Supply-chain Risk Perceptions and Corporate Investment: The Roles of Uncertainty and Sentiment

Guangzhi Ye[a], Rui Zeng[b]

[a] School of Social Sciences, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 (guangzhi.ye@ntu.edu.sg)

[b] School of Banking and Finance, University of New South Wales, High St, Kensington NSW 2052, Australia (rui.zeng3@student.unsw.edu.au)

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Abstract

How do firms adjust investment in response to supply-chain risk perceptions? This paper distinguishes between first-moment (directional outlook) and second-moment (uncertainty) components of supply-chain risk using text-based measures derived from earnings-call transcripts. Using data on U.S. publicly listed firms, we show that these two dimensions have distinct and economically meaningful effects on investment. Perceived supply-chain uncertainty is associated with a short-run decline in investment, consistent with precautionary behavior, whereas supply-chain sentiment is linked to persistent investment expansion. These effects differ systematically across capital types: physical investment responds primarily to the directional outlook, while intangible investment is more sensitive to uncertainty. Within intangible capital, knowledge and organizational capital exhibit distinct dynamic adjustment patterns. We further show that financing constraints and adjustment frictions shape these responses. Firms facing tighter financial conditions contract investment more strongly in response to uncertainty, while capital that is less redeployable responds less to improvements in sentiment. Overall, the results indicate that heterogeneity in investment responses arises primarily across types of capital rather than across firms, highlighting the central role of capital characteristics in shaping firms' responses to supply-chain risk perceptions.

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1 Introduction

How do firms adjust investment in response to supply-chain risk perceptions? This question has become increasingly important as global production networks expose firms to disruptions arising from input shortages, logistics constraints, and geopolitical shocks. A large literature shows that uncertainty reduces investment, while favorable expectations stimulate it (Bloom 2009; Gennaioli et al. 2015; Pindyck 1991). However, much less is known about how different dimensions of risk perceptions jointly shape firms' investment decisions, particularly in the context of supply chains.

In this environment, firms may respond to adverse supply-chain conditions not only by adjusting the level of investment, but also by reallocating resources across operational margins, including inventory, cash holdings, R&D, and intangible investment (Pankratz and Schiller 2024). At the same time, recent studies show that risk-related information contains distinct components, directional tone and uncertainty, that exert separable effects on firm behavior (Ersahin et al. 2024; Hassan et al. 2019, 2023, 2024a,b; Sautner et al. 2023). This raises a central question: how do these different dimensions of supply-chain risk perceptions shape not only how much firms invest, but how they allocate investment across different types of capital?

In this paper, we argue that the key margin of adjustment operates not only through how much firms invest, but through how they allocate investment across different types of capital. In particular, we show that supply-chain risk perceptions reshape investment primarily through differences across types of capital, between physical and intangible investment, rather than through systematic differences across firms.

To study this mechanism, we distinguish between first-moment supply-chain sentiment and second-moment perceived supply-chain uncertainty. Supply-chain sentiment captures the directional outlook of supply-chain discussions and reflects managerial expectations about future conditions, while perceived uncertainty captures the dispersion and unpredictability of those expectations. By separating these two components, we provide a more precise characterization of how supply-chain risk perceptions influence both the level and the composition of firm investment.

From a theoretical perspective, these two dimensions map into distinct mechanisms. In standard investment models with uncertainty and adjustment frictions, increases in perceived uncertainty raise the option value of waiting and lead firms to delay or reduce investment (Bernanke 1983; Bloom 2009; Dixit and Pindyck 1994; Pindyck 1991). In contrast, enhancements in directional outlook reflect more optimistic expectations regarding future fundamentals, increasing the expected payoff on investment and hence encouraging firms to increase capital expenditures (Abel and Eberly 1994; Gennaioli et al. 2015; Hayashi 1982). Our empirical analysis maps these theoretical predictions to firm-level data by separately identifying the effects of perceived supply-chain sentiment and perceived supply-chain uncertainty across different types of investment.

We examine how firms change total investment and reallocate resources between physical investment and intangible investment, with a more granular focus on knowledge and organizational capital. This internal reallocation margin is particularly important because firms also adjust along external supply-chain margins, such as supplier reconfiguration, vertical integration, and inventory buffering. These responses are often costly and resource-intensive, potentially crowding out some internal investment activities, especially R&D, while also redirecting product design choices and requiring organizational reconfiguration. (Randall and Ulrich 2001; Ersahin et al. 2024; Wu 2024; Li et al. 2024). Moreover, firms may not fully observe or internalize the risks faced by their suppliers, leaving them insufficiently prepared to respond to increases in perceived supply-chain uncertainty (Choi et al. 2020).

Our empirical results reveal systematic differences in how firms respond to the two dimensions of supply-chain risk perceptions. Total investment responds to both perceived supply-chain uncertainty and supply-chain sentiment, but with opposite signs and distinct dynamics. Perceived uncertainty is associated with a short-run decline in investment, while supply-chain sentiment is associated with persistent investment expansion.

These responses differ sharply across investment types. Physical investment responds primarily to supply-chain sentiment, suggesting that tangible capital is more sensitive to the directional outlook of supply-chain conditions. In contrast, intangible investment is more sensitive to perceived supply-chain uncertainty, indicating that nonphysical capital is more exposed to uncertainty-related adjustment frictions. Further decomposition shows that knowledge and organizational capital exhibit distinct timing and persistence in their responses, highlighting additional heterogeneity within intangible investment.

We also examine whether firms with different capital compositions respond differently to supply-chain risk perceptions. While firms with higher intangible capital intensity exhibit somewhat more muted investment responses, our results suggest that the main differences in investment responses arise across types of capital rather than across firms. In other words, physical and intangible investment behave differently within firms, while firms themselves do not exhibit strongly different responses. This highlights the central role of capital heterogeneity in shaping investment behavior.

To interpret these patterns, we examine three mechanisms: financing constraints, depreciation, and adjustment costs. Financing constraints amplify the negative effect of perceived supply-chain uncertainty, as firms facing tighter financial conditions reduce investment more strongly. Adjustment costs limit firms' ability to expand investment in response to favorable supply-chain sentiment, particularly for less redeployable capital.

In contrast, the influence of depreciation is relatively limited and primarily affects the timing and composition of investment responses.

This paper makes three main contributions. First, we show that supply-chain risk perceptions affect investment through distinct informational channels, uncertainty and directional outlook, that have systematically different effects on firm behavior. While perceived uncertainty is associated with short-run investment contraction, directional outlook is linked to persistent investment expansion.

Second, we document that the primary margin of adjustment operates through within-firm reallocation of investment. Investment responses differ sharply across types of capital: physical investment responds primarily to the directional outlook, whereas intangible investment is more sensitive to perceived uncertainty. Within intangible investment, knowledge and organizational capital exhibit distinct dynamic adjustment patterns. These findings highlight that heterogeneity arises primarily across types of capital rather than across firms.

Third, we provide evidence on the economic mechanisms underlying these responses. Financing constraints and adjustment frictions shape how different types of capital respond to risk perceptions, amplifying the contractionary effects of uncertainty and limiting the expansionary effects of favorable outlook. Together, our results emphasize the joint role of uncertainty, expectations, and capital characteristics in shaping firms' investment decisions.

Our results point to a cohesive perspective on how firms respond to supply-chain risk perceptions. Perceived uncertainty and directional outlook represent distinct informational channels, with uncertainty primarily affecting investment through precautionary and financing-related mechanisms, and sentiment operating through expectations of future profitability. The heterogeneity in responses across physical and intangible investment further suggests that capital characteristics, such as collateralizability and adjustment flexibility, play a central role in shaping firms' adjustment decisions. This framework helps reconcile the diverse empirical patterns documented in the paper and highlights the importance of jointly considering uncertainty, expectations, and capital heterogeneity when analyzing firm behavior.

Related Literature. Our paper relates to three strands of literature. First, we contribute to the literature on supply chains and firm behaviors. In the context of global production, supply chains form complex networks that span borders and connect activities ranging from raw material sourcing to manufacturing, transportation, and final sales (Grigoris and Segal 2026; Kong et al. 2023; Li et al. 2023; Qin et al. 2024). Prior studies show that supply-chain risks arise from uncertainty surrounding input prices, trade costs, transportation disruptions, and offshore production (Ersahin et al. 2024; Grigoris and Segal 2026). Because modern production systems are highly optimized and operate with limited slack, localized disruptions can propagate through supply-chain networks and affect firms both upstream and downstream (Acemoglu et al. 2012; Barrot and Sauvagnat 2016; Carvalho and Tahbaz-Salehi 2019; Carvalho et al. 2021; Hertzel et al. 2008).

A growing body of work studies how firms respond to supply-chain risks through external and internal adjustments, including vertical integration, mergers and acquisitions, inventory accumulation, and buffer-stock adjustments (Alessandria et al. 2023; Ersahin et al. 2024; Pankratz and Schiller 2024; Wu 2024; Zhong et al. 2024), and supply-chain reorganization in response to climate risk and other disruptions (Pankratz and Schiller 2024; Zhong et al. 2024). Grigoris and Segal (2026) show that supply-chain uncertainty affects investment through a real-options channel, with responses depending on the origin of uncertainty along the supply chain. We complement this literature by focusing on firms' internal investment responses and by examining how different supply-chain risk perceptions shape the allocation between physical and intangible capital.

Second, we relate to the literature on risk perceptions and uncertainty based on textual analysis. A large and growing literature constructs firm-level measures of risk exposure using earnings call transcripts and other disclosures, and studies their effects on corporate policies (Hassan et al. 2019, 2023, 2024a,b; Sautner et al. 2023). A key insight from this literature is that risk-related discussions contain distinct informational components: first-moment sentiment, which captures directional outlook, and second-moment uncertainty, which captures perceived risk. Current applications encompass political risk, non-political risk, Brexit, COVID-19, and climate risk, among others. We contribute to this strand by applying these textual measures to supply-chain risk perceptions and linking them to firm-level investment decisions. Unlike other existing firm-level narrative measures, supply-chain risk perceptions generate structured and capital-specific investment responses, highlighting an internal reallocation margin that is largely absent in prior work.

Third, we contribute to the literature on intangible capital and investment. Investment plays a central role in both short-run fluctuations and long-run growth (Fazzari et al. 1988; Jorgenson 1967; Solow 1956). Recent research shows that intangible investment, such as R&D and organizational investment, have become increasingly important and are now comparable in magnitude to physical investment in aggregate (Corrado et al. 2009). Prior work documents that intangible investment differs from physical investment in financing, adjustment dynamics, and sensitivity to risk and exogenous shocks (Döttling and Ratnovski 2023; Ewens et al. 2025; Li 2025; Zhang and Zhou 2026). Li et al. (2023) show that firms exposed to climate-related risks may reduce R&D unless such risks are actively managed.

Building on this literature, we further decompose intangible investment into knowledge and organizational investment (Corrado et al. 2009; Corrado and Hulten 2014; Corrado et al. 2022; Eisfeldt and Papanikolaou 2013, 2014; Falato et al. 2022; Lev and Radhakrishnan 2005). Consistent with Peters and Taylor (2017) and Ewens et al. (2025), we interpret R&D expenditures as investment in knowledge capital and a portion of SG&A expenditures as investment in organizational capital. We contribute by examining how supply-chain risk perceptions relate to investment in these components and how these responses connect to capital characteristics such as collateral value and adjustment costs.

The remainder of the paper is organized as follows. Section 2 describes the data, sample construction, and key variables. Section 3 develops a simple conceptual framework and testable implications. Section 4 outlines the empirical specification and presents baseline evidence on the effects of supply-chain sentiment and perceived supply-chain uncertainty on investment. Section 5 examines heterogeneity in these responses across firms with different capital compositions. Section 6 extends the analysis to other firm-level outcomes. Section 7 investigates the underlying mechanisms, focusing on financing constraints, depreciation rate, and adjustment costs. Section 8 compares supply-chain risk perceptions with other firm-level narrative exposures. Section 9 concludes. The Appendix provides additional details on data construction and selected supporting tables, while the Online Appendix contains supplementary figures, robustness checks, and extended results.

2 Data Construction and Description

2.1 Firm-level Data

We obtain firm-specific investments, characteristics, and fundamentals from Capital IQ Compustat annual frequency data, executive compensation data from ExecuComp, and corporate bond data from FISD-TRACE, all accessed via WRDS. We measure physical investments as capital expenditures ($CAPX$), and measure physical capital stock through the value of net property, plant, and equipment ($PPENT$). We measure firms' internally generated intangible investment using an expenditure-based capitalization approach that is standard in the literature (Döttling and Ratnovski 2023; Eisfeldt and Papanikolaou 2014; Ewens et al. 2025; Grullon and Ikenberry 2025; Peters and Taylor 2017). Specifically, we proxy knowledge investment with research and development (R&D) expense (XRD) and organizational investment with a capitalizable share of selling, general, and administrative (SG&A) expense ($XSGA$), where the SG&A capitalization share varies by SIC industry (Ewens et al. 2025). Intangible investment is then defined as the sum of R&D expense and organizational investment. Following Peters and Taylor (2017) and Ewens et al. (2025), we abstract from balance-sheet intangibles, which primarily reflect acquisition accounting. To obtain intangible capital stocks, we leverage the annual organizational and knowledge capital provided by Ewens et al. (2025), which implements a perpetual-inventory method with SIC-based capitalization. We define intangible capital as the sum of organizational and knowledge capital, and total capital as net property, plant, and equipment plus intangible capital.

Our analysis excludes financial companies (SIC codes 4900 - 4999), utility companies (SIC codes 6000 - 6999), and government entities (SIC codes 9000 and above), to keep the analysis relevant, following the standard approaches employed in corporate finance research. Firms that have missing data or negative values for assets, sales, capital expenditures, R&D, or SG&A expenses are excluded from sample selection. The study focuses exclusively on U.S. firms. The final sample consists of 7529 firms and 64214 observations. The data spans the years 2001 to 2021, including all firms in the matched Compustat sample after sample selection. Table 1 presents the summary statistics of the variables, reporting data for all firms while distinguishing between intangible and tangible firms. For a detailed elaboration of each variables, please refer to Appendix A.1.

