intstitutions of Capitalism. Free Press.
Wu, W., Firth, M., Rui, O.M., 2014. Trust and the provision of trade credit. J. Bank. Financ. 39, 146–159. https://doi.org/10.1016/j.jbankfin.2013.11.019
Yu, F. (Frank), 2008. Analyst coverage and earnings management. J. Finan. Econ. 88, 245–271. https://doi.org/10.1016/j.jfineco.2007.05.008

Appendix A: Variable Definitions

Table A1 Variable Definitions

Variable	Definition	Source
ARS	Trade credit provision, equals the ratio of accounts receivable scaled by revenues.	CSAMR
Certed	Dummy variable, equals 1 if a firm's equipment is certified as the First (Set of) Key Technological Equipment during the sample period, and zero otherwise.	Manual
CertedPost	Dummy variable, equals 1 for firm-year observations after the firm certified its equipment as the First (Set of) Key Technological Equipment, and zero otherwise.	Manual
Fixta	Property, plant, and equipment divided by total assets.	CSAMR
Insured	Dummy variable, equals 1 if the listed firm (including holding subsidiaries) maintains insurances on its First (Set of) Key Technological Equipment, and zero otherwise.	Manual
InsuredpairPost	Dummy variable, equals 1 for supplier-customer-pair-year observations after the supplier purchase insurance for the equipment sold to the customer, and zero otherwise.	Manual
InsuredPost	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains insurance on its First (Set of) Key Technological Equipment, and zero otherwise.	Manual
InsuredPost_State	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance subsidized by the central government, and zero otherwise.	Manual
InsuredPost_Province	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance subsidized by the provincial government, and zero otherwise.	Manual
InsuredPost_Repeat	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance if the firm purchases equipment insurance across different years over the sample period, and zero otherwise.	Manual
InsuredPost_Once	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance if the firm purchases equipment insurance for only one year over the sample period, and zero otherwise.	Manual
InsuredPost_Moreins	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance if the firm maintains multiple insurance contracts during the first subscription year, and zero otherwise.	Manual
InsuredPost_Oneins	Dummy variable, firm-year observations equal 1 after the listed firm (including holding subsidiaries) maintains the equipment insurance if the firm maintains only one insurance contract during the first subscription year, and zero otherwise.	Manual
Levb	The ratio of total liabilities scaled by total assets.	CSAMR
Lnage	The natural logarithm of 1 plus years since the firm is established.	CSAMR
LnAR	The natural logarithm of 1 plus accounts receivable.	CSMAR
OCF	Cash from operations scaled by total assets.	CSAMR
Qculture	Dummy variable, equals 1 if the firm maintains integrity culture over the past three years, and zero otherwise.	CNRDS

Qhonor	Dummy variable, equals 1 if the firm receives certifications and accolades in the field of product quality over the past three years, and zero otherwise.	CNRDS
Qsystem	Dummy variable, equals 1 if the firm has a product quality management system over the past three years, and zero otherwise.	CNRDS
ROA	The ratio of net profits scaled by total assets.	CSAMR
Size	The natural logarithm of total assets.	CSAMR
SOE	Dummy variable, equals to 1 if the ultimate controlling party of a firm is the government, and zero otherwise.	CSAMR
TC	Trade credit provision, equals the ratio of accounts receivable scaled by total assets.	CSMAR
TCPair	The ratio of trade credit between the supplier and the customer scaled by the supplier's total assets.	CSMAR
Top1	The fraction of shares held by a firm's largest shareholder.	CSAMR

Appendix B: Differences in Pre-PPICM Characteristics

Table A2 Differences in pre-PPICM characteristics

	Pre-PSM				Post-PSM			
	Mean		Difference	T-value	Mean		Difference	T-value
	Treat	Control			Treat	Control		
Size	22.477	21.878	0.599	5.75	22.288	22.380	-0.092	-0.55
Levb	0.492	0.444	0.048	2.61	0.477	0.474	0.003	0.13
MB	2.839	3.497	-0.658	-2.03	2.820	2.788	0.031	0.10
ROA	0.022	0.036	-0.014	-3.00	0.026	0.022	0.003	0.47
Fixta	0.189	0.230	-0.041	-3.05	0.193	0.197	-0.004	-0.28
OCF	0.020	0.036	-0.016	-2.72	0.020	0.025	-0.006	-0.79
Top1	0.351	0.345	0.006	0.51	0.343	0.344	-0.000	-0.04
SOE	0.512	0.368	0.144	3.66	0.480	0.467	0.013	0.23
Lnage	2.141	2.236	-0.095	-1.76	2.166	2.152	0.013	0.18

