Weathering Cash Flow Shocks

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复习和回顾

- **工具变量的内涵**

在回归方程中，一个有效的工具变量应满足以下两个条件：

(i) 相关性：工具变量与内生解释变量相关，即$\mathrm{Cov}(x_t, p_t) \neq 0$。

(ii) 外生性：工具变量与扰动项不相关，即$\mathrm{Cov}(x_t, u_t) = 0$。

工具变量的外生性也称“排他性约束”(exclusion restriction)，因为外生性意味着，工具变量影响被解释变量的唯一渠道是通过与其相关的内生解释变量，它排除了所有其他的可能影响渠道。

但是，在恰好识别的情况下，目前公认无法检验工具变量的外生性。

复习和回顾

- **信贷额度的概念**

Credit Line

信贷额度，又称“信贷限额”，是借款人与银行在协议中规定的**允许借款人的最高限额**。但是这一规定并不具有法律约束力，如果银行缺乏信贷资金或客户财务状况较差，银行可根据情况改变信用限额或拒绝提供贷款。

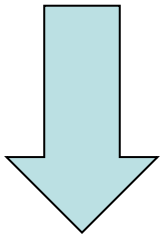
通常在信贷额度内，企业可随时向银行申请借款。如借款人超过规定限额继续向银行借款，银行则停止办理，银行并不承担提供全部信贷额度的义务。如果企业信誉恶化，即使银行曾经同意按信贷额度提供贷款，企业也可能得不到借款；这时，银行不会承担法律责任。同理，若企业在期限内没有使用完限额，也不会承担责任。信贷额度是银企之间的一种协议，不具有法律效力。

在商业信贷中，信贷额度类似于银企之间的“信用卡”。

研究动机

How useful to firms are bank lines of credit?

- Credit lines precommit banks to **provide debt financing** when firms face negative shocks
- Access to credit lines is **restricted** following a decline in borrower profitability



- To examine whether firms use of credit lines when they face a liquidity shock that is **not directly related to fundamentals**

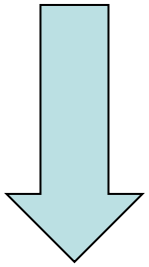
-- isolate a **pure** liquidity shock and largely **avoid the confounding effects** of changes in a firm's long-term profitability in its credit needs and the supply of credit from banks

主要故事

1.（企业端）如何管理外生的现金流冲击；管理现金流冲击政策持续时间

2.（银行端）支持 or 反对？具体怎么做？

3. 异质性



思考：有哪些工具可以管理现金流冲击？

难点：如何衡量/测度外生的现金流冲击？

边际贡献

- Provide novel evidence that, for **solvent smaller firms**, bank credit lines are an important tool for managing the nonfundamental component of cash flow volatility
  - most evidence comes from surveys or studies of how **larger firms** use credit lines when facing severe financial market disruptions or long-term operational problems;
  - a focus on how credit lines are used to **manage general (overall) cash flow volatility**, which is driven by both endogenous and exogenous factors -- 混杂效应
- Broader liquidity management literature
  - our findings related to the large literature on the value of **lending relationships**, suggesting a specific channel through which **banking relationships are valuable**
- Contribute to a growing literature on **the effects of natural events on firm decision-making and economic activity**

Data Construction and Sample Descriptive Statistics

（一）样本选择和数据来源

- 基础样本：2012—2016年102742个公司—年度样本

  扩展样本：189312个借款人—年度样本；公司—年度—季度面板

- **Schedule H.1** of the Federal Reserve's **Y-14Q** data collection
  - began in June of 2012 to support the Dodd-Frank Stress Tests and the Comprehensive Capital Analysis and Review
  - provide loan-level data on their corporate loan portfolio whenever a loan exceeds **$1 million** in commitment exposure (**outstanding**)

    -- **70%** of all commercial loans extended in the United States

    -- **98%** of all banks credit line exposure in the Shared National Credit data between 2011 and 2015
  - contains **quarterly** information on **bank loan characteristics,** including credit line limits and credit line utilization, and **annnual** information from **borrowers' financial statements** such as operating income and total assets

