

Dancing with Macroeconomic Surprises: How do Business Cycle Shocks Affect Corporate Risk-Taking in China?*

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This paper examines how macroeconomic surprises affect corporate risk-taking in China. Using structurally-identified business cycle shocks, we show that corporate risk-taking responds procyclically to macroeconomic surprises on average. Cross-sectional evidence indicates that this relationship is primarily driven by a financing channel: favorable shocks relax financial constraints and enable firms, particularly financially constrained firms, to undertake riskier investments. However, this average effect masks important asymmetries. During adverse macroeconomic conditions, risk-taking responses become weaker or reverse, consistent with agency-driven risk-shifting among distressed firms. The effects are stronger among non-state-owned firms, firms with higher managerial ownership, greater growth opportunities, and lower internal liquidity.

Key Words: Corporate risk-taking; Business cycle shocks; Financial constraints; Agency costs.

JEL Classification Numbers: G00, G32.

1. INTRODUCTION

Corporate finance research has long emphasized the role of risk-taking in shaping firm performance (Boubakri et al., 2013) and sustaining com-

* Chen would like to acknowledge the financial support received from Guangdong Basic and Applied Basic Research Foundation (Grant No.2025A1515010403, 2026A1515010839), The Scientific Research Startup Foundation of Beijing Normal University (Grant No.7312200502510), and The National Social Science Fund of China (Grant No.23BGL094). Jiang would like to acknowledge the financial support received from the National Natural Science Foundation of China (Grant No.71903049) and the National Social Science Fund of China (Grant No.23BJY204 and Grant No.22&ZD157). We take full responsibility for any remaining errors. We declare no conflicts of interest. We declare no conflicts of interest.

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petitive advantage (Cai et al., 2024). While a large literature examines corporate risk-taking in China from the perspective of firm characteristics and institutional factors, relatively little is known about how aggregate macroeconomic fluctuations influence firm-level risk-taking behavior. This gap is particularly important in the Chinese context, where recent episodes, including the COVID-19 pandemic, real-estate sector distress, and geopolitical tensions, have generated substantial macroeconomic volatility. Understanding how firms adjust risk-taking in response to such shocks is crucial for interpreting corporate behavior, financial stability, and stock market dynamics in China.

To address this question, we study how business cycle shocks—defined as unexpected aggregate fluctuations—affect corporate risk-taking in China. Following Mountford and Uhlig (2009), we construct these shocks using a sign-restriction approach in a VAR model that includes 11 Chinese macroeconomic variables, such as real GDP, government expenditure, tax revenue, monetary aggregates, prices, and investment components.¹ By construction, these shocks capture unanticipated co-movements in key macroeconomic aggregates and are common across firms, making them plausibly exogenous to individual firm decisions. Our empirical analysis is based on a panel of 3,286 Chinese non-financial listed firms from 2002q1 to 2017q4, and focuses on three questions: (i) how corporate risk-taking responds to business cycle shocks, (ii) through which mechanisms these effects operate, and (iii) how firm characteristics shape this response.

Existing theories suggest two complementary mechanisms linking macroeconomic shocks to corporate risk-taking. The cash-flow channel posits that favorable (adverse) macroeconomic shocks relax (tighten) financial constraints, enabling firms to increase (reduce) investment in risky projects (e.g. Bolton et al., 2013; Gupta and Krishnamurti, 2018). In contrast, the agency channel emphasizes that firms—particularly those facing financial distress or weak governance—may adjust risk-taking in a counter-cyclical manner due to risk-shifting incentives (Bloom, 2009; Chen and Strebulaev, 2019; Herskovic et al., 2016). Rather than viewing these mechanisms as mutually exclusive, we examine how their relative importance varies across firms and economic conditions.

To guide our empirical analysis, we develop a simple framework that highlights these two channels. The framework illustrates how improvements in macroeconomic conditions can relax financing constraints and increase firms' ability to undertake risky but potentially value-enhancing projects, while also potentially amplifying agency-driven risk-taking when internal funds are abundant. The framework is not intended as a full structural

¹For further technical details on business cycle shock estimation, please refer to Section 3.3.

model, but rather serves to organize the empirical predictions and clarify how firm characteristics map into the underlying mechanisms.

Our main empirical findings show that business cycle shocks are positively associated with corporate risk-taking. A one-percent increase in the shock leads to a 4.5% (3.75%) increase in EBIT (operating income) volatility. This effect is economically meaningful and robust across a wide range of specifications, including alternative measures, fixed effects structures, and sample restrictions. Further analysis reveals important asymmetries across economic conditions. During expansions, the increase in risk-taking is broad-based and consistent with a financing channel, whereby improved internal and external funding conditions enable firms to undertake riskier investments. In contrast, during adverse shocks, we find more limited and selective evidence of increased risk-taking, consistent with risk-shifting behavior among certain firms.

To further distinguish between mechanisms, we exploit cross-sectional variation in firm characteristics. We find that the response of risk-taking to business cycle shocks is stronger among financially constrained firms, firms with lower cash holdings, and firms with greater growth opportunities. These patterns are consistent with a financing-based mechanism in which improved macroeconomic conditions relax constraints and allow firms to undertake valuable but inherently risky projects. In addition, firms with more volatile cash flows exhibit stronger responses to business cycle shocks, suggesting that macroeconomic conditions have larger effects on firms facing greater internal uncertainty.

At the same time, we find that firms with higher free cash flow and weaker governance characteristics exhibit stronger procyclical risk-taking, which is consistent with agency-based interpretations. However, we interpret this evidence cautiously, as these characteristics may capture multiple underlying mechanisms. Further analysis of governance shows that firms with higher managerial ownership exhibit lower baseline risk-taking, but a stronger sensitivity to business cycle shocks, suggesting that better-aligned managers engage in more state-contingent risk-taking. In contrast, we find limited evidence that leverage amplifies risk-taking during downturns, indicating that shareholder–debtholder conflicts may play a less prominent role in our setting.

We also document that the effect of business cycle shocks on risk-taking is less pronounced among state-owned enterprises (SOEs), consistent with their weaker financing constraints and distinct institutional environment (Cull and Xu, 2003; Lin and Tan, 1999; Megginson et al., 2014). Taken together, these findings suggest that both financing and agency channels may operate, with stronger and more systematic evidence supporting the financing mechanism in the Chinese context.

Our study contributes to several strands of literature. First, we extend the literature on corporate risk-taking (e.g., Acharya et al., 2011; Bergeron et al., 2010; Faccio et al., 2011; Langenmayr and Lester, 2018; Li et al., 2013; Ljungqvist et al., 2017) by providing new evidence on how unexpected macroeconomic shocks affect firm-level risk-taking in China. In doing so, we introduce a novel approach that incorporates structurally identified business cycle shocks into corporate finance analysis.

Second, we contribute to the literature on macroeconomic risk and corporate behavior (Bloom, 2009; Bolton et al., 2013; Chen and Strebulaev, 2019; Gupta and Krishnamurti, 2018; Herskovic et al., 2016) by providing evidence on how financing and agency mechanisms jointly shape firms' responses to macroeconomic fluctuations. Rather than emphasizing one channel over the other, our findings highlight how their relative importance varies across firms and economic conditions.

Third, we add micro-level evidence to the literature on macroeconomic shock transmission (e.g., Anderson and Cesa-Bianchi, 2020; Bayer et al., 2024; Bianchi et al., 2024; Crouzet, 2021; Holm-Hadulla and Thürwächter, 2021; Jeenas, 2023; Ottonello and Winberry, 2020; Rocheteau et al., 2018), which has largely relied on macroeconomic models. Our firm-level analysis provides complementary insights into how aggregate shocks propagate through corporate behavior in China.

Finally, our findings have implications for understanding stock return volatility in the Chinese market. Bartram et al. (2017) shows that cash flow volatility is a key determinant of idiosyncratic risk. As macroeconomic fluctuations influence firms' risk-taking behavior, they may play an important role in shaping asset price dynamics. More broadly, our study complements the literature on uncertainty and corporate behavior (e.g., Akey and Lewellen, 2017; Amore and Monichilli, 2018; Bhattacharya et al., 2017; Chen, 2021; D'Mello and Toscano, 2020; Julio and Yook, 2012; Tran, 2019; Vural-Yavaş, 2020; Zhang et al., 2021) by focusing on firms' ex post responses to realized macroeconomic shocks, rather than their reactions to anticipated uncertainty.

The remainder of this paper proceeds as follows. Section 2 discusses the related literature, develops a theoretical framework, and proposes our hypothesis. Section 3 describes data and research design. Section 4 presents our results for the relationship between business cycle shocks and corporate risk-taking. Section 5 examines the plausible mechanism underlying our results and conducts a set of heterogeneity studies. Section 6 concludes.

2. RELATED LITERATURE, THEORETICAL FRAMEWORK, AND HYPOTHESIS DEVELOPMENT

2.1. Related literature

The crux of corporate risk-taking is the tradeoff between cash flow and uncertain risks in the firm investment decision-making process. See Acharya et al. (2011) and Lumpkin and Dess (1996). Concretely, firms must shift from a lower level of uncertainty to a high one for considerable returns from risky investment projects. Just as Acharya et al. (2011) point out, the expected future payoff with inescapable uncertainty is the decisive factor for corporate risk-taking. In reality, macroeconomic shock is one of the most critical risks for corporate operation, so it should be a vital factor affecting many decisions of firms, such as investment and risk-taking decisions. See generally Chen and Strebulaev (2019) and Tran (2019).

A growing literature has verified the implication of uncertainty at the aggregate level on corporate decisions, although most focus on policy-related uncertainties. For example, Gulen and Ion (2016), Jens (2017), Julio and Yook (2012), Kelly et al. (2016), Pástor and Veronesi (2012), and Pástor and Veronesi (2013) analyze the effects of political uncertainty on corporate performance and find that aggregate risk-taking reduces during periods of high political uncertainty. Moreover, based on the strategic growth option theories, Atanassov et al. (2016) and Chen (2021) show that political uncertainty encourages corporate R&D investment. Different conclusions are also obtained from the relevant research on economic policy uncertainty (EPU). On the one hand, several studies find that EPU negatively affects corporate risk-taking (Gulen and Ion, 2016; Tran, 2019; Vural-Yavas, 2020). Concretely, a lower level of risk-taking could be caused by a higher degree of information asymmetry between lenders and borrowers due to EPU (e.g., Brogaard and Detzel, 2015; Phan et al., 2019; Tran, 2019). Bernanke (1983) and Dixit and Pindyck (1994) claim that higher EPU increases the value of delay options so that firms are inclined to postpone investment and risk-taking until the uncertainty is resolved or mitigated. On the other hand, some studies such as Chatjuthamard et al. (2020), Mirza and Ahsan (2020), and Zhang et al. (2021) document that an increase in EPU leads to more risk taken by firms.

However, the business cycles could be driven by factors other than political and policy uncertainties, which should attract equal attention. As far as we know, there exists barely any empirical study directly relating macroeconomic shocks to corporate risk-taking in the Chinese market study. For now, Burger et al. (2017), Cloyne et al. (2018), and Begenau and Salomao (2019) only find that corporate leverage and R&D activities are positively correlated with business cycles. Theoretical research such as Bolton et al. (2013) and Gupta and Krishnamurti (2018) argues that positive macroeconomic shocks will likely increase a firm's current and future cash flows and

result in lower risk aversion and higher risk-taking. In particular, Bolton et al. (2013) demonstrate that firms prefer to strategically time risky investments. That is, firms prefer to invest more conservatively, issue equity sooner, delay payouts to shareholders, and act risk-averse when facing unfavorable macroeconomic conditions. Empirically, Gupta and Krishnamurti (2018) show that firms take on less risk when oil prices rise. However, firms increase risk-taking with rising oil prices if the macroeconomic outlook is good, which indirectly implies the importance of macroeconomic conditions on corporate risk-taking. In addition, if we consider business cycle shocks as background risk, adverse business cycle shocks could increase risk aversion. See generally Guiso and Paiella (2008), Gupta and Krishnamurti (2018), and Heaton and Lucas (2000). This suggests that business cycle fluctuations are likely to exhibit a positive correlation with corporate risk-taking behaviors.

On the other hand, many theoretical studies discuss the risk-shifting problem and argue that shareholders are not obligated to pay back creditors from their pockets at bankruptcy.² Shareholders have limited downside risk but can receive unlimited upside profits. When firms are distressed due to adverse business cycle shocks, stockholders have incentives to increase risk-taking to save the firm strategically. Such a mechanism suggests that business cycle shocks could negatively correlate with corporate risk-taking. Recent literature also implies that firms should adjust their risk-taking level countercyclically.³ Consequently, this line of reasoning suggests that business cycle shocks are likely to demonstrate an inverse relationship with corporate risk-taking behaviors.

2.2. The model and hypotheses

The cash-flow channel perspective posits that positive business cycle shocks increase cash flows, reducing risk aversion and encouraging firms to take on more risk, while negative shocks reduce cash flows and discourage risk-taking. In contrast, the agency cost theory suggests that during adverse shocks, especially in distressed firms, equity holders may increase risk-taking to shift risk onto creditors, exploiting the limited liability structure. To capture these dynamics and to motivate our empirical work, we develop a framework that integrates both cash-flow and agency perspectives into a cohesive structure.

²See Jensen and Meckling (1976), Leland (1998), Cheng and Milbradt (2012), Favara et al. (2017), and Della Seta et al. (2020).

³See Hackbarth et al. (2006), Bloom (2009), Bhamra et al. (2010), Chen (2010), Chen and Strebulaev (2019), and Herskovic et al. (2016).

2.2.1. A simple model

Consider a firm that makes investment decisions to maximize shareholder value, where the level of risk-taking, denoted R , influences future cash flows. The firm's decision depends on **business cycle shocks** (BC), where $BC > 0$ represents positive shocks (e.g., economic booms), and $BC < 0$ represents negative shocks (e.g., recessions); and **firm characteristics** (D), where, specifically, leverage (D) amplifies agency conflicts in distress.

The firm chooses risk-taking to maximize shareholder value. Its utility is represented by a function that balances expected returns, risk, and incentives arising from agency conflicts. We define this as:

$$U(R, BC, D) = \mathbb{E}[\Pi|BC] - \frac{\gamma}{2} \text{Var}[\Pi|BC] + \lambda(D, BC) \cdot R$$

where $\mathbb{E}[\Pi|BC]$ represents expected profit conditional on macroeconomic state, reflecting the cash-flow channel; $\text{Var}[\Pi|BC]$ denotes the conditional variance of profit, capturing the risk trade-off; γ is the risk aversion parameter, reflecting the firm's sensitivity to risk; $\lambda(D, BC) \cdot R$ delineates the agency cost term, representing the incentive to increase risk-taking due to conflicts between shareholders and creditors.

Expected profit (cash-flow channel). The expected profit depends on the risk-taking level R and the business cycle shock S . We assume:

$$\mathbb{E}[\Pi|BC] = a(BC) + b(BC)R$$

where $a(BC)$ captures the baseline profit, which may vary with BC but is not central to risk-taking. $b(BC)$ is the marginal return to risk-taking, where $b(BC) > 0$ and $b'(BC) > 0$, meaning that positive shocks increase the expected return to risky investments. For example, during a boom ($BC > 0$), higher cash flows or lower capital costs make risky projects more attractive, while during a downturn ($BC < 0$), the opposite occurs.

Variance. The variance of profit reflects the uncertainty associated with risk-taking:

$$\text{Var}[\Pi|BC] = \sigma^2 R^2$$

where σ^2 is the constant variance parameter, assuming risk scales quadratically with R .

Agency cost incentive. The agency term captures the incentive for shareholders to increase risk-taking when it benefits them at the expense of creditors, particularly during negative shocks:

$$\lambda(D, BC) = \lambda_0 D \cdot \max(0, -BC)$$

where λ_0 reflects the strength of the agency effect. D denotes financial leverage, which increases the potential for risk-shifting as the firm nears distress. The term $\max(0, -BC)$ ensures the agency effect is active only for negative shocks ($BC < 0$), with its magnitude growing as BC becomes more negative. When $BC \geq 0$, this term is zero, as agency conflicts are less relevant in favorable conditions.

Substituting these components into the utility function yields

$$U(R, BC, D) = a(BC) + b(BC)R - \frac{\gamma}{2}\sigma^2 R^2 + \lambda_0 D \cdot \max(0, -BC) \cdot R$$

This function encapsulates **cash-flow channel** through $b(BC)R$, where positive BC boosts returns and encourages risk-taking, and **agency cost** through $\lambda_0 D \cdot \max(0, -BC) \cdot R$, where negative BC and high D incentivize risk-taking to shift risk to creditors.

The firm maximizes the following program:

$$\max_R U(R, BC, D) = a(BC) + b(BC)R - \frac{\gamma}{2}\sigma^2 R^2 + \lambda_0 D \cdot \max(0, -BC) \cdot R$$

The first order condition is given by

$$\frac{\partial U}{\partial R} = b(BC) - \gamma\sigma^2 R + \lambda_0 D \cdot \max(0, -BC) = 0$$

Solving for the optimal risk-taking R^* gives

$$R^* = \frac{b(BC) + \lambda_0 D \cdot \max(0, -BC)}{\gamma\sigma^2} \quad (1)$$

This expression is the core of the model, showing how risk-taking depends on both the cash-flow channel and agency costs.

2.2.2. Analysis of the model

We divide our analysis of the model into two distinct cases based on the sign of BC .

Case 1: Positive shocks ($BC \geq 0$). In this case, $\max(0, -BC) = 0$, and thus,

$$R^* = \frac{b(BC)}{\gamma\sigma^2}$$

Since $b'(BC) > 0$, R^* increases with BC . Positive shocks enhance expected returns, reducing risk aversion and promoting risk-taking, consistent with the cash-flow channel.

Case 2: Negative shocks ($BC < 0$). In this case, $\max(0, -BC) = -S > 0$, and hence

$$R^* = \frac{b(BC) + \lambda_0 D(-BC)}{\gamma \sigma^2}$$

Therefore, the effect of BC on R^* depends on two opposing forces — **cash-flow channel**, where $b(BC)$ decreases as BC becomes more negative (since $b'(BC) > 0$), reducing R^* , and **agency cost**, where $\lambda_0 D(-BC)$ increases as BC becomes more negative, raising R^* .

To explore which force dominates, differentiating R^* with respect to BC when $BC < 0$ yields

$$\frac{\partial R^*}{\partial BC} = \frac{b'(BC) - \lambda_0 D}{\gamma \sigma^2}$$

This implies that the cash-flow channel dominates if $b'(BC) > \lambda_0 D$ since in this scenario $\partial R^* / \partial BC > 0$, and thereby R^* decreases as BC becomes more negative, while the agency cost channel dominates if $b'(BC) < \lambda_0 D$ since in this situation $\partial R^* / \partial BC < 0$, and thereby R^* increases as BC becomes more negative.