This table shows the summary statistics of pre-PPICM characteristics between the treatment group (i.e., insured firms) and the control group (i.e., non-insured firms) before and after the propensity-score-matching procedure. Specifically, using the data from the year before the implementation of PPICM, we estimate a logit model in which the dependent variable, *Insured*, equals one if the firm maintains insurances on its First (Set of) Key Technological Equipment between 2011 and 2022 (insured group), and zero otherwise (non-insured group). Independent variables include firm-specific characteristics, including firm size (*Size*), financial leverage ratio (*Levb*), growth opportunities (*MB*), profitability (*ROA*), the ratio of fixed assets to total assets (*Fixta*), operating cash flow (*OCF*), the fraction of shares held by the largest shareholder (*Top1*), the equity nature (*SOE*), and the firm age (*Lnage*). We also include industry fixed effects to control time invariant industry characteristics. Then we use the propensity scores calculated from the logit regression to conduct the nearest-neighbor propensity score matching without replacement, and set the caliper of the matching to 0.05. Appendix A provides detailed descriptions of the variables.

Appendix C: Model Clauses for Equipment Insurance of Vessels

Liability Insurance Clauses for First (Set) Key Technological Equipment of Vessels

China Pacific Property Insurance Co., Ltd.

General Provisions

1. Basic Policy Provisions

1.1 This insurance contract (hereinafter referred to as "this Contract") shall consist of the insurance clauses, the application form, the insurance policy or other insurance certificates, and any written documents related to this Contract, including declarations, annotations, endorsements, or supplementary agreements. All terms of this Contract shall be in writing.

1.2 Any legally established enterprise or institution within the People's Republic of China (excluding Hong Kong, Macau, and Taiwan regions) engaged in the manufacture or sale of vessel that complies with national or provincial regulatory standards for first (set) key technological equipment may act as the policyholder and insured under this insurance.

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Part I. Product Quality Warranty

6. Insurance Liability

This section indemnifies the insured for expenses incurred to fulfill obligations under quality warranty clauses or construction/transfer contracts signed with the vessel owner/purchaser at the time of vessel sale under this policy:

6.1 Repair costs for damage to the insured vessel caused by product quality defects during the liability period;

6.2 Costs to replace defective parts/components firstly identified and documented during specialized inspections, maintenance, or operational monitoring during the liability period.

The insurer's liability under this section is limited to the actual costs of restoring the vessel to its pre-incident condition or replacing parts/components to match the vessel's condition at purchase. Costs for research and development to reduce defects, improve product quality, or correct defective designs are excluded.

Total Investigation, Testing, and Defense Costs under this section shall not exceed the replacement value of the allegedly or suspectedly defective parts/components.

7. Repair Costs

7.1 Vessel repair costs shall include transportation (land or air) of personnel, materials, tools, and equipment necessary for repairs, or transportation of the vessel/damaged components to/from the repair site, using the most practical means.

7.2 If repairs/replacements are conducted at the insured's premises: Compensation shall cover actual expenses only, excluding internal equipment/resource usage or profit loss.

7.3 If repairs/replacements are performed by the insured: Labor costs per person-hour shall not exceed 250% of actual wages paid, and material costs shall include actual procurement costs plus 10% for reasonable transportation and storage. Replacement part costs shall equal the new part's production cost minus the residual value of the replaced part.

7.4 If repairs/replacements are performed by third parties: Costs shall cover actual expenses plus the insured's reasonable and necessary supervision fees.

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Part II. Product Liability

10. Insurance Liability

During the liability period, the Insurer shall indemnify the Insured for third-party bodily injury or property damage caused by product defects in the insured vessel, as legally required.

Investigation, Testing, and Defense Costs under this section shall not exceed 30% of the liability limit specified herein.

11. Exclusions

The Insurer shall not indemnify the following losses or liabilities under this section:

11.1 Removal, elimination, or cleanup of penetrating, polluting, or corrosive substances;

11.2 Loss or damage to the insured vessel or its components;

11.3 Costs for repair, refurbishment, improvement, or replacement of the insured vessel or its components, or economic losses arising therefrom;

11.4 Liabilities arising from quality defects that the Insured should have known based on their knowledge of vessel structure, machinery, or operational control.

Part III. General Provisions

……

17. Definitions Applicable to All Sections of This Policy

17.1 “Bodily Injury”: Death, physical injury, illness, or disease of any person.

17.2 “Property Damage”: Loss of possession or control of tangible property; or physical damage to tangible property.

17.3 “Product Quality Defect”:

1) A defect in the vessel or its components caused by imperfect materials, workmanship, construction, design, or failure to comply with instructions from the manufacturer, classification society, or regulatory authorities;

2) An inherent defect, fault, imperfection, deficiency, or other flaw in the vessel or its components;

3) Failure of the vessel or its components to be produced in accordance with the contract terms, manufacturer’s specifications, or requirements; or

4) Non-compliance with conditions, notes, qualifications, recommendations, reservations, or limitations stated in certificates issued by the classification society or regulatory authorities.