The Hadlock and Pierce (2010) index, the Whited and Wu (2006) index, and the Kaplan and Zingales (1997) index serve as measures of financial constraints. We construct these indices following Gulen et al. (2024), utilizing the original methodology derived from their respective foundational papers. Physical capital depreciation rates are calculated based on BEA measures of the consumption of fixed capital and the net stock of private fixed assets. Data on asset redeployability are obtained from Kim and Kung (2017), stock compensation data are drawn from ExecuComp, and adjustment cost of capital is based on Hall (2004). We use these variables to test the underlying mechanisms of the baseline findings.

2.2 Supply Chain Uncertainty and Sentiment

We use firm-level supply-chain uncertainty (*SCRisk*) and supply-chain sentiment (*SCSentiment*) constructed by Ersahin et al. (2024) using textual analysis of earnings conference call transcripts as the sources for measuring supply-chain risk perceptions. The underlying perceptions data are available at the annual frequency. Following the exposure-scaling convention in Hassan et al. (2023), Hassan et al. (2024a,b), and Sautner et al. (2023), we rescale both *SCRisk* and *SCSentiment* for ease of interpretation. Summary statistics for these variables are reported in Table 2.

2.3 Macro-level Data

We obtain the Consumer Price Index (CPI) from the Federal Reserve Economic Data (FRED) database. For each firm–year, we use the CPI corresponding to the calendar year in which the firm's fiscal year ends and assumes contemporaneous deflation, not anticipation. Nominal firm-level monetary variables, including sales, investment, assets, and cash flow, are deflated using the GDP deflator to obtain real values. Variables constructed as ratios or growth rates are based on nominal values, following standard practice in the corporate finance literature.

3 Conceptual Framework

This section provides a simple framework to guide the interpretation of the empirical results. The goal is not to develop a fully specified structural model, but to clarify how different dimensions of supply-chain risk perceptions map into firms' investment decisions and how these responses vary across types of capital. The framework is intentionally stylized and serves to organize empirical predictions rather than provide structural estimation.

3.1 Setup

Consider a firm that chooses investment in two types of capital: physical capital I^p and intangible capital I^i. These two forms of capital differ in their economic characteristics, including their reliance on external finance, rates of depreciation, and ease of adjustment or redeployment.

The firm's investment decisions are influenced by two components of supply-chain risk perceptions. The first is the *directional outlook*, which captures whether managers perceive supply-chain conditions as improving or deteriorating, including conditions related to inputs, costs, logistics, demand, and profitability. The second is *perceived uncertainty*, which reflects the dispersion and unpredictability of future supply-chain conditions. These two dimensions correspond to the first and second moments of firms' beliefs about supply-chain conditions.

3.2 Economic Mechanisms

We consider three key dimensions of capital that shape firms' responses to these risk perceptions.

First, financing constraints affect the ability of firms to sustain investment when conditions deteriorate. Capital that relies more heavily on external finance is more sensitive to increases in perceived uncertainty, as tighter financial conditions amplify precautionary behavior.

Second, depreciation determines the extent to which firms must adjust investment to maintain or replace capital. Capital with higher depreciation rates may require more frequent adjustment, affecting the timing of investment responses.

Third, adjustment costs capture the ease with which capital can be expanded, reduced, or redeployed. Capital that is more difficult to adjust or less redeployable is likely to respond more cautiously to changes in risk perceptions.

Importantly, these dimensions describe the economic nature of capital rather than representing distinct channels of supply-chain risk. As a result, they shape how different types of capital respond to the same underlying changes in perceived uncertainty and directional outlook.

3.3 Testable Implications and Empirical Predictions

This framework yields a set of testable implications.

Proposition 1. An increase in perceived uncertainty reduces investment, reflecting precautionary behavior. This effect is stronger for types of capital that are more dependent on external finance or more costly to adjust.

Proposition 2. An improvement in directional outlook increases investment by raising expected future profitability. This effect is more pronounced for types of capital that can be adjusted or expanded more flexibly.

Proposition 3. Investment responses differ across types of capital due to differences in financing dependence, depreciation, and adjustment costs. As a result, heterogeneity arises primarily across investment types rather than across firms.

These predictions guide the empirical analysis that follows. In particular, we examine how physical and intangible investment respond differently to supply-chain uncertainty and sentiment, and how these responses vary with proxies for financing constraints, depreciation, and adjustment frictions.

4 Empirical Specification and Main Results

This section presents the baseline empirical results. Guided by the conceptual framework, we examine how investment responds to perceived uncertainty and directional outlook, corresponding to Proposition 1 and Proposition 2. We then assess whether these responses differ across types of capital, as suggested by Proposition 3.

Standard investment theories with adjustment costs and frictions imply that firms adjust investment gradually in response to changes in economic conditions. In particular, when facing uncertainty, firms may delay investment due to option value considerations, while changes in expected conditions may generate more immediate responses. Motivated by these dynamics, we examine the temporal responses of investment to supply-chain risk perceptions using a local projection framework (Jordà 2005). For each horizon h, we estimate the following regression:

$$y_{it+h} - y_{it-1} = \beta_1^h \cdot SCRisk_{it} + \beta_2^h \cdot SCSentiment_{it} + (X_{it-1})'\Gamma^h + \mu_i + \eta_{jt} + \epsilon_{it+h}. \quad (1)$$

The dependent variable y_{it} denotes the logarithm of investment, measured across five categories: total investment, physical investment, intangible investment, knowledge investment, and organizational investment. Following Döttling and Ratnovski (2023), we construct the dependent variable as the cumulative change in log investment between year $t-1$ and $t+h$, for $h = 0, 1, 2, 3$. This specification captures the dynamic adjustment of investment over time. Our dynamic specification mitigates reverse causality concerns by linking contemporaneous perceptions to future investment outcomes.

The key explanatory variables are firm-level supply-chain risk perceptions. In line with our interpretation framework, $SCRisk_{it}$ captures perceived supply-chain uncertainty (second moment), while $SCSentiment_{it}$ captures the directional tone of supply-chain discussions (first moment).

The coefficients β_1^h and β_2^h are the main parameters of interest. β_1^h measures how investment responds to perceived supply-chain uncertainty, while β_2^h captures the association between supply-chain sentiment and investment, conditional on uncertainty. This distinction allows us to separately identify the roles of uncertainty and directional outlook in shaping firm investment decisions.

Tables 3–7 report the baseline local projection estimates. Tables 3, 4, and 5 present results for total, physical, and intangible investment, respectively. Tables 6 and 7 further decompose intangible investment into knowledge investment and organizational investment. Columns (1)–(4) present results with firm and industry-by-year fixed effects. Columns (5)–(8) further incorporate lagged firm-level controls X_{it-1}, including Tobin's Q, cash holdings, leverage, firm size, cash flow, and a dividend payment indicator, variables that have been widely shown in the literature to be key determinants of corporate investment decisions. Columns (1), and (5) report contemporaneous responses ($h = 0$), while subsequent columns trace the dynamic effects over longer horizons.

All specifications include firm fixed effects (μ_i), which control for time-invariant firm characteristics, and industry-by-year fixed effects (η_{jt}) at the 2-digit SIC level, which absorb common industry-level variation in supply-chain conditions and macroeconomic factors. Standard errors are clustered at the firm level. Our empirical design follows the growing literature using text-based measures of risk perceptions to study firm responses

(Caldara et al. 2020; Ersahin et al. 2024; Hassan et al. 2019, 2023, 2024a,b; Wu 2024).

4.1 Total Investment

Columns (5)–(8) of Table 3 show that total investment responds to both dimensions of supply-chain risk perceptions, with opposite signs and distinct dynamics. A one-standard-deviation increase in perceived supply-chain uncertainty (*SCRisk*) is associated with an immediate decline in total investment growth of approximately 0.6 percentage points at $h = 0$, with a similarly sized negative effect at $h = 1$. These effects are statistically significant but attenuate at longer horizons and become indistinguishable from zero at $h = 2$ and $h = 3$. This pattern suggests that firms respond to perceived uncertainty primarily through short-run decline in investment.

In contrast, supply-chain sentiment (*SCSentiment*), which captures the directional outlook embedded in supply-chain discussions, is positively associated with total investment growth across all horizons. A one-standard-deviation increase in sentiment raises investment growth by about 1.1 percentage points on impact, with effects increasing to around 1.3–1.6 percentage points at longer horizons. These estimates indicate that improvements in supply-chain outlook are associated with economically meaningful and persistent expansions in investment.

Taken together, these results are consistent with Proposition 1 and Proposition 2. Higher perceived uncertainty is associated with a contraction in investment, while a more favorable directional outlook predicts investment expansion. These total investment responses provide a benchmark for the more disaggregated analysis that follows. The results suggest that uncertainty and directional outlook represent distinct informational channels that jointly shape firms' investment decisions.

Robustness Checks. Appendix Tables B.1–B.3 report key robustness analyses addressing sample composition and endogeneity concerns. Re-estimating the baseline total investment specifications, restricting the sample to firms for which both physical and intangible investment are observed, yields virtually identical estimates (Table B.1), indicating that sample selection does not drive our results.

We find no evidence of pre-trends or reverse causality. In placebo tests, supply-chain measures do not predict lagged investment growth (Table B.2), supporting a forward-looking interpretation. Similarly, using lagged uncertainty and sentiment yields no systematic relationship with subsequent investment growth (Table OA.1). Excluding sentiment from the baseline specification leaves the estimated effect of perceived supply-chain uncertainty largely unchanged (Table B.3), indicating that the results are not driven by correlated variation in directional outlook.

Our findings are also robust to alternative fixed-effect specifications. Replacing two-digit SIC×year fixed effects with three-digit SIC×year fixed effects produces quantitatively similar estimates (Table OA.2). Overall, the results are robust to sample composition, pre-trends, and alternative specifications.

Instrumental-variables evidence. To address potential endogeneity in perceived supply-chain uncertainty, we implement an instrumental-variables strategy based on an industry-level leave-one-out measure of peer firms' *SCRisk* within two-digit and three-digit SIC industry-years.[1]. Because the instrument varies primarily at the industry-year level, the specification replaces industry-by-year fixed effects with separate industry and year fixed effects. Under this approach, the 2SLS estimates are generally imprecise at short horizons and differ from the baseline panel estimates, with some effects emerging only at longer horizons (Table B.4). Overall, the IV results are not sufficiently precise to provide strong additional support for the baseline estimates. We therefore interpret the IV evidence as complementary.

Taken together, the combination of dynamic responses, absence of pre-trends, and robustness across specifications supports a forward-looking interpretation of the results, although we do not claim strict causal identification.

Multicollinearity between uncertainty and sentiment. Our baseline specifications include both perceived supply-chain uncertainty (*SCRisk*) and sentiment (*SCSentiment*), which are constructed from the same earnings-call transcripts in the literature. Conceptually, *SCRisk* captures second-moment uncertainty, while *SCSentiment* captures the directional tone (first moment). Empirically, the correlation between the two variables is small and further reduced after controlling for fixed effects and lagged covariates. The corresponding variance inflation factors are close to one (Table B.5), indicating that multicollinearity is not a concern. Consistent with this, the baseline results remain stable when sentiment is orthogonalized with respect to uncertainty.

4.2 Physical Investment

Columns (5)–(8) of Table 4 show that physical investment responds primarily to the directional component of supply-chain risk perceptions. The effect of perceived supply-chain

[1] We also explore an instrumental-variable strategy based on lagged supplier exposure following Ersahin et al. (2024). However, implementing this approach requires extensive supplier-level matching and imputation of missing supplier uncertainty measures. Given the limited coverage of supplier links and the resulting reduction in the usable sample, the first-stage relationship becomes weak in many specifications and only exceeds conventional relevance thresholds after filling a substantial number of missing values. This issue is also noted by Ersahin et al. (2024). Because the first stage is weak in our preferred fixed-effect specifications and the results are sensitive to data construction choices, we treat the IV evidence as supplementary and rely on the baseline panel estimates, robustness checks, and placebo tests to establish the empirical patterns.

uncertainty (*SCRisk*) is economically small and statistically indistinguishable from zero across all horizons. The estimated coefficients are modest in magnitude and imprecisely estimated, indicating that physical investment does not exhibit a systematic response to perceived uncertainty in this setting.

In contrast, supply-chain sentiment (*SCSentiment*), which captures the directional outlook embedded in supply-chain discussions, is strongly and positively associated with physical investment growth at all horizons. A one-standard-deviation increase in sentiment raises physical investment growth by approximately 1.8 to 2.3 percentage points, with effects that are both economically large and highly persistent.

Taken together, these findings indicate that physical investment responds primarily to first-moment supply-chain perceptions rather than to second-moment uncertainty. While improvements in supply-chain outlook are associated with sustained expansions in physical investment, perceived uncertainty does not have a statistically or economically meaningful effect on tangible capital expenditures.

These findings are consistent with Proposition 2, as physical investment responds strongly to changes in directional outlook. At the same time, the limited sensitivity to perceived uncertainty suggests that physical capital is less affected by precautionary motives, highlighting differences in how capital types respond to supply-chain risk perceptions. According to the literature, tangible capital, which is often collateralizable and relatively easier to finance and redeploy, is less sensitive to precautionary motives associated with uncertainty (Almeida and Campello 2007; Bloom et al. 2007; Kim and Kung 2017). Instead, firms adjust physical investment in response to changes in expected supply-chain conditions, which aligns with an expectations-driven investment channel (Campello and Kankanhalli 2024).

4.3 Intangible Investment

Columns (5)–(8) of Table 5 show that intangible investment responds to both dimensions of supply-chain risk perceptions, with opposite signs and distinct dynamics. A one-standard-deviation increase in perceived supply-chain uncertainty (*SCRisk*) is associated with an immediate decline in intangible investment growth of approximately 0.4–0.5 percentage points at short horizons ($h = 0, 1$), with effects that are statistically significant but attenuate and become indistinguishable from zero at longer horizons. This pattern indicates that perceived uncertainty leads to a short-run decline in intangible investment.

In contrast, supply-chain sentiment (*SCSentiment*), which captures the directional outlook embedded in supply-chain discussions, is positively associated with intangible investment growth across all horizons. A one-standard-deviation increase in sentiment raises intangible investment growth by approximately 0.6 percentage points, with effects that are persistent and statistically significant throughout.

These results indicate that intangible investment responds to both second-moment uncertainty and first-moment directional outlook. Unlike physical investment, which is primarily driven by supply-chain sentiment, intangible investment is sensitive to perceived supply-chain uncertainty, particularly at short horizons. This difference highlights an important dimension of capital heterogeneity in firms' investment responses.