Consequently, for firms with low leverage (D) or weak agency effects (λ_0), negative shocks reduce risk-taking. For highly leveraged firms or large negative shocks, the agency effect can outweigh the cash-flow effect, leading to increased risk-taking.

Summarizing the discussion gives the following proposition:

PROPOSITION 1. *The firm's optimal risk-taking level is determined by Equation 1. During positive business cycle shocks, optimal risk-taking increases with BC through the cash-flow channel, as enhanced expected returns dominate risk considerations. Conversely, during negative business cycle shocks, optimal risk-taking is governed by the interplay between two opposing forces: the cash-flow channel, where diminished returns ($b(BC)$) discourage risk-taking, and the agency cost mechanism, where heightened agency incentives ($\lambda_0 D(-BC)$) promote greater risk-taking.*

2.2.3. An extension

To generate more testable empirical implications, we consider a simple extension of the model. We reformulate the components of the utility function as follows.

Expected profit. The expected profit now incorporates three key variables: business cycle shocks (BC), risk-taking (R), and financial constraints (FC), which interact in the following manner:

$$\mathbb{E}[\Pi|BC, FC] = a_0 + a_1 BC + (b_0 + b_1 BC - b_2 FC)R$$

where $a_0, a_1, b_0, b_1, b_2 > 0$. Here, $a_1 BC$ represents the baseline profit effect of business conditions, and the term $(b_0 + b_1 BC - b_2 FC)R$ captures how risk-taking's marginal return increases with BC and decreases with FC . The marginal return is typically nonnegative.

Variance. We now incorporate a framework where profit uncertainty increases with both the level of risk-taking and the magnitude of business cycle shocks:

$$\text{Var}[\Pi|BC] = \sigma_0^2(1 + \eta|BC|)R^2$$

where $\sigma_0^2, \eta > 0$. The term $1 + \eta|BC|$ reflects greater volatility during larger shocks.

Risk aversion. The firm's risk aversion increases with financial constraints:

$$\gamma(FC) = \gamma_0 + \gamma_1 FC$$

where $\gamma_0, \gamma_1 > 0$.

Agency cost incentive. Agency costs now emerge from the interaction of three key factors — leverage, negative business cycle shocks, and financial constraints in the following way:

$$\lambda(D, BC, FC) = \lambda_0 D \cdot \max(0, -BC) \cdot (1 + \phi FC)$$

where $\lambda_0, \phi > 0$. This term is active only when $BC < 0$, amplifying risk-taking incentives in distress.

Additionally, we incorporate **adjustment costs** associated with changes in the risk-taking level. Specifically, Scaling risk-taking incurs a quadratic cost:

$$\kappa R^2, \quad \kappa > 0$$

The firm's utility function now integrates four essential components: expected profit, risk aversion, agency incentives, and adjustment costs, which

interact in the following form:

$$\begin{aligned} U(R, BC, D, FC) = & a_0 + a_1 BC + (b_0 + b_1 BC - b_2 FC)R \\ & - \frac{\gamma_0 + \gamma_1 FC}{2} \sigma_0^2 (1 + \eta |BC|) R^2 \\ & + \lambda_0 D \cdot \max(0, -BC) \cdot (1 + \phi FC) R - \kappa R^2 \end{aligned}$$

The firm's optimization problem is characterized by the following program:

$$\max_R U(R, BC, D, FC)$$

To find the optimal risk-taking level R^* , we take the first-order condition (FOC) by differentiating U with respect to R and setting it to zero:

$$\begin{aligned} \frac{\partial U}{\partial R} = & b_0 + b_1 BC - b_2 FC + \lambda_0 D \cdot \max(0, -BC) \cdot (1 + \phi FC) \\ & - [\gamma_0 + \gamma_1 FC] \sigma_0^2 (1 + \eta |BC|) R - 2\kappa R = 0 \end{aligned}$$

Solving for R^* yields

$$R^* = \frac{b_0 + b_1 BC - b_2 FC + \lambda_0 D \cdot \max(0, -BC) \cdot (1 + \phi FC)}{[\gamma_0 + \gamma_1 FC] \sigma_0^2 (1 + \eta |BC|) + 2\kappa} \quad (2)$$

Comparative statics. We analyze how R^* changes with BC , FC , and D . Similar to Section 2.2.2, we consider two regimes: positive shocks ($BC \geq 0$) and negative shocks ($BC < 0$).

Case 1: Positive shocks ($BC \geq 0$). In this case, agency term vanishes ($\max(0, -BC) = 0$), and thus,

$$R^* = \frac{b_0 + b_1 BC - b_2 FC}{[\gamma_0 + \gamma_1 FC] \sigma_0^2 (1 + \eta BC) + 2\kappa}$$

Taking the partial derivative of R^* with respect to BC yields

$$\frac{\partial R^*}{\partial BC} = \frac{b_1(A + B) - A\eta(b_0 - b_2 FC)}{[A(1 + \eta BC) + B]^2}$$

where $A = [\gamma_0 + \gamma_1 FC] \sigma_0^2 > 0$ and $B = 2\kappa > 0$.

Note that $b_0 - b_2 FC$ depends on FC . If FC is small, $b_0 - b_2 FC > 0$; if FC is large, it could be negative. Typically, $b_1(A + B) > A\eta(b_0 - b_2 FC)$, since b_1 (cash-flow sensitivity) is significant, $A + B > 0$, and η (volatility effect) is relatively small. Thus, $\partial R^* / \partial BC > 0$ under reasonable parameter

values. Therefore, the impact of business cycle shocks BC on risk-taking behavior remains consistent with Proposition 1.

Similarly, we consider the role played by financial constraints by differentiating R^* with respect to FC . We have

$$\frac{\partial R^*}{\partial FC} = \frac{-b_2[A(1 + \eta BC) + B] - (b_0 + b_1 BC - b_2 FC)\gamma_1 \sigma_0^2(1 + \eta BC)}{[A(1 + \eta BC) + B]^2}$$

Since both numerator terms are negative, $\partial R^*/\partial FC < 0$, suggesting that tighter financial constraints reduce risk-taking.

Case 2: Positive shocks ($BC < 0$). For $BC < 0$, $\max(0, -BC) = -BC$. Consequently,

$$R^* = \frac{b_0 + b_1 BC - b_2 FC + \lambda_0 D(-BC)(1 + \phi FC)}{[\gamma_0 + \gamma_1 FC]\sigma_0^2(1 + \eta(-BC)) + 2\kappa}$$

We define the numerator and denominator as functions $f(BC) = b_0 + b_1 BC - b_2 FC + \lambda_0 D(-BC)(1 + \phi FC)$ and $g(BC) = [\gamma_0 + \gamma_1 FC]\sigma_0^2(1 - \eta BC) + 2\kappa$, respectively. Taking the partial derivative of R^* with respect to BC gives

$$\frac{\partial R^*}{\partial BC} = \frac{f'(BC)g(BC) - f(BC)g'(BC)}{[g(BC)]^2} = \frac{C(A + B - A\eta BC) + A\eta f(BC)}{[A(1 - \eta BC) + B]^2} \quad (3)$$

where $C = b_1 - \lambda_0 D(1 + \phi FC)$.

Clearly, $C > 0$ if and only if $b_1 > \lambda_0 D(1 + \phi FC)$ (cash-flow effects are more likely to prevail), while $C < 0$ if and only if $b_1 < \lambda_0 D(1 + \phi FC)$ (agency incentives become more relevant). If $C > 0$, in Equation 3, the first term is positive, and $f(BC)$ (numerator of R^*) is typically positive unless BC is extremely negative. Thus, $\partial R^*/\partial BC > 0$, meaning R^* decreases as BC becomes more negative. If $C < 0$, the first term is negative, and as $-BC$ grows, $f(BC)$ increases (agency term dominates), potentially making the numerator negative, so $\partial R^*/\partial BC < 0$, and R^* increases as BC becomes more negative.

Next, we investigate the impact of financial constraints. To this end, taking the partial derivative of R^* with respect to FC yields:

$$\frac{\partial R^*}{\partial FC} = \frac{M[-\gamma_0 b_2 + \lambda_0 D(-BC)\phi\gamma_0 - \gamma_1(b_0 + b_1 BC + \lambda_0 D(-BC))] + B[-b_2 + \lambda_0 D(-BC)\phi]}{[(\gamma_0 + \gamma_1 FC)M + B]^2}$$

where $M = \sigma_0^2[1 + \eta(-BC)] > 0$.

The overall sign of the M -term depends on the relative magnitudes:

$$M\text{-term} = -\gamma_0 b_2 - \gamma_1 b_0 + \lambda_0 D(-BC)\phi\gamma_0 + \gamma_1 b_1 |BC| - \gamma_1 \lambda_0 D(-BC)$$

Grouping agency-related term gives

$$M\text{-term} = -\gamma_0 b_2 - \gamma_1 b_0 + \lambda_0 D(-BC)(\phi\gamma_0 - \gamma_1) + \gamma_1 b_1 |BC|$$

If $\phi\gamma_0 > \gamma_1$, then $\lambda_0 D(-BC)(\phi\gamma_0 - \gamma_1) > 0$, and the agency effect could dominate, especially for large $-BC$ or D . Otherwise, the negative terms prevail.

Therefore, the overall $\partial R^*/\partial FC$ remains generally negative unless agency effects are exceptionally strong.

Empirical implications. The model highlights that the effect of business cycle shocks on corporate risk-taking is inherently state-dependent and heterogeneous across firms, reflecting the interaction between financing conditions and agency incentives.

When business cycle shocks are positive ($BC \geq 0$), the model suggests that firms are more likely to increase risk-taking. This effect operates primarily through the cash-flow channel: favorable macroeconomic conditions improve expected returns and relax financing constraints, thereby enabling firms to undertake riskier investments. The strength of this response is expected to be greater for firms with better access to external finance, lower financial constraints, and stronger growth opportunities.

When business cycle shocks are negative ($BC < 0$), the model implies that the response of risk-taking may vary depending on the relative strength of two opposing forces. On the one hand, tighter cash flows and increased uncertainty tend to reduce risk-taking. On the other hand, agency incentives—particularly in firms with higher leverage or weaker governance—may encourage risk-taking as shareholders seek to shift risk onto creditors. As a result, risk-taking may decline under moderate negative shocks but can increase when adverse shocks are sufficiently severe and agency considerations become more salient.

These mechanisms imply that the relationship between business cycle shocks and corporate risk-taking is asymmetric across economic states and depends critically on firm characteristics such as financial constraints, leverage, governance, and growth opportunities. Collectively, the model provides a framework for interpreting both the average effect of business cycle shocks and the substantial cross-sectional variation observed in the data. These predictions guide our empirical analysis, which examines both average effects and cross-sectional heterogeneity in firms' responses to macroeconomic shocks.

Overall, the model does not imply a uniform effect of business cycle shocks on corporate risk-taking. Instead, it highlights that the observed re-

lationship reflects the interaction between financing conditions and agency incentives. In particular, the model suggests that positive shocks are more likely to increase risk-taking through improved financing conditions, while agency-driven effects may arise under adverse shocks for certain firms. These mechanisms generate testable cross-sectional and state-dependent predictions.

Taken together, our theoretical framework, in conjunction with the analysis presented in Section 2.1, yields the following main hypothesis:

H1. (Baseline effect) *Corporate risk-taking responds systematically to macroeconomic shocks. In particular, we expect a positive relationship between business cycle shocks and risk-taking on average, as favorable macroeconomic conditions relax financing constraints and enable firms to undertake riskier investments.*

This baseline hypothesis implies a set of testable cross-sectional and state-dependent predictions. First, if the financing (cash-flow) channel is the primary mechanism, the sensitivity of risk-taking to business cycle shocks should be stronger among firms that are more financially constrained or more dependent on internal liquidity. Accordingly, we expect larger responses for non-state-owned enterprises, firms with lower cash holdings, higher cash flow volatility, and greater investment opportunities.

Second, the effect of business cycle shocks should be asymmetric across macroeconomic states. The financing channel is expected to dominate during economic expansions, leading to a positive relationship between shocks and risk-taking. In contrast, during economic downturns, tightening financial conditions may attenuate this effect or even reverse it.

Third, if agency considerations become more relevant under financial distress, adverse macroeconomic shocks may induce risk-shifting behavior. In this case, the negative relationship between business cycle shocks and risk-taking in downturns should be more pronounced among financially distressed firms and in settings where governance frictions are more salient.

Taken together, these predictions allow us to distinguish between financing and agency mechanisms and to assess how their relative importance varies across firms and macroeconomic conditions.

3. SAMPLE SELECTION, VARIABLE CONSTRUCTION AND MODEL SPECIFICATION

3.1. Data and sample selection

Our sample consists of all non-financial firms listed on the Shanghai and Shenzhen Stock Exchanges from 2002Q1 to 2017Q4. Following convention,

our sample excludes (1) financial firms, (2) firms under special markers (i.e., ST, *ST, suspension of listing (PT), and delisting), (3) firms with incomplete data, and (4) firms listed in the current year. Finally, the sample comprises 107,419 firm-quarter observations of 3,286 non-financial firms. We obtain firm-level financial and accounting information from the China Stock Market & Accounting Research (CSMAR) database. The source of macroeconomic data to estimate business cycle shocks is from *Federal Reserve Bank of Atlanta's China's Macroeconomy: Time Series Data* and *WIND database*. We winsorize all continuous firm-level variables at the 1% and 99% levels to mitigate potential outliers' influence.

3.2. Measures of corporate risk-taking

Following Boubakri et al. (2013), John et al. (2008), and Koirala et al. (2020), we use earnings volatility as our primary variable for corporate risk-taking.⁴ Specifically for the baseline analysis, we employ two measures, *Risk1*, the three-quarter rolling standard deviation of earnings before interest and taxes (EBIT) scaled by total assets, and *Risk2*, the three-quarter rolling standard deviation of operating income scaled by total assets minus total liabilities. Besides, we introduce six more proxies for robustness tests: *Risk3*, the difference between the maximum and minimum *ROA* (earnings before interest and taxes, EBIT, scaled by total assets) over the three overlapping quarters (Zhang et al., 2021), *Risk4*, the difference between the maximum and minimum *ROE* (defined in the definition of *Risk2*) over the three overlapping quarters, *Risk5*, the three-quarter rolling standard deviation of earnings before interest, taxes, depreciation, and amortization scaled by total assets (EBITDA volatility) (Koirala et al., 2020), *Risk6*, the three-quarter rolling standard deviation of operating income scaled by total assets, which is just a variant of *Risk1* used to capture operating income volatility, *Risk7*, the difference between the maximum and minimum *EBITDA/Total assets* over the three overlapping quarters, and *Risk8*, the difference between the maximum and minimum *Operating income/Total assets* over the three overlapping quarters. The intuition of risk measures *Risk4*, *Risk7*, and *Risk8* is similar to that of *Risk3*, and thus they are used to gauge earning volatilities. A larger

⁴Earnings volatility can better capture a firm's choice of risk because they are under the firm's control (Ljungqvist et al., 2017). Moreover, previous literature on risk-taking behavior of China's listed firms also documents that our measures are good proxies of firms' choice of risk (Jiang and Chen, 2021; Luo et al., 2022; Tan et al., 2023; Zhang et al., 2021).

Risk1 (*Risk2*, *Risk3*, *Risk4*, *Risk5*, *Risk6*, *Risk7*, and *Risk8*) represents a higher level of corporate risk-taking.

3.3. Measures of business cycle shock

The estimation of business cycle shocks to the Chinese economy is conducted in accordance with the methodology proposed by Uhlig (2005) and Mountford and Uhlig (2009). The first step involves estimating a reduced-form VAR model that captures the dynamics of the Chinese economy. The model setup is as below:

$$Y_t = \sum_{i=1}^L B_i Y_{t-i} + u_t \quad t = 1, \dots, T \quad E[u_t u_t'] = \Sigma \quad (4)$$

where Y_t are $m \times 1$ vectors. L is the lag length of the VAR. B_i are $m \times m$ coefficient matrices and u_t is the one-step-ahead prediction error with the covariance matrix Σ . We consider 11 macroeconomic variables, i.e., $m = 11$, in our empirical analysis. The detail information and source of these variables are provided in Panel B of Table A1. All the time series except for government revenues are from China's Macroeconomy: Time Series Data (CMTS data) of the Federal Reserve Bank of Atlanta. Government revenue series source from WIND financial service. CMTS data provides seasonally adjusted series, and the government revenue data are seasonally adjusted by ourselves using the X13 algorithm. All data except M2, repo rate, and the price indices are in real per capita terms. To accommodate the unique characteristics of the Chinese economy, we make several adjustments to the model specification and data selection in Mountford and Uhlig (2009). Specifically, we replace the federal funds rate with M2 as it had been the intermediate target of Chinese monetary policy until 2016. We use the repo rate to measure market liquidity, similar to unborrowed reserves. We also distinguish between SOE and non-SOE investments, with the latter representing real private investment. Finally, we limit our analysis to one period lag due to sample size, which is supported by the Bayesian information criterion.⁵

The estimation of the reduced-form VAR model is then followed by shock identifications, that is, translating the m -dimension prediction errors, u_t to m *fundamental* shocks with specific economic meaning, v_t . v_t are also $m \times 1$ vectors with the covariance matrix $E[v_t v_t'] = I_m$, where I_m is the $m \times m$ identity matrix. These features imply these *fundamental* shocks are mutually orthogonal to each other and of variance 1. Consequently,

⁵The estimation uses the log of variables following Mountford and Uhlig (2009).

identification of these shocks collapses to find a matrix A , such that $u_t = Av_t$ and $AA' = \Sigma$. The s th column of A , $a^{(s)}$, indicates the immediate impact of a unit innovation of the s th shock on all variables. Therefore, A can be called the impulse matrix with each column corresponding to a specific *fundamental* shock. Namely, $a^{(s)}$ is the impulse vector associated with the fundamental shock s . The classic literature proposes many methods to obtain A , such as Sims (1986), Bernanke (1986), Blanchard and Watson (1986), Blanchard and Quah (1989), and Galí (1992). Their general idea is to impose $m(m-1)/2$ additional conditions to fully identify all the elements in A , which demands all m shocks to be identified simultaneously.

In contrast, Uhlig (2005) and Mountford and Uhlig (2009) introduce the strategy identifying only shocks of interest based on restricting their corresponding impulse responses, as they show that a given impulse matrix uniquely identifies the fundamental shocks corresponding to it and that any impulse response can be written as a linear combination of those identified by the Cholesky decomposition. Namely, if the Cholesky decomposition of Σ is represented by a $m \times m$ lower triangular matrix $\tilde{A}$, that is, $\tilde{A}\tilde{A}' = \Sigma$, then any impulse matrix can be written as $[a^{(1)}, \dots, a^{(n)}] = \tilde{A}Q = \tilde{A}[q^{(1)}, \dots, q^{(n)}]$, in which Q is a $m \times n$ matrix and n is not necessarily equal to m but $QQ' = I_n$, implying q , any column in Q , is orthonormal.