17.4 “Pollution”: Contamination of the atmosphere, water, land, or other tangible property.

17.5 “Contract”: The construction/transfer contract entered into between the Insured and the owner/purchaser of the insured vessel.

17.6 “Occurrence”: An unforeseen and unintended event caused by a product defect that results in bodily injury and/or property damage, including continuous or repeated exposure to substantially the same harmful conditions. All bodily injury and/or property damage arising from such continuous or repeated exposure during the insurance period shall be deemed a single occurrence.

Figures

Figure 1 Parallel Trends Test

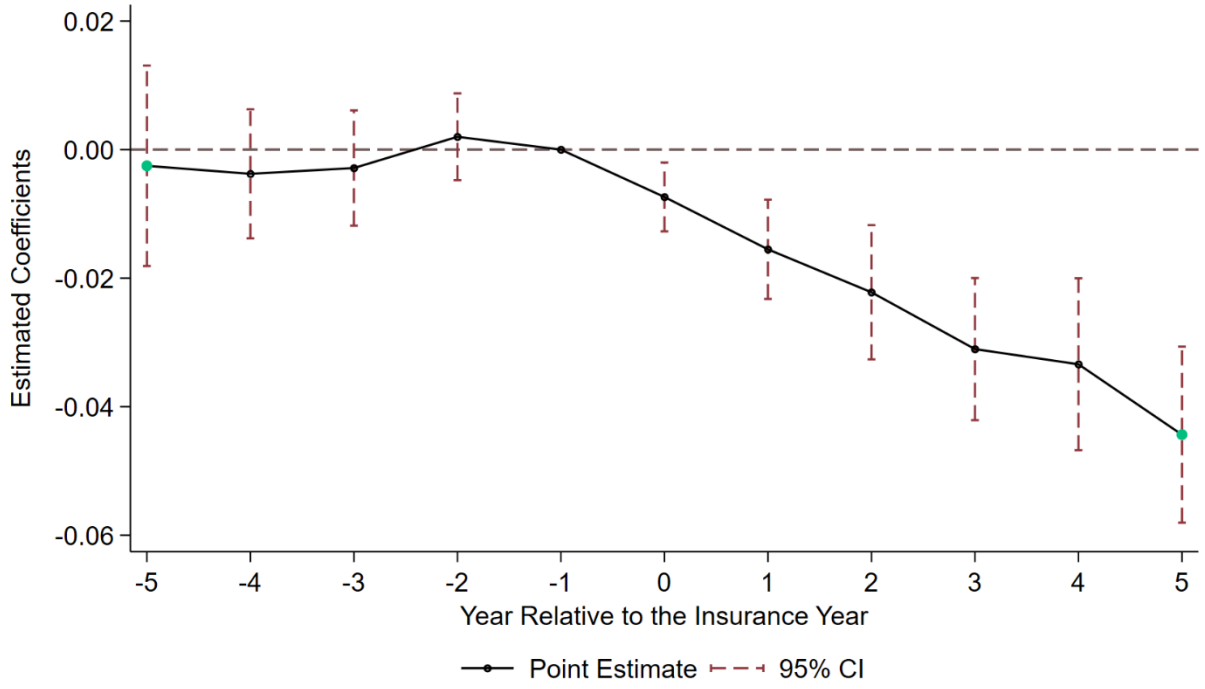


Figure 1 plots the estimated coefficients and corresponding 95% confidence intervals of the parallel trends test which examine the dynamic impact of the equipment insurance on trade credit provision. The year before the insurance is treated as the benchmark period. The full set of control variables with firm- and year-fixed effects are included.