One possible explanation is that intangible investment is more exposed to uncertainty-related frictions. Intangible capital is typically less collateralizable, more difficult to finance externally, and often involves higher adjustment costs and greater irreversibility (Döttling and Ratnovski 2023; Kim and Kung 2017). Consequently, firms may reduce intangible investment more aggressively in response to heightened perceived uncertainty. Meanwhile, improvements in supply-chain outlook are associated with sustained increases in intangible investment, suggesting that expectations about future conditions continue to play an important role.

Overall, these findings are consistent with Proposition 1 and 2, and suggest that intangible investment reflects a combination of precautionary responses to uncertainty and expansionary responses to improved outlook, providing a contrast with the primarily sentiment-driven behavior observed for physical investment.

4.4 Knowledge and Organizational Capital

Columns (5)–(8) of Tables 6 and 7 further decompose intangible investment into knowledge and organizational investment. The results show that both components respond to supply-chain risk perceptions, but with distinct dynamics across horizons.

For perceived supply-chain uncertainty (*SCRisk*), knowledge investment exhibits a short-run decline. A one-standard-deviation increase in uncertainty reduces knowledge investment growth at $h = 0$ and $h = 1$, with economically meaningful and statistically significant effects, but these effects attenuate at longer horizons and become statistically insignificant. In contrast, organizational investment displays a more persistent response: the effect of *SCRisk* is negative and statistically significant across all horizons, indicating a sustained contraction in organizational investment in response to perceived uncertainty.

For supply-chain sentiment (*SCSentiment*), both knowledge and organizational investment respond positively, but the persistence differs. Knowledge investment reacts strongly at short horizons, with positive and statistically significant effects at $h = 0$ and $h = 1$, while the effects weaken and lose statistical significance at longer horizons. Organizational investment shows a similar pattern, with positive responses at short horizons that attenuate over time. It is worth noting that the effects at the aggregate level may mask important heterogeneity across investment components. Although both knowledge and organizational investment respond positively to supply-chain sentiment at short horizons, their effects differ in magnitude and timing. When aggregated, these differences reduce the precision of the estimated effect on intangible investment, leading to weaker or statistically insignificant results at the aggregate level.

These findings highlight important heterogeneity within intangible investment. Knowledge investment is more responsive at short horizons but adjusts more transiently, whereas organizational investment responds more persistently to perceived supply-chain uncertainty. This difference is consistent with the idea that organizational capital, which is often embedded in firm structure and processes, is more costly to adjust and therefore exhibits more gradual and sustained responses (Prescott and Visscher 1980).

Overall, these patterns provide further support for Proposition 3. Although both components respond to supply-chain sentiment and uncertainty, their timing and persistence differ, indicating that heterogeneity arises within intangible capital itself. This suggests that differences in adjustment costs and redeployability may play a role in shaping investment dynamics.

4.5 Event-Style Evidence

To provide event-style evidence that supports a forward-looking interpretation of the baseline results on the dynamic effects of supply-chain uncertainty, we conduct an analysis based on large increases in perceived uncertainty. Specifically, we define a "high uncertainty event" as an observation in which the change in *SCRisk* falls in the top decile of its distribution.

We then examine the average path of investment around these events, plotting investment growth from two periods before to two periods after the event. Figure 1 plots the average path of investment around high uncertainty events. The figure shows that investment declines sharply following the change, with no evidence of systematic pretrends. The contraction is more pronounced for intangible investment than for physical investment, consistent with the baseline regression results. This pattern is consistent with the baseline local projection results and supports a forward-looking interpretation of the relationship between perceived uncertainty and investment. The absence of pre-trends and the sharp post-event decline provide additional evidence consistent with a causal interpretation of the relationship between perceived uncertainty and investment.

Additional figures in the Online Appendix provide further supporting evidence. The investment-type-specific event-study plots in Figures OA.1–OA.5 show consistent post-event declines across total, physical, intangible, knowledge, and organizational investment, with the most persistent and pronounced responses observed for intangible and organizational investment.

These figures provide complementary visual evidence that increases in perceived supply-chain uncertainty are associated with precautionary reductions in investment, and that these responses differ systematically across capital types.

5 Investment Responses by Capital Composition

Firms accumulate capital through both physical and intangible investment, leading to substantial heterogeneity in capital composition. Some firms are relatively intangible-intensive, while others rely more heavily on tangible capital. This raises the question of whether firms with different capital composition respond differently to supply-chain risk perceptions.

This section examines heterogeneity across capital composition. We augment the baseline specification with interaction terms between perceived supply-chain uncertainty (*SCRisk*) and an indicator for intangible-intensive firms, as well as between supply-chain sentiment (*SCSentiment*) and the same indicator. The intangible-firm indicator is defined as a year-specific dummy equal to one if a firm's intangible capital share exceeds the annual median. We use the lagged indicator to ensure that firm type is predetermined with respect to investment outcomes. The specification is as follows:

$$\begin{aligned} y_{it+h} - y_{it-1} &= \beta_1^h \cdot SCRisk_{it} + \beta_2^h \cdot SCSentiment_{it} + \beta_3^h \cdot IntangibleFirm_{it-1} \\ &+ \beta_4^h \cdot (SCRisk_{it} \times IntangibleFirm_{it-1}) + \beta_5^h \cdot (SCSentiment_{it} \times IntangibleFirm_{it-1}) \\ &+ (X_{it-1})'\Gamma^h + \mu_i + \eta_{jt} + \epsilon_{it+h}. \quad (2) \end{aligned}$$

The coefficients β_4^h and β_5^h capture whether the responses to perceived supply-chain uncertainty and sentiment differ systematically between intangible-intensive firms and other firms, conditional on baseline effects and controls.

Tables 8 and 9 report the results. Overall, the interaction effects are limited. Across investment categories, the baseline effects of *SCRisk* remain negative, but the interaction terms with the intangible-firm indicator are generally small and statistically insignificant. The main exception is total investment at longer horizons, where the interaction term is positive and statistically significant, indicating that the negative effect of perceived uncertainty is somewhat weaker for intangible-intensive firms in the long run.

A similar pattern emerges for supply-chain sentiment. While *SCSentiment* is positively associated with investment in the baseline specifications, its interaction with the intangible-firm indicator is generally small and imprecisely estimated across investment categories. For physical investment, the strong positive response to sentiment does not differ materially across firm types. For intangible investment, the interaction terms are likewise statistically insignificant, indicating that the sensitivity of intangible investment to both perceived uncertainty and directional outlook does not vary systematically with firm-level capital composition.

Table 9 shows that this pattern extends to the components of intangible investment. For both knowledge investment and organizational investment, the interaction terms with $SCRisk$ and $SCSentiment$ are statistically insignificant across all horizons. Thus, while the baseline results reveal distinct response patterns across investment types, allowing these responses to vary by firm type yields little additional heterogeneity.

Taken together, these findings suggest that differences in firms' responses to supply-chain risk perceptions arise primarily across types of capital rather than across types of firms. In other words, the key margin of adjustment operates through how firms reallocate investment between physical and intangible capital, rather than through differential responses across firms with different capital compositions.

This result provides an important insight. While intangible-intensive firms differ from other firms in their balance-sheet structure, financing conditions, and exposure to uncertainty, these differences do not translate into systematically different marginal responses to supply-chain risk perceptions once firm fixed effects are accounted for. Instead, the dominant source of heterogeneity lies in the characteristics of capital itself, including collateralizability, depreciation, and adjustment frictions, rather than in firm-level capital composition.

6 Firm-Level Real Activity and Financing Responses

After examining the effects of perceived supply-chain uncertainty ($SCRisk$) and supply-chain sentiment ($SCSentiment$) on firms' investment decisions, we extend the analysis to a broader set of firm-level outcomes that capture real activity and financing adjustments. Tables 10 and 11 report the effects of supply-chain risk perceptions on these dimensions. All specifications include the same lagged controls and fixed effects as in the baseline regressions.

The results show a clear pattern across first- and second-moment supply-chain risk perceptions. Supply-chain sentiment is positively associated with short-horizon expansions in real activity. In particular, $SCSentiment$ is linked to higher sales growth and COGS growth, as well as increased equity issuance at short horizons ($h = 0, 1$). It is also positively related to markup changes, with effects that remain statistically significant through $h = 2$. These findings suggest that a more favorable supply-chain outlook is associated with near-term increases in revenues, operating costs, and pricing power.

By contrast, perceived supply-chain uncertainty is associated with contractions in real activity. The coefficients on $SCRisk$ are negative and statistically significant for sales growth and employment growth, with the strongest effects occurring at short to medium horizons. This pattern is consistent with firms scaling back production and labor demand in response to elevated uncertainty. In contrast, neither $SCRisk$ nor $SCSentiment$ exhibits a robust relationship with debt growth, indicating limited adjustment along this financing margin.

These results provide additional evidence on the economic channels through which supply-chain risk perceptions affect firm behavior. Supply-chain sentiment appears to capture variation in expected demand conditions, leading firms to expand not only investment but also real activity, as reflected in higher sales, production costs, and markups. In contrast, perceived supply-chain uncertainty is associated with precautionary adjustments that reduce real activity, consistent with firms scaling back production and employment in response to increased risk.

Importantly, these patterns reinforce the interpretation of our investment results. The contraction in investment under uncertainty is accompanied by broader reductions in firm activity, suggesting that uncertainty operates through a precautionary channel affecting both capital accumulation and operational decisions. Conversely, the expansion in investment associated with improved sentiment aligns with increases in sales and pricing power, consistent with an expectations-driven demand channel.

Overall, these findings indicate that supply-chain risk perceptions influence firms along multiple margins. While our primary focus is on investment, the evidence from real activity and pricing outcomes highlights that firms adjust both capital allocation and operational behavior in response to distinct dimensions of perceived supply-chain risk.

Heterogeneous responses across firm types. To assess whether the heterogeneity documented for investment extends to other firm-level outcomes, we re-estimate Equation (2) by interacting $SCRisk$ and $SCSentiment$ with a lagged indicator for intangible-intensive firms. The results, reported in Table OA.3, provide only weak and mixed evidence of heterogeneity across firm types, with estimates that are generally imprecise and not consistently statistically significant.

Across most outcomes, the interaction terms are small and statistically insignificant. For sales and COGS growth, the negative association with $SCRisk$ is broadly similar across firms. For employment growth, the adverse effect of perceived uncertainty is somewhat attenuated among intangible-intensive firms at intermediate horizons, although this pattern is not consistently robust. For debt and equity growth, as well as markup changes, interaction effects are economically small and imprecisely estimated.

Overall, these results suggest that, similar to investment decisions, non-investment outcomes do not exhibit strong differences across firms with different capital compositions. This finding reinforces our central result that the primary margin of adjustment operates across types of capital rather than across types of firms. In other words, while firms differ in their capital structure, their responses along non-investment margins are broadly similar, and the key heterogeneity arises in how different types of capital adjust within firms.

Given the focus of this paper on corporate investment behavior, we treat these results as supplementary and report them for completeness without further structural interpretation.

7 Mechanism Analysis

The baseline results show that firms respond differently to first- and second-moment supply-chain risk perceptions across investment categories. In particular, physical and intangible investment, as well as knowledge and organizational capital, exhibit distinct response patterns. These differences suggest that capital is not homogeneous from the standpoint of firm adjustment, and that both the characteristics of capital and firm-level frictions play a central role in shaping investment responses.

This section examines the mechanisms underlying the heterogeneous investment responses, corresponding to the channels described in the conceptual framework. In particular, we assess how financing constraints, depreciation, and adjustment frictions shape the responses predicted by Proposition 1–Proposition 3.

Rather than representing distinct channels of supply-chain risk, these mechanisms characterize the response of capital to such risk perceptions. Differences in reversibility, redeployability, and exposure to downside risk imply that intangible capital adjusts more cautiously and gradually than physical capital when firms face changes in perceived uncertainty and directional outlook.

The financing channel predicts that firms facing tighter financing conditions reduce investment more strongly in response to increases in perceived uncertainty, while firms with greater financial flexibility are better able to translate improvements in supply-chain sentiment into actual investment (Almeida and Campello 2007; Fazzari et al. 1988). This mechanism is particularly relevant in our setting because different types of capital differ in their dependence on external finance and in their ability to be sustained under adverse conditions. As a result, financing constraints can amplify the sensitivity of investment to both uncertainty and sentiment, but may affect different types of capital to varying degrees.

The depreciation channel focuses on the role of capital turnover. Capital that depreciates more rapidly may require more frequent replacement, increasing the need to adjust investment in response to changing supply-chain conditions. In this sense, higher depreciation rates can amplify the responsiveness of investment to both perceived uncertainty and improvements in sentiment by raising the cost of delaying adjustment (Pindyck 1991). However, because depreciation primarily affects the timing and intensity of adjustment rather than the direction of responses across capital types, its explanatory power for the observed heterogeneity may be more limited.

The adjustment cost channel emphasizes differences in the cost and flexibility of capital adjustment. Some forms of capital are more costly to scale, reverse, or redeploy due to firm-specificity, planning requirements, or limited secondary markets (Kermani and Ma 2023; Kim and Kung 2017). When adjustment frictions are high, firms may respond more cautiously to perceived uncertainty and may be less able to expand investment in response to favorable supply-chain sentiment. In contrast, investment that is easier to adjust can respond more elastically to changes in expected demand conditions. These differences are particularly relevant for understanding the distinct responses of physical and intangible capital, as well as the heterogeneous dynamics within intangible investment.

Our empirical analysis evaluates these predictions by interacting supply-chain risk perceptions with proxies for financing conditions, depreciation, and adjustment frictions. Across these mechanisms, we find the strongest and most consistent evidence for financing constraints and adjustment frictions, while the role of depreciation is more limited and less systematic.

These findings suggest that the heterogeneity in investment responses documented in earlier sections is jointly shaped by financing capacity, adjustment flexibility, and the intrinsic characteristics of capital. In particular, the stronger sensitivity of intangible investment to perceived uncertainty is consistent with higher irreversibility and adjustment costs, while the dominant role of sentiment in driving physical investment reflects its greater flexibility and closer link to expected demand conditions.

The following subsections examine each mechanism in turn. Our goal is not to attribute the results to a single channel, but to assess which economic forces are most consistent with the cross-sectional patterns in firms' responses to perceived supply-chain uncertainty and directional outlook.