Given all information above, the m -dimensional impulse response at horizon k to the impulse vector $a \equiv \tilde{A}q$ is given by

$$r_a(k) = \sum_{i=1}^m q_i r_i(k) \quad (5)$$

in which q_i is the i th element of q and $r_i(k)$ is the impulse response of m variables at horizon k to the i th column of $\tilde{A}$.⁶ Therefore, we can identify the shocks by imposing restriction on the associated impulse responses, that is, to find an orthonormal vector q , which satisfies the given conditions characterizing the impulse responses of a specific shock.⁷

Such restrictions can be implemented by minimizing the value of the criterion function, which rewards the signs of impulse responses that are in

⁶The procedures to solve impulse response are straightforward. Once the initial impulse, $k = 0$, is given, the responses of remaining periods, $k = 1, 2, \dots$, can be obtained by rolling forward using the VAR system. Hence, indexing the response function $r_a(k)$ with the impulse vector a is reasonable. $r(k)$ is just a specific impulse function associated with a specific impulse matrix, the Cholesky decomposition lower triangular matrix $\tilde{A}$.

⁷See the appendix of Mountford and Uhlig (2009).

line with the given restrictions and punishes those that are not, given by

$$\begin{aligned} a &\equiv \arg \min_{a=\tilde{A}q} \Psi(a) \\ &= \arg \min_{a=\tilde{A}q} \left[\sum_{j \in J_+} \sum_{k=0}^K f\left(-\frac{r_{ja}(k)}{s_j}\right) + \sum_{j \in J_-} \sum_{k=0}^K f\left(\frac{r_{ja}(k)}{s_j}\right) \right] \end{aligned} \quad (6)$$

where the function f on the real line is defined per $f(x) = 100x$ if $x \geq 0$ and $f(x) = x$ if $x \leq 0$. Moreover, $r_{ja}(k)$ represents the impulse response of j th variable in Y at horizon k to the impulse vector $a \equiv \tilde{A}q$. s_j is the standard deviation of j th variable. J_+ and J_- denote the index set of variables whose responses are required to be not negative and positive, respectively. K represents the maximum periods the restriction should be effective.

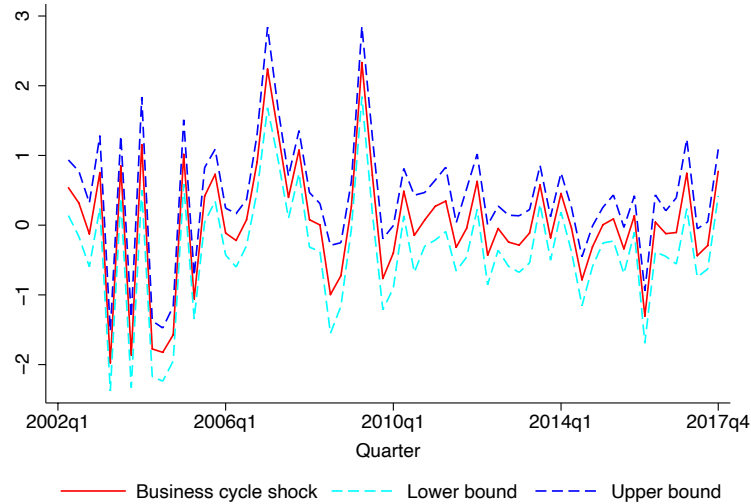
In order to obtain the business cycle shocks, our restrictions on impulse responses generally align with Mountford and Uhlig (2009). Positive impulse responses of GDP, consumption, investment, and tax revenues are imposed for four periods in case of a positive business cycle shock. Namely, J_+ should include the indices of GDP, consumption, SOE and Non-SOE investment, and tax revenues and $k = 0, \dots, 3$. Then we can solve for a through the minimization problem implied by Equation 6. Further, once a is achieved, we find a vector $\tilde{b} \neq 0$ with $(\Sigma - aa')\tilde{b} = 0$ normalized so that $b'a = 1$. Then, $v_t^{(a)} = b'u_t$ is the business cycle shocks. The application of the same algorithm in the study of the Chinese economy can refer to El-Shagi and Zhang (2022). Our estimation indicates that a 1% business cycle shock would generate an immediate increase of 0.43% in real GDP, 1.02% in tax revenue, 0.27% in consumption, 3.99% in SOE investment, and 2.30% in non-SOE investment.

We denote the business cycle shock with BC in the regression model, representing unexpected changes in the Chinese macroeconomic conditions. According to our designed restriction, a positive innovation of business cycle shocks leads GDP, consumption, investment, and tax revenues to increase for at least one year. Therefore, a larger value of BC indicates a more favorable macroeconomic condition. For robustness, we also consider the lower bound of BC , BC_{lower} , the upper bound of BC , BC_{upper} , and the average of BC_{upper} and BC_{lower} , BC_{avg} , as proxies of business cycle shock, where similarly a larger value of BC_{lower} (BC_{upper} , BC_{avg}) indicates a more favorable business cycle shock.⁸ Figure 1 presents time-series plots

⁸The VAR model estimation is based on Bayesian methodology, which allows for the generation of impulse response functions through draws of coefficients and variance

of business cycle shock estimates over 2002Q1 to 2017Q4, revealing that *BC* has considerable variations over our sample period.

FIG. 1. Business cycle shock estimate. This figure presents time-series plots of business cycle shock estimate over quarters from 2002q1 to 2017q4. The red solid line, the cyan dashed line, and the blue dashed line represent the business cycle shock estimate, its lower bound estimate, and its upper bound estimate, respectively.



3.4. Control variables

As John et al. (2008), Faccio et al. (2011), Boubakri et al. (2013), Khaw et al. (2016), Koirala et al. (2020), and Jiang and Chen (2021) imply, we add various variables that can affect corporate risk-taking decisions as control variables, including *Firm size*, the natural logarithm of total assets; Tobin's Q (*TQ*), the ratio of the market value of equity minus book value of equity plus book value of debt to total assets; quarterly sales growth rate (*Growth*); leverage (*Lev1*), the ratio of total liabilities to total assets; profitability (*ROA*), earnings before interest and taxes, EBIT, scaled by total assets; liquidity (*Liquidity*), the ratio of current assets to current liabilities; and an indicator for state-ownership (*SOE*) taking one for state-owned enterprises and zero otherwise. Panel A of Table A1 provides the definitions for all variables.

estimators. As a result, it is straightforward to compute the statistics of responses and shocks, such as the median and any percentiles.

3.5. Summary statistics

The summary statistics of the variables in our analysis are presented in Table 1. The means of *Risk1* and *Risk2* are 0.011 and 0.024, respectively, with standard deviations of 0.012 and 0.034. Similarly, the means of *Risk3*-*Risk8* are 0.020, 0.045, 0.019, 0.010, 0.037, and 0.019 with standard deviations of 0.022, 0.063, 0.014, 0.011, 0.027, and 0.021, respectively. The mean of *BC* is -0.007 with a standard deviation of 0.757. The lower bound of *BC* has a mean (median) of -0.390 (-0.383), while the upper bound has a mean (median) of 0.382 (0.310). The average firm size is 21.810 with a standard deviation of 1.270, and Tobin's *Q* ranges widely from the first quartile of 0.94 to the third quartile of 2.462 with a mean of 2.071. Quarterly sales growth rate has an average of 16.7% with a big variation of 72%, while ROA has a mean of 1.4% and a standard deviation of 2.1%. The ratio of total liabilities to total assets is 46% on average, and the average ratio of current assets to current liabilities is 2.308. SOE observations account for around 48.8% of the sample, and the average quarterly operating cash flow is 1.1% of total assets. The mean capitalization is 22.224 after transforming to the natural logarithm, and the average quarterly change in working capital is around -0.1% of total assets, while the ratio of quarterly change in short liabilities to total assets is even lower. A representative firm in the sample has been listed around 14.43 years ($e^{2.669}$). SA index has a mean (median) of 4.342 (4.100). Finally, the quarterly changes in total bank loans and long-term bank loans are on average 0.3% and 0.2%, respectively, of total assets.

Table 2 presents the Pearson correlations between business cycle shock (*BC*) and corporate risk-taking (*Risk1* and *Risk2*) and implies a strong positive correlation. Firm size negatively correlates with corporate risk-taking, which is consistent with the idea that large firms tend to take less risk due to their higher quality of information disclosure (e.g., Hope, 2003; Tran, 2019). We also observe that firms with higher Tobin's *Q* and sales growth rates are more likely to engage in more risk (Boubakri et al., 2013). This finding confirms that firms with higher Tobin's *Q* and sales growth rates have more investment opportunities. Firms with better accounting performance also tend to take less risk, which follows agency theory, where managers exhibit risk-averse preference on account of their career concerns (Jensen and Meckling, 1976). Managers in better-performing firms tend to reach their target performance with a higher likelihood and thus have a lower inclination to take risks (Faccio et al., 2016). The ratio of total liabilities to total assets is positively correlated with corporate risk-taking,

TABLE 1.

Descriptive Statistics

	Mean	Std.Dev	P25	Median	P75	N
Risk1	0.011	0.012	0.003	0.007	0.013	107419
Risk2	0.024	0.034	0.006	0.012	0.025	107419
Risk3	0.020	0.022	0.006	0.013	0.024	107419
Risk4	0.045	0.063	0.012	0.024	0.048	107419
Risk5	0.019	0.014	0.009	0.016	0.025	107419
Risk6	0.010	0.011	0.003	0.006	0.012	107419
Risk7	0.037	0.027	0.017	0.030	0.048	107419
Risk8	0.019	0.021	0.006	0.012	0.023	107419
BC	-0.007	0.757	-0.311	-0.044	0.417	107419
BC_{lower}	-0.390	0.749	-0.677	-0.383	0.099	107419
BC_{upper}	0.382	0.768	0.003	0.310	0.812	107419
BC_{avg}	0.001	0.757	-0.312	-0.421	0.469	107419
Firm Size	21.810	1.270	20.905	21.656	22.526	107419
TQ	2.071	1.888	0.940	1.446	2.462	107419
Growth	0.167	0.720	-0.138	0.042	0.261	107419
ROA	0.014	0.021	0.005	0.013	0.023	107419
Lev1	0.460	0.223	0.289	0.461	0.619	107419
Lev2	0.073	0.102	0	0.025	0.111	107419
Liquidity	2.308	2.697	1.011	1.465	2.393	107419
SOE	0.488	0.500	0.000	0.000	1.000	107419
CF	0.011	0.041	-0.009	0.010	0.032	107417
Mkt Cap	22.224	1.071	21.484	22.162	22.861	104883
Capex	0.015	0.018	0.002	0.008	0.020	106942
ΔNWC	-0.001	0.072	-0.029	0.001	0.029	107414
$\Delta Sdebt$	-0.000	0.037	-0.010	0.000	0.010	107418
Firm Age	2.669	0.395	2.439	2.724	2.958	107419
SA	4.342	1.494	3.282	4.100	5.106	107419
$\Delta Loan_TA$	0.003	0.066	-0.021	0.000	0.025	107418
$\Delta Long\ Loan_TA$	0.002	0.022	0.000	0.000	0.000	107418

This table presents the summary statistics of the variables used in the main analyses. Variable definitions are presented in Panel A of Table A1.

which is in line with the idea that the agency conflict between shareholders and debtholders is more severe in firms with higher debt levels. Table 2 also shows a strong correlation between corporate liquidity and risk-taking, which agrees that firms that expect financing uncertainty may build up internal liquidity to hedge against possible future credit shocks. Finally, SOEs are less willing to take risks, squaring with prior literature (e.g., Hsu et al., 2020; Khaw et al., 2016).

TABLE 2.

Pearson correlation matrix

	Risk1	Risk2	BC	Firm Size	TQ	Growth	ROA	Lev1	Liquidity	SOE
Risk1	1.0000									
Risk2	0.7358***	1.0000								
BC	0.0358***	0.0293***	1.0000							
Firm Size	-0.1864***	-0.0562***	0.0003	1.0000						
TQ	0.2230***	0.1010***	0.0418***	-0.4119***	1.0000					
Growth	0.0545***	0.0483***	-0.0179***	0.0022	0.0275***	1.0000				
ROA	-0.1268***	-0.1771***	0.0251***	0.0824***	0.0958***	0.1875***	1.0000			
Lev1	0.1009***	0.3230***	0.0259***	0.3143***	-0.1435***	0.0388***	-0.2311***	1.0000		
Liquidity	-0.0283***	-0.1452***	-0.0107***	-0.2410***	0.1956***	-0.0078**	0.1018***	-0.6110***	1.0000	
SOE	-0.0537***	0.0253***	-0.0000	0.2590***	-0.2427***	-0.0173***	-0.0613***	0.2490***	-0.2447***	1.0000

This table shows Pearson correlations among the main variables. The data come from the CSMAR database, and the sample period is from 2002q1 to 2017q4. There are 107419 firm-quarter observations covering 3286 firms. ***, **, and * denote significance at the 1%, 5%, and 10%, respectively.

3.6. Model specification

Our baseline specification is similar to Hsu et al. (2020) and John et al. (2008) and has the following form:

$$Risk_{it+1} = \alpha + \beta BC_t + \Gamma' X_{it} + Year\ FE + Industry\ FE + \epsilon_{it+1} \quad (7)$$

In Equation 7, i and t denote firm and quarter, respectively. $Risk_{it+1}$ is the risk-taking level of firm i in quarter $t+1$, measured by either $Risk1$ or $Risk2$ in the baseline specification. The explanatory variable is business cycle shock, BC . X is a vector of control variables that explain corporate risk-taking according to existing literature, that is *Firm size*, *Tobin Q*, *Growth*, *Lev1*, *ROA*, *Liquidity*, and *SOE*. The baseline specification also includes industry fixed effects to control for unobserved time-invariant industry-level common factors.⁹ We do not control for quarter fixed effects because business cycle shock shows strong correlations with quarter dummies as in Gulen and Ion (2016), Phan et al. (2019), and Yang et al. (2017), but we do control for year fixed effects. We lead the dependent variable by one period to capture the time it takes firms to respond to busi-

⁹When controlling the industry fixed effect, we are aware of the possible change in the industrial classification of each firm. Therefore, we use the CSMAR database to follow each firm's industrial coding. In the CSMAR sub-database of industry financial indicators, specifically the China-listed firms' research series, there is a table called Track of Industry Changes, which records each firm's yearly changes in industry classification. It is from this table that we derive our variable for industry coding. If a specific firm changes industry classification, its industrial coding will also update accordingly.

ness cycle shocks and to alleviate endogeneity concerns. Finally, we use the heteroscedasticity-robust standard errors clustered by firms for statistical inference.

4. EMPIRICAL ANALYSES

4.1. Baseline results

Table 3 reports the estimated effect of business cycle shocks on corporate risk-taking. Columns (1) and (2) present specifications including only industry or year fixed effects. Columns (3) and (4) incorporate control variables along with industry fixed effects, while the last two columns further include both industry and year fixed effects.

Across all specifications, the coefficients on BC are positive and statistically significant at the 1% level, indicating that, on average, firms increase their risk-taking as business cycle conditions become more favorable. This finding is consistent with the financing (cash-flow) channel highlighted in the theoretical framework, whereby positive macroeconomic shocks improve firms' funding conditions and enable them to undertake riskier investments.

The estimated effects are also economically meaningful. For example, the coefficient on BC in column (3) (0.0005) corresponds to an increase of approximately 4.5% relative to the sample mean of risk-taking ($= 0.0005/0.011$), while the coefficient in column (4) (0.0009) implies an increase of about 3.75% relative to its corresponding mean ($= 0.0009/0.024$). The estimates reported in the remaining specifications are of similar magnitude, reinforcing the economic significance of the results.

While these baseline findings document a robust positive average relationship, the theoretical framework suggests that the effect of business cycle shocks may vary across firms and economic conditions. We explore such heterogeneity and the underlying mechanisms in the subsequent analysis.

The coefficients of control variables all carry the expected signs if significant. For instance, *SOE* is negatively related to risk-taking at the significance level of 1% in all columns of Table 3. It coincides with the notion of Boubakri et al. (2013), Khaw et al. (2016), and Zhang et al. (2021) that state-owned firms consider stability as their best interest and are less likely to promote risky projects. In addition, *Firm Size* affects corporate risk-taking negatively, as Koirala et al. (2020) suggests. Finally, both *TQ* (Tobin's Q) and *Growth* are significant and positively associated, at the 1% significance level, with risk-taking, implying that firms with more growth

TABLE 3.

Business cycle shock and corporate risk taking: Baseline results

	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2	(5) Risk1	(6) Risk2
BC	0.0004*** (9.46)	0.0010*** (8.57)	0.0005*** (8.82)	0.0009*** (5.96)	0.0004*** (9.79)	0.0010*** (8.92)
Firm Size			−0.0015*** (−16.34)	−0.0033*** (−12.47)	−0.0014*** (−12.70)	−0.0033*** (−10.63)
TQ			0.0011*** (20.74)	0.0018*** (9.97)	0.0012*** (19.64)	0.0018*** (8.97)
Growth			0.0009*** (14.41)	0.0022*** (12.55)	0.0010*** (14.98)	0.0022*** (12.70)
ROA			−0.0643*** (−15.49)	−0.1719*** (−15.29)	−0.0670*** (−16.32)	−0.1727*** (−15.24)
Levl			0.0088*** (12.65)	0.0592*** (24.43)	0.0085*** (12.19)	0.0595*** (24.09)
Liquidity			−0.0000 (−0.04)	0.0006*** (7.28)	0.0000 (0.20)	0.0007*** (7.80)
SOE			−0.0008*** (−3.62)	−0.0016*** (−2.84)	−0.0008*** (−3.71)	−0.0015*** (−2.56)
Constant	0.0107*** (93.03)	0.0237*** (69.14)	0.0380*** (19.80)	0.0657*** (12.27)	0.0352*** (15.51)	0.0652*** (10.36)
Year	Yes	Yes	No	No	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	107419	107419	107419	107419	107419	107419
Adj. R^2	0.040	0.033	0.132	0.171	0.136	0.174

This table reports the impact of business cycle shock on corporate risk-taking. Columns (1) and (2) present the univariate estimates with both industry and year fixed effects but without control variables, columns (3) and (4) report the multivariate estimates with control variables and industry fixed effects, and columns (5) and (6) report the estimates with control variables and with both industry and year fixed effects. We do not consider quarter-fixed effects in all regressions because business cycle shock strongly correlates with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

opportunities are inclined to invest more in risky projects. See Coles et al. (2006), Ferris et al. (2017).