Figure 2 Paired-Sample Trade Credit Provision

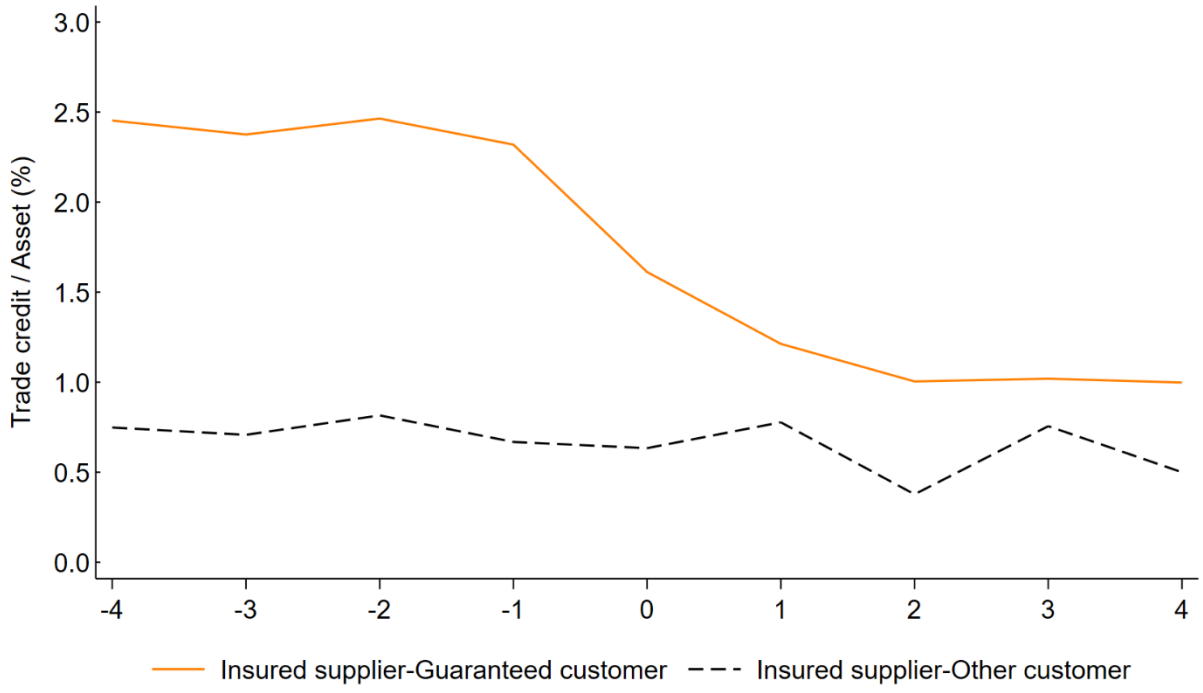


Figure 2 plots the average of trade credit between supplier-customer pair scaled by the supplier's assets during [-4, +4] window surrounding the insurance purchase year.

Figure 3 Estimation with Callaway and Sant' Anna (2020)

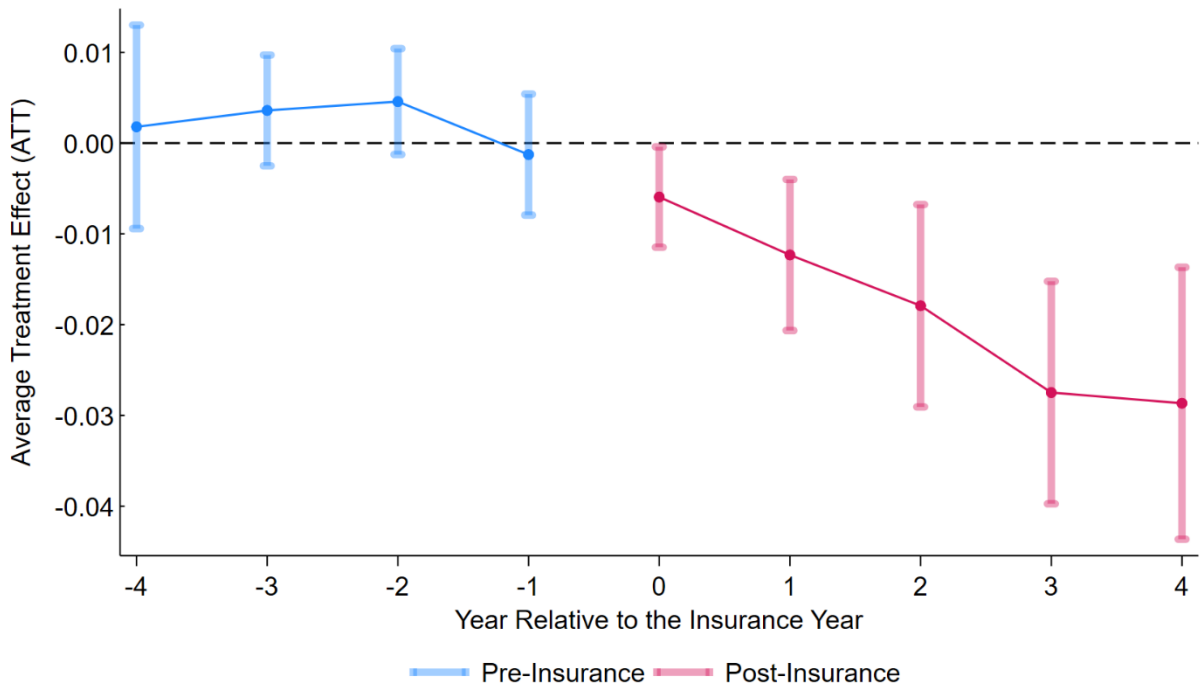


Figure 3 plots the estimated coefficients and corresponding 95% confidence intervals based on the regression approach proposed by Callaway and Sant'Anna (2021), which examines the average insurance effect on trade credit provision of the insured firms in different years [-4,+4] relative to the insurance year.