7.1 Financing Constraints

To examine the role of financing conditions, we estimate interaction regressions that allow the effects of perceived supply-chain uncertainty ($SCRisk$) and supply-chain sentiment ($SCSentiment$) to vary with firm-level proxies for financial constraints. We employ multiple measures, including cash holdings, leverage, the KZ index, and bond credit spreads. Results for the baseline specifications are reported in Tables 12–13, with additional evidence reported in Appendix Tables B.6-B.7.

For perceived supply-chain uncertainty, the results provide strong evidence of a financing channel. Firms facing tighter financing conditions exhibit a larger contraction in investment in response to increases in $SCRisk$. In particular, the interaction between bond credit spreads and $SCRisk$ is negative and statistically significant, especially for total and organizational investment (Table 12), indicating that firms exposed to higher external financing costs reduce investment more strongly when perceived uncertainty rises. Similar patterns emerge using balance-sheet proxies: highly leveraged firms display greater sensitivity to $SCRisk$, while firms with higher cash holdings are less adversely affected (Tables 13 and B.6). Overall, the most consistent evidence from market-based and balance-sheet measures supports the view that perceived supply-chain uncertainty depresses investment more strongly when financing conditions are tight.

For supply-chain sentiment, the results reflect the interaction of two forces: an expectations channel and a financing constraint channel. On the one hand, improvements in $SCSentiment$ raise expected profitability and increase investment demand. On the other hand, financing frictions limit the ability of firms to translate improved outlook into realized investment.

Consistent with financing constraint channel, firms with stronger balance sheets respond more to positive sentiment. Firms with higher cash holdings exhibit a stronger positive response to $SCSentiment$, while highly leveraged firms respond less (Tables 13 and B.6). Similarly, firms facing lower credit spreads show larger investment expansions following improvements in sentiment (Table 12).

Results based on the KZ index align more with the expectations channel. The interaction between the KZ index and $SCSentiment$ is positive in several specifications (Table B.7), suggesting that firms classified as more constrained exhibit stronger sensitivity to changes in sentiment. This pattern likely reflects the fact that composite indices such as the KZ index capture multiple firm characteristics, including investment opportunities and cash-flow sensitivity, rather than isolating financing frictions alone (Hadlock and Pierce 2010; Kaplan and Zingales 1997).

The evidence indicates that supply-chain sentiment operates through both expected profitability and financing capacity. While improved outlook increases investment demand, the extent to which firms can act on these opportunities depends critically on their financing conditions.

Overall, these results provide support for Proposition 1. Perceived supply-chain uncertainty leads to larger investment contractions among financially constrained firms, while the ability to respond to favorable supply-chain sentiment is amplified for firms with greater financial flexibility.

7.2 Adjustment Costs

To examine the role of adjustment costs, we estimate interaction regressions that allow the effects of perceived supply-chain uncertainty ($SCRisk$) and supply-chain sentiment ($SCSentiment$) to vary with proxies for the cost and flexibility of capital adjustment. We consider three measures: a direct adjustment-cost proxy, redeployability, and stock compensation. The corresponding results are reported in Table 14 and Appendix Tables B.8–B.9. Because adjustment costs are not directly observable and may operate through multiple channels, these alternative proxies help capture different aspects of the mechanism.

Regarding perceived supply-chain uncertainty, the most consistent evidence of an adjustment-frictions channel arises from redeployability. Firms with lower redeployability, indicating higher adjustment costs, reduce investment more strongly in response to increases in $SCRisk$. This pattern is particularly pronounced for intangible, knowledge, and organizational investment at medium and longer horizons (Table 14). These results align closely with the baseline findings, where perceived uncertainty disproportionately affects nonphysical investment.

In contrast, evidence based on the direct adjustment-cost proxy is more limited. While some interaction terms are negative and statistically significant, particularly for total investment at short horizons (Table B.8), the overall pattern is less systematic. Similarly, results using stock compensation are weaker and less consistent across investment categories (Table B.9), suggesting that this proxy captures broader firm characteristics rather than adjustment frictions per se.

Turning to supply-chain sentiment, the results again highlight the importance of redeployability. Firms with lower redeployability exhibit a weaker positive response of investment to $SCSentiment$, particularly for intangible and organizational investment. This indicates that adjustment frictions limit the ability of firms to translate improved supply-chain outlook into realized investment. In contrast, the evidence based on the direct adjustment-cost proxy is more concentrated and less robust, while the stock-compensation proxy yields little systematic variation.

These findings provide support for an adjustment-frictions channel. Perceived supply-chain uncertainty leads to larger investment contractions when capital is more difficult to adjust, while the positive effects of supply-chain sentiment are dampened when firms face higher adjustment frictions. Among the proxies considered, redeployability provides the clearest and most consistent evidence, especially for intangible and organizational investment.

Overall, the results are consistent with the propositions. Adjustment frictions play an important role in shaping firms' investment responses to supply-chain risk perceptions. In particular, the stronger sensitivity of intangible investment to perceived uncertainty, and the weaker response of such investment to improved sentiment, are consistent with higher adjustment costs and lower redeployability of nonphysical capital.

7.3 Depreciation

To examine the role of depreciation, we estimate interaction regressions that allow the effects of perceived supply-chain uncertainty and supply-chain sentiment to vary with firms' lagged weighted depreciation rates. Table B.10 reports the results across investment categories and horizons. As a complementary exercise, we also consider heterogeneity based on the depreciation gap between intangible and tangible capital. These results are less stable and are therefore reported in Table B.11.

Overall, the evidence for a depreciation channel is mixed and varies across investment types. For perceived supply-chain uncertainty, there is some evidence that firms with higher depreciation rates adjust physical investment more strongly at short to medium horizons, as indicated by negative and statistically significant interaction terms. However, for total and intangible investment, the interaction effects are generally small and statistically insignificant, suggesting limited systematic heterogeneity along these margins.

For supply-chain sentiment, the results indicate somewhat stronger but still uneven patterns. Firms with higher depreciation rates exhibit a stronger positive response of physical investment at short horizons, and similar patterns emerge for knowledge investment at selected horizons. However, these effects are not consistently observed across all investment categories or time horizons, and the interaction terms for total and organizational investment are generally insignificant.

These findings suggest that depreciation plays a secondary role in shaping firms' responses to supply-chain risk perceptions. While higher depreciation rates are associated with stronger short-run adjustment in certain investment categories, particularly physical and, to a lesser extent, knowledge investment, the effects are not uniform across capital types or horizons.

To sum up, the evidence is consistent with a limited depreciation channel, whereby firms with greater capital replacement needs adjust the timing and composition of investment in response to supply-chain risk perceptions, but this mechanism is weaker and less systematic than the financing and adjustment-frictions channels in explaining the heterogeneous responses.

8 Comparison with Other Narrative Risk Measures

A natural question is whether the investment responses documented in this paper are specific to supply-chain risk perceptions or instead reflect more general patterns associated with firm-level narrative measures of uncertainty and sentiment. A large literature constructs such measures from earnings-call transcripts and shows that they predict firm behavior across a wide range of settings. This raises the concern that our findings may simply capture broader narrative-based variation in firm outlook rather than supply-chain-specific mechanisms.

To address this question, we compare our supply-chain measures with a set of firm-level narrative exposures constructed using similar methodologies by Hassan et al. (2019), Hassan et al. (2023), Hassan et al. (2024a) and Sautner et al. (2023). These measures capture broad perceived uncertainty (second-moment content) and directional outlook (first-moment content) across several topics, including overall, political, non-political, Brexit, and climate-related discussions. All measures are standardized to follow the same scaling convention as our baseline supply-chain variables, facilitating direct comparison of magnitudes across specifications. We then re-estimate our baseline specifications using these alternative measures. For parsimony, we report the results based on these measures of risk-perceptions in the Online Appendix (Tables OA.4–OA.8).

The results reveal important differences between supply-chain risk perceptions and broader narrative-based measures. Second-moment uncertainty measures constructed from general topics exhibit heterogeneous and often unstable associations with investment, with signs and magnitudes varying across horizons and investment categories. By contrast, first-moment directional-outlook measures are more consistently positively associated with investment, although these effects tend to attenuate at longer horizons.

Compared to these benchmark measures, supply-chain risk perceptions display more systematic and economically interpretable patterns. In particular, perceived supply-chain uncertainty is consistently associated with short-run contractions in investment, while supply-chain sentiment is linked to persistent investment expansion. Moreover, these effects differ in a structured way across investment types, a feature that is less evident in broader narrative-based measures.

These findings suggest that supply-chain risk perceptions capture a distinct and economically meaningful dimension of firm-level information. Rather than reflecting general sentiment or uncertainty, supply-chain measures appear to contain more targeted information about firms' operational environment, which translates into more structured and interpretable investment responses.

9 Conclusion

This paper studies how firms adjust investment in response to supply-chain risk perceptions. Using text-based measures of perceived supply-chain uncertainty (*SCRisk*) and supply-chain sentiment (*SCSentiment*) from the literature, we show that the first- and second-moment components of supply-chain risk perceptions have distinct and economically meaningful effects on corporate investment.

We document three main findings. First, perceived supply-chain uncertainty is associated with a contraction in investment at short horizons, while supply-chain sentiment is linked to persistent investment expansion. Second, these responses differ systematically across investment margins. Physical investment responds primarily to the directional outlook embedded in supply-chain discussions, whereas intangible investment is more sensitive to perceived uncertainty. Within intangible investment, knowledge and organizational capital exhibit distinct dynamic adjustment patterns, highlighting additional heterogeneity across nonphysical capital. Third, these effects extend beyond investment. Perceived uncertainty is associated with weaker real activity, while supply-chain sentiment is linked to short-run expansion in sales, costs, and markups.

We examine the mechanisms underlying these patterns. The evidence points most strongly to financing conditions and adjustment frictions. Tighter financing constraints amplify the contractionary effect of perceived uncertainty on investment, while lower capital redeployability weakens firms' ability to respond to favorable sentiment and intensifies contractions in nonphysical investment when uncertainty rises. In contrast, the role of depreciation is more limited and less systematic.

Taken together, our findings point to a unified interpretation of how firms respond to supply-chain risk perceptions. Consistent with the conceptual framework, perceived uncertainty operates through a precautionary channel that leads firms to contract investment (Proposition 1), while directional outlook reflects expected profitability and drives investment expansion (Proposition 2). Importantly, these effects manifest primarily through differences across types of capital rather than across firms, highlighting that the key margin of adjustment lies in within-firm reallocation of investment across capital types (Proposition 3).

This perspective has broader implications for understanding firm behavior under risk. By distinguishing between uncertainty and expectations, and by recognizing the role of capital heterogeneity, our results provide a framework for interpreting how risk perceptions propagate within firms and across production networks. In particular, the differential responses of physical and intangible capital suggest that the composition of investment is a critical but often overlooked channel through which risk perceptions affect economic activity.

Our results open several avenues for future research. An important extension is to distinguish between upstream and downstream sources of supply-chain risk, which may have asymmetric effects on firms' investment and production decisions. Embedding the mechanisms studied in a general equilibrium framework would further clarify how firm-level adjustments propagate through production networks and affect aggregate outcomes. Finally, advances in large language models offer promising tools to extract richer information on the causes, transmission channels, and domains of risk from unstructured text, enabling a deeper understanding of supply-chain risk beyond traditional dictionary-based approaches.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used AI-assisted tools, including ChatGPT and Grammarly, to edit the manuscript for content organization and improving clarity and language. After using these tools and services, the authors reviewed and edited the content as needed and take full responsibility for the manuscript.

Data Statement

This study combines proprietary and publicly available data sources. Firm-level financial data are obtained from Capital IQ Compustat, while executive compensation data are drawn from ExecuComp. Information on corporate bond markets is obtained from FISD and TRACE, accessed via WRDS. Macroeconomic variables are sourced from publicly available databases, including the Federal Reserve Economic Data (FRED). Access to certain datasets (e.g., Compustat, ExecuComp, FISD, and TRACE) is subject to institutional licensing agreements via WRDS, and the authors are therefore unable to redistribute these proprietary data. All data sources, sample construction, and variable definitions are described in detail in the paper and appendix. Replication code is available from the authors upon reasonable request.

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Tables and Figures

Figures

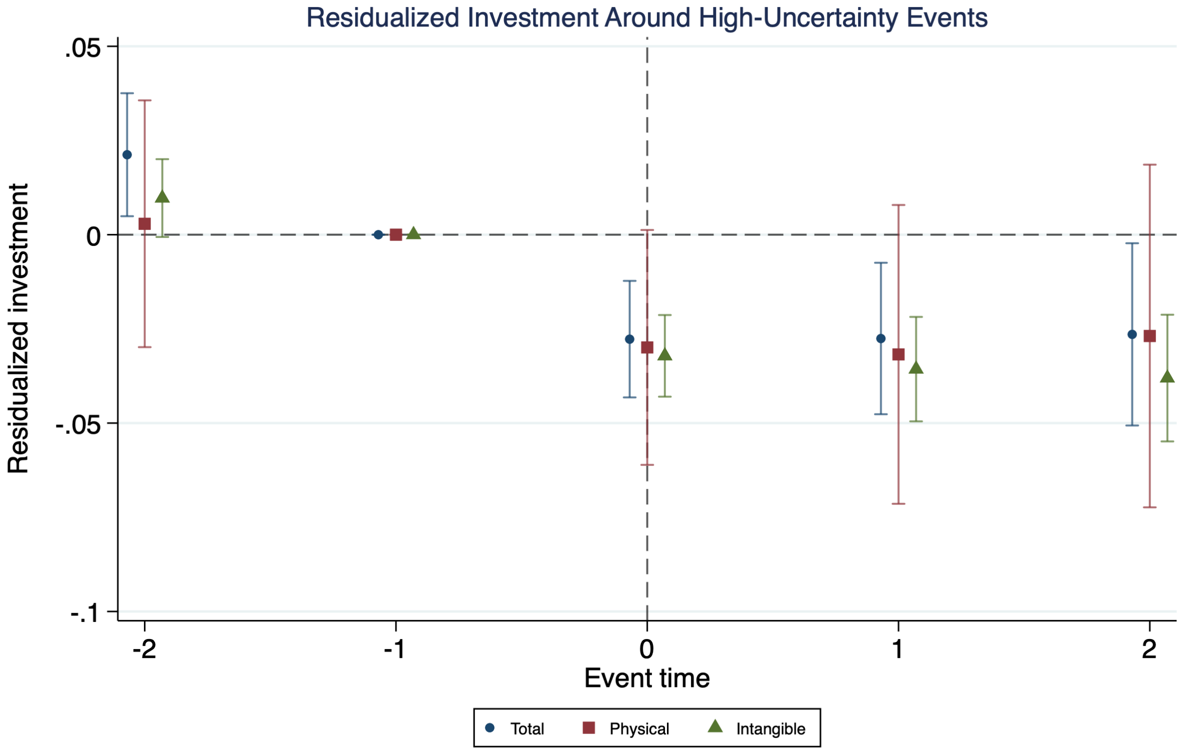

Figure 1: Residualized Total, Physical, and Intangible Investment Around High-Uncertainty Events