In addition, given the persistence of corporate risk-taking documented in prior literature, we explicitly account for dynamic adjustment by estimating a dynamic panel specification that includes the lagged dependent variable. Using a system GMM estimator, which treats the lagged dependent variable as endogenous, we find that risk-taking exhibits significant

persistence. Importantly, the estimated effect of business cycle shocks remains positive and statistically significant, and is quantitatively similar to our baseline estimates. These findings suggest that our results are not driven by dynamic misspecification or reverse causality.¹⁰

4.2. Robustness tests

We conduct several robustness tests to address potential issues such as omitted variables and measurement errors. First, we run panel regressions with various fixed effects to eliminate omitted variable bias. Second, we use alternative estimates of business cycle shock to test the sensitivity of our baseline results to shock measures. Third, we replace *Risk1* and *Risk2* with alternative proxies to test the sensitivity of baseline results to risk-taking measures. Finally, we also conducted a subsample analysis to mitigate the influence of the 2008 global financial crisis and the subsequent four trillion-yuan stimulus package.¹¹

4.2.1. Fixed effects analysis

Table 4 shows the estimation results with more fixed effects considered. Precisely, we control for both firm and year fixed effects in columns (1) and (2). Furthermore, as social culture can influence corporate risk-taking decisions (Arping, 2019; Jiang and Chen, 2021), we simultaneously control for industry, year, and province fixed effects in columns (3) and (4). Previous

¹⁰For details, see Section 4.2.7 and Appendix Table A9

¹¹Our risk measures follow common practice in the literature on corporate risk-taking behavior. For example, Luo et al. (2022) use similar risk measures with an even more extended sample period (over 2000Q4-2019Q3) to investigate the risk-taking behavior of China's listed firms. Given that our choice of risk measures is standard, we still examined whether the changes in accounting standards in China affect our main conclusions. We located a significant change consisting of 38 specific standards implemented since 2007. This change marked a milestone in China's convergence toward international accounting standards. We repeated our baseline empirical analysis using a subsample from 2007Q1 to 2017Q4 to address any potential impact of this accounting standard change. Remarkably, our findings get even more significant according to this subsample regression. See the first two columns of Table A2. Another major revision of the Chinese accounting standards occurred in 2017, involving seven specific standards. These modifications pertained to non-current assets held for sale and discontinued operations, recognition and measurement of financial instruments, transfer of financial assets, hedge accounting, the presentation of financial instruments, revenue from customer contracts, and government subsidies. However, it is essential to note that none was related to our risk measures. Despite this minimal impact, we still decided to restrict our sample from 2007Q1 to 2016Q4 to eliminate any concerns caused by this event. We repeated the baseline empirical analysis using this further reduced sample, and the relevant findings remained consistent with the baseline result. See the last two columns of Table A2. There was also a minor change in accounting standards in 2014, but it did not impact our proxies of risk-taking directly.

TABLE 4.

Fixed effects model

	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2	(5) Risk1	(6) Risk2
BC	0.0004*** (9.30)	0.0010*** (8.43)	0.0004*** (9.74)	0.0010*** (8.83)	0.0004*** (9.62)	0.0010*** (8.75)
Firm Size	-0.0025*** (-13.19)	-0.0046*** (-7.74)	-0.0013*** (-12.41)	-0.0032*** (-10.56)	-0.0014*** (-12.75)	-0.0034*** (-10.85)
TQ	0.0005*** (7.89)	0.0003* (1.74)	0.0013*** (20.13)	0.0018*** (8.55)	0.0012*** (19.35)	0.0017*** (8.26)
Growth	0.0005*** (9.30)	0.0012*** (7.54)	0.0010*** (14.90)	0.0022*** (12.38)	0.0009*** (14.37)	0.0020*** (11.81)
ROA	-0.0554*** (-14.81)	-0.1424*** (-13.53)	-0.0682*** (-16.75)	-0.1708*** (-15.08)	-0.0643*** (-15.89)	-0.1609*** (-14.40)
Lev1	0.0092*** (10.99)	0.0537*** (19.69)	0.0086*** (12.49)	0.0596*** (24.09)	0.0086*** (12.52)	0.0597*** (24.44)
Liquidity	-0.0001 (-1.42)	0.0003*** (2.72)	0.0000 (0.03)	0.0007*** (7.57)	-0.0000 (-0.25)	0.0006*** (7.47)
SOE	-0.0005 (-0.82)	0.0006 (0.35)	-0.0009*** (-4.08)	-0.0016*** (-2.63)	-0.0011*** (-4.77)	-0.0020*** (-3.21)
Constant	0.0616*** (14.84)	0.0991*** (7.83)	0.0337*** (15.20)	0.0647*** (10.27)	0.0350*** (15.57)	0.0673*** (10.60)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	No	No	No	No
Industry	No	No	Yes	Yes	Yes	Yes
Province	No	No	No	No	Yes	Yes
Industry by Year	No	No	Yes	Yes	Yes	Yes
Province by Year	No	No	No	No	Yes	Yes
<i>N</i>	107419	107419	107419	107419	107419	107419
Adj. R^2	0.282	0.296	0.150	0.185	0.158	0.193

This table reports the estimates of the impact of business cycle shock on corporate risk-taking with various fixed effects. Columns (1) and (2) present the univariate estimates with year and firm fixed effects, columns (3) and (4) report the multivariate estimates with year, industry, and industry by year fixed effects, and the last two columns report the estimates with year, industry, province, industry by year, and province by year fixed effects. We do not consider quarter-fixed effects in all regressions because business cycle shock strongly correlates with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

studies also document that industry-level and provincial-level time-variant factors, e.g., product market competition, can also affect corporate risk choices (Arping, 2019; Jiang et al. 2015; Jiang and Chen 2021; Li et al. 2013). Thus, we employ a stricter model specification by introducing two

more fixed effects, industry by year and province by year, in columns (5) and (6). The results of the specifications above are all highly consistent with those reported in Table 3. Therefore, our baseline results remain intact with various fixed effects considered.

4.2.2. Instrumental variable approach

To alleviate endogeneity concerns, we consider instrumental variable (IV) approach. It is hard to find good IVs that are related to BC , and meanwhile are mean-independent of the error term in Equation 7. we adopt the technique applied by Lewbel (2012), that exploits the presence of heteroscedasticity in the regression residuals, to find IVs. This technique is also used by recent empirical studies (e.g. Chen et al. 2021; Gong et al. 2018). We sketch the intuition below. Assume that we are interested in estimating the following linear triangular model:

$$y_1 = \alpha_1 + X'\beta_1 + \gamma_1 y_2 + \epsilon_1 \quad (8)$$

$$y_2 = \alpha_2 + X'\beta_2 + \epsilon_2 \quad (9)$$

where y_2 is the endogenous variable (BC in our context). Assume that the standard conditions that $E[X\epsilon_1] = E[X\epsilon_2] = 0$, and $\text{cov}(X, \epsilon_1\epsilon_2) = 0$ hold. Then if heteroscedasticity issue occurs ($\text{cov}(X, \epsilon_2^2) \neq 0$), $X\epsilon_2$ can be used as instruments for y_2 . The rationale is that the assumption that $\text{cov}(X, \epsilon_1\epsilon_2) = 0$ can guarantee that $X\epsilon_2$ is uncorrelated with ϵ_1 , whereas the presence of heteroscedasticity ($\text{cov}(X, \epsilon_2^2) \neq 0$), lends support to the correlation between $X\epsilon_2$ and y_2 . Meeting these two requirements justifies the validity of $X\epsilon_2$ as instruments.

Our untabulated results (Breusch-Pagan test) confirm the existence of heteroscedasticity in Equation 7 ($\text{cov}(X, \epsilon_2^2) \neq 0$) for all regressions presented in Table 3. Therefore, we can confidently use the technique outlined above. The results are reported in Table 5.¹² Clearly, our baseline results remain valid under this alternative specification.

4.2.3. Alternative measures of business cycle shocks

To correct the possible measurement errors of business cycle shocks, we replace the business cycle shock BC with the lower bound of BC , BC_{lower} , the upper bound of BC , BC_{upper} , and the average of BC , BC_{avg} in our

¹²We partial out industry and year dummies by applying Frisch-Waugh theorem to avoid non-invertible variance-covariance matrices, and thus no constant term is reported in Table 5.

TABLE 5.

Instrumental variable approach

	(1) Risk1	(2) Risk2
$\widehat{BC}$	0.0004*** (10.13)	0.0011*** (9.20)
Firm Size	-0.0014*** (-12.70)	-0.0033*** (-10.63)
TQ	0.0012*** (19.64)	0.0018*** (8.97)
Growth	0.0010*** (14.98)	0.0022*** (12.71)
ROA	-0.0670*** (-16.32)	-0.1727*** (-15.24)
Lev1	0.0085*** (12.19)	0.0595*** (24.09)
Liquidity	0.0000 (0.20)	0.0007*** (7.80)
SOE	-0.0008*** (-3.71)	-0.0015** (-2.56)
Year	Yes	Yes
Industry	Yes	Yes
N	107419	107419
Adj. R^2	0.099	0.145

This table reports the impact of business cycle shock on corporate risk-taking using instrumental variable approach. We do not consider quarter-fixed effects in all regressions because business cycle shock strongly correlates with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

baseline specification, respectively. Panel A of Table 6 presents the estimated effect of business cycle shock on corporate risk-taking using these measures, which suggests that business cycle shocks always lead corporate risk-taking to move in the same direction significantly on average.

4.2.4. Alternative measures of risk-taking

We also examine the sensitivity of our results to different measures of risk-taking. In Panel B of Table 6, the dependent variable of baseline regression, *Risk1* or *Risk2*, is replaced with *Risk3*, *Risk4*, *Risk5*, *Risk6*, *Risk7*, and *Risk8*, respectively in each column. We find that the coeffi-

icients of business cycle shock are always significant and positive, implying that our results are not bothered by risk-taking measure errors.

TABLE 6.

Alternative measures of business cycle shocks and corporate risk-taking						
Panel A: Alternative Business Cycle Shock Measures						
	(1)	(2)	(3)	(4)	(5)	(6)
	Risk1	Risk2	Risk1	Risk2	Risk1	Risk2
BC_{lower}	0.0004*** (10.25)	0.0011*** (9.42)				
BC_{upper}			0.0004*** (9.06)	0.0009*** (8.29)		
BC_{avg}					0.0004*** (9.72)	0.0010*** (8.92)
Constant	0.0353*** (15.59)	0.0656*** (10.43)	0.0350*** (15.45)	0.0648*** (10.30)	0.0352*** (15.51)	0.0652*** (10.36)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	107419	107419	107419	107419	107419	107419
Adj. R^2	0.136	0.174	0.136	0.174	0.136	0.174

4.2.5. Exposure-based specification

To further strengthen identification, we exploit cross-sectional variation in firms' exposure to aggregate business cycle shocks. Specifically, we construct an exposure-based measure using pre-sample industry sensitivities of sales growth to aggregate fluctuations. This approach relies on predetermined heterogeneity in exposure that is plausibly exogenous to contemporaneous firm-level decisions. By interacting aggregate shocks with this predetermined exposure ($BC_Exposure$), the specification isolates differential responses across firms while holding the aggregate shock constant, in the spirit of a shift-share design. As such, this approach mitigates concerns that our baseline results are driven by endogenous sorting of firms into more shock-sensitive industries or by omitted time-varying confounders correlated with both macroeconomic conditions and firm behavior.

The results are reported in Appendix Table A7. The coefficients on $BC_Exposure$ are positive and statistically significant at the 1% level across both risk measures. In terms of economic magnitude, the estimates (0.0005 for $Risk1$ and 0.0015 for $Risk2$) imply increases of approximately 4.55% and 6.25% relative to the sample means (0.011 and 0.024), respec-

TABLE 6—Continued

Panel B: Alternative Risk-Taking Measures						
	(1) Risk3	(2) Risk4	(3) Risk5	(4) Risk6	(5) Risk7	(6) Risk8
BC	0.0007*** (9.73)	0.0019*** (9.00)	0.0004*** (10.69)	0.0010*** (8.92)	0.0005*** (5.96)	0.0008*** (10.64)
Constant	0.0655*** (15.41)	0.1189*** (10.21)	0.0308*** (14.27)	0.0652*** (10.36)	0.0839*** (14.24)	0.0575*** (14.15)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	107419	107419	107419	107419	107419	107419
Adj. <i>R</i> ²	0.137	0.176	0.108	0.174	0.176	0.109

This table reports the estimates of the impact of business cycle shock on corporate risk-taking using alternative measures of business cycle shocks in Panel A and alternative measures of risk-taking in Panel B, respectively. Columns (1) and (2) of Panel A present the estimates using the lower bound of the business cycle shock estimate, BC_{lower} ; Columns (3) and (4) of Panel A report the estimates using the upper bound of the business cycle shock estimate, BC_{upper} ; the last two columns of Panel A report the estimates using the simple average of the lower bound and the upper bound of the business cycle shock estimate, BC_{avg} , as an alternative metric of BC . Columns (1) - (6) of Panel B present the estimates using $Risk3$, $Risk4$, $Risk5$, $Risk6$, $Risk7$, and $Risk8$, as dependent variables, respectively, where $Risk3$ is the difference between the maximum and minimum ROA (defined below) over the three overlapping quarters from $t + 1$ to $t + 3$; $Risk4$ is the difference between the maximum and minimum ROE (defined in the definition of $Risk2$) over the three overlapping quarters from $t + 1$ to $t + 3$; $Risk5$ is the three-quarter rolling standard deviation of earnings before interest, taxes, depreciation and amortization scaled by total assets over the window quarter $t + 1$ to $t + 3$; $Risk6$ is the three-quarter rolling standard deviation of operating income scaled by total assets over the window quarter $t + 1$ to $t + 3$; $Risk7$ is the difference between the maximum and minimum $EBITDA/Total\ assets$ over the three overlapping quarters from $t + 1$ to $t + 3$; and $Risk8$ is the difference between the maximum and minimum $Operating\ income/Total\ assets$ over the three overlapping quarters from $t + 1$ to $t + 3$. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock strongly correlates with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

tively. These findings suggest that firms with greater exposure to macroeconomic fluctuations exhibit stronger risk-taking responses, reinforcing the interpretation that business cycle shocks affect corporate behavior through economically meaningful channels rather than purely mechanical correlations.

4.2.6. *Parsimonious specification and balanced panel*

Another concern is that the baseline results may be sensitive to the inclusion of control variables or driven by an unbalanced panel. To address this, we first estimate a parsimonious specification without control variables, which allows us to retain a substantially larger set of firm-quarter observations. As shown in Columns (1)–(2) of Appendix Table A8, the coefficient on *BC* remains positive and highly significant. The estimated magnitudes are also economically meaningful, corresponding to increases of approximately 4.55% (*Risk1*) and 4.17% (*Risk2*) relative to their respective sample means.

We further restrict the sample to a balanced panel of firms that are continuously observed over the entire sample period. Columns (3)–(4) show that the coefficient on *BC* remains positive and statistically significant, although somewhat smaller in magnitude. Even in this more restrictive setting, the implied effects correspond to increases of approximately 1.82% (*Risk1*) and 1.67% (*Risk2*), indicating that the baseline results are not driven by entry, exit, or compositional changes in the sample.

4.2.7. *Alternative business cycle measure and dynamic panel analysis*

We next examine whether our results are sensitive to the construction of business cycle shocks and to potential dynamic endogeneity. First, we replace the baseline shock measure with the cyclical component of output extracted using the Hodrick–Prescott filter. As reported in Columns (1)–(2) of Appendix Table A9, the coefficients on *BC_{HP}* are positive and statistically significant at the 1% level, confirming that our findings are robust to alternative detrending methods.

Second, to address concerns about reverse causality and persistence in corporate risk-taking, we estimate a dynamic panel model using the system GMM estimator. This approach explicitly controls for the lagged dependent variable and treats it as endogenous. The results in Columns (3)–(4) show that the coefficient on *BC* remains positive and statistically significant, even after accounting for the persistence of risk-taking behavior. The estimated coefficients imply economically meaningful effects of approximately 3.64% (*Risk1*) and 4.17% (*Risk2*) relative to the sample means.

Importantly, the diagnostic tests support the validity of the GMM specification: the Hansen test fails to reject the null of instrument validity, and there is no evidence of second-order serial correlation. These results alleviate concerns that the baseline findings are driven by reverse causality or omitted dynamic factors.

4.2.8. *The global financial crisis*

The 2008 global financial crisis could be a confounding event in our sample period. Some firms may be more affected by the financial crisis, leading to a more significant change in risk-taking and contaminating our baseline results. To address this issue, we first remove the observations in 2008, re-estimate Equation 7, and report the results in the first two columns of Table 7. If the financial crisis acts as a driving factor, our baseline results are supposed to change significantly. However, the coefficients of *Risk1* and *Risk2* in columns (1) and (2) are still positive and significant at the 1% level. So the global financial crisis does not compromise our baseline results. As an alternative approach, we keep the observations after 2010 only, re-estimate Equation 7, and show the corresponding results in columns (3) and (4). We still find a positive and significant effect of business cycle shock on corporate risk-taking. In sum, the first four columns of Table 7 indicate that our baseline results are unlikely to be driven by the global financial crisis.

4.2.9. *China's four-trillion-yuan stimulus package*

After the 2008 global financial crisis, the Chinese central government announced the four-trillion-yuan fiscal program in November to prevent a deep recession. The stimulus package reshapes the financing environment to a large degree (Chen et al., 2020; Jiang and Chen, 2021), and may greatly impact Chinese firms' risk choices. The stimulus plan focuses on infrastructure projects, in which 1.5 trillion yuan was used for the construction of railways, roads, airports, water conservancy, and urban power grids, 1.14 trillion yuan was invested in indemnification and comfortable housing, rural livelihood, and other infrastructure, and 1 trillion was spent on the post-disaster rebuilding of Wenchuan. Therefore, a large portion of funding flew into the construction and real estate industries.

To mitigate the possible influence of the stimulus package, we construct a subsample by deleting firms in the construction and real estate industry and re-estimate Equation 7. We are supposed to obtain a less significant effect with this subsample if our baseline results are driven by construction and real estate firms. However, columns (5) and (6) of Table 7 present the opposite, that is, the significant and positive coefficients of *BC* are not determined by specific sectors closely related to the four-trillion-yuan fiscal program.

Overall, the robustness checks consistently show that the positive relationship between business cycle shocks and corporate risk-taking is sta-

ble across alternative specifications, sample constructions, and estimation methods. Moreover, the economic magnitudes remain nontrivial across all tests, reinforcing the practical relevance of the results. Together, these findings provide strong support for the baseline conclusion that macroeconomic shocks have a meaningful impact on corporate risk-taking behavior in China.

TABLE 7.