Tables

Table 1 Summary Statistics

Variable	N	Mean	SD	Min	P25	P50	P75	Max
TC	25921	0.114	0.102	0.000	0.031	0.090	0.169	0.469
Insured	25921	0.079	0.269	0.000	0.000	0.000	0.000	1.000
InsuredPost	25921	0.038	0.192	0.000	0.000	0.000	0.000	1.000
Size	25921	22.313	1.346	19.503	21.381	22.165	23.102	26.314
Levb	25921	0.452	0.217	0.052	0.282	0.446	0.612	0.976
Fixta	25921	0.216	0.166	0.001	0.085	0.181	0.312	0.704
MB	25921	3.647	4.394	0.374	1.566	2.441	4.008	33.112
ROA	25921	0.026	0.076	-0.388	0.010	0.031	0.059	0.193
OCF	25921	0.041	0.072	-0.197	0.003	0.041	0.081	0.242
Top1	25921	0.327	0.148	0.080	0.212	0.301	0.425	0.731
SOE	25921	0.407	0.491	0.000	0.000	0.000	1.000	1.000
Lnage	25921	2.500	0.623	0.693	2.079	2.639	2.996	3.367

This table presents the summary statistics of the main variables. The sample is an unbalanced panel of 25,921 firm-year observations between 2011 and 2022. Detailed definitions of all variables are reported in Appendix A. All continuous variables are winsorized at the 1% and the 99% levels, respectively.

Table 2 The Insurance Effect on Trade Credit Provision

	(1)	(2)	(3)	(4)
	TC	*TC*	*TC*	*TC*
InsuredPost	-0.021***	-0.019***	-0.022***	-0.021***
	(-3.713)	(-3.622)	(-5.231)	(-5.213)
Insured	0.040***	0.030***		
	(5.537)	(4.516)		
Size		-0.013***		-0.001
		(-9.362)		(-0.722)
Levb		0.098***		0.017**
		(11.654)		(2.270)
MB		-0.001***		-0.000
		(-3.516)		(-0.768)
ROA		0.106***		0.036***
		(7.923)		(3.951)
Fixta		-0.139***		-0.044***
		(-15.354)		(-4.507)
OCF		-0.123***		-0.067***
		(-10.082)		(-8.661)
Top1		-0.025**		-0.001
		(-2.309)		(-0.116)
SOE		0.000		0.001
		(0.054)		(0.203)
Lnage		-0.031***		-0.006
		(-9.754)		(-1.587)
Constant	0.112***	0.482***	0.115***	0.167***
	(65.097)	(16.314)	(727.954)	(3.886)
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	NO	NO
Firm FE	NO	NO	YES	YES
N	25921	25921	25921	25921
Adj-R2	0.190	0.294	0.772	0.775

This table presents the results on the impact of the equipment insurance on trade credit provision. The dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. *Insured* is a dummy variable which equals 1 if a firm insured its equipment during the sample period, and zero otherwise. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 3 Parallel Trend Test and Dynamic Effects

	(1)
	TC
$Insured^{-5}$	-0.003
	(-0.317)
$Insured^{-4}$	-0.004
	(-0.736)
$Insured^{-3}$	-0.003
	(-0.626)
$Insured^{-2}$	0.002
	(0.579)
$Insured^{0}$	-0.007***
	(-2.700)
$Insured^{+1}$	-0.016***
	(-3.940)
$Insured^{+2}$	-0.022***
	(-4.168)
$Insured^{+3}$	-0.031***
	(-5.504)
$Insured^{+4}$	-0.033***
	(-4.896)
$Insured^{+5}$	-0.044***
	(-6.349)
Controls	YES
Year FE	YES
Firm FE	YES
N	25921
Adj-R2	0.776

This table reports the empirical results of the dynamic effects of the equipment insurance on trade credit provision. The dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. $Insured^{-5}$ ($Insured^{-4}$, $Insured^{-3}$, $Insured^{-2}$) is coded 1 for five or more years before (four years before, three years before, two years before) the firm insures its equipment, and 0 otherwise. $Insure^{0}$ ($Insured^{+1}$, $Insured^{+2}$, $Insured^{+3}$, $Insured^{+4}$, $Insured^{+5}$) is coded 1 for the year of (one year after, two years after, three years after, four years after, five or more years after) the firm insures its equipment, and 0 otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered by firm. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 4 Cross-Sectional Tests: Demand-Side Incentive of Quality Guarantee