Data Construction and Sample Descriptive Statistics

（一）样本选择和数据来源

- 数据处理
  - Restrict the sample to **domestic borrowers**, excluding government entities, individual borrowers, foreign entities, and nonprofit organizations
  - To compute borrower-level outcomes within this firm-year pannel, we **aggregate all loan-level variables** across all lenders in a given borrower-year

    --may bias the total bank borrowing of **large firms downward**
  - Require **at least two consecutive years** of bank financing information so that we can compute changes in credit line limits and utilization
  - **Winsorize** all financial and loan variables with the exception of loan interest rate at 1st and 99th percentiles
  - **Trim** the interest rate variable at 1st and 99th percentiles
  - To exclude **likely data errors**

Data Construction and Sample Descriptive Statistics

（一）样本选择和数据来源

Field No.	Field Name; (*Technical Field Name*)	MDRM	Description	Allowable Values
1	Customer ID (*CustomerID*)	CLCOM047	Report the unique internal identifier for the customer relationship under which the obligor's exposure is aggregated in the reporting entity's credit systems. Customer ID is a relationship concept under which multiple borrowers are aggregated because they have related risks, including, but not limited to parent/subsidiary relationships. For stand-alone or ultimate parent obligors, the Customer ID may be the same as the unique internal identifier for the obligor provided in Field 2.	Must not contain a carriage return, line feed, comma or any unprintable character.
2	Internal ID (*InternalObligor ID*)	CLCOM300	Report the reporting entity's unique internal identifier for the obligor. Internal ID is a borrower concept that identifies the entity under which multiple loans are aggregated.	Must not contain a carriage return, line feed, comma or any unprintable character.
3	Original Internal ID (*OriginalInterna lObligorID*)	CLCOG064	Report the internal identification code assigned to the obligor in the previous submission. If there is no change from the prior submission, or if this is the first submission, the Internal ID reported in Field 2 should be used as the Original Internal ID.	Must not contain a carriage return, line feed, comma or any unprintable character.
4	Obligor Name (*ObligorName*)	CLCO9017	Report the obligor name on the credit facility. Full legal corporate name is desirable. If the borrowing entity is an individual(s) (Natural Person(s)), do not report the name; instead substitute with the text: "Individual." For fronting exposures, report legal name of the participant lender.	Must not contain a carriage return, line feed, comma or any unprintable character.

Data Construction and Sample Descriptive Statistics

（一）样本选择和数据来源

- 变量定义

变量	定义	主要数据来源
Total Assets$_{it-1}$	总资产账面价值的一阶滞后值	70（71）
Cash Flow$_{it}$	（营业收入+折旧和摊销）/**t-1期总资产**	56、57
Sales$_{it-1}$	t-2到t-1期的净销售额/**t-1期总资产**	55
Leverage$_{it-1}$	总负债的一阶滞后/**t-1期总资产**	80
Fixed Assets$_{it-1}$	总固定资产的一阶滞后/**t-1期总资产**	69
WorkCap$_{it-1}$	（流动资产的一阶滞后 — 流动负债的一阶滞后 — 现金和有价证券的一阶滞后）/**t-1期总资产**	66（67）、76（77）、61
Cash$_{it-1}$	现金和有价证券的一阶滞后/**t-1期总资产**	61
Debt$_{it-1}$	（短期负债+长期负债）一阶滞后/**t-1期总资产**	74、78
Lines$_{it-1}$	信贷额度承诺的一阶滞后/**t-1期总资产**	24
Draw$_{it-1}$	信贷额度提取的一阶滞后/**t-1期总资产**	25

Data Construction and Sample Descriptive Statistics

（一）样本选择和数据来源

- 变量定义

变量	定义	主要数据来源
ΔLine Size$_{it}$	信贷额度的年度变动/**t-1期总资产**	24
Line Increase$_{it}$	虚拟变量，当企业i在第t年的总信用额度承诺超过企业i在第t-1年的总信用额度承诺时，其值为1。	
ΔDraw$_{it}$	信贷额度提取的年度变动/**t-1期总资产**	25
ΔCash$_{it}$	现金和有价证券的年度变动/**t-1期总资产**	61
ΔLiabilities$_{it}$	总负债的年度变动/**t-1期总资产**	80
ΔDebt$_{it}$	短期负债与长期负债之和的年度变动/**t-1期总资产**	74、78
ΔTradeCred$_{it}$	（t-1到t期应收账款变动额—t-1到t期应付账款变动额）/t-2到t-1期的净销售额	62、63、72、73、55
ΔAssets$_{it}$	总资产的年度变动/**t-1期总资产**	70
ΔFixed Assets$_{it}$	固定资产的年度变动/**t-1期总资产**	69
ΔWorkCap$_{it}$	非现金营运资本的年度变动/**t-1期总资产**	