Tables

Table 1: Descriptive Statistics of Firm-level Variables

Variable	All Firms				Tangible Firms				Intangible Firms			
	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	N
Intangible Ratio	0.60	0.68	0.32	55560	0.32	0.33	0.22	27786	0.87	0.88	0.09	27774
Asset Tangibility	0.40	0.32	0.32	55560	0.68	0.67	0.22	27786	0.13	0.12	0.09	27774
Cash	0.23	0.13	0.24	64212	0.11	0.07	0.13	27784	0.33	0.27	0.27	27774
Leverage	0.24	0.18	0.32	64214	0.29	0.26	0.26	27786	0.16	0.06	0.35	27774
Age	17.26	13.00	15.26	64214	19.47	15.00	16.19	27786	14.55	11.00	12.64	27774
Book Assets	3878.40	419.31	17435.91	64214	5263.70	849.55	20328.47	27786	1718.09	161.28	8671.47	27774
Size	6.07	6.04	2.10	64214	6.74	6.74	1.91	27786	5.23	5.08	1.95	27774
Total Capital	1729.63	203.41	8167.62	55577	2607.36	406.93	10541.51	27786	852.58	107.69	4558.38	27774
PPE (Net)	1160.56	63.77	6629.29	64178	1951.53	259.68	8464.09	27786	155.53	10.95	902.62	27774
Intangible Capital (MS)	675.91	87.60	3370.85	55609	655.84	79.83	3020.33	27786	697.06	94.31	3690.91	27774
Organizational Capital	494.69	59.97	2416.13	55609	528.34	69.65	2464.47	27786	461.76	51.87	2368.46	27774
Knowledge Capital	179.73	2.23	1282.68	56107	127.50	0.00	1126.94	27786	235.29	16.86	1430.66	27774
Tobin's Q	1.95	1.31	2.44	64214	1.46	1.13	1.19	27786	2.25	1.52	2.88	27774
Total Q	1.28	0.97	1.23	55609	1.25	1.00	0.98	27786	1.30	0.94	1.43	27774
Dividend Paid (Dummy)	0.34	0.00	0.47	64214	0.47	0.00	0.50	27786	0.21	0.00	0.41	27774
Debt Growth	0.06	-0.00	0.98	48190	0.08	0.00	0.79	23809	-0.01	-0.03	1.20	17327
Equity Growth	0.04	0.06	0.53	56523	0.06	0.07	0.45	24892	-0.00	0.04	0.57	24565
Total Inv. Rate	0.42	0.26	10.04	55239	0.47	0.22	14.42	26507	0.37	0.30	1.24	26327
Tangible Inv. Rate	0.52	0.20	19.85	60464	0.48	0.17	28.61	26486	0.56	0.27	7.06	26241
Intangible Inv. Rate	0.41	0.30	7.06	50054	0.47	0.29	10.26	23536	0.36	0.31	0.80	24153
Org. Inv. Rate	0.40	0.26	7.39	48483	0.45	0.26	10.30	23453	0.35	0.25	2.57	22771
Know. Inv. Rate	0.52	0.47	0.83	28423	0.58	0.50	1.10	8961	0.49	0.45	0.68	17843
CAPX / Intan. Inv.	2.71	0.32	11.60	62222	5.64	1.11	16.82	26194	0.17	0.11	0.20	27603
Debt-to-Sales	2.58	0.18	96.37	64214	1.37	0.26	58.55	27786	3.32	0.06	124.45	27774
Cash Flow	0.05	0.10	1.25	60756	0.15	0.13	1.83	26558	-0.03	0.06	0.41	26385
Bond Credit Spread	3.59	2.36	5.35	10016	3.82	2.62	5.65	6641	3.13	2.01	3.94	2034
Observations	64214				27786				27774			

Note: This table presents the mean, median, standard deviation, and number of observations employed in the regression analysis. Columns 1–4 pertain to the complete sample of all firms. Columns 5–8 apply to the sample of tangible firms, while columns 9–12 correspond to intangible firms. Intangible firms are defined as those above the median of the lagged intangible ratio within each year, and tangible firms are those below the median. Certain variables are winsorized at the 1% and 99% levels.

Table 2: Descriptive Statistics of Supply Chain Uncertainty and Sentiment

Variable	Mean	Median	Std. Dev.
Supply Chain Uncertainty	4.369556	2.126188	8.115157
Supply Chain Sentiment	41.79039	17.02033	94.39104
Observations	33588		

Note: This table displays the mean, median, standard deviation, and number of observations pertaining to supply chain risk perceptions. During the preprocessing stage, SCRisk and SCSentiment were scaled by a factor of 100,000, complying with the methodology outlined by Hassan et al. (2019). To enhance interpretability, we scale them down by a factor of 100. The net effect is that both SCRisk and SCSentiment are scaled up by a factor of 1,000.

Table 3: Baseline Regression Results: Total Investment Rate

	OLS + FE				OLS + FE + Control Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00578**	-0.00411	-0.000857	-0.00404	-0.00639**	-0.00463	-0.00127	-0.00489
	(0.00289)	(0.00377)	(0.00440)	(0.00453)	(0.00282)	(0.00368)	(0.00428)	(0.00431)
SCSentiment(std)	0.0104***	0.0129***	0.0139***	0.00945**	0.0113***	0.0138***	0.0154***	0.0107**
	(0.00231)	(0.00341)	(0.00393)	(0.00461)	(0.00221)	(0.00326)	(0.00367)	(0.00418)
Total Q					0.0394***	0.00520	-0.0406***	-0.0746***
					(0.00452)	(0.00640)	(0.00852)	(0.00985)
Size					-0.122***	-0.237***	-0.326***	-0.379***
					(0.00714)	(0.0119)	(0.0172)	(0.0211)
Leverage					-0.0981***	0.0278	0.180***	0.255***
					(0.0320)	(0.0355)	(0.0495)	(0.0555)
Dividend Dummy					-0.00610	-0.0129	-0.0136	-0.0316
					(0.00900)	(0.0140)	(0.0196)	(0.0247)
Cash					0.363***	0.417***	0.346***	0.241***
					(0.0312)	(0.0430)	(0.0523)	(0.0609)
Cashflow					0.0198	0.0241	0.0756	0.0765
					(0.0329)	(0.0548)	(0.0956)	(0.137)
Observations	27892	24646	21588	18844	27882	24637	21579	18835
R^2	0.222	0.298	0.329	0.356	0.262	0.349	0.387	0.420
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: Industries are classified at the two-digit SIC code level. All variables are defined in Appendix B. Robust standard errors, clustered at the firm level, are reported in parentheses. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively. Columns 1–4 include firm fixed effects and industry-by-year fixed effects. Columns 5–8 additionally include standard control variables commonly used in corporate investment studies; all controls are lagged to mitigate simultaneity bias and alleviate concerns about endogeneity. The dependent variable is calculated as the change in the logarithm of total investment between year $t + h$ and year $t - 1$, where $h = 0, 1, 2, 3$. The total investment rate is calculated as the ratio of total investment to lagged total capital. Total investment is defined as the sum of physical and intangible investment, and total capital as the sum of physical and intangible capital.

Table 4: Baseline Regression Results: Physical Investment Rate

	OLS + FE				OLS + FE + Control Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00353	-0.00409	-0.00315	0.00179	-0.00660	-0.00364	-0.00384	0.00211
	(0.00511)	(0.00640)	(0.00747)	(0.00794)	(0.00570)	(0.00678)	(0.00718)	(0.00762)
SCSentiment(std)	0.0121***	0.0155**	0.0195***	0.0184**	0.0183***	0.0234***	0.0200***	0.0187**
	(0.00457)	(0.00651)	(0.00739)	(0.00871)	(0.00461)	(0.00639)	(0.00710)	(0.00821)
R^2	0.173	0.245	0.273	0.305	0.170	0.261	0.313	0.352
Observations	30345	28204	24940	22024	27804	26325	24858	21959
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. We measure physical investment as capital expenditures (CAPX), and measure physical capital stock through the value of net property, plant, and equipment (PPENT).

Table 5: Baseline Regression Results: Intangible Investment Rate

	OLS + FE				OLS + FE + Control Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00431***	-0.00502**	-0.00343	-0.000245	-0.00439***	-0.00537**	-0.00349	-0.000541
	(0.00149)	(0.00234)	(0.00278)	(0.00320)	(0.00145)	(0.00230)	(0.00266)	(0.00295)
SCSentiment(std)	0.00573***	0.00568**	0.00427	0.00447	0.00650***	0.00647***	0.00572**	0.00561*
	(0.00151)	(0.00237)	(0.00291)	(0.00339)	(0.00146)	(0.00226)	(0.00268)	(0.00302)
R^2	0.224	0.305	0.365	0.411	0.255	0.359	0.437	0.494
Observations	26303	23105	20142	17494	26295	23098	20137	17489
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The intangible investment rate is calculated as the ratio of intangible investment to lagged intangible capital. Intangible investment is the sum of R&D expenses and a proportion of SG&A expenses. The value of intangible capital is taken from Ewens et al. (2025).

Table 6: Baseline Regression Results: Knowledge Investment Rate

	OLS + FE				OLS + FE + Control Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00730**	-0.00857**	0.000199	0.00893*	-0.00747***	-0.00924**	-0.000150	0.00819*
	(0.00284)	(0.00417)	(0.00486)	(0.00485)	(0.00284)	(0.00421)	(0.00489)	(0.00491)
SCSentiment(std)	0.00546*	0.00673	-0.000197	0.000306	0.00813***	0.00996**	0.00415	0.00443
	(0.00315)	(0.00467)	(0.00600)	(0.00596)	(0.00310)	(0.00456)	(0.00577)	(0.00550)
Observations	14813	12917	11175	9672	14757	12878	11145	9649
R^2	0.172	0.229	0.264	0.286	0.194	0.263	0.306	0.340
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The dependent variable is the change in the logarithm of knowledge investment between year $t + h$ and year $t - 1$, where $h = 0, 1, 2, 3$. Knowledge investment rate is calculated by knowledge investment divided by lagged knowledge capital. The value of knowledge capital is taken from Ewens et al. (2025).

Table 7: Baseline Regression Results: Organizational Investment Rate

	OLS + FE				OLS + FE + Control Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00371**	-0.00645**	-0.00858**	-0.00759*	-0.00382**	-0.00681**	-0.00871***	-0.00781**
	(0.00188)	(0.00276)	(0.00346)	(0.00422)	(0.00183)	(0.00268)	(0.00328)	(0.00391)
SCSentiment(std)	0.00468***	0.00484*	0.00305	0.00225	0.00522***	0.00542**	0.00417	0.00308
	(0.00155)	(0.00247)	(0.00297)	(0.00351)	(0.00152)	(0.00242)	(0.00279)	(0.00321)
Observations	25252	22217	19394	16858	25244	22210	19389	16853
R^2	0.223	0.317	0.370	0.412	0.241	0.360	0.431	0.481
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The dependent variable is calculated as the change in the logarithm of organizational investment between year $t+h$ and year $t - 1$, where $h = 0, 1, 2, 3$. The organizational investment rate is calculated as organizational investment divided by lagged organizational capital. And the value of organizational capital is taken from Ewens et al. (2025).

Table 8: Interaction Term Regression Results: Total, Physical, and Intangible Investment Rates

	$\Delta \log(I)$			
	$h=0$	$h=1$	$h=2$	$h=3$
Total Investment				
Intangible Firm	0.102***	0.107***	0.108***	0.107***
	(0.0120)	(0.0156)	(0.0194)	(0.0306)
SCRisk(std)	-0.00757**	-0.00590	-0.00105	-0.0109*
	(0.00337)	(0.00462)	(0.00581)	(0.00609)
Intangible Firm × SCRisk(std)	0.00265	0.00269	-0.000517	0.0136*
	(0.00558)	(0.00728)	(0.00818)	(0.00811)
SCSentiment(std)	0.0136***	0.0137***	0.0168***	0.0121**
	(0.00305)	(0.00450)	(0.00508)	(0.00586)
Intangible Firm × SCSentiment(std)	-0.00549	0.000279	-0.00324	-0.00316
	(0.00419)	(0.00601)	(0.00682)	(0.00796)
Observations	27882	24635	21579	18835
R^2	0.265	0.351	0.388	0.421
Physical Investment				
Intangible Firm	0.386***	0.356***	0.306***	0.281***
	(0.0276)	(0.0333)	(0.0384)	(0.0438)
SCRisk(std)	-0.00702	-0.000282	0.00457	0.00244
	(0.00562)	(0.00784)	(0.00816)	(0.00877)
Intangible Firm × SCRisk(std)	0.000228	-0.00878	-0.0209	-0.00124
	(0.0115)	(0.0137)	(0.0143)	(0.0155)
SCSentiment(std)	0.0198***	0.0233***	0.0259***	0.0255***
	(0.00471)	(0.00679)	(0.00764)	(0.00882)
Intangible Firm × SCSentiment(std)	-0.00360	0.000625	-0.0135	-0.0167
	(0.00938)	(0.0132)	(0.0146)	(0.0167)
Observations	27804	26325	24858	21959
R^2	0.178	0.266	0.316	0.354
Intangible Investment				
Intangible Firm	0.00287	0.0167	0.0243	0.0348*
	(0.00863)	(0.0132)	(0.0163)	(0.0182)
SCRisk(std)	-0.00457**	-0.00740**	-0.00562*	-0.00313
	(0.00195)	(0.00296)	(0.00315)	(0.00366)
Intangible Firm × SCRisk(std)	0.000315	0.00432	0.00441	0.00522
	(0.00279)	(0.00464)	(0.00539)	(0.00564)
SCSentiment(std)	0.00655***	0.00387	0.00330	0.00334
	(0.00186)	(0.00299)	(0.00344)	(0.00397)
Intangible Firm × SCSentiment(std)	-0.000434	0.00555	0.00513	0.00461
	(0.00296)	(0.00435)	(0.00509)	(0.00555)
Observations	26287	23093	20134	17488
R^2	0.254	0.359	0.438	0.494

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. We classify a firm as an intangible firm in year t if its intangible capital share exceeds the annual median, and use the lagged indicator in the regressions.