Subsample analysis

	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2	(5) Risk1	(6) Risk2
BC	0.0002*** (6.00)	0.0007*** (5.67)	0.0009*** (13.81)	0.0024*** (13.10)	0.0004*** (9.11)	0.0010*** (8.38)
Constant	0.0354*** (15.57)	0.0670*** (10.56)	0.0338*** (13.92)	0.0663*** (9.99)	0.0319*** (13.26)	0.0584*** (8.80)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	101748	101748	73469	73469	98992	98992
Adj. <i>R</i> ²	0.135	0.174	0.131	0.181	0.133	0.174

This table reports the estimates of the impact of business cycle shock on corporate risk-taking using three subsamples separately. Columns (1) and (2) present the estimates using the subsample without firm-quarter observations in 2008 (the financial crisis year), and columns (3) and (4) report the estimates using the subsample over 2010q1-2017q4 to remove the confounding influence of the financial crisis, and the last two columns report the estimates using the subsample excluding the firms in construction and real estate industries, which are more affected by the four-trillion stimulus package. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock strongly correlates with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

5. MECHANISMS: FINANCING AND AGENCY CHANNELS

We examine the mechanisms through which business cycle shocks affect corporate risk-taking. Guided by the hypothesis and empirical implications developed in Section 3, we focus on two complementary channels: a financing (cash-flow) channel, which constitutes the primary mechanism, and an agency channel, which becomes relevant under financial distress. We fur-

ther allow for asymmetric responses across macroeconomic states, which provides additional discipline for distinguishing between these channels.

In this section, we examine the mechanisms through which business cycle shocks affect corporate risk-taking. Consistent with the hypotheses developed in the introduction, we focus on two channels: a financing (cash-flow) channel, which serves as our primary mechanism, and an agency channel, which plays a complementary role. In addition, we explicitly allow for asymmetric responses to positive and negative macroeconomic shocks, which provide further insight into the underlying mechanisms.

5.1. Asymmetric effects

While the baseline results document a positive average relationship between business cycle shocks and corporate risk-taking, the theoretical framework suggests that this relationship may vary across macroeconomic states. In particular, the financing (cash-flow) channel is expected to dominate during economic expansions, whereas agency considerations may become more relevant during periods of economic distress. To examine this asymmetry, we partition the sample into observations with positive and non-positive business cycle shocks, labeled as Expansion ($BC > 0$) and Recession ($BC \leq 0$) periods, respectively, and re-estimate Equation 7 for each subsample.

Table 8 reports the results. During expansion periods (columns (1) and (2)), the coefficients on BC are positive and statistically significant at the 1% level for both risk measures. In economic terms, a one-unit increase in BC is associated with an increase in $Risk1$ of approximately 0.0016, which corresponds to about 14.5% relative to its sample mean (0.011), and an increase in $Risk2$ of about 0.0030, or 12.5% relative to its mean (0.024). These results suggest that, in favorable macroeconomic conditions, firms increase risk-taking as business cycle shocks improve, consistent with the financing channel whereby improved cash flows and relaxed financial constraints enable firms to undertake riskier investments.

In contrast, during recession periods (columns (3) and (4)), the coefficients on BC become negative or statistically insignificant. For $Risk1$, the coefficient of -0.0005 implies that a one-unit decrease in BC (i.e., a more severe negative shock) is associated with an increase in risk-taking of approximately 4.5% relative to the sample mean. This pattern suggests that, as adverse shocks intensify, firms may increase risk-taking, consistent with risk-shifting incentives under financial distress. The weaker statistical significance for $Risk2$ indicates that this effect may depend on how

TABLE 8.

Asymmetric effect

	Expansion Period		Recession Period	
	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2
BC	0.0016*** (13.30)	0.0030*** (9.14)	-0.0005*** (-3.40)	-0.0001 (-0.35)
Firm Size	-0.0014*** (-11.43)	-0.0031*** (-8.93)	-0.0013*** (-12.19)	-0.0034*** (-10.78)
TQ	0.0012*** (17.05)	0.0016*** (7.44)	0.0012*** (17.31)	0.0019*** (8.61)
Growth	0.0007*** (7.69)	0.0014*** (5.20)	0.0012*** (12.17)	0.0028*** (10.69)
ROA	-0.0715*** (-13.43)	-0.1820*** (-12.40)	-0.0649*** (-13.66)	-0.1696*** (-12.29)
Lev1	0.0092*** (11.56)	0.0602*** (21.69)	0.0078*** (10.99)	0.0588*** (23.74)
Liquidity	0.0000 (0.07)	0.0006*** (6.10)	0.0000 (0.20)	0.0007*** (8.17)
SOE	-0.0010*** (-3.90)	-0.0021*** (-3.08)	-0.0007*** (-3.22)	-0.0011* (-1.88)
Constant	0.0351*** (13.74)	0.0614*** (8.68)	0.0344*** (14.69)	0.0676*** (10.30)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	50045	50045	57374	57374
Adj. R^2	0.147	0.174	0.139	0.184

This table reports the estimates of the asymmetric impact of business cycle shocks on firm risk-taking. Columns (1) and (2) present the results for prosperity period ($BC > 0$), while columns (3) and (4) present the results for recession period ($BC \leq 0$). Both industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

risk-taking is measured, but the overall pattern points to an asymmetric response across economic states.

Taken together, these findings suggest that the aggregate relationship masks fundamentally different mechanisms across macroeconomic states.

TABLE 9.

Agency channel

Panel A: Business Cycle Shocks, Financial Distress Risk (FDR), and Corporate Risk-Taking				
	High FDR		Low FDR	
	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2
BC	-0.0009*** (-3.41)	-0.0015* (-1.94)	-0.0007*** (-3.53)	-0.0004 (-1.01)
Constant	0.0479*** (14.79)	0.1145*** (10.90)	0.0158*** (5.85)	0.0131*** (2.68)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	29240	29240	28134	28134
Adj. R^2	0.205	0.191	0.099	0.086
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$				
P-value: Risk1		0.335		
P-value: Risk2		0.007***		

To further examine this mechanism, we consider cross-sectional variation in financial distress risk using $O - score$. Following Ohlson (1980), we introduce $O - score$ to measure financial distress risk, which has been widely used in literature (e.g., Megginson et al., 2019), calculated as $-1.32 - 0.407 \times Firm\ size + 6.03 \times Lev1 - 1.43 \times \frac{WC}{TA} + 0.076 \times Liquidity - 1.72 \times D_{TL-TA} - 2.37 \times \frac{NI}{TA} - 1.83 \times \frac{OCF}{TL} + 0.285 D_{LOSS} - 0.521 \times \frac{NI_t - NI_{t-1}}{|NI_t| + |NI_{t-1}|}$, where TA is total assets; TL total liabilities; WC working capital; D_{TL-TA} is a dummy variable which takes value 1 if total liabilities are higher than total assets, and 0 otherwise; NI is net income; OCF funds from operations; and D_{LOSS} is a dummy variable taking a value of 1 if the company realized a net loss in the last two years, and zero otherwise. We then partition the subsample with non-positive values of BC into two subgroups based on $O - score$. We label the subgroup of firms with the $O - score$ above (below) the sample mean as a high (low) financial distress group. We then explore the impact of business cycle shocks using these two subgroups separately.¹³

¹³We also consider Altman's Z-score for emerging markets to measure financial distress risk for robustness (Altman et al., 1995). Our untabulated results are quite similar, which is available upon request.

TABLE 9—*Continued*

Panel B: Business Cycle Shocks, Managerial Ownership (MO), Financial Distress Risk, and Corporate Risk-Taking				
	High FDR and High MO		Low FDR and Low MO	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	−0.0008** (−2.17)	−0.0007 (−0.68)	−0.0006* (−1.69)	−0.0004 (−0.73)
Constant	0.0329*** (7.38)	0.0890*** (5.59)	0.0263*** (7.15)	0.0350*** (5.08)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	11028	11028	11425	11425
Adj. <i>R</i> ²	0.174	0.173	0.112	0.086
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$				
P-value: Risk1			0.386	
P-value: Risk2		0.054***		

This table reports the estimates of the impact of business cycle shocks on firm risk-taking during recession period for firms with high and low agency conflicts of interest between equity holders and debt holders. Panel A presents the estimates of the impact of business cycle shocks on corporate risk-taking for firms with high financial distress risk and low financial distress risk during recession period ($BC \leq 0$) in columns (1)-(2) and (3)-(4), respectively. Financial distress risk is captured by O-score. Panel B presents the estimates of the impact of business cycle shocks on corporate risk-taking for firms with high financial distress risk and high managerial ownership, and low financial distress risk and low managerial ownership during recession period in columns (1)-(2) and (3)-(4), respectively. High and low FDR (MO) are partitioned on the sample average of O-score (managerial ownership). Both industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. The last two rows in Panel A (B) report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples with high FDR and low FDR (with the intersection of high FDR and high MO and the intersection of low FDR and low MO) respectively are equal. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

Panel A of Table 9 examines heterogeneity across firms with different levels of financial distress during recession periods. The estimates show

that the negative association between business cycle shocks and risk-taking is more pronounced among high-distress firms. For instance, the coefficient on BC for $Risk1$ is -0.0009 for high-distress firms, compared to -0.0007 for low-distress firms. A similar pattern emerges for $Risk2$, with statistically significant differences confirmed by Fisher permutation tests. This pattern is consistent with the notion that financial distress amplifies risk-shifting incentives, as declining firm value and tighter financing constraints increase the convexity of equity payoffs.

The preceding evidence suggests that the negative or muted relationship between business cycle shocks and risk-taking during downturns is concentrated among financially distressed firms, consistent with risk-shifting incentives. However, financial distress alone does not fully capture agency conflicts. A key implication of the agency framework is that risk-shifting incentives should be stronger when equity incentives are more pronounced, as shareholders benefit disproportionately from upside outcomes while downside risks are partially borne by creditors.

To provide a sharper test of this mechanism, we jointly consider financial distress and managerial ownership, which strengthens the alignment between managers and shareholders. If the observed behavior reflects agency-driven risk-shifting, the sensitivity of risk-taking to adverse shocks should be strongest among firms that are both financially distressed and have high managerial ownership.

Panel B provides a more stringent test of the agency mechanism by jointly considering financial distress and managerial ownership. The results indicate that the sensitivity of risk-taking to adverse business cycle shocks is strongest among firms that simultaneously exhibit high financial distress and high managerial ownership.

Economically, this pattern suggests that when managers' incentives are closely aligned with equity holders, the propensity to increase risk-taking in response to adverse shocks becomes more pronounced in financially distressed firms. In contrast, firms with both low distress and low managerial ownership exhibit a weaker response.

While the differences are not uniformly strong across specifications, the overall pattern suggests that agency distortions become more relevant under financial distress, particularly when combined with weaker governance structures.

Taken together, these findings provide direct support for the agency-based risk-shifting channel: the increase in risk-taking during downturns is not uniform, but is concentrated in firms where both financial distress and equity-aligned incentives amplify risk-taking incentives.

Overall, these results reinforce the asymmetric mechanism highlighted above: while the financing channel dominates during expansions, the agency-driven risk-shifting channel becomes more relevant in downturns, particularly among firms facing both financial distress and strong equity-based incentives.

The asymmetric pattern across macroeconomic states points to distinct underlying mechanisms. During expansion periods, the positive and economically large response of risk-taking to business cycle shocks is consistent with a financing (cash-flow) channel. Improved macroeconomic conditions increase internally generated funds and relax financing constraints, enabling firms—particularly those that are financially constrained or have strong investment opportunities—to undertake riskier but value-enhancing projects.

In contrast, during recession periods, the relationship weakens or reverses. For one of our risk measures, more adverse shocks are associated with higher risk-taking. This countercyclical pattern is difficult to reconcile with a pure financing-based explanation, which would predict a contraction in risk-taking as constraints tighten.

Instead, this evidence is consistent with an agency-based risk-shifting mechanism. When firms approach financial distress, equity holders have stronger incentives to undertake risky projects, as the upside accrues to shareholders while downside risks are partially borne by creditors.

Supporting this interpretation, we find that the increase in risk-taking during downturns is significantly stronger among firms with higher financial distress risk, as measured by O-score. This cross-sectional heterogeneity provides direct evidence that the recession-period effect is driven by distress-induced risk-shifting, rather than by financing conditions alone.

Taken together, the results suggest that corporate risk-taking responds to macroeconomic shocks through a state-dependent mechanism: the financing channel dominates during expansions, while agency considerations become more salient during periods of economic distress.

5.2. Financing channel

We first examine the financing channel, which is expected to dominate during economic expansions. Our primary hypothesis posits that business cycle shocks affect corporate risk-taking through a financing channel. In the presence of financial frictions, firms' ability to undertake risky investments depends on internal liquidity and access to external finance. Positive business cycle shocks improve operating cash flows and ease financing conditions, thereby relaxing financial constraints and enabling firms to un-

dertake riskier, potentially value-enhancing projects. Conversely, adverse shocks tighten constraints and limit such activities.

As Hadlock and Pierce (2010) suggests, we employ the SA index (SA), calculated as $-0.737 \times Firm\ Size + 0.043 \times Firm\ Size^2 - 0.040 \times Firm\ Age$, to measure financial constraint of each firm. The SA index has been widely used in literature (e.g. Choi et al., 2021; Li, 2011), and firms with a larger value of SA are more financially constrained than those with a smaller one.

We take two steps to test our hypothesis with the SA index. In the first step, we regress one-quarter ahead SA on BC and a set of control variables, including operating cash flows (CF), market capitalization ($Mkt\ Cap$), capital expenditures ($Capex$), quarterly change in net working capital (ΔNWC), quarterly change in short-term debt ($\Delta Sdebt$), the natural logarithm of a firm's listing years ($Firm\ Age$), Tobin's Q (TQ), return on asset (ROA), quarterly sales growth rate ($Growth$), and firm ownership (SOE). Both industry and year fixed effects are controlled. Column (1) of Table 10 presents the results. The coefficient on BC is negative and significant at the 1% level, suggesting that favorable (adverse) business cycle shocks are associated with a relaxation of financial constraints. Namely, financial constraints get looser (tighter) as the aggregate economy surprisingly improves (deteriorates).

In the second step, we construct subsamples consisting of firms with SA above and below the sample median, name them the group of tightly financially constrained and loosely financially constrained, and then estimate Equation 7 with these two subsamples, separately. Columns (2)–(5) of Table 10 report the results for subsamples of firms with high and low financial constraints. For both groups, business cycle shocks are positively associated with risk-taking. However, the magnitude of the effect is substantially larger for more financially constrained firms. In addition, this conclusion is also supported by the Fisher permutation test. For example, when risk-taking is measured by $Risk1$, a one-unit increase in BC corresponds to an increase of approximately 5.45% relative to the sample mean for financially constrained firms, compared to 2.73% for less constrained firms. Using $Risk2$ yields similar patterns, with corresponding increases of 6.67% and 2.50%, respectively.

These results suggest that the positive relationship between business cycle shocks and corporate risk-taking is stronger among firms facing tighter financial constraints, consistent with the financing channel highlighted in the theoretical framework. Therefore, these findings provide strong support for the importance of financing conditions as a key mechanism.

TABLE 10.

		Financial constraints			
		High Financial Constraints		Low Financial Constraints	
	(1) SA	(2) Risk1	(3) Risk2	(4) Risk1	(5) Risk2
BC	-0.0195*** (-15.61)	0.0006*** (9.60)	0.0016*** (9.62)	0.0003*** (4.78)	0.0006*** (3.94)
CF	-0.3967*** (-5.83)				
Mkt Cap	1.2281*** (109.16)				
Capex	-0.3648 (-1.59)				
ΔNWC	-0.3007*** (-9.87)				
$\Delta Sdebt$	-0.1471*** (-2.75)				
Firm Age	0.1485*** (6.53)				

The SA index is measured using firm age and total assets, which may lead to concern for endogeneity since business cycle shocks potentially affect total assets. For instance, firms may expand their assets when a favorable business cycle shock comes. To address this concern, we consider an alternative proxy of financial constraints, KZ index, developed by Kaplan and Zingales (1997). We estimate KZ index using China's data and calculate it as $-24.194 \times CF + 0.473 \times TQ + 4.919 \times Lev1 - 4.293 \times Div - 6.692 \times Cash$, where Div is the dividend scaled by total assets, $Cash$ is cash and cash equivalents deflated by total assets, and CF , TQ , and $Lev1$ are defined in Panel A of Table A1. Firms with a larger value of KZ are more financially constrained than those with a smaller one. We conduct a similar exercise as we did in Table 10 then. Table A3 presents the results, which are highly consistent with those in Table 10. Therefore, the results using the alternative proxy are consistent with the baseline findings, alleviating concerns that the results are driven by the construction of the SA index.

To address the financing channel more directly, we further examine how business cycle shocks affect corporate leverage. For this purpose, we introduce four measures of corporate leverage: $Lev1$, the ratio of total liabilities to total assets, $Lev2$, the ratio of long-term liabilities to total assets, $\Delta Loan.TA$, quarterly change in total loan to lagged total assets,

TABLE 10—Continued

		High Financial Constraints		Low Financial Constraints	
	(1) SA	(2) Risk1	(3) Risk2	(4) Risk1	(5) Risk2
TQ	−0.3315*** (−51.69)	0.0013*** (10.74)	0.0033*** (12.58)	0.0011*** (14.84)	0.0013*** (5.32)
ROA	−5.0800*** (−19.46)	−0.0439*** (−6.42)	−0.1587*** (−8.77)	−0.0787*** (−16.29)	−0.1901*** (−13.66)
Growth	0.0341*** (9.70)	0.0008*** (10.28)	0.0023*** (10.20)	0.0011*** (10.69)	0.0021*** (7.73)
SOE	0.1985*** (10.99)	−0.0006** (−2.10)	−0.0010 (−1.27)	−0.0009*** (−3.00)	−0.0017** (−2.05)
Firm Size		−0.0007*** (−5.59)	−0.0022*** (−5.52)	−0.0020*** (−7.81)	−0.0041*** (−6.23)
Lev1		0.0014 (1.63)	0.0539*** (17.02)	0.0131*** (15.04)	0.0645*** (19.72)
Liquidity		−0.0001 (−1.32)	0.0009*** (5.20)	0.0001*** (3.49)	0.0008*** (7.28)
Constant	−22.6464*** (−91.24)	0.0245*** (8.27)	0.0411*** (4.82)	0.0460*** (8.70)	0.0826*** (6.05)
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
<i>N</i>	104415	51085	51085	56334	56334
Adj. <i>R</i> ²	0.862	0.073	0.139	0.166	0.206
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$					
P-value: Risk1			0.005***		
P-value: Risk2			0.000***		

This table presents the channel analysis of the impact of business cycle shock on corporate risk-taking. Column (1) presents the estimates of the impact of business cycle shock on firm financial constraints measured by *SA* index, defined as $-0.737 \times Firm\ Size + 0.043 \times Firm\ Size^2 - 0.040 \times Firm\ Age$. Columns (2) and (3) report the estimates of the impact of business cycle shock on corporate risk-taking using the subsample consisting of firms with high financial constraints (*SA* above its sample median). In contrast, the last two columns report the estimates using its complement subsample (*SA* below its sample median). The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

and $\Delta Long\ Loan_TA$, quarterly change in long-term loan to lagged total assets. We then regress one-quarter ahead *Lev1*, *Lev2*, $\Delta Loan_TA$, and $\Delta Long\ Loan_TA$ on *BC* separately. Following Cao et al. (2019) and Firth

et al. (2009), we control *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *SOE* (state ownership indicator), and *Liquidity* (current assets over current liabilities) in all regressions. Industry and year fixed effects are also considered.