Data Construction and Sample Descriptive Statistics

（二）描述性统计

	Mean	*SD*	P25	P50	P75
Total Assets ($ Millions)	706.92	3021.84	7.98	21.34	92.64
Cash Flow	0.16	0.21	0.06	0.12	0.20
Leverage	0.61	0.21	0.47	0.63	0.77
Fixed Assets	0.29	0.27	0.06	0.20	0.45
Sales	2.31	1.94	1.06	1.96	3.03
Cash	0.10	0.13	0.01	0.05	0.14
Debt	0.32	0.24	0.12	0.29	0.48
WorkCap	0.10	0.21	−0.03	0.07	0.22
Line Size	0.24	0.19	0.09	0.20	0.35
Δ *Line Size*	0.03	0.12	0.00	0.00	0.01
Draw	0.09	0.15	0.00	0.00	0.12
Δ *Drawn*	0.02	0.10	0.00	0.00	0.01

- **Small firms** dominate our sample —— 回应边际贡献第一点

-- samller the book value of total assets; less sales; more levered; larger credit line commitments to total assets; substantial variation in credit line size; less cash holdings of total assets.

Severe Weather and Cash Flow

（一）测度恶劣冬季天气

- 要求——**unexpectedly[3] bad[2]** winter **weather[1]** is unlikely to impact long-run firm outcomes
- 基础数据：snow cover —— it combines the **intuitive** negative effects that both **snowfall** and **cold winter temperatures** may have on firms' cash flows
- 来源：the National Oceanic and Atmospheric Adminstration's website
- 具体构造步骤：