Panel A: Quality control measured based on the quality management system			
		Qsystem=0	*Qsystem*=1
	(1)	(2)	(3)
	TC	*TC*	*TC*
InsuredPost		-0.022***	-0.015**
		(-3.900)	(-2.575)
Qsystem	-0.003*		
	(-1.769)		
Size	-0.002	-0.000	-0.001
	(-0.763)	(-0.204)	(-0.246)
Levb	0.019**	0.017*	0.041***
	(2.480)	(1.926)	(3.028)
MB	-0.000	-0.000	-0.001
	(-1.076)	(-0.908)	(-0.997)
ROA	0.041***	0.034***	0.073***
	(4.320)	(3.276)	(3.669)
Fixta	-0.042***	-0.041***	-0.047*
	(-4.171)	(-3.592)	(-1.708)
OCF	-0.071***	-0.071***	-0.043**
	(-8.995)	(-8.179)	(-2.509)
Top1	0.003	0.001	0.013
	(0.225)	(0.074)	(0.535)
SOE	0.002	-0.003	0.012
	(0.363)	(-0.496)	(1.543)
Lnage	-0.007*	-0.008*	-0.002
	(-1.690)	(-1.714)	(-0.209)
Constant	0.169***	0.156***	0.108
	(3.759)	(2.987)	(1.122)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	24963	18932	6031
Adj-R2	0.777	0.765	0.854
Empirical *p*-value		0.000***	
Panel B: Quality control measured based on integrity culture			
		Qculture=0	*Qculture*=1
	(1)	(2)	(3)
	TC	*TC*	*TC*
InsuredPost		-0.023***	-0.013**
		(-4.041)	(-2.204)
Qculture	-0.006**		
	(-2.314)		

Size	-0.001	-0.001	-0.001
	(-0.644)	(-0.509)	(-0.283)
Levb	0.019**	0.020**	0.012
	(2.435)	(2.170)	(0.915)
MB	-0.000	-0.000	-0.000
	(-1.054)	(-1.040)	(-0.661)
ROA	0.041***	0.032***	0.067***
	(4.301)	(2.953)	(3.951)
Fixta	-0.042***	-0.043***	-0.039*
	(-4.186)	(-3.590)	(-1.742)
OCF	-0.071***	-0.070***	-0.061***
	(-9.010)	(-7.752)	(-3.909)
Top1	0.003	0.002	0.027
	(0.233)	(0.148)	(1.211)
SOE	0.002	-0.000	0.005
	(0.348)	(-0.021)	(0.599)
Lnage	-0.007*	-0.008*	0.001
	(-1.675)	(-1.687)	(0.139)
Constant	0.164***	0.173***	0.112
	(3.658)	(3.341)	(1.168)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	24963	17345	7618
Adj-R2	0.777	0.762	0.849
Empirical *p*-value		0.000***	

Panel C: Quality control measured based on quality-related certifications and accolades

		Qhonor=0	*Qhonor*=1
	(1)	(2)	(3)
	TC	*TC*	*TC*
InsuredPost		-0.022***	-0.015***
		(-3.937)	(-2.641)
Qhonor	-0.005***		
	(-2.627)		
Size	-0.001	-0.000	0.001
	(-0.687)	(-0.034)	(0.207)
Levb	0.019**	0.013	0.034***
	(2.466)	(1.526)	(2.606)
MB	-0.000	-0.000	-0.001**
	(-1.078)	(-0.859)	(-2.197)
ROA	0.041***	0.037***	0.051***
	(4.336)	(3.556)	(2.769)
Fixta	-0.042***	-0.039***	-0.031*
	(-4.169)	(-3.428)	(-1.779)
OCF	-0.071***	-0.071***	-0.059***
	(-9.010)	(-8.157)	(-3.714)
Top1	0.003	-0.002	0.034

	(0.234)	(-0.113)	(1.484)
SOE	0.002	0.000	0.011
	(0.368)	(0.081)	(1.343)
Lnage	-0.007*	-0.010**	0.003
	(-1.765)	(-2.040)	(0.430)
Constant	0.166***	0.151***	0.049
	(3.712)	(2.966)	(0.529)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	24963	19165	5798
Adj-R2	0.777	0.766	0.873
Empirical *p*-value		0.000***	

This table presents the results on the impact of the equipment insurance on trade credit provision of the insured firms among firms with good (poor) quality control measures. The dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Panel A reports the results focused on the quality control as measured by the quality management system. *Qsystem* equals 1 when the firm has set up a management system on product quality over the past three years, and zero otherwise. Panel B reports the results focused on the quality control as measured by integrity corporate culture. *Qculture* equals 1 if the firm has maintained a philosophy and institutional safeguards for integrity in business operations over the past three years, and zero otherwise. Panel C reports the results focused on the quality control as measured by quality-related certifications and accolades. *Qhonor* equals 1 if the firm has received certifications and accolades in the field of product quality over the past three years, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. The last row reports the empirical p-values, which test the differences in the coefficients of *InsuredPost*, based on Fisher's permutation test by bootstrapping 1,000 times. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 5 Cross-Sectional Tests: Supply-Side Strength of Quality Guarantee