Table 11 reports the relevant results. Columns (1) and (2) show that the effects of *BC* on *Lev1* and *Lev2* are strongly positive with statistical significance at the 1% and 5% levels, respectively, which suggests that favorable (adverse) business cycle shocks encourage (discourage) firms to take more debt financing. Similarly, the last two columns manifest that *BC* positively impacts another two alternative measures of access to finance, $\Delta Loan.TA$ and $\Delta Long\ Loan.TA$, with statistical significance at 1% level, further affirming the above conclusion with bank loans.

State ownership is a central institutional feature of Chinese corporate finance, and prior studies document that ownership structure systematically shapes firms' risk-taking behavior (e.g., Boubakri et al. 2013; Clarke, 2003; Khaw et al. 2016; Zhang et al., 2021). In particular, state-owned enterprises (SOEs) often pursue multiple objectives beyond profit maximization, including maintaining employment, supporting strategic industries, and fulfilling political mandates. These objectives tend to favor stability over risk, making SOEs less inclined to undertake high-risk projects. Consistent with this view, existing evidence generally finds a negative association between state ownership and corporate risk-taking.

In our setting, these institutional features also imply that the sensitivity of risk-taking to business cycle shocks may differ across ownership types. Because SOEs typically benefit from softer budget constraints and implicit government support, their financing conditions are less sensitive to macroeconomic fluctuations. In contrast, non-SOEs rely more heavily on market-based financing and are therefore more exposed to changes in aggregate economic conditions. As a result, the financing channel is expected to operate more strongly among non-SOEs.

To test this conjecture, we partition the sample into SOEs and non-SOEs and re-estimate the baseline specification for each group. The results, reported in Table 12, show that the coefficients on *BC* are positive and statistically significant for both subsamples, indicating that favorable business cycle shocks are associated with increased risk-taking regardless of ownership type. However, the economic magnitude of the effect differs substantially across groups. For non-SOEs, the estimated coefficient on *BC* is approximately 0.0006 for *Risk1* and 0.002 for *Risk2*, compared to 0.0002 and 0.0004, respectively, for SOEs. Evaluated relative to the sam-

TABLE 11.

Business cycle shock and access to external finance

	(1)	(2)	(3)	(4)
	Lev1	Lev2	$\Delta Loan.TA$	$\Delta Long Loan.TA$
BC	0.0015*** (4.36)	0.0003** (2.03)	0.0009** (2.11)	0.0004*** (3.56)
Firm Size	0.0526*** (22.99)	0.0303*** (22.08)	-0.0007*** (-6.22)	0.0006*** (7.65)
TQ	0.0201*** (11.39)	0.0017*** (3.15)	0.0005*** (5.41)	0.0003*** (6.37)
Growth	0.0134*** (14.33)	0.0028*** (5.25)	-0.0044*** (-10.61)	0.0005*** (3.69)
ROA	-2.3258*** (-31.65)	-0.3906*** (-12.18)	0.0539*** (5.48)	0.0039 (1.06)
Liquidity	-0.0386*** (-38.97)	-0.0022*** (-7.81)	-0.0001*** (-3.99)	-0.0002*** (-7.43)
Firm Age	0.0550*** (9.12)	0.0103*** (3.49)	-0.0016*** (-6.29)	-0.0008*** (-3.99)
SOE	0.0082 (1.55)	-0.0003 (-0.13)	0.0000 (0.18)	-0.0004** (-2.52)
Constant	-0.7557*** (-14.30)	-0.6068*** (-19.05)	0.0209*** (8.43)	-0.0095*** (-5.02)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	107910	107910	107910	107910
Adj. <i>R</i> ²	0.522	0.370	0.002	0.011

This table reports the estimates of the impact of business cycle shock on firm access to external finance. The dependent variables are one quarter ahead ratio of total liabilities to total assets (*Lev1*), one quarter ahead ratio of long-term liabilities to total assets (*Lev2*), one quarter ahead quarterly change in total loan to lagged total assets ($\Delta Loan.TA$), and one quarter ahead quarterly change in long-term loan to lagged total assets ($\Delta Long Loan.TA$) in columns (1) - (4), respectively. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *SOE* (state ownership indicator), and *Liquidity* (current assets over current liabilities) in all regressions. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The *t*-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

ple means (0.011 for *Risk1* and 0.024 for *Risk2*), these estimates imply that a one-unit increase in *BC* raises risk-taking by about 5.45% (*Risk1*)

and 8.33% (*Risk2*) for non-SOEs, whereas the corresponding increases for SOEs are only 1.82% and 1.67%, respectively.

TABLE 12.

Firm ownership

	SOE		Non-SOE	
	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2
BC	0.0002*** (4.61)	0.0004** (2.54)	0.0006*** (8.66)	0.0020*** (10.17)
Constant	0.0346*** (11.10)	0.0662*** (7.46)	0.0340*** (10.50)	0.0591*** (6.69)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	52393	52393	55026	55026
Adj. R^2	0.135	0.180	0.149	0.183
$H_0 : \beta_{BC}^{SOE} = \beta_{BC}^{Non-SOE}$				
P-value: Risk1	0.000***			
P-value: Risk2	0.000***			

This table reports the impact of business cycle shock on corporate risk-taking for firms with different ownership structures. Columns (1) and (2) report the results using the subsample consisting of state-owned enterprises (SOEs), while columns (3) and (4) report the results using the subsample consisting of Non-SOEs. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), and *Liquidity* (current assets over current liabilities) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

This difference is not only economically large but also statistically significant. The Fisher permutation tests reported in the last two rows confirm that the coefficients on *BC* differ across the two groups at the 1% level. Taken together, these findings indicate that non-SOEs are substantially

more responsive to business cycle shocks in adjusting their risk-taking behavior.¹⁴

These results are consistent with the financing-based mechanism highlighted in our framework. Because non-SOEs face tighter financing constraints and greater exposure to macroeconomic conditions, improvements in business cycle conditions relax their constraints more substantially, allowing them to expand into riskier activities. By contrast, SOEs' privileged access to funding and policy-oriented objectives dampen their sensitivity to macroeconomic shocks, leading to a more muted adjustment in risk-taking.

We have shown that favorable business cycle shocks relax financial constraints and thereby encourage firms to undertake riskier projects. At the same time, we document that the sensitivity of risk-taking to business cycle shocks is substantially stronger for non-SOEs than for SOEs. Combining these two findings suggests that the effect of business cycle shocks should be particularly pronounced among firms that are both financially constrained and more reliant on market-based financing—namely, non-SOEs.

To examine this joint mechanism, we conduct a subsample analysis based on the intersection of financial constraints and ownership structure. Specifically, we compare (i) non-SOEs with high financial constraints and (ii) SOEs with low financial constraints. We then re-estimate Equation 7 separately for these two groups.

Table 13 reports the results. Columns (1) and (2) present the estimates for financially constrained non-SOEs, while Columns (3) and (4) report the results for less constrained SOEs. For the former group, the coefficients on *BC* are positive, economically large, and statistically significant at the 1% level. In contrast, for the latter group, the coefficients are substantially smaller in magnitude and become weakly significant or insignificant.

The economic differences are sizable. For financially constrained non-SOEs, the estimated coefficients (0.0011 for *Risk1* and 0.0033 for *Risk2*) imply increases of approximately 10.0% and 13.75% relative to the sample means (0.011 and 0.024), respectively. By comparison, for less constrained

¹⁴Given that China is a relation-based economy (e.g., Allen et al., 2005; Wong, 2016), state ownership may not fully capture the non-economic factors that shape firms' financing conditions. We therefore also consider political connections and bank-firm relationships as alternative proxies for institutional support. Following Brahma et al. (2023), a firm is defined as politically connected if its CEO or Chairman has current or prior experience in government, the military, the CPC, or the CPPCC. Following Zheng et al. (2018), a firm is considered to have a bank relationship if at least one of its top ten shareholders is a bank. We find that politically connected and bank-connected firms exhibit weaker sensitivity of risk-taking to business cycle shocks, reinforcing the role of institutional support in mitigating macroeconomic exposure.

TABLE 13.

Financial constraints and ownership structure

	High Financial Constraints: Non-SOEs		Low Financial Constraints: SOE	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0011*** (8.74)	0.0033*** (9.98)	0.0002** (2.23)	0.0000 (0.13)
Constant	0.0229*** (4.20)	0.0365** (2.49)	0.0494*** (5.70)	0.1095*** (4.51)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	20674	20674	21981	21981
Adj. <i>R</i> ²	0.080	0.126	0.162	0.205
$H_0 : \beta_{BC}^{Non-SOE-High} = \beta_{BC}^{SOE-Low}$				
P-value: Risk1	0.000***			
P-value: Risk2	0.000***			

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on the extent of financial constraints and ownership structure. Columns (1) and (2) present the results on Non-SOE observations with high financial constraints (*SA* above its sample median), and columns (3) and (4) report the results on SOE observations with low financial constraints (*SA* below its sample median). We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's *Q*), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

SOEs, the corresponding effects are only about 1.82% (*Risk1*) and economically negligible for *Risk2*. These results indicate that the responsiveness of risk-taking to business cycle shocks is an order of magnitude larger among financially constrained non-SOEs.

The differences across groups are also statistically significant. The Fisher permutation tests reported in the last two rows reject the null hypothesis of equal coefficients at the 1% level for both risk measures.

Taken together, these results indicate that favorable (adverse) business cycle shocks are associated with improved (deteriorated) access to external finance. This evidence further supports the view that changes in financing conditions are an important mechanism through which business cycle

shocks affect corporate risk-taking. These findings are consistent with Hypothesis 1 and supports the view that financing constraints amplify the sensitivity of corporate risk-taking to macroeconomic shocks.

While these results highlight the importance of financing conditions, they do not rule out the presence of other mechanisms, such as agency considerations, which we explore in subsequent analyses.

TABLE 14.

Cash holdings

	Low Cash Holdings		High Cash Holdings	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0005*** (8.16)	0.0014*** (7.32)	0.0003*** (4.29)	0.0006*** (4.11)
Constant	0.0412*** (13.78)	0.0868*** (9.67)	0.0274*** (9.68)	0.0441*** (6.46)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	53974	53974	53445	53445
Adj. R^2	0.169	0.188	0.111	0.145
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$				
P-value: Risk1		0.016**		
P-value: Risk2		0.000***		

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on cash holdings (the ratio of cash and cash equivalents to net assets (total assets minus cash and cash equivalents)). Columns (1) and (2) present the results on observations whose cash holdings are below the sample median, and columns (3) and (4) report the results on observations whose cash holdings are above the sample median. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables, and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

We next examine the role of internal liquidity. Our empirical hypothesis implies that the effect of business cycle shocks on corporate risk-taking depends not only on external financing conditions but also on firms' internal liquidity. Firms with greater internal funds should be less reliant on external financing and therefore less sensitive to macroeconomic fluctuations in credit conditions.

To examine this mechanism, we use cash holdings as a proxy for internal liquidity, measured as the ratio of cash and cash equivalents to net assets. We partition firms into cash-rich and cash-poor groups based on the sample median and estimate equation Equation 7 separately for each group.

Table 14 reports the results. Across both subsamples, the coefficients on BC are positive and statistically significant, consistent with the baseline finding that favorable business cycle shocks are associated with increased corporate risk-taking. However, the magnitude of the effect differs substantially across groups. For cash-poor firms, the coefficient on BC is 0.0005 (*Risk1*) and 0.0014 (*Risk2*), whereas for cash-rich firms the corresponding coefficients are 0.0003 and 0.0006. Relative to the sample means (0.011 and 0.024), these estimates imply that a one-unit increase in BC raises risk-taking by approximately 4.5% and 5.8% for cash-poor firms, compared to about 2.7% and 2.5% for cash-rich firms. The Fisher permutation tests confirm that these differences are statistically significant.

These findings are consistent with the financing channel: firms with limited internal liquidity are more dependent on external financing, so improvements in macroeconomic conditions translate more strongly into risk-taking. In contrast, cash-rich firms can buffer adverse shocks and finance investments internally, which dampens their responsiveness to business cycle fluctuations.

To further probe this mechanism, we examine heterogeneity based on cash flow volatility, which captures the uncertainty of internally generated funds. Firms with more volatile cash flows face greater difficulty in planning and financing investment, making them more exposed to fluctuations in external financing conditions.

Table A10 presents the results. While the coefficients on BC remain positive and significant across all subsamples, the magnitude is substantially larger for firms with high cash flow volatility. For instance, the coefficient on BC for *Risk1* increases from 0.0005 in the low-volatility group to 0.0013 in the high-volatility group, and a similar pattern holds for *Risk2*. These differences are economically meaningful and statistically significant based on Fisher permutation tests.

This evidence reinforces the interpretation that macroeconomic shocks affect corporate risk-taking by altering the tightness of financing constraints.

Finally, to distinguish between efficient and potentially inefficient risk-taking, we examine heterogeneity in investment opportunities using Tobin's Q. As discussed in the introduction, Tobin's Q captures variation in the availability of investment opportunities rather than directly measuring firm value.

TABLE 15.

	Growth opportunities			
	High TQ		Low TQ	
	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2
BC	0.0006*** (8.81)	0.0015*** (8.02)	0.0001** (2.21)	0.0005*** (3.30)
Constant	0.0572*** (17.25)	0.0831*** (9.18)	0.0318*** (13.29)	0.0604*** (8.60)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	56314	56314	51105	51105
Adj. R^2	0.134	0.199	0.068	0.135
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$				
P-value: Risk1		0.000***		
P-value: Risk2		0.000***		

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on Tobin's Q. Columns (1) and (2) present the results on observations whose TQ is above the sample median, and columns (3) and (4) report the results on observations whose TQ is below the sample median. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We control for *Firm Size* (the natural logarithm of total assets), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables, and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

To capture heterogeneity in investment opportunities, we use Tobin's Q as a proxy. Importantly, we interpret Tobin's Q not as a direct measure of "growth" per se, but as a forward-looking indicator of the market value of investment opportunities and expected marginal returns to capital. We partition the sample into high- and low- Q firms based on the sample median and re-estimate equation Equation 7 separately for the two groups.

Table 15 reports the results. Across both subsamples, the coefficients on BC are positive and statistically significant, consistent with the baseline finding that favorable business cycle shocks are associated with greater corporate risk-taking. However, the magnitude of the effect differs markedly across groups. For high- Q firms, the coefficient on BC is 0.0006 for $Risk1$ and 0.0015 for $Risk2$, whereas for low- Q firms the corresponding coefficients are 0.0001 and 0.0005. Evaluated relative to the sample means (0.011 for $Risk1$ and 0.024 for $Risk2$), these estimates imply that a one-unit increase in BC raises risk-taking by approximately 5.5% and 6.3% for high- Q firms, compared to about 0.9% and 2.1% for low- Q firms. The Fisher permutation tests confirm that these differences are statistically significant at the 1% level. This pattern is consistent with Hypothesis 2 and suggests that improved macroeconomic conditions enable firms with better investment opportunities to undertake riskier, positive-NPV projects.

These results support the interpretation that business cycle shocks affect risk-taking not only through financing conditions but also through the availability and valuation of investment opportunities. When Tobin's Q is high, firms have stronger incentives to undertake risky projects because the expected returns to such investments are higher. As a result, the same macroeconomic shock translates into a larger increase in risk-taking.

Taken together, the asymmetric response to business cycle shocks and the cross-sectional evidence across financial constraints, liquidity, and investment opportunities provide strong support for the financing channel as the primary mechanism.

5.3. Agency channel

We then turn to the agency channel, which is expected to be most relevant during economic downturns when financial distress intensifies incentive distortions. In addition to the financing channel, our framework allows for an agency-based mechanism that may shape how firms adjust risk-taking in response to macroeconomic conditions. As outlined in the introduction, we distinguish between manager-shareholder conflicts and shareholder-debtholder conflicts, which imply different empirical predictions, particularly during adverse economic conditions.

If agency-driven risk-shifting were the dominant mechanism, one would expect firms, especially highly levered ones, to increase risk-taking during downturns (“gambling for resurrection”). However, the asymmetric patterns discussed above provide limited support for this prediction, as we do not observe a systematic increase in risk-taking in response to negative business cycle shocks.

TABLE 16.

Management shareholdings

	High Management Shareholdings		Low Management Shareholdings	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0008*** (11.94)	0.0021*** (12.15)	0.0002*** (3.59)	0.0005*** (3.54)
Constant	0.0220*** (7.19)	0.0397*** (4.89)	0.0438*** (14.62)	0.0842*** (9.63)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	48642	48642	58777	58777
Adj. <i>R</i> ²	0.112	0.153	0.163	0.182
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$				
P-value: Risk1	0.000***			
P-value: Risk2	0.000***			

This table reports the impact of business cycle shock on corporate risk-taking on subsamples partitioned on management shareholdings (the percentage of outstanding shares held by management). Columns (1) and (2) present the results on observations whose management shareholdings are above the sample median, and columns (3) and (4) report the results on observations whose management shareholdings are below the sample median. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin’s Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

We first examine manager–shareholder conflicts using managerial ownership as a proxy for incentive alignment. Our theoretical framework predicts that better-aligned managers engage in more state-contingent risk-taking.

To examine this mechanism, we partition the sample based on the median level of managerial ownership and re-estimate the baseline specification for each subsample. The results are reported in Table 16. Across both groups, the coefficients on *BC* are positive and statistically significant at the 1% level, indicating that favorable business cycle shocks are associated with increased corporate risk-taking regardless of managerial ownership.

However, the magnitude of the response differs substantially across groups. For both risk measures, the estimated coefficient on *BC* for firms with high managerial ownership is approximately four times larger than that for firms with low managerial ownership. Relative to the sample means (0.011 for *Risk1* and 0.024 for *Risk2*), these estimates imply economically meaningful differences in responsiveness. The Fisher permutation tests further confirm that the inter-group differences are statistically significant at the 1% level.

This finding suggests that incentive alignment enhances firms' responsiveness to favorable macroeconomic conditions, consistent with more disciplined and state-contingent risk-taking behavior.

To further investigate agency mechanisms, Appendix Table A11 examines both managerial ownership and leverage. Consistent with the alignment hypothesis, managerial ownership is negatively associated with baseline risk-taking, indicating that better governance reduces excessive risk-taking in normal times. At the same time, the stronger responsiveness to business cycle shocks documented above suggests that these firms adjust risk more actively when conditions improve. In contrast, we find limited support for a leverage-based risk-shifting mechanism.¹⁵ The interaction between leverage and adverse business cycle shocks is generally small and statistically insignificant, providing little evidence that shareholder–debtholder conflicts materially amplify risk-taking in downturns.