Table 9: Interaction Term Regression Results: Knowledge Investment and Organizational Investment Rates

	$\Delta\log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Knowledge Investment				
Intangible Firm	0.0202	0.0295	-0.00392	-0.0316
	(0.0178)	(0.0247)	(0.0345)	(0.0371)
SCRisk(std)	-0.00736*	-0.0134**	-0.00660	0.00400
	(0.00434)	(0.00573)	(0.00575)	(0.00611)
Intangible Firm × SCRisk(std)	-0.000362	0.00812	0.0125	0.00794
	(0.00568)	(0.00817)	(0.00956)	(0.00946)
SCSentiment(std)	0.00635	0.00481	-0.00146	-0.00364
	(0.00482)	(0.00671)	(0.00909)	(0.00870)
Intangible Firm × SCSentiment(std)	0.00325	0.00969	0.0105	0.0153
	(0.00688)	(0.00893)	(0.0113)	(0.0108)
Observations	14756	12878	11145	9649
R^2	0.194	0.263	0.306	0.340
Organizational Investment				
Intangible Firm	0.0127	0.0216	0.0245	0.0408**
	(0.00967)	(0.0138)	(0.0173)	(0.0201)
SCRisk(std)	-0.00474*	-0.00853**	-0.00970**	-0.0106*
	(0.00259)	(0.00379)	(0.00475)	(0.00557)
Intangible Firm × SCRisk(std)	0.00203	0.00371	0.00196	0.00587
	(0.00346)	(0.00521)	(0.00629)	(0.00728)
SCSentiment(std)	0.00582***	0.00411	0.00247	0.00290
	(0.00192)	(0.00320)	(0.00368)	(0.00413)
Intangible Firm × SCSentiment(std)	-0.00176	0.00258	0.00351	-0.000280
	(0.00310)	(0.00460)	(0.00534)	(0.00608)
Observations	25236	22205	19386	16852
R^2	0.240	0.361	0.431	0.482

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. We classify a firm as an intangible firm in year t if its intangible capital share exceeds the annual median, and use the lagged indicator in the regressions.

Table 10: Supply-chain Risk Perceptions and Real Activity

	$\Delta \log(Y)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Sales Growth				
SCRisk(std)	-0.0034**	-0.0074***	-0.0070**	-0.0074**
	(0.0017)	(0.0025)	(0.0028)	(0.0032)
SCSentiment(std)	0.0077***	0.0072***	0.0022	0.0014
	(0.0017)	(0.0025)	(0.0030)	(0.0034)
Observation	27957	26471	25037	22113
Employment Growth				
SCRisk(std)	-0.0031**	-0.0057***	-0.0037	-0.0034
	(0.0013)	(0.0021)	(0.0027)	(0.0033)
SCSentiment(std)	0.0037***	0.0020	0.0006	-0.0012
	(0.0014)	(0.0023)	(0.0028)	(0.0033)
Observation	27550	26101	24687	21810
COGS Growth				
SCRisk(std)	-0.0032*	-0.0081***	-0.0098***	-0.0072**
	(0.0017)	(0.0026)	(0.0029)	(0.0035)
SCSentiment(std)	0.0055***	0.0045*	-0.0006	0.0007
	(0.0019)	(0.0026)	(0.0032)	(0.0037)
Observation	27949	26467	25033	22110

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. Sales, employment, and COGS outcomes are measured as log changes of the corresponding firm-level variables.

Table 11: Supply-chain Risk Perceptions and Financing and Pricing Outcomes

	$\Delta \log(Y)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Debt Growth				
SCRisk(std)	0.0057	-0.0112	-0.0032	0.0059
	(0.0064)	(0.0081)	(0.0099)	(0.0105)
SCSentiment(std)	-0.0057	-0.0082	-0.0049	-0.0012
	(0.0066)	(0.0088)	(0.0107)	(0.0133)
Observation	22081	20440	19155	16735
Equity Growth				
SCRisk(std)	-0.0003	0.0000	-0.0034	-0.0010
	(0.0026)	(0.0033)	(0.0041)	(0.0050)
SCSentiment(std)	0.0097***	0.0086**	0.0053	0.0070
	(0.0027)	(0.0042)	(0.0054)	(0.0060)
Observation	26458	24809	23316	20531
Markup Change				
SCRisk(std)	-0.0009	0.0002	0.0020	-0.0008
	(0.0011)	(0.0014)	(0.0015)	(0.0022)
SCSentiment(std)	0.0027**	0.0028**	0.0029*	0.0010
	(0.0013)	(0.0013)	(0.0016)	(0.0019)
Observation	27949	26467	25033	22110

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. Debt, equity, and COGS outcomes are measured as log changes of the corresponding firm-level variables. Markup change is computed as the log change in the sales-to-COGS ratio.

Table 12: Interaction Term Regression Results: Heterogeneous Effects by Bond Credit Spread

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Bond Credit Spread × SCRisk(std)	-0.00352*	-0.00339	0.00127	-0.000924
	(0.00204)	(0.00345)	(0.00604)	(0.00597)
Bond Credit Spread × SCSentiment(std)	-0.00276**	-0.00756***	-0.00676***	-0.00680***
	(0.00126)	(0.00184)	(0.00223)	(0.00260)
Observations	6270	5606	4962	4359
Panel B: Physical Investment				
Bond Credit Spread × SCRisk(std)	-0.00433	-0.000997	0.00308	-0.00320
	(0.00337)	(0.00461)	(0.00696)	(0.00632)
Bond Credit Spread × SCSentiment(std)	-0.00203	-0.00893***	-0.00832**	-0.00894**
	(0.00212)	(0.00319)	(0.00348)	(0.00375)
Observations	6270	6030	5788	5184
Panel C: Intangible Investment				
Bond Credit Spread × SCRisk(std)	-0.00206	-0.00615**	-0.00622**	-0.00674*
	(0.00149)	(0.00244)	(0.00295)	(0.00381)
Bond Credit Spread × SCSentiment(std)	-0.000622	-0.00151	-0.00203	-0.00282
	(0.000892)	(0.00114)	(0.00134)	(0.00179)
Observations	6014	5363	4737	4157
Panel D: Knowledge Investment				
Bond Credit Spread × SCRisk(std)	0.000696	-0.00154	-0.00279	-0.00724
	(0.00232)	(0.00462)	(0.00563)	(0.00631)
Bond Credit Spread × SCSentiment(std)	0.000958	-0.000411	-0.00163	-0.00355
	(0.00217)	(0.00268)	(0.00264)	(0.00340)
Observations	2791	2486	2202	1953
Panel E: Organizational Investment				
Bond Credit Spread × SCRisk(std)	-0.00234**	-0.00544***	-0.00410**	-0.00316
	(0.00115)	(0.00156)	(0.00200)	(0.00279)
Bond Credit Spread × SCSentiment(std)	-0.00108	-0.00235**	-0.00263*	-0.00317*
	(0.000926)	(0.00113)	(0.00136)	(0.00170)
Observations	5990	5340	4715	4136

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Bond Credit Spread* is the one-period lagged bond credit spread, which captures firms' financing conditions and the tightness of credit markets.

Table 13: Interaction Term Regression Results: Heterogeneous Effects by Cash Holdings

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Cash × SCRisk(std)	0.00166	0.000179	-0.00320	0.0250
	(0.0148)	(0.0200)	(0.0253)	(0.0247)
Cash × SCSentiment(std)	0.0120	0.0316	0.0328	0.0426*
	(0.0131)	(0.0208)	(0.0220)	(0.0245)
Observations	27882	24637	21579	18835
Panel B: Physical Investment				
Cash × SCRisk(std)	-0.0615	-0.0649	-0.101*	-0.00132
	(0.0396)	(0.0504)	(0.0544)	(0.0547)
Cash × SCSentiment(std)	0.0720*	0.0946*	0.0645	-0.0133
	(0.0380)	(0.0506)	(0.0518)	(0.0524)
Observations	27804	26325	24858	21959
Panel C: Intangible Investment				
Cash × SCRisk(std)	-0.00499	-0.00261	-0.00120	0.0129
	(0.00889)	(0.0138)	(0.0176)	(0.0170)
Cash × SCSentiment(std)	0.0201**	0.0344**	0.0533***	0.0560***
	(0.00958)	(0.0146)	(0.0170)	(0.0189)
Observations	26295	23098	20137	17489
Panel D: Knowledge Investment				
Cash × SCRisk(std)	-0.000257	0.00979	-0.0112	-0.00576
	(0.0146)	(0.0219)	(0.0258)	(0.0256)
Cash × SCSentiment(std)	0.0517***	0.0755***	0.0806***	0.0601**
	(0.0159)	(0.0238)	(0.0274)	(0.0288)
Observations	14757	12878	11145	9649
Panel E: Organizational Investment				
Cash × SCRisk(std)	-0.000674	-0.00739	0.00373	0.0115
	(0.0112)	(0.0136)	(0.0173)	(0.0216)
Cash × SCSentiment(std)	0.0218**	0.0350**	0.0475***	0.0456**
	(0.0102)	(0.0148)	(0.0166)	(0.0213)
Observations	25244	22210	19389	16853

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Cash* is a lagged variable indicating the amount of last year's cash holdings for each year.

Table 14: Interaction Term Regression Results: Heterogeneous Effects by Redeployability

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Low Redeployability× SCRisk(std)	0.0259	-0.0232	-0.0369	-0.0108
	(0.0292)	(0.0397)	(0.0453)	(0.0416)
Low Redeployability× SCSentiment(std)	-0.0216	-0.0398	-0.0668	-0.0503
	(0.0272)	(0.0406)	(0.0441)	(0.0514)
Observations	26404	23425	20637	18111
Panel B: Physical Investment				
Low Redeployability× SCRisk(std)	0.0666	-0.0322	-0.0380	0.0459
	(0.0594)	(0.0819)	(0.0847)	(0.0839)
Low Redeployability× SCSentiment(std)	0.00923	-0.0543	-0.0984	-0.0350
	(0.0558)	(0.0777)	(0.0891)	(0.112)
Observations	26329	24965	23638	20978
Panel C: Intangible Investment				
Low Redeployability× SCRisk(std)	-0.000956	-0.0310	-0.0637**	-0.0600*
	(0.0167)	(0.0281)	(0.0286)	(0.0332)
Low Redeployability× SCSentiment(std)	-0.0487**	-0.0468	-0.0727*	-0.0869**
	(0.0192)	(0.0307)	(0.0372)	(0.0397)
Observations	24914	21979	19264	16814
Panel D: Knowledge Investment				
Low Redeployability× SCRisk(std)	-0.00548	-0.127*	-0.0674	-0.0654
	(0.0419)	(0.0656)	(0.0672)	(0.0712)
Low Redeployability× SCSentiment(std)	-0.0208	-0.0254	-0.0197	0.0394
	(0.0501)	(0.0805)	(0.101)	(0.0909)
Observations	14012	12282	10707	9333
Panel E: Organizational Investment				
Low Redeployability× SCRisk(std)	-0.0278	-0.0413	-0.0840***	-0.0752*
	(0.0195)	(0.0296)	(0.0326)	(0.0390)
Low Redeployability× SCSentiment(std)	-0.0469**	-0.0410	-0.0537	-0.0778*
	(0.0195)	(0.0303)	(0.0365)	(0.0416)
Observations	23883	21108	18529	16189

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Low Redeployability* is a one-period lagged indicator for firms with low asset redeployability. And lower redeployability implies higher adjustment costs.

Appendix

A Variable Construction and Data Description

A.1 Definition of Firm-level Variables

Term	Definition
Physical Capital (PP&E)	Net property, plant, and equipment (PPENT) from Compustat, measured in nominal U.S. dollars.
Asset Tangibility	Book-based tangibility, defined as net PP&E scaled by total assets, $\text{PPENT}_t/\text{AT}_t$.
Intangible Capital	Off–balance sheet intangible capital from Ewens et al. (2025), computed as the sum of organizational capital and knowledge capital ($\text{orgCapital}_t + \text{knowCapital}_t$) obtained via a perpetual–inventory method with industry–specific capitalization and depreciation parameters. Balance-sheet intangibles (INTAN) are not included.
Total Capital	Sum of physical and off–balance sheet intangible capital, $K_t^P + K_t^I = \text{PPENT}_t + \text{orgCapital}_t + \text{knowCapital}_t$.
Intangible Ratio	Intangible capital share of total capital, $K_t^I/(K_t^P + K_t^I)$.
Intangible Investment	Sum of knowledge and organizational investment. Knowledge investment equals R&D expense (XRD); organizational investment equals an industry–specific capitalizable share of cleaned SG&A, following Ewens et al. (2025).
Total Investment	Sum of physical investment (capital expenditures, CAPX) and intangible investment.
Intangible Investment Rate	Intangible investment divided by lagged intangible capital, $(\text{knowinv}_t + \text{orginv}_t)/K_{t-1}^I$.
Physical Investment Rate	Capital expenditures divided by lagged physical capital, $\text{CAPX}_t/\text{PPENT}_{t-1}$.
Total Investment Rate	Total investment divided by lagged total capital, $\text{totalinv}_t/(K_{t-1}^P + K_{t-1}^I)$.
Knowledge Investment Rate	Knowledge investment (R&D expense) divided by lagged knowledge capital, $\text{knowinv}_t/\text{knowCapital}_{t-1}$.
Organizational Investment Rate	Organizational investment divided by lagged organizational capital, $\text{orginv}_t/\text{orgCapital}_{t-1}$.
CAPX / Intan. Inv.	Composition ratio of physical to intangible investment, $\text{CAPX}_t/(\text{knowinv}_t + \text{orginv}_t)$.