	(1)	(2)	(3)
	TC	*TC*	*TC*
InsuredPost_State	-0.029***		
	(-5.190)		
InsuredPost_Province	-0.012**		
	(-2.539)		
InsuredPost_Repeat		-0.027***	
		(-5.191)	
InsuredPost_Once		-0.011*	
		(-1.795)	
InsuredPost_Moreins			-0.027***
			(-5.156)
InsuredPost_Oneins			-0.016***
			(-2.625)
Size	-0.001	-0.001	-0.001
	(-0.737)	(-0.750)	(-0.739)
Levb	0.017**	0.017**	0.017**
	(2.262)	(2.265)	(2.278)
MB	-0.000	-0.000	-0.000
	(-0.775)	(-0.777)	(-0.777)
ROA	0.036***	0.036***	0.036***
	(3.957)	(3.964)	(3.954)
Fixta	-0.044***	-0.044***	-0.044***
	(-4.521)	(-4.492)	(-4.498)
OCF	-0.067***	-0.067***	-0.067***
	(-8.649)	(-8.661)	(-8.654)
Top1	-0.002	-0.001	-0.002
	(-0.126)	(-0.116)	(-0.130)
SOE	0.001	0.001	0.001
	(0.166)	(0.231)	(0.188)
Lnage	-0.007*	-0.007	-0.007
	(-1.716)	(-1.633)	(-1.620)
Constant	0.169***	0.168***	0.168***
	(3.939)	(3.926)	(3.914)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	25921	25921	25921
Adj-R2	0.776	0.775	0.775
F-statistics of the test: $\beta 1=\beta 2$	5.16**	3.93**	1.95

This table reports the cross-sectional results on the impact of the equipment insurance on trade credit provision. The

dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. *InsuredPost_State* (*InsuredPost_Province*) equals 1 for observations after the firm maintains equipment insurance subsidized by the central (local) government, and zero otherwise. *InsuredPost_Repeat* (*InsuredPost_Once*) equals 1 for observations after the equipment insurance by the repeatedly (one-time) insured firms, and zero otherwise. *InsuredPost_Moreins* (*InsuredPost_Oneins*) equals 1 for observations after a firm subscribes multiple (one) insurance contracts, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 6 Instrumental Variable Approach

	(1)	(2)
	InsuredPost	*TC*
CertedPost	0.463***	
	(17.808)	
Fitted InsuredPost		-0.023***
		(-3.339)
Size	-0.004	-0.001
	(-1.208)	(-0.722)
Levb	-0.006	0.017**
	(-0.486)	(2.273)
MB	-0.000	-0.000
	(-0.696)	(-0.771)
ROA	0.014	0.036***
	(0.994)	(3.957)
Fixta	-0.009	-0.044***
	(-0.671)	(-4.507)
OCF	0.012	-0.067***
	(1.105)	(-8.654)
Top1	0.014	-0.001
	(0.690)	(-0.114)
SOE	-0.006	0.001
	(-0.682)	(0.198)
Lnage	0.023**	-0.006
	(2.343)	(-1.556)
Constant	0.033	
	(0.455)	
Year FE	YES	YES
Firm FE	YES	YES
N	25921	25921
Adj-R2	0.679	0.017

This table reports the empirical results of 2SLS approach. Columns (1) and (2) report the first- and second-stage results, respectively. *TC* is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. *CertededPost* is a dummy variable that equals 1 for firm-year observations after the firm's equipment is certified by the government as the First (Set of) Key Technological Equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered by firm. t-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 7 Using the Certified Sample

	(1)
	TC
InsuredPost	-0.014***
	(-2.920)
Size	0.001
	(0.236)
Levb	0.017
	(0.878)
MB	0.001
	(0.969)
ROA	0.056**
	(2.277)
Fixta	-0.040
	(-1.628)
OCF	-0.088***
	(-3.542)
Top1	0.040
	(1.330)
SOE	0.009
	(0.605)
Lnage	0.017**
	(1.969)
Constant	0.088
	(0.827)
Year FE	YES
Firm FE	YES
N	3737
Adj-R2	0.745

This table reports the empirical results of the impact of the equipment insurance on trade credit provision using a subsample comprising firms with certified equipment between 2011 and 2022. *TC* is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered by firm. t-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 8 Paired-Sample Analysis

	(1)	(2)
	TCPair	*TCPair*
InsuredpairPost	-0.004**	-0.004***
	(-3.746)	(-4.715)
Year FE	YES	NO
Pair FE	YES	YES
Supplier-Year FE	NO	YES
N	1864	1864
Adj-R2	0.883	0.890

This table reports the empirical results of the impact of the equipment insurance on trade credit provision based on paired samples comprising insured suppliers and their guaranteed and non-guaranteed customers. *TCPair* is defined as the ratio of the supplier's accounts receivable from a customer, scaled by the supplier's assets. *InsuredpairPost* is a dummy variable that equals 1 for supplier-customer-pair-year observations after the supplier insured its equipment for the counterparty customer, and zero otherwise. Heteroscedasticity-robust standard errors are two-way clustered by supplier and insurance purchase year. t-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 9 Robustness Tests: Stacked DID