6. CONCLUSION

This paper brings macroeconomic shocks into the analysis of corporate risk-taking. We first construct a measure of business cycle shocks that captures unexpected changes in macroeconomic conditions in China. We then

¹⁵To more directly examine risk-shifting incentives, we estimate specifications that include an interaction between negative business cycle shocks and firm leverage. While leverage is positively associated with corporate risk-taking, the interaction term between *BC_neg* and leverage is statistically insignificant. This suggests that leverage does not systematically amplify firms' risk-taking responses to adverse macroeconomic shocks in our setting. Therefore, the agency channel documented in the main text is more likely to operate through cross-sectional heterogeneity in financial distress and incentive structures, rather than through a simple leverage-based mechanism.

examine how these shocks affect firm-level risk-taking, combining empirical evidence with a mechanism-based interpretation grounded in financial constraints and agency considerations.

Our baseline results show that business cycle shocks are positively associated with corporate risk-taking, indicating that firms increase (decrease) risk exposure following favorable (adverse) macroeconomic surprises. A central mechanism underlying this relationship is the evolution of financial constraints: improvements in macroeconomic conditions relax financing frictions and enable firms, especially those that are more constrained, to undertake riskier but value-enhancing projects.

However, this average effect masks important asymmetries. When focusing on adverse shocks, the relationship weakens or reverses, consistent with the agency-based risk-shifting view. In downturns, financially distressed firms may increase risk-taking incentives due to conflicts between shareholders and creditors, highlighting that the dominant mechanism depends on macroeconomic conditions. In this sense, the financing channel and agency channel are not mutually exclusive but operate in different states of the business cycle. We further document substantial cross-sectional heterogeneity. The effect of business cycle shocks on risk-taking is stronger for non-state-owned enterprises, firms with higher managerial ownership, firms with higher Tobin's Q , and firms with lower internal liquidity or more volatile cash flows. These patterns consistently support a unified interpretation: macroeconomic shocks have larger real effects when firms both face tighter financing frictions and possess stronger incentives to adjust risk-taking.

Our findings have several implications. For investors, the results suggest that corporate risk-taking is systematically linked to macroeconomic conditions and firm characteristics, and that this relationship is state-dependent. In particular, risk-taking during downturns may reflect agency-driven incentives rather than improved fundamentals, which has implications for portfolio risk management and asset pricing.

For policymakers, the results highlight the importance of financial conditions as a transmission channel of macroeconomic shocks. Policies that affect credit availability can have significant effects on firm-level risk-taking, especially among financially constrained firms. At the same time, the asymmetric response documented in downturns suggests that stabilizing policies should also consider agency-related distortions, as adverse shocks may induce inefficient risk-taking behavior. More broadly, the interaction between macroeconomic policies and firm-level incentives implies that coordinating

financial, industrial, and macroeconomic policies is essential to mitigate excessive risk accumulation over the business cycle.

Overall, this paper provides evidence that macroeconomic shocks shape corporate risk-taking through both financing and agency channels, with their relative importance varying across economic conditions and firm characteristics.

APPENDIX A

TABLE A1.

Variable definitions.

Panel A: Variables for the baseline estimation	
Risk1	Earnings volatility, defined as the three-quarter rolling standard deviation of earnings before interest and taxes (EBIT) scaled by total assets over the window quarter $t + 1$ to $t + 3$.
Risk2	ROE volatility, defined as the three-quarter rolling standard deviation of operating income scaled by total assets minus total liabilities over the window quarter $t + 1$ to $t + 3$.
Risk3	The difference between the maximum and minimum <i>ROA</i> (earnings before interest and taxes (EBIT) scaled by total assets) over the three overlapping quarters from $t + 1$ to $t + 3$.
Risk4	The difference between the maximum and minimum <i>ROE</i> (defined in the definition of <i>Risk2</i>) over the three overlapping quarters from $t + 1$ to $t + 3$.
Risk5	EBITDA volatility, defined as the three-quarter rolling standard deviation of earnings before interest, taxes, depreciation and amortization scaled by total assets over the window quarter $t + 1$ to $t + 3$.
Risk6	Operating income volatility, defined as the three-quarter rolling standard deviation of operating income scaled by total assets over the window quarter $t + 1$ to $t + 3$.
Risk7	The difference between the maximum and minimum <i>EBITDA/Total assets</i> over the three overlapping quarters from $t + 1$ to $t + 3$.
Risk8	The difference between the maximum and minimum <i>Operating income/Total assets</i> over the three overlapping quarters from $t + 1$ to $t + 3$.
BC	Business cycle shock estimate.
BC_{lower}	The lower bound of business cycle shock estimate.
BC_{upper}	The upper bound of business cycle shock estimate.
BC_{avg}	The average of BC_{lower} and BC_{upper} .
Firm Size	The natural logarithm of total assets (in RMB).

TABLE A1—Continued

TQ	The ratio of market value of equity minus book value of equity plus book value of debt to total assets.
Growth	Quarterly sales growth rate.
ROA	Earnings before interest and taxes (EBIT) scaled by total assets.
Lev1	The ratio of total liabilities to total assets.
Lev2	The ratio of long-term liabilities to total assets.
Liquidity	The ratio of current assets to current liabilities.
SOE	An indicator variable taking a value of one for state-owned enterprises, and zero otherwise.
CF	Operating cash flows deflated by total assets.
Mkt Cap	The natural logarithm of market capitalization.
Capex	Capital expenditures deflated by total assets.
ΔNWC	Quarterly change in net working capital (current assets minus current liabilities divided by total assets).
$\Delta Sdebt$	Quarterly change in short term debt over total assets.
Firm Age	The natural logarithm of listing days divided by 365 plus 1.
SA	SA index, calculated as $-0.737 \times Firm\ Size + 0.043 \times Firm\ Size^2 - 0.040 \times Firm\ Age$, following Hadlock and Pierce (2010).
KZ	KZ index, following Kaplan and Zingales (1997), we estimate KZ index using China's data and calculate it as $-24.194 \times CF + 0.473 \times TQ + 4.919 \times Lev - 4.293 \times Div - 6.692 \times Cash$, where Div is the dividend scaled by total assets, $Cash$ is cash and cash equivalents deflated by total assets, and CF , TQ , and $Lev1$ are defined as above.
O-score	Following Ohlson (1980), calculated as $-1.32 - 0.407 \times Firm\ size + 6.03 \times Lev1 - 1.43 \times \frac{WC}{TA} + 0.076 \times Liquidity - 1.72 \times D_{TL-TA} - 2.37 \times \frac{NI}{TA} - 1.83 \times \frac{OCF}{TL} + 0.285 D_{LOSS} - 0.521 \times \frac{NI_t - NI_{t-1}}{ NI_t + NI_{t-1} }$, where TA is total assets; TL total liabilities; WC working capital; D_{TL-TA} is a dummy variable which takes value 1 if total liabilities are higher than total assets, and 0 otherwise; NI is net income; OCF funds from operations; and D_{LOSS} is a dummy variable taking a value of 1 if the company realized a net loss in the last two years, zero otherwise.
$\Delta Loan.TA$	The ratio of quarterly change in total loan to lagged total assets from quarter t to $t + 1$ in percentage.
$\Delta Long\ Loan.TA$	The ratio of quarterly change in long-term loan to lagged total assets from quarter t to $t + 1$ in percentage.
Panel B: Variables for business cycle shock estimation	
GDP deflator [†]	GDPDeflator : Implicit price deflator for GDP by value added
Real GDP [†]	NominalGDPva : GDP by value added divided by GDPDeflator
Government expenditure [†]	NominalGovtC : Government consumption by expenditure divided by CPI

TABLE A1—Continued

Government revenue	Government revenue
M2†	M2
7-day repo rate†	R7dRepo : The 7-day Repo rate
PPI†	PPI : Producer price index
Household consumption†	NominalHHC : Household consumption by expenditure divided by CPI
SOE investment†	NominalFAISOEexGovt : Fixed asset investment: SOEs excluding government divided by GFCFPriceIndex
Non-SOE investment†	NominalNonSOEGFCF : Gross fixed capital formation: other non-SOE enterprises divided by GFCFPriceIndex
Real wage†	AvgNominalWage : Aggregate average nominal wages divided by CPI

All variables followed by † are from China's Macroeconomy: Time Series Data of Atlanta Federal Reserves (CMTS data). The series names in the dataset are highlighted in bold. GFCFPriceIndex and CPI for computation of real variables are also from the same source, referring to the price index for gross fixed capital formation and consumer price index, respectively.

TABLE A2.

Considering major changes in accounting standard

	Subsample over 2007Q1-2017Q4		Subsample over 2007Q1-2016Q4	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0010*** (18.20)	0.0023*** (15.52)	0.0007*** (11.70)	0.0016*** (9.80)
Constant	0.0349*** (15.01)	0.0645*** (10.12)	0.0359*** (14.80)	0.0658*** (9.80)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	90298	90298	78673	78673
Adj. <i>R</i> ²	0.137	0.179	0.149	0.189

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples restricted in the 2007Q1-2017Q4, and the 2007Q1-2016Q4 periods, respectively, to eliminate the concern on the possible impact of changes in accounting standard during our sample period on risk proxies. Columns (1) and (2) present the results from the subsample over the 2007Q1-2017Q4, and columns (3) and (4) report the results from the subsample over the 2007Q1-2016Q4. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's *Q*), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A3.

Plausible channel: Alternative measure of financial constraints

		High Financial Constraints		Low Financial Constraints	
	(1) KZ	(2) Risk1	(3) Risk2	(4) Risk1	(5) Risk2
BC	−0.0142*** (−4.42)	0.0004*** (6.91)	0.0011*** (5.89)	0.0003*** (5.61)	0.0008*** (5.86)
CF	−28.0504*** (−147.43)				
Mkt Cap	0.0702*** (2.86)				
Capex	−1.0716* (−1.74)				
ΔNWC	−0.0190 (−0.19)				
$\Delta Sdebt$	−0.1220 (−0.69)				
Firm Age	0.8908*** (14.58)				
TQ	0.4297*** (30.06)	0.0013*** (17.19)	0.0019*** (5.43)	0.0009*** (10.50)	0.0015*** (9.88)
ROA	−17.5565*** (−27.44)	−0.0945*** (−18.82)	−0.2330*** (−14.89)	−0.0089 (−1.52)	−0.0364*** (−3.26)
Growth	0.0287*** (2.98)	0.0008*** (10.59)	0.0022*** (9.20)	0.0011*** (10.22)	0.0019*** (8.95)
SOE	0.4236*** (9.15)	−0.0012*** (−4.23)	−0.0015* (−1.68)	−0.0005* (−1.80)	−0.0017*** (−3.57)
Firm Size		−0.0018*** (−13.80)	−0.0045*** (−11.33)	−0.0003** (−2.04)	−0.0002 (−0.81)
Lev1		0.0146*** (15.21)	0.0764*** (17.78)	−0.0031*** (−3.33)	0.0172*** (9.91)
Liquidity		−0.0000 (−0.28)	0.0008*** (3.09)	−0.0002*** (−5.41)	−0.0002*** (−3.80)
Constant	−2.7489*** (−4.95)	0.0403*** (14.39)	0.0825*** (9.54)	0.0153*** (5.81)	0.0135*** (2.83)
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
N	104415	56726	56726	50693	50693
Adj. R^2	0.538	0.189	0.168	0.075	0.064
$H_0 : \beta_{BC}^{High} = \beta_{BC}^{Low}$					
P-value: Risk1				0.029**	
P-value: Risk2				0.000***	

This table presents the channel analysis of the impact of business cycle shock on corporate risk-taking. Column (1) presents the estimates of the impact of business cycle shock on firm financial constraints measured by KZ index, estimated as $-24.194 \times CF + 0.473 \times TQ + 4.919 \times Lev1 - 4.293 \times Div - 6.692 \times Cash$, where Div is the dividend scaled by total assets, $Cash$ is cash and cash equivalents deflated by total assets, and CF , TQ , and $Lev1$ are defined in Panel A of Table A1. Columns (2) and (3) report the estimates of the impact of business cycle shock on corporate risk-taking using the subsample consisting of firms with high financial constraints (KZ above its sample median). In contrast, the last two columns report the estimates using its complement subsample (KZ below its sample median). The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A4.
Financial constraints and ownership structure: Alternative measure of financial constraints

	High Financial Constraints: Non-SOEs		Low Financial Constraints: SOE	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0005*** (4.46)	0.0021*** (6.29)	0.0000 (0.53)	0.0000 (0.22)
Constant	0.0373*** (8.86)	0.0732*** (5.81)	0.0175*** (4.60)	0.0207*** (3.15)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	25953	25953	21621	21621
Adj. R^2	0.197	0.174	0.090	0.076
$H_0 : \beta_{BC}^{Non-SOE-High} = \beta_{BC}^{SOE-Low}$				
P-value: Risk1		0.004***		
P-value: Risk2		0.000***		

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on the extent of financial constraints and ownership structure. Columns (1) and (2) present the results on Non-SOE observations with high financial constraints (KZ above its sample median), and columns (3) and (4) report the results on SOE observations with low financial constraints (KZ below its sample median). We control for *Firm Size* (the natural logarithm of total assets), TQ (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A5.

The influence of political connections

	Politically Connected Firms (PC)		Non-Politically Connected Firms (Non-PC)	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0007*** (7.57)	0.0018*** (6.48)	0.0011*** (16.44)	0.0025*** (13.70)
Constant	0.0327*** (8.42)	0.0623*** (6.49)	0.0362*** (14.10)	0.0671*** (9.21)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	21873	21873	68426	68426
Adj. R^2	0.134	0.212	0.142	0.175
$H_0 : \beta_{BC}^{PC} = \beta_{BC}^{Non-PC}$				
P-value: Risk1			0.024**	
P-value: Risk2			0.000***	

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on a firm's political connections. Columns (1) and (2) present the results on politically connected firms, where we define a firm being politically connected if its CEO or chairman of a firm has currently or formerly served in government, military, People's Congress (CPC) or People's Political Consultative Conference (CPPCC). Columns (3) and (4) report the results on firms without such political connections. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A6.

The influence of firm-bank relationship

	Bank-Related Firms (BR)		Non-Bank-Related Firms (NBR)	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0003*** (3.67)	0.0003 (1.54)	0.0005*** (7.43)	0.0012*** (5.64)
Constant	0.0348*** (13.95)	0.0599*** (8.98)	0.0357*** (15.75)	0.0593*** (8.99)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	52019	52019	55400	55400
Adj. <i>R</i> ²	0.110	0.157	0.153	0.181
$H_0 : \beta_{BC}^{BR} = \beta_{BC}^{NBR}$				
P-value: Risk1			0.016**	
P-value: Risk2			0.000***	

This table reports the estimates of the impact of business cycle shock on corporate risk-taking on subsamples partitioned on firm-bank relationship. Columns (1) and (2) present the results on firms with bank relationship, where we define a firm as bank-related firm if at least one of its top 10 largest shareholders is a bank. Columns (3) and (4) report the results on firms without such bank relationships. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's *Q*), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. The last two rows report the p-values from Fisher permutation tests with 1000 simulations to test whether the coefficients from the two subsamples are equal. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A7.

Exposure-based specification

	(1)	(2)
	Risk1	Risk2
BC_Exposure	0.0005*** (2.67)	0.0015*** (3.01)
Exposure	0.0014*** (2.58)	0.0025 (1.60)
Constant	0.0349*** (15.25)	0.0648*** (10.21)
Controls	Yes	Yes
Year	Yes	Yes
Industry	Yes	Yes
<i>N</i>	104351	104351
Adj. R^2	0.136	0.175

This table reports the exposure-based estimates of the impact of business cycle shock on corporate risk-taking. We first compute industry-level covariance by regressing quarterly sales growth rate *Growth* on *BC* by industry based on the data from 2002q1 to 2002q4, extract the coefficient on *BC* for each regression, and call this variable as exposure. We then merge the data set and create the exposure-based variable *BC_Exposure*. We then regress out risk-taking measures on *BC*, *BC_Exposure*, and other control variables using the sample after removing the observations in the period 2002q1-2002q4. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A8.

Robustness to parsimonious specification and sample selection

	Parsimonious Specification		Balanced Panel	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
BC	0.0005*** (13.56)	0.0010*** (10.01)	0.0002*** (3.00)	0.0004*** (2.91)
Constant	0.0111*** (88.96)	0.0242*** (68.90)	0.0432*** (12.19)	0.0840*** (8.47)
Controls	No	No	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	115603	115371	50590	50590
Adj. <i>R</i> ²	0.042	0.033	0.154	0.173

This table reports robustness checks addressing potential sample selection concerns. Columns (1)-(2) present results from a parsimonious specification without control variables, allowing for a larger sample of firm-quarter observations. Columns (3)-(4) restrict the sample to a balanced panel of firms continuously observed over the sample period. The dependent variables are the same risk measures as in the main analysis. The key independent variable is the same business cycle shock variable. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in Columns (3) and (4). For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A9.

HP and Dynamic Panel Analysis

	Hodrick-Prescott Filter		GMM	
	(1)	(2)	(3)	(4)
	$Risk1_{t+1}$	$Risk2_{t+1}$	$Risk1_{t+1}$	$Risk2_{t+1}$
BC_HP	0.0056*** (4.79)	0.0103*** (3.06)		
$Risk1_t$			0.0861*** (3.05)	
$Risk2_t$				0.0826** (2.04)
BC			0.0004*** (2.95)	0.0010*** (3.17)
Constant	0.0351*** (15.47)	0.0650*** (10.33)	3.6737 (0.70)	9.4606 (0.77)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	107419	107419	107419	107419
Adj. R^2	0.136	0.173		
Hansen J-test: P-value			0.209	0.368
AR(1) test: P-value			0.000***	0.000***
AR(2) test: P-value			0.215	0.342

This table reports robustness checks for the baseline results using alternative specifications. Columns (1)-(2) present estimates using an alternative measure of business cycle conditions constructed from the cyclical component of aggregate output obtained via the Hodrick-Prescott (HP) filter. The HP-based measure is used to assess the sensitivity of the results to the detrending method used to construct business cycle shocks. Columns (3)-(4) report results from a dynamic panel specification that includes the lagged dependent variable to account for persistence in corporate risk-taking. These models are estimated using the system GMM estimator, treating the lagged dependent variable as endogenous and including time fixed effects. The dependent variables are the same risk measures as in the main analysis. The key independent variable is the same business cycle shock variable. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in Columns (3) and (4). For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

TABLE A10.