Term	Definition
Tobin's Q	Standard market-to-book Q, defined as $(\text{MVE}_t + \text{Debt}_t)/\text{AT}_t$, where market equity $\text{MVE}_t = \text{PRCC\_F}_t \times \text{CSHO}_t$ and Debt_t is the sum of short-term (DLC) and long-term debt (DLTT).
Total Q	Intangible-augmented Q, defined as $(\text{MVE}_t + \text{Debt}_t)/(\text{AT}_t + \text{orgCapital}_t + \text{knowCapital}_t)$.
Cash	Cash and short-term investments scaled by total assets, CHE_t/AT_t.
Leverage	Book leverage, defined as total debt (DLC + DLTT) divided by total assets, $\text{total\_debt}_t/\text{AT}_t$.
Debt-to-Sales	Total debt scaled by annual sales, $\text{total\_debt}_t/\text{SALE}_t$.
Cash Flow	Operating income before depreciation (OIBDP) scaled by lagged total assets, $\text{OIBDP}_t/\text{AT}_{t-1}$.
Age	Firm age in years, measured as the number of years since the firm first appears in Compustat.
Book Assets	Total assets (AT). We also use $\log(\text{AT}_t)$ as the main size measure.
Dividend Paid	Indicator equal to one if cash dividends (DV) are strictly positive in fiscal year t, and zero otherwise.
Debt Growth	Log change in total nominal debt, $\log(\text{total\_debt}_t) - \log(\text{total\_debt}_{t-1})$, computed when both current and lagged debt are positive.
Equity Growth	Log change in book equity, $\log(\text{CEQ}_t) - \log(\text{CEQ}_{t-1})$, computed when both current and lagged book equity are positive.
Sales Growth	Log change in real sales, $\log(\text{SALE}_t) - \log(\text{SALE}_{t-1})$.
Employment Growth	Growth in firm employment, measured as the log change in the number of employees between t and $t-1$.
Markup Change	Log change in markup, measured as $\log(\text{SALE}_t/\text{COGS}_t) - \log(\text{SALE}_{t-1}/\text{COGS}_{t-1})$.
WW Index	Whited–Wu index of financial constraints constructed as in Whited and Wu (2006) and implemented following Gulen et al. (2024). It is a weighted linear combination of cash flow, dividend status, leverage, firm size, and sales growth; higher values indicate tighter financial constraints.

Term	Definition
KZ Index	Kaplan–Zingales index of financial constraints based on Kaplan and Zingales (1997), constructed following Gulen et al. (2024). The index combines cash flow, leverage, dividends, cash holdings, and the market-to-book ratio; higher scores correspond to more constrained firms.
HP Index	Hadlock–Pierce index of financial constraints proposed by Hadlock and Pierce (2010), constructed following Gulen et al. (2024). The index is a parsimonious function of firm size (log of assets) and firm age, deliberately excluding endogenous variables such as cash flow or investment. Higher values indicate greater financial constraints.
Bond Credit Spread	Firm's bond credit spread, defined as the difference between the yield to maturity of a corporate bond and the corresponding risk-free Treasury yield. Bond information is obtained by merging FISD-TRACE (providing bond issuance and transaction data) with the Compustat sample.
Weighted Depreciation Rate	Firm-level depreciation is defined as the capital-stock-weighted average of the depreciation rates of physical, organizational, and knowledge capital: $Weighted\ Depreciation\ Rate = (PPENT \times TangDepRate + OrgCapital \times OrgDepRate + KnowCapital \times KnowDepRate)/(PPENT + OrgCapital + KnowCapital)$.

A.2 Construction of Supply Chain Exposures

We use the firm-level measurements related to supply chain exposures developed by Ersahin et al. (2024). Their method is provided here for elaborative purposes. Ersahin et al. (2024) use the textual analysis methodology to assess firm-specific exposure to supply chain risk perceptions and the sentiment surrounding related discussions. Two firm-year variables derived from earnings call transcripts, *SCRisk* and *SCSentiment*, are applied.

Supply chain risk perception (SCRisk) *SCRisk* is constructed by identifying supply chain-related bigrams that occur within a ±10-word window of synonyms for "risk" or "uncertainty" in earnings call transcripts. Each valid bigram match is assigned a weight based on its relative frequency in a precompiled dictionary. The calculation of the measure is as follows:

$$\text{SCRisk}_{i,t} = \frac{1}{T_{i,t}} \sum_{w \in \mathcal{S}} \mathbb{I}(\text{dist}(w, r) \leq 10) \cdot \omega_w$$

where: $T_{i,t}$ represents the total count of bigrams found in a firm's earnings call transcripts for a specified year t; $\text{dist}(w, r)$ is the distance from bigram w to the nearest synonym of "risk"; ω_w is the frequency-based weight of bigram w from the training dictionary; $\mathbb{I}(\cdot)$ is the indicator function, which equals to 1 when the bigram is located within the defined window, and 0 in all other cases. This variable measures the prominence of supply chain uncertainty in a firm's communications.

Supply Chain Sentiment (SCSentiment) The tone of supply chain discussions is evaluated using *SCSentiment*, which is derived by aggregating the sentiment scores of words located within ±10 words of each supply chain bigram, in accordance with the methodology established by Ersahin et al. (2024).

$$\text{SCSentiment}_{i,t} = \frac{1}{T_{i,t}} \sum_{w \in \mathcal{S}} \left(\sum_{k \in \mathcal{N}(w)} s_k \right) \cdot \omega_w$$

where: $\mathcal{N}(w)$ denotes the ±10-word window around bigram w; s_k is the sentiment score of word k, taking values in $\{-1, 0, 1\}$; other notation is as defined in the *SCRisk* part. This score indicates the overall positive or negative sentiment of supply chain-related discussions during a firm's earnings calls.

Both *SCRisk* and *SCSentiment* have been validated by Ersahin et al. (2024), demonstrating that these measures rise during significant supply chain disruptions, including

COVID-19 and trade disputes, and are indicative of future firm performance. SCRisk exhibits a negative correlation with future sales growth and profitability, whereas SCSentiment shows a positive correlation with favorable outcomes. The findings indicate that the measures effectively capture significant variation in firm-level supply chain exposure.

B Additional Empirical Results

This appendix reports selected supporting results that complement the main empirical analysis. Tables B.1–B.5 provide robustness checks for the baseline investment results, including sample restrictions, placebo tests, alternative specifications, instrumental-variable evidence, and multicollinearity diagnostics. Tables B.6–B.11 report additional mechanism results that support the financing, adjustment-cost, and depreciation analyses in Section 7.

B.1 Robustness Checks for the Baseline Results

Table B.1 examines whether the baseline total-investment results are affected by sample composition. We re-estimate the baseline specification using the restricted sample in which both physical and intangible investment measures are available. The estimates are similar to those in the main text, indicating that the baseline findings are not driven by changes in sample coverage. Table B.2 reports placebo regressions using lagged investment growth as the dependent variable. The absence of systematic predictive relationships supports the interpretation that supply-chain risk perceptions are associated with subsequent investment responses rather than pre-existing investment trends. Table B.3 re-estimates the baseline specification excluding *SCSentiment*. The estimated effect of *SCRisk* remains similar, suggesting that the uncertainty results are not driven by correlated variation in the directional tone of supply-chain discussions.

Table B.1: Common-Sample Robustness: Total Investment

	Total Investment			
	(1)	(2)	(3)	(4)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	-0.00490**	-0.00358	-0.000200	-0.00545
	(0.00230)	(0.00322)	(0.00407)	(0.00444)
SCSentiment(std)	0.00896***	0.0119***	0.0132***	0.00949**
	(0.00192)	(0.00301)	(0.00351)	(0.00411)
R^2	0.166	0.253	0.308	0.346
Observations	26185	23005	20053	17421
Firm Fixed Effect	yes	yes	yes	yes
Clustered S.D.	yes	yes	yes	yes
Firm Controls (t−1)	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes

Note: This table reports a common-sample robustness check for total investment. For each horizon h, the sample is restricted to firm-year observations for which total, physical, and intangible investment outcomes are all observed. All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity.

Table B.2: Pre-trend Placebo: Total Investment

	$\log I_{t-1} - \log I_{t-2}$	
	(1)	(2)
	OLS + FE	OLS + FE + Control Variables
SCRisk(std)	0.00149	-0.00107
	(0.00241)	(0.00261)
SCSentiment(std)	0.00177	0.00157
	(0.00230)	(0.00256)
Observations	27555	25766
R^2	0.222	0.243
Firm Fixed Effect	yes	yes
Clustered S.D	yes	yes
Firm Control Last Year	no	yes
Industry(2 digits) × Year FE	yes	yes

Note: This table reports a pre-trend placebo test for total investment. The dependent variable is the lagged growth rate of total investment, defined as $\log I_{t-1} - \log I_{t-2}$. All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity.

Table B.3: Total Investment Rate: Specification without Sentiment

	OLS + FE				OLS + FE + Control Variables			
	(1) $h = 0$	(2) $h = 1$	(3) $h = 2$	(4) $h = 3$	(5) $h = 0$	(6) $h = 1$	(7) $h = 2$	(8) $h = 3$
SCRisk(std)	-0.00556*	-0.00393	-0.000770	-0.00403	-0.00615**	-0.00444	-0.00118	-0.00488
	(0.00289)	(0.00377)	(0.00441)	(0.00453)	(0.00282)	(0.00368)	(0.00430)	(0.00432)
Observations	27892	24646	21588	18844	27882	24637	21579	18835
R^2	0.221	0.298	0.329	0.356	0.262	0.349	0.386	0.420
Firm Fixed Effect	yes	yes	yes	yes	yes	yes	yes	yes
Clustered S.D	yes	yes	yes	yes	yes	yes	yes	yes
Firm Control Last Year	no	no	no	no	yes	yes	yes	yes
Industry(2 digits) × Year FE	yes	yes	yes	yes	yes	yes	yes	yes

Note: This table reports OLS estimates excluding supply-chain sentiment (SCSentiment). All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity.

B.2 Instrumental-Variable Evidence and Multicollinearity

Table B.4 reports instrumental-variable estimates based on industry-level leave-one-out measures of peer firms' *SCRisk*. Because the instrument varies primarily at the industry-year level, these specifications replace industry-by-year fixed effects with separate industry and year fixed effects. The estimates are less precise than the baseline panel estimates and are therefore interpreted as complementary rather than as the main source of identification.

Table B.5 reports multicollinearity diagnostics for *SCRisk* and *SCSentiment*. The variance inflation factors are close to one, indicating that the baseline estimates are not affected by serious multicollinearity between the uncertainty and sentiment measures.

Table B.4: IV (2SLS) Results with Size-weighted Leave-one-out Industry SCRisk Instrument: Total Investment Rate (3 digits)

	IV + FE + Control Variables			
	(1)	(2)	(3)	(4)
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
SCRisk(std)	0.0260	-0.0477	-0.143	-0.395**
	(0.0521)	(0.0874)	(0.159)	(0.198)
SCSentiment(std)	0.0118***	0.0163***	0.0168***	0.00995
	(0.00264)	(0.00383)	(0.00441)	(0.00700)
Observations	27905	24660	21606	18865
R^2	0.042	0.060	0.032	-0.268
Kleibergen–Paap rk Wald F	36.87	21.94	11.57	12.01
Firm Fixed Effect	yes	yes	yes	yes
Clustered S.E.	yes	yes	yes	yes
Firm Controls (t−1)	yes	yes	yes	yes
Year Fixed Effect	yes	yes	yes	yes
Industry (3 digits) Fixed Effect	yes	yes	yes	yes

Note: Industries are classified at the three-digit SIC code level. The Kleibergen–Paap rk Wald F statistic is reported to assess instrument strength under heteroskedasticity/cluster-robust inference. All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity.

Table B.5: Correlation and Multicollinearity Diagnostics for Standardized Supply-chain Uncertainty and Sentiment

Panel A: Correlation between core regressors (SCRisk vs. SCSentiment)		
Overall (raw) corr(SCRisk(std), SCSentiment(std))	0.0554	(implied VIF: 1.003)
FE-residualized corr(SCRisk(std), SCSentiment(std))	0.0173	(implied VIF: 1.000)

Panel B: Within VIF (core regressors), by horizon h	Total Investment in Horizon h			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Baseline stability	1.000	1.000	1.000	1.000
Orthogonalization (sentiment residual)	1.001	1.002	1.002	1.003
Firm fixed effects	yes	yes	yes	yes
Industry×year fixed effects	yes	yes	yes	yes
Lagged firm controls (t−1)	yes	yes	yes	yes
Clustered S.E. (firm)	yes	yes	yes	yes

Note: SCRisk(std) and SCSentiment(std) denote standardized (mean-zero, unit-variance) supply-chain uncertainty and sentiment measures, respectively. **Panel A** reports (i) the raw correlation corr(SCRisk(std), SCSentiment(std)) and (ii) the FE-residualized correlation computed by residualizing each measure with respect to firm fixed effects α_i, industry×year fixed effects $\alpha_{g\times t}$, and lagged firm controls $X_{i,t-1}$, and then taking the correlation of the resulting residuals. The implied VIF is $1/(1-\rho^2)$, where ρ is the reported correlation.

Panel B reports within-VIFs for the two core regressors in our total-investment-rate regressions at horizons $h \in \{0, 1, 2, 3\}$, where we include lagged firm controls, firm fixed effects, and industry×year fixed effects, and cluster standard errors at the firm level. "Baseline stability" refers to the baseline specification that includes both SCRisk(std) and SCSentiment(std) jointly. "Orthogonalization" replaces SCSentiment(std) with the residual from projecting SCSentiment(std) on SCRisk(std) and re-estimates the baseline specification using SCRisk(std) and this residualized sentiment measure.

B.3 Additional Financing-Constraint Results

Tables B.6 and B.7 provide additional evidence on the financing channel. Table B.6 reports interaction results using leverage as a balance-sheet measure of financial constraints. Table B.7 reports results using the KZ index. These tables complement the main financing results in Tables 12 and 13 by showing how alternative measures of financing conditions shape firms' responses to supply-chain uncertainty and sentiment.