①计算每个县各个气象站日积雪量（单位：英寸）的平均值（中位数）

②计算2000至2016年每个县季度的日积雪量**平均值**和**95分位数**

③计算基准：A.**滚动窗口**：前10年的平均第一季度积雪量★

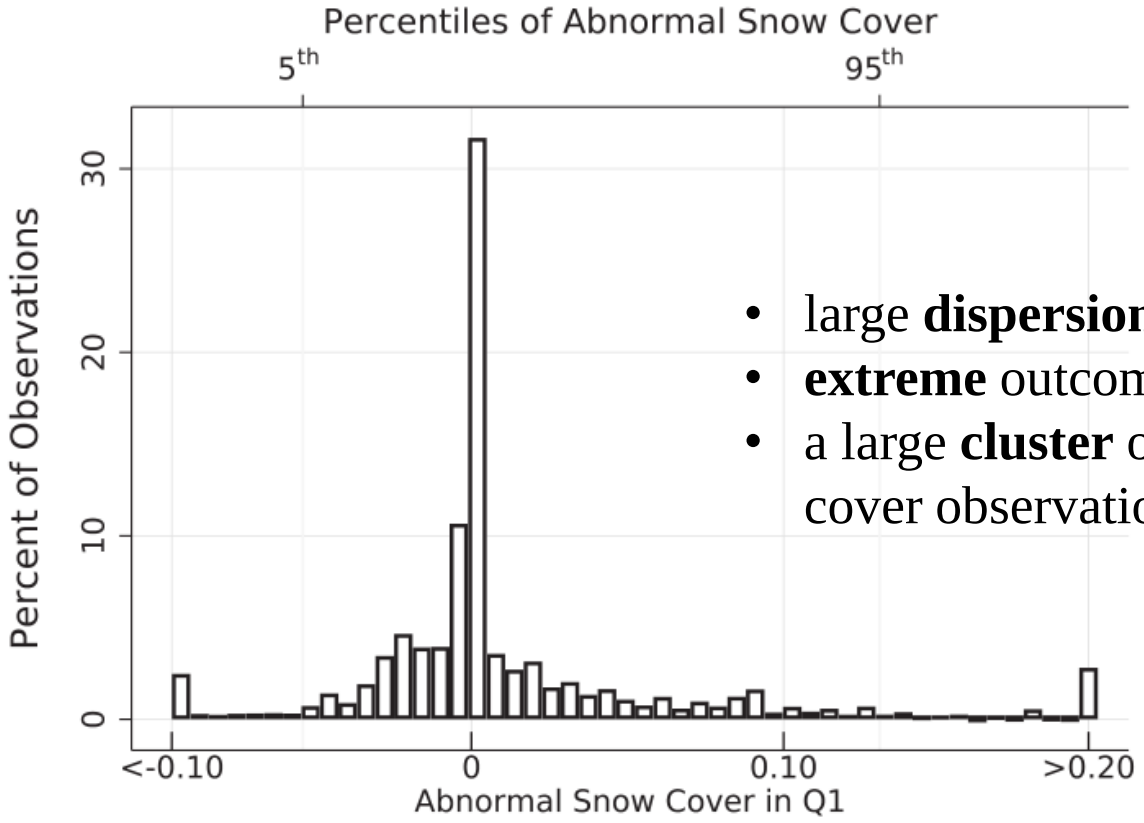
B.**固定窗口**：2001至2010年的平均第一季度积雪量（稳健）

④Abnormal Snow/ Abnormal Snow 95 = 第一季度积雪量 - 基准

⑤指标除以1000

Severe Weather and Cash Flow

（一）测度恶劣冬季天气

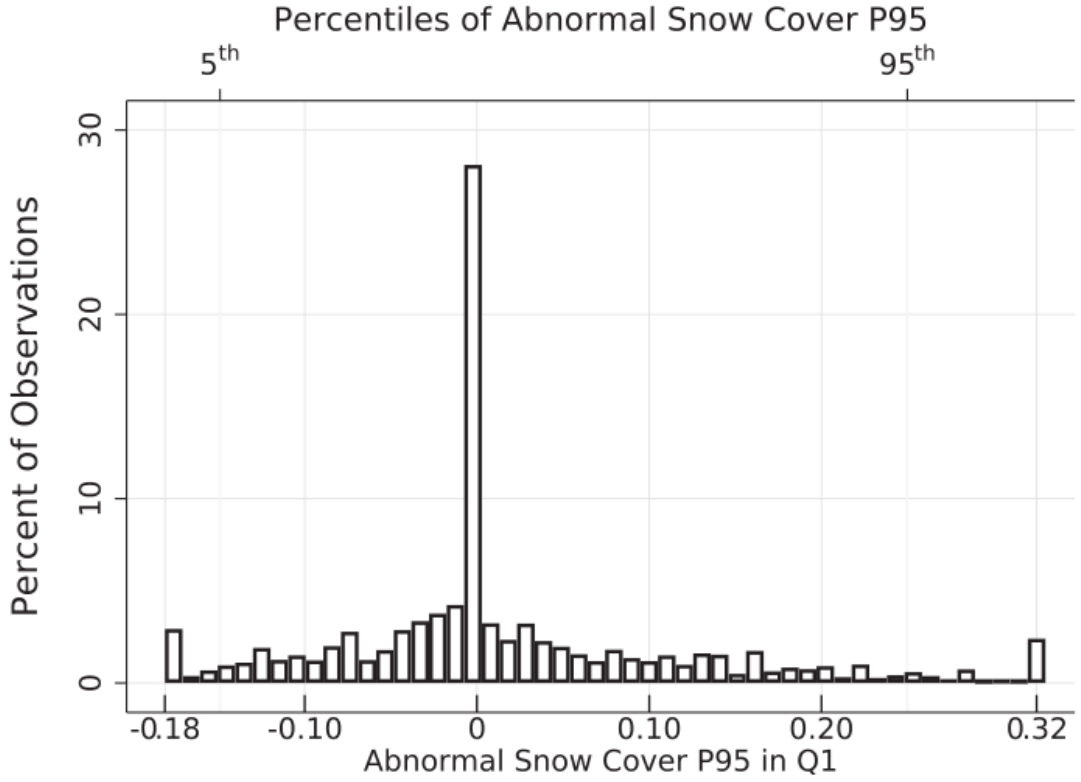


(a) *Abormal Snow Cover*

- large **dispersion**;
- **extreme** outcomes; **?**
- a large **cluster** of abnormal snow cover observations near zero

Severe Weather and Cash Flow

（一）测度恶劣冬季天气



(b) *Abnormal Snow Cover P95*

- It is **reasonable** to assume that our abnormal snow measures are **unrelated** to a borrower's future investment opportunities or a lender's ability to supply liquidity.