Cash flow volatility

	Low Volatility		High Volatility	
	(1)	(2)	(3)	(4)
	Risk1	Risk1	Risk2	Risk2
BC	0.0005*** (7.57)	0.0003*** (5.34)	0.0013*** (7.49)	0.0008*** (4.33)
Constant	0.0362*** (11.71)	0.0312*** (12.51)	0.0677*** (8.14)	0.0541*** (7.15)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>N</i>	55279	52139	55279	52139
Adj. <i>R</i> ²	0.142	0.115	0.168	0.175
$H_0 : \beta_{BC}^{LV} = \beta_{BC}^{HV}$				
P-value: Risk1		0.000***		
P-value: Risk2		0.000***		

This table reports the results of subsample analyses based on cash flow volatility. We classify firms into low and high cash flow volatility groups based on the median of cash flow volatility, which is calculated as the standard deviation of operating cash flow over total assets in the past eight quarters. Columns (1)-(2) present results for the low volatility group, while Columns (3)-(4) present results for the high volatility group. The dependent variables are the same risk measures as in the main analysis. The key independent variable is the same business cycle shock variable. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1. The bottom panel reports p-values from tests comparing the coefficients on BC between low and high volatility groups from Fisher permutation tests with 1000 simulations.

TABLE A11.

Agency mechanisms and corporate risk-taking

	Leverage		Management Ownership	
	(1) Risk1	(2) Risk2	(3) Risk1	(4) Risk2
BC_neg	0.0004 (1.43)	0.0007 (0.89)		
Lev1	0.0084*** (11.65)	0.0597*** (23.05)	0.0081*** (11.53)	0.0583*** (24.12)
<i>BC_neg</i> × <i>Lev1</i>	−0.0004 (−0.68)	0.0006 (0.33)		
Mgtshare			−0.0031*** (−5.43)	−0.0049*** (−4.01)
Constant	0.0353*** (15.57)	0.0655*** (10.42)	0.0358*** (15.62)	0.0636*** (10.12)
<i>N</i>	107419	107419	103559	103559
Adj. <i>R</i> ²	0.136	0.173	0.134	0.172

This table examines the role of agency-related factors in corporate risk-taking. Columns (1)-(2) examine the interaction between leverage and negative business cycle shocks to test for risk-shifting incentives. Columns (3)-(4) report regressions of risk-taking on managerial ownership measured by the share percentage held by the corporate management, capturing the relationship between managerial incentives and baseline risk-taking behavior. We control for *Firm Size* (the natural logarithm of total assets), *TQ* (Tobin's Q), *Growth* (quarterly sales growth rate), *ROA* (return on assets), *Lev1* (total liabilities over total assets), *Liquidity* (current assets over current liabilities), and *SOE* (state ownership indicator) in all regressions. For brevity, we do not report the coefficients for such control variables and denote them by *Controls*. Industry and year fixed effects are controlled in all regressions. We do not consider quarter fixed effects in all regressions because business cycle shock shows strong correlations with quarter dummies. The t-statistics based on standard errors clustered by firms are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are presented in Panel A of Table A1.

REFERENCES

- Acharya, V. V., Y. Amihud, and L. Litov, 2011. Creditor rights and corporate risk-taking. *Journal of Financial Economics* **102**, 150–166.
- Akey, P., and S. Lewellen, 2017. Policy uncertainty, political capital, and firm risk-taking. Working paper.
- Allen, F., J. Qian, and M. Qian, 2005. Law, finance, and economic growth in China. *Journal of Financial Economics* **77**, 57–116.
- Altman, E., J. Hartzell, and M. Peck, 1995. Emerging markets corporate bonds: A scoring system. Salomon Brothers Inc. New York, and in Levich, R. and Mei, J.P. "The Future of Emerging Market Flaws". Kluwer. and revisited in Altman, E. and Hotchkiss, E. (2006) *Corporate Financial distress & Bankruptcy*. J. Wiley & Sons.

- Amore, M. D., and A. Minichilli, 2018. Local political uncertainty, family control and investment behavior. *Journal of Financial and Quantitative Analysis* **53**, 1781–1804.
- Anderson, G., and A. Cesa-Bianchi, 2020. Crossing the credit channel: Credit spreads and firm heterogeneity. Working paper.
- Arping, S., 2019. Competition and risk taking in banking: The charter value hypothesis revisited. *Journal of Banking & Finance* **107**, 105609.
- Atanasov, J., B. Julio, and T. Leng, 2016. The bright side of political uncertainty: The case of R&D. Working paper.
- Bargeron, L. L., K. M. Lehn, and C. J. Zutter, 2010. Sarbanes-oxley and corporate risk-taking. *Journal of Accounting and Economics* **49**, 34–52.
- Bartram, S. M., G. Brown, and R. M. Stulz, 2017. Why Does Idiosyncratic Risk Increase with Market Risk? CESifo Working Paper Series 6560. CESifo.
- Bayer, C., B. Born, and R. Luetticke, 2024. Shocks, frictions, and inequality in us business cycles. *American Economic Review* **114**, 1211–1247.
- Begenau, J., and J. Salomao, 2019. Firm financing over the business cycle. *The Review of Financial Studies* **32**, 1235–1274.
- Bernanke, B. S., 1983. Irreversibility, uncertainty, and cyclical investment. *Quarterly Journal of Economics* **98**, 85–106.
- Bernanke, B. S., 1986. Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy* **25**, 49–99.
- Bhamra, H. S., L. A. Kuehn, and I. A. Strebulaev, 2010. The aggregate dynamics of capital structure and macroeconomic risk. *The Review of Financial Studies* **23**, 4187–4241.
- Bhattacharya, U., P. H. Hsu, X. Tian, and Y. Xu, 2017. What affects innovation more: Policy or policy uncertainty? *Journal of Financial and Quantitative Analysis* **52**, 1869–1901.
- Bianchi, F., C. Ilut, and H. Saijo, 2024. Diagnostic business cycles. *Review of Economic Studies* **91**, 129–162.
- Blanchard, O. J., and D. Quah, 1989. The Dynamic Effects of Aggregate Demand and Supply Disturbances. *American Economic Review* **79**, 655–673.
- Blanchard, O. J., and M. W. Watson, 1986. Are Business Cycles All Alike?, in: *The American Business Cycle: Continuity and Change*. National Bureau of Economic Research, Inc. NBER Chapters, pp. 123–180.
- Bloom, N., 2009. The impact of uncertainty shocks. *Econometrica* **77**, 623–685.
- Bolton, P., H. Chen, and N. Wang, 2013. Market timing, investment, and risk management. *Journal of Financial Economics* **109**, 40–62.
- Boubakri, N., J. C. Cosset, and W. Saffar, 2013. The role of state and foreign owners in corporate risk-taking: Evidence from privatization. *Journal of Financial Economics* **108**, 641–658.
- Brahma, S., J. Zhang, A. Boateng, and C. Nwafor, 2023. Political connection and M&A performance: Evidence from China. *International Review of Economics & Finance* **85**, 372–389.
- Brogaard, J., and A. Detzel, 2015. The asset-pricing implications of government economic policy uncertainty. *Management Science* **61**, 3–18.
- Burger, J. D., N. Sedgley, and K. M. Tan, 2017. Macroeconomic shocks and corporate R&D. *The BE Journal of Macroeconomics* **17**, 20160090.

- Cai, W., W. Shi, and F. Jiang, 2024. Cheap talk? strategy disclosure intensity, corporate risk-taking and financial performance. *British Journal of Management*.
- Cao, C., Y. Dong, W. Hou, Y. Liu, and X. Qian, 2019. Provincial official turnover and bank loans. *Pacific-Basin Finance Journal* **57**, 101202.
- Chatjuthamard, P., P. Wongboonsin, K. Kongsompong, and P. Jiraporn, 2020. Does economic policy uncertainty influence executive risk-taking incentives? *Finance Research Letters* **37**, 101385.
- Chen, H., 2010. Macroeconomic conditions and the puzzles of credit spreads and capital structure. *The Journal of Finance* **65**, 2171–2212.
- Chen, Y., 2021. Does political turnover stifle or stimulate corporate innovation? *International Review of Economics & Finance* **79**, 1126–1145.
- Chen, Y., C. Peng, and K. C. Chan, 2021. Earnings management uncertainty, implicit guarantees, and the corporate bond yield spread: Evidence from China. *Borsa Istanbul Review* **21**, 340–358.
- Chen, Z., Z. He, and C. Liu, 2020. The financing of local government in China: Stimulus loan wanes and shadow banking waxes. *Journal of Financial Economics* **137**, 42–71.
- Chen, Z., and I. A. Strebulaev, 2019. Macroeconomic risk and idiosyncratic risk-taking. *The Review of Financial Studies* **32**, 1148–1187.
- Cheng, I. H., and K. Milbradt, 2012. The hazards of debt: Rollover freezes, incentives, and bailouts. *The Review of Financial Studies* **25**, 1070–1110.
- Choi, J. J., M. Ju, L. Trigeorgis, and X. T. Zhang, 2021. Outsourcing flexibility under financial constraints. *Journal of Corporate Finance* **67**, 101890.
- Clarke, D. C., 2003. Corporate governance in China: An overview. *China Economic Review* **14**, 494–507.
- Cloyne, J., C. Ferreira, M. Froemel, and P. Surico, 2018. Monetary policy, corporate finance and investment. Technical Report. National Bureau of Economic Research.
- Coles, J. L., N. D. Daniel, and L. Naveen, 2006. Managerial incentives and risk-taking. *Journal of Financial Economics* **79**, 431–468.
- Crouzet, N., 2021. Credit disintermediation and monetary policy. *IMF Economic Review* **69**, 23–89.
- Cull, R., and L. C. Xu, 2003. Who gets credit? the behavior of bureaucrats and state banks in allocating credit to Chinese state-owned enterprises. *Journal of Development Economics* **71**, 533–559.
- Della Seta, M., E. Morellec, and F. Zucchi, 2020. Short-term debt and incentives for risk-taking. *Journal of Financial Economics* **137**, 179–203.
- Dixit, A. K., and R. S. Pindyck, 1994. Investment under uncertainty. Princeton university press.
- D’Mello, R., and F. Toscano, 2020. Economic policy uncertainty and short-term financing: The case of trade credit. *Journal of Corporate Finance* **64**, 101686.
- El-Shagi, M., and L. Zhang, 2022. The role of SOEs in the transmission of fiscal policy shocks in China. CFDS Discussion Paper Series 2022/2. Henan University.
- Faccio, M., M. T. Marchica, and R. Mura, 2011. Large shareholder diversification and corporate risk-taking. *The Review of Financial Studies* **24**, 3601–3641.
- Faccio, M., M. T. Marchica, and R. Mura, 2016. CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance* **39**, 193–209.

- Favara, G., E. Morellec, E. Schroth, and P. Valta, 2017. Debt enforcement, investment, and risk taking across countries. *Journal of Financial Economics* **123**, 22–41.
- Ferris, S. P., D. Javakhadze, and T. Rajkovic, 2017. CEO social capital, risk-taking and corporate policies. *Journal of Corporate Finance* **47**, 46–71.
- Firth, M., C. Lin, P. Liu, and S. M. Wong, 2009. Inside the black box: Bank credit allocation in China's private sector. *Journal of Banking & Finance* **33**, 1144–1155.
- Gali, J., 1992. How Well Does The IS-LM Model Fit Postwar U. S. Data? *The Quarterly Journal of Economics* **107**, 709–738.
- Gong, G., S. Xu, and X. Gong, 2018. On the value of corporate social responsibility disclosure: An empirical investigation of corporate bond issues in China. *Journal of Business Ethics* **150**, 227–258.
- Guiso, L., and M. Paiella, 2008. Risk aversion, wealth, and background risk. *Journal of the European Economic association* **6**, 1109–1150.
- Gulen, H., and M. Ion, 2016. Policy uncertainty and corporate investment. *The Review of Financial Studies* **29**, 523–564.
- Gupta, K., and C. Krishnamurti, 2018. Do macroeconomic conditions and oil prices influence corporate risk-taking? *Journal of Corporate Finance* **53**, 65–86.
- Hackbarth, D., J. Miao, and E. Morellec, 2006. Capital structure, credit risk, and macroeconomic conditions. *Journal of Financial Economics* **82**, 519–550.
- Hadlock, C. J., and J. R. Pierce, 2010. New evidence on measuring financial constraints: Moving beyond the KZ index. *The Review of Financial Studies* **23**, 1909–1940.
- Heaton, J., and D. Lucas, 2000. Portfolio choice in the presence of background risk. *The Economic Journal* **110**, 1–26.
- Herskovic, B., B. Kelly, H. Lustig, and S. Van Nieuwerburgh, 2016. The common factor in idiosyncratic volatility: Quantitative asset pricing implications. *Journal of Financial Economics* **119**, 249–283.
- Holm-Hadulla, F., and C. Thuürwächter, 2021. Heterogeneity in corporate debt structures and the transmission of monetary policy. *European Economic Review* **136**, 103743.
- Hope, O. K., 2003. Firm-level disclosures and the relative roles of culture and legal origin. *Journal of International Financial Management & Accounting* **14**, 218–248.
- Hsu, C., Z. Ma, L. Wu, and K. Zhou, 2020. The effect of stock liquidity on corporate risk-taking. *Journal of Accounting, Auditing & Finance* **35**, 748–776.
- Jeenas, P., 2023. Firm balance sheet liquidity, monetary policy shocks, and investment dynamics. Working paper.
- Jens, C. E., 2017. Political uncertainty and investment: Causal evidence from US gubernatorial elections. *Journal of Financial Economics* **124**, 563–579.
- Jensen, M. C., and W. H. Meckling, 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* **3**, 305–360.
- Jiang, F., Z. Jiang, K. A. Kim, and M. Zhang, 2015. Family-firm risk-taking: Does religion matter? *Journal of Corporate Finance* **33**, 260–278.
- Jiang, J., and Y. Chen, 2021. How does labor protection influence corporate risk-taking? Evidence from China. *Pacific-Basin Finance Journal* **68**, 101572.
- John, K., L. Litov, and B. Yeung, 2008. Corporate governance and risk-taking. *The Journal of Finance* **63**, 1679–1728.

- Julio, B., and Y. Yook, 2012. Political uncertainty and corporate investment cycles. *Journal of Finance* **67**, 45–83.
- Kaplan, S. N., and L. Zingales, 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? —it. *The quarterly Journal of Economics* **112**, 169–215.
- Kelly, B., L. Pástor, and P. Veronesi, 2016. The price of political uncertainty: Theory and evidence from the option market. *The Journal of Finance* **71**, 2417–2480.
- Khaw, K. L. H., J. Liao, D. Tripe, and U. Wongchoti, 2016. Gender diversity, state control, and corporate risk-taking: Evidence from China. *Pacific-Basin Finance Journal* **39**, 141–158.
- Koirala, S., A. Marshall, S. Neupane, and C. Thapa, 2020. Corporate governance reform and risk-taking: Evidence from a quasi-natural experiment in an emerging market. *Journal of Corporate Finance* **61**, 101396.
- Langenmayr, D., and R. Lester, 2018. Taxation and corporate risk-taking. *The Accounting Review* **93**, 237–266.
- Leland, H. E., 1998. Agency costs, risk management, and capital structure. *The Journal of Finance* **53**, 1213–1243.
- Lewbel, A., 2012. Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. *Journal of Business & Economic Statistics* **30**, 67–80.
- Li, D., 2011. Financial constraints, R&D investment, and stock returns. *The Review of Financial Studies* **24**, 2974–3007.
- Li, K., D. Griffin, H. Yue, and L. Zhao, 2013. How does culture influence corporate risk-taking? *Journal of Corporate Finance* **23**, 1–22.
- Lin, J.Y., and G. Tan, 1999. Policy burdens, accountability, and the soft budget constraint. *American Economic Review* **89**, 426–431.
- Ljungqvist, A., L. Zhang, and L. Zuo, 2017. Sharing risk with the government: How taxes affect corporate risk taking. *Journal of Accounting Research* **55**, 669–707.
- Lumpkin, G. T., and G. G. Dess, 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of management Review* **21**, 135–172.
- Luo, W., Y. Wang, and X. Zhang, 2022. Monetary policy uncertainty and firm risk-taking. *Pacific-Basin Finance Journal* **71**, 101695.
- Meggison, W. L., A. Meles, G. Sampagnaro, and V. Verdoliva, 2019. Financial distress risk in initial public offerings: How much do venture capitalists matter? *Journal of Corporate Finance* **59**, 10–30.
- Meggison, W. L., B. Ullah, and Z. Wei, 2014. State ownership, soft-budget constraints, and cash holdings: Evidence from China's privatized firms. *Journal of Banking & Finance* **48**, 276–291.
- Mirza, S. S., and T. Ahsan, 2020. Corporates' strategic responses to economic policy uncertainty in China. *Business Strategy and the Environment* **29**, 375–389.
- Mountford, A., and H. Uhlig, 2009. What are the effects of fiscal policy shocks? *Journal of Applied Econometrics* **24**, 960–992.
- Ohlson, J., 1980. Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research* **18**, 109–131.
- Ottonello, P., and T. Winberry, 2020. Financial heterogeneity and the investment channel of monetary policy. *Econometrica* **88**, 2473–2502.
- Pástor, L., and P. Veronesi, 2012. Uncertainty about government policy and stock prices. *The Journal of Finance* **67**, 1219–1264.

- Pástor, L., and P. Veronesi, 2013. Political uncertainty and risk premia. *Journal of Financial Economics* **110**, 520–545.
- Phan, H. V., N. H. Nguyen, H. T. Nguyen, and S. Hegde, 2019. Policy uncertainty and firm cash holdings. *Journal of Business Research* **95**, 71–82.
- Rocheteau, G., R. Wright, and C. Zhang, 2018. Corporate finance and monetary policy. *American Economic Review* **108**, 1147–86.
- Sims, C. A., 1986. Are forecasting model usable for policy analysis? *Quarterly Review* **10**, 2–16.
- Tan, W., Y. Chen, Y. Sun, X. Guo, and Z. Li, 2023. Internal capital markets and risk-taking: Evidence from China. *Pacific-Basin Finance Journal* **78**, 101968.
- Tran, Q. T., 2019. Economic policy uncertainty and corporate risk-taking: International evidence. *Journal of Multinational Financial Management* **52**, 100605.
- Uhlig, H., 2005. What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics* **52**, 381–419.
- Vural-Yava Ç., 2020. Corporate risk-taking in developed countries: The influence of economic policy uncertainty and macroeconomic conditions. *Journal of Multinational Financial Management* **54**, 100616.
- Wong, T. J., 2016. Corporate governance research on listed firms in china: Institutions, governance and accountability. *Foundations and Trends® in Accounting* **9**, 259–326.
- Yang, X., L. Han, W. Li, X. Yin, and L. Tian, 2017. Monetary policy, cash holding and corporate investment: Evidence from China. *China Economic Review* **46**, 110–122.
- Zhang, W., X. Zhang, X. Tian, and F. Sun, 2021. Economic policy uncertainty nexus with corporate risk-taking: The role of state ownership and corruption expenditure. *Pacific-Basin Finance Journal* **65**, 101496.
- Zheng, G., S. Wang, and Y. Xu, 2018. Monetary stimulation, bank relationship and innovation: Evidence from China. *Journal of Banking & Finance* **89**, 237–248.