	(1)
	TC
InsuredPost	-0.016***
	(-4.079)
Size	0.002
	(1.103)
Levb	0.003
	(0.439)
MB	-0.038***
	(-4.035)
ROA	-0.000
	(-0.332)
Fixta	0.011
	(1.382)
OCF	-0.056***
	(-7.255)
Top1	0.000
	(0.034)
SOE	-0.001
	(-0.155)
Lnage	-0.018***
	(-3.053)
Constant	0.119**
	(2.569)
Cohort×Year FE	YES
Cohort×Firm FE	YES
N	94855
Adj-R2	0.835

This table presents the results of a stacked DID model examining the impact of the equipment insurance on trade credit provision. We create a dataset with seven cohorts of the equipment insurance. For each cohort, we include a group of insured firms and a group of control firms that never insured their equipment during the sample period. We retain the data over the [–3,+3] treatment window and stack all of these datasets together. The dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 10 Robustness Tests: Matched Samples

	Simple	PSM	Entropy
	(1)	(2)	(3)
	TC	*TC*	*TC*
InsuredPost	-0.017***	-0.018***	-0.015***
	(-3.795)	(-3.145)	(-3.962)
Size	-0.002	-0.000	-0.000
	(-0.444)	(-0.024)	(-0.027)
Levb	0.044***	0.038*	0.028*
	(2.629)	(1.786)	(1.930)
MB	-0.001**	-0.000	-0.001
	(-2.205)	(-0.367)	(-1.395)
ROA	0.040**	0.091***	0.056***
	(2.296)	(3.924)	(3.084)
Fixta	-0.068***	-0.059**	-0.076***
	(-3.891)	(-2.383)	(-4.209)
OCF	-0.098***	-0.098***	-0.085***
	(-6.031)	(-4.305)	(-5.302)
Top1	0.027	0.036	0.018
	(1.133)	(1.165)	(0.789)
SOE	-0.001	0.011	0.004
	(-0.133)	(0.809)	(0.363)
Lnage	0.005	-0.002	0.006
	(0.553)	(-0.174)	(0.857)
Constant	0.173*	0.145	0.138*
	(1.884)	(1.089)	(1.766)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	5758	3280	25921
Adj-R2	0.783	0.770	0.799

This table presents the results on the impact of the equipment insurance on trade credit provision based on matched samples. The dependent variable, *TC*, is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. The matched samples in Column (1)–(3) are constructed by a simple matching procedure, a propensity score matching procedure, and an entropy balancing procedure, respectively. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Table 11 Robustness Tests: Alternative Variables and Alternative Samples

			Short window
	(1)	(2)	(3)
	ARS	*LnAR*	*TC*
InsuredPost	-0.047***	-0.126***	-0.016***
	(-3.542)	(-2.980)	(-4.348)
Size	0.016***	0.843***	-0.002
	(3.125)	(31.245)	(-0.796)
Levb	-0.046**	-0.094	0.016**
	(-2.465)	(-0.871)	(2.154)
MB	-0.001	0.005	-0.000
	(-1.121)	(1.227)	(-0.743)
ROA	-0.085***	0.872***	0.034***
	(-3.083)	(6.536)	(3.763)
Fixta	-0.097***	-0.052	-0.043***
	(-3.669)	(-0.366)	(-4.308)
OCF	-0.211***	-0.609***	-0.067***
	(-9.537)	(-5.101)	(-8.558)
Top1	-0.048	0.278	-0.004
	(-1.540)	(1.482)	(-0.305)
SOE	0.008	0.046	0.000
	(0.701)	(0.719)	(0.089)
Lnage	-0.035***	-0.075	-0.008*
	(-3.110)	(-1.277)	(-1.818)
Constant	0.035	0.890	0.173***
	(0.310)	(1.492)	(3.925)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	25917	25921	25175
Adj-R2	0.707	0.849	0.778

This table presents the results on the impact of the equipment insurance on trade credit provision using alternative variables and samples. The dependent variables are *ARS*, *LnAR*, and *TC*. *ARS* is defined as the ratio of accounts receivable to sales. *LnAR* is defined as the natural logarithm of 1 plus accounts receivable. *TC* is defined as the ratio of accounts receivable to total assets. *InsuredPost* is a dummy variable that equals 1 for firm-year observations after the firm insured its equipment, and zero otherwise. Appendix A provides detailed descriptions of the other variables. Columns (1) and (2) use the baseline sample. Column (3) limits the sample period for the insured group over a seven-year window (i.e., [-3,+3]) around the first subscription of the equipment insurance. Heteroscedasticity-robust standard errors are clustered at the firm level. *t*-statistics are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.