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Severe Weather and Cash Flow

（二）异常天气和现金流

- whether winter snow cover affects the cash flow of ongoing projects
- 是2SLS的第一阶段，为后续分析做铺垫

$$\begin{aligned} Cash\ Flow_{it} = {} & \alpha_0 + \alpha_1 Abnormal\ Snow_{jt} + \alpha_2 Fixed\ Assets_{it-1} \\ & + \alpha_3 Log(Assets)_{it-1} + \alpha_4 Leverage_{t-1} + \alpha_5 Sales_{t-1} \\ & + \alpha_6 Cash_{t-1} + \alpha_7 Debt_{t-1} + \alpha_8 WorkCap_{t-1} + \boldsymbol{\gamma X} + \varepsilon_{it}, \end{aligned} \quad (1)$$

- Cash Flow$_{it}$ ——公司i在t年实现的现金流
- Abnormal Snow$_{jt}$——公司i总部所在县j在t年的异常积雪量
- X——固定效应：4位数NAICS行业×年度-季度和县级固定效应

Severe Weather and Cash Flow

（二）异常天气和现金流

Our measures of abnormal snow triggering cash flow shocks that are **unrelated** to preshock firm fundamentals

	$Cash\ Flow_{it}$			
	(1)	(2)	(3)	(4)
Abn. Snow	−0.029***	−0.028***		
	(0.006)	(0.006)		
Abn. Snow P95			−0.019***	−0.017***
			(0.004)	(0.004)
$Log(Assets_{it-1})$		−0.003*		−0.003*
		(0.001)		(0.001)
$Fixed\ Assets_{it-1}$		0.093***		0.093***
		(0.013)		(0.013)
$Leverage_{it-1}$		−0.078***		−0.078***
		(0.021)		(0.0321)
$Sales_{it-1}$		0.034***		0.034***
		(0.004)		(0.004)
$Cash_{it-1}$		0.222***		0.222***
		(0.035)		(0.035)
$Debt_{it-1}$		0.003		0.003
		(0.024)		(0.024)
$WorkCap_{it-1}$		0.023***		0.023***
		(0.008)		(0.008)
Industry × Year-Quarter FEs	YES	YES	YES	YES
County Fixed Effects	YES	YES	YES	YES
Adjusted R^2	0.139	0.235	0.139	0.235
Observations	102,742	102,742	102,742	102,742

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Severe Weather and Cash Flow

（二）异常天气和现金流

异质性

- COMPUSTAT firms ✕ —— 小公司更容易受影响
- 分行业

industries with significant **outdoor** operations and industries reliant on a supply chain that operates extensively **outdoors**

	Ab. Snow (SE)	Ab. Snow P95 (SE)	% Obs	Obs
MANUFACTURING	−0.027** (0.013)	−0.012 (0.008)	23.6%	24,370
WHOLESALE	−0.015 (0.012)	−0.014** (0.007)	17.4%	17,927
RETAIL	−0.022* (0.013)	−0.015* (0.008)	14.1%	14,509
BUSINESS SERVICES	−0.053 (0.037)	−0.016 (0.022)	9.5%	9,778
REAL ESTATE	−0.082*** (0.026)	−0.056*** (0.015)	7.5%	7,729
CONSTRUCTION	−0.041** (0.018)	−0.020** (0.010)	7.1%	7,320
EDUCATION & HEALTH	−0.036 (0.074)	−0.010 (0.043)	4.6%	4,733
TRANSPORTATION	−0.059* (0.032)	−0.037** (0.018)	4.1%	4,217

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管理外生的现金流波动

（一）模型设定

模型一：2SLS

$$\begin{aligned} Cash\ Flow_{it} = {} & \alpha_0 + \alpha_1 Abnormal\ Snow_{jt} + \alpha_2 Fixed\ Assets_{