Table B.6: Interaction Term Regression Results: Heterogeneous Effects by Leverage

	$\Delta \log(I)$			
	$h=0$	$h=1$	$h=2$	$h=3$
Panel A: Total Investment				
Leverage × SCRisk(std)	-0.00961	-0.0280	-0.00626	0.00607
	(0.0132)	(0.0176)	(0.0212)	(0.0230)
Leverage × SCSentiment(std)	0.00715	-0.0140	-0.00975	-0.0112
	(0.00783)	(0.00993)	(0.0110)	(0.0121)
Observations	27882	24637	21579	18835
Panel B: Physical Investment				
Leverage × SCRisk(std)	0.00647	-0.0134	0.0106	0.0308
	(0.0237)	(0.0308)	(0.0329)	(0.0383)
Leverage × SCSentiment(std)	0.00634	-0.0404*	-0.0217	-0.0110
	(0.0151)	(0.0235)	(0.0245)	(0.0272)
Observations	27804	26325	24858	21959
Panel C: Intangible Investment				
Leverage × SCRisk(std)	0.00321	-0.0316***	-0.0203	-0.0244*
	(0.0127)	(0.0115)	(0.0124)	(0.0142)
Leverage × SCSentiment(std)	0.00690	0.00387	0.000620	-0.000566
	(0.00493)	(0.00791)	(0.00894)	(0.00894)
Observations	26295	23098	20137	17489
Panel D: Knowledge Investment				
Leverage × SCRisk(std)	-0.0126	-0.0326	-0.0250	-0.0427
	(0.0167)	(0.0248)	(0.0256)	(0.0289)
Leverage × SCSentiment(std)	-0.00425	-0.00939	-0.0226	-0.0333
	(0.0179)	(0.0277)	(0.0366)	(0.0392)
Observations	14757	12878	11145	9649
Panel E: Organizational Investment				
Leverage × SCRisk(std)	-0.00260	-0.0377***	-0.0251	-0.0268
	(0.0141)	(0.0142)	(0.0168)	(0.0197)

Continued on next page

Table B.6 continued

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Leverage × SCSentiment(std)	0.00211	0.00117	-0.00440	-0.000816
	(0.00589)	(0.00875)	(0.0102)	(0.00892)
Observations	25244	22210	19389	16853

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Leverage* is a lagged variable indicating the amount of last year's leverage for each year.

Table B.7: Interaction Term Regression Results: Heterogeneous Effects by the KZ Index

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
KZ Index × SCRisk(std)	-0.0000135	-0.000112	0.0000854	0.0000308
	(0.000139)	(0.000183)	(0.000341)	(0.000449)
KZ Index × SCSentiment(std)	0.000365***	0.000443***	0.000408*	0.000699*
	(0.000109)	(0.000151)	(0.000223)	(0.000395)
Observations	27574	24385	21373	18677
Panel B: Physical Investment				
KZ Index × SCRisk(std)	-0.000401	-0.000285	-0.0000335	-0.000897
	(0.000591)	(0.000404)	(0.000436)	(0.000605)
KZ Index × SCSentiment(std)	0.000911*	0.000558	0.000465	0.000631
	(0.000475)	(0.000494)	(0.000571)	(0.000728)
Observations	27804	26325	24858	21959
Panel C: Intangible Investment				
KZ Index × SCRisk(std)	0.0000203	-0.000263**	-0.000241	-0.000341
	(0.0000933)	(0.000134)	(0.000161)	(0.000221)
KZ Index × SCSentiment(std)	0.0000769	0.000287*	0.000257	0.000456**
	(0.000104)	(0.000156)	(0.000190)	(0.000198)
Observations	25993	22857	19946	17343
Panel D: Knowledge Investment				
KZ Index × SCRisk(std)	-0.0000384	-0.000160	-0.000130	-0.000374
	(0.000133)	(0.000174)	(0.000272)	(0.000369)
KZ Index × SCSentiment(std)	0.000101	0.000557**	0.000433	0.000742**
	(0.000166)	(0.000247)	(0.000361)	(0.000311)
Observations	14598	12744	11043	9565
Panel E: Organizational Investment				
KZ Index × SCRisk(std)	-0.0000233	-0.000224	-0.000165	-0.000168
	(0.0000875)	(0.000143)	(0.000138)	(0.000183)
KZ Index × SCSentiment(std)	0.0000391	0.000166	0.0000988	0.000252
	(0.000114)	(0.000162)	(0.000196)	(0.000213)
Observations	24966	21989	19214	16717

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable $KZIndex$ is the one-period lagged Kaplan–Zingales (KZ) index, which serves as a proxy for firms' financing constraints.

B.4 Additional Adjustment-Cost Results

Tables B.8 and B.9 report additional results for the adjustment-frictions channel. Table B.8 uses a direct adjustment-cost proxy, while Table B.9 uses stock compensation as an alternative proxy related to adjustment incentives and managerial exposure. These results complement the main redeployability results in Table 14. Overall, they provide supporting evidence, although the patterns are less systematic than those based on redeployability.

Table B.8: Interaction Term Regression Results: Heterogeneous Effects by Adjustment Cost

	$\Delta \log(I)$			
	$h=0$	$h=1$	$h=2$	$h=3$
Panel A: Total Investment				
Adjustment Cost × SCRisk(std)	-0.00621**	-0.00371	-0.00437	0.00210
	(0.00306)	(0.00485)	(0.00832)	(0.00748)
Adjustment Cost × SCSentiment(std)	-0.00549	-0.00713	-0.00512	0.00212
	(0.00344)	(0.00619)	(0.00830)	(0.00614)
Observations	14720	12949	11293	9822
Panel B: Physical Investment				
Adjustment Cost × SCRisk(std)	-0.00732	-0.00117	-0.00837	-0.00166
	(0.00549)	(0.00626)	(0.00761)	(0.00923)
Adjustment Cost × SCSentiment(std)	-0.0147**	-0.0102	-0.0155	0.00298
	(0.00592)	(0.00793)	(0.00988)	(0.00873)
Observations	14713	13926	13178	11622
Panel C: Intangible Investment				
Adjustment Cost × SCRisk(std)	-0.00340	-0.00226	-0.00131	-0.00291
	(0.00263)	(0.00356)	(0.00500)	(0.00481)
Adjustment Cost × SCSentiment(std)	0.000843	-0.00191	0.00281	0.00569
	(0.00261)	(0.00351)	(0.00453)	(0.00582)
Observations	14137	12412	10808	9384
Panel D: Knowledge Investment				
Adjustment Cost × SCRisk(std)	-0.00564	-0.00321	0.00578	0.00114
	(0.00414)	(0.00541)	(0.00747)	(0.00470)
Adjustment Cost × SCSentiment(std)	0.00195	0.00113	0.00343	0.00290
	(0.00411)	(0.00529)	(0.00602)	(0.00961)
Observations	6043	5276	4571	3954
Panel E: Organizational Investment				
Adjustment Cost × SCRisk(std)	0.00105	0.000575	0.00217	-0.00269

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Table B.8 continued

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
	(0.00180)	(0.00293)	(0.00417)	(0.00542)
Adjustment Cost × SCSentiment(std)	-0.00293	-0.00157	0.00455	0.000428
	(0.00296)	(0.00456)	(0.00590)	(0.00665)
Observations	14094	12369	10772	9349

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Adjustment Cost* is the one-period lagged adjustment-cost measure, proxied by the inverse of asset redeployability, so that higher values indicate greater adjustment frictions.

Table B.9: Interaction Term Regression Results: Heterogeneous Effects by Stock Compensation

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Stock Compensation × SCRisk(std)	0.00000686	-0.00000472	-0.0000405*	-0.00000968
	(0.00000514)	(0.00000709)	(0.0000239)	(0.0000352)
Stock Compensation × SCSentiment(std)	-0.0000199	-0.0000410	-0.0000368	-0.0000110
	(0.0000145)	(0.0000284)	(0.0000276)	(0.0000283)
Observations	25093	21948	19040	16411
Panel B: Physical Investment				
Stock Compensation × SCRisk(std)	0.00000124	-0.0000197	-0.0000300***	-0.0000310**
	(0.00000846)	(0.0000120)	(0.0000110)	(0.0000127)
Stock Compensation × SCSentiment(std)	-0.0000436	-0.0000617	-0.0000475	-0.0000376
	(0.0000334)	(0.0000472)	(0.0000516)	(0.0000540)
Observations	25016	23629	22302	19522
Panel C: Intangible Investment				
Stock Compensation × SCRisk(std)	0.0000116**	0.0000106*	-2.59e-08	0.0000238
	(0.00000480)	(0.00000581)	(0.0000203)	(0.0000231)
Stock Compensation × SCSentiment(std)	0.00000317	-0.0000121	-0.0000156	1.76e-08
	(0.00000707)	(0.0000176)	(0.0000216)	(0.0000316)
Observations	24127	21037	18203	15650
Panel D: Knowledge Investment				
Stock Compensation × SCRisk(std)	0.0000138**	0.0000102	-0.0000172	0.0000118
	(0.00000591)	(0.00000728)	(0.0000249)	(0.0000287)
Stock Compensation × SCSentiment(std)	-0.00000134	-0.0000383	-0.0000436	-0.0000120
	(0.0000104)	(0.0000252)	(0.0000283)	(0.0000418)
Observations	13674	11833	10149	8706
Panel E: Organizational Investment				
Stock Compensation × SCRisk(std)	0.0000114**	0.00000969	-0.00000976	0.0000158
	(0.00000541)	(0.00000610)	(0.0000224)	(0.0000232)
Stock Compensation × SCSentiment(std)	-0.00000534	-0.0000230	-0.0000267	-0.0000196
	(0.00000752)	(0.0000204)	(0.0000235)	(0.0000251)
Observations	23111	20187	17488	15051

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Stock Compensation* is the one-period lagged measure of stock-based compensation.

B.5 Depreciation-Related Heterogeneity

Tables B.10 and B.11 examine whether depreciation-related measures shape investment responses to supply-chain risk perceptions. Table B.10 reports results using weighted depreciation rates, while Table B.11 reports results based on the depreciation gap between intangible and tangible capital. The evidence is mixed and less systematic than the financing and adjustment-cost results, suggesting that depreciation plays a secondary role in explaining the heterogeneous investment responses.

Table B.10: Interaction Term Regression Results: Heterogeneous Effects by Weighted Depreciation Rate

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Weighted Depreciation Rate$_{t-1}$ × SCRisk(std)	-0.0403	-0.0770	-0.0592	0.202***
	(0.0580)	(0.0757)	(0.0831)	(0.0689)
Weighted Depreciation Rate$_{t-1}$ × SCSentiment(std)	-0.0204	0.0211	-0.0380	-0.00605
	(0.0446)	(0.0653)	(0.0717)	(0.0831)
Observations	27882	24635	21579	18835
Panel B: Physical Investment				
Weighted Depreciation Rate$_{t-1}$ × SCRisk(std)	-0.130*	-0.204*	-0.224*	0.122
	(0.0780)	(0.121)	(0.123)	(0.124)
Weighted Depreciation Rate$_{t-1}$ × SCSentiment(std)	0.0998	0.223*	-0.00398	-0.0508
	(0.0996)	(0.124)	(0.141)	(0.159)
Observations	27804	26325	24858	21959
Panel C: Intangible Investment				
Weighted Depreciation Rate$_{t-1}$ × SCRisk(std)	-0.0218	-0.00930	0.00107	0.0780
	(0.0243)	(0.0420)	(0.0492)	(0.0519)
Weighted Depreciation Rate$_{t-1}$ × SCSentiment(std)	0.0154	0.0504	0.0561	0.0959*
	(0.0307)	(0.0421)	(0.0527)	(0.0559)
Observations	26287	23093	20134	17488
Panel D: Knowledge Investment				
Weighted Depreciation Rate$_{t-1}$ × SCRisk(std)	0.00406	0.0835	0.0567	0.105
	(0.0432)	(0.0681)	(0.0760)	(0.0835)
Weighted Depreciation Rate$_{t-1}$ × SCSentiment(std)	0.0797	0.146*	0.174	0.243**
	(0.0591)	(0.0843)	(0.115)	(0.112)
Observations	14756	12878	11145	9649
Panel E: Organizational Investment				

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Table B.10 continued

	$\Delta \log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Weighted Depreciation Rate$_{t-1}$ × SCRisk(std)	0.0225	-0.000905	-0.0201	0.0368
	(0.0288)	(0.0431)	(0.0470)	(0.0556)
Weighted Depreciation Rate$_{t-1}$ × SCSentiment(std)	-0.00499	0.0200	0.0300	0.0191
	(0.0319)	(0.0449)	(0.0527)	(0.0618)
Observations	25236	22205	19386	16852

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Weighted Depreciation Rate* is the one-period lagged weighted depreciation rate, which captures the depreciation intensity of firms' capital stock.

Table B.11: Interaction Term Regression Results: Heterogeneous Effects by Depreciation Gap

	$\Delta\log(I)$			
	$h = 0$	$h = 1$	$h = 2$	$h = 3$
Panel A: Total Investment				
Depreciation Gap × SCRisk(std)	-0.0613	-0.116	-0.138	0.0682
	(0.0668)	(0.0817)	(0.0867)	(0.0699)
Depreciation Gap × SCSentiment(std)	0.0322	0.0261	0.0237	-0.0280
	(0.0426)	(0.0644)	(0.0765)	(0.0813)
Observations	27570	24349	21317	18597
Panel B: Physical Investment				
Depreciation Gap × SCRisk(std)	-0.0759	-0.0522	-0.123	0.0389
	(0.128)	(0.122)	(0.127)	(0.144)
Depreciation Gap × SCSentiment(std)	0.0429	0.148	0.0929	-0.115
	(0.119)	(0.148)	(0.169)	(0.190)
Observations	27492	26021	24564	21687
Panel C: Intangible Investment				
Depreciation Gap × SCRisk(std)	-0.0398	-0.0329	-0.0272	0.0439
	(0.0277)	(0.0459)	(0.0509)	(0.0533)
Depreciation Gap × SCSentiment(std)	0.0209	-0.0163	0.0138	0.0491
	(0.0341)	(0.0481)	(0.0586)	(0.0655)
Observations	26295	23098	20137	17489
Panel D: Knowledge Investment				
Depreciation Gap × SCRisk(std)	-0.0265	0.0383	-0.169*	0.00949
	(0.0613)	(0.0911)	(0.102)	(0.0934)
Depreciation Gap × SCSentiment(std)	0.0611	0.0490	0.0922	0.130
	(0.0713)	(0.0843)	(0.111)	(0.112)
Observations	14757	12878	11145	9649
Panel E: Organizational Investment				
Depreciation Gap × SCRisk(std)	0.0109	-0.0215	-0.0396	-0.0166
	(0.0445)	(0.0637)	(0.0780)	(0.0873)
Depreciation Gap × SCSentiment(std)	-0.00460	-0.0162	-0.00707	-0.0131
	(0.0385)	(0.0563)	(0.0647)	(0.0773)
Observations	25244	22210	19389	16853

Note: All specifications include the same fixed effects, lagged firm controls, standard-error clustering, and significance-level conventions as in Table 3. Control coefficients are omitted for brevity. The variable *Depreciation Gap* is the one-period lagged depreciation gap, defined as the difference between the depreciation rate of intangible capital and that of tangible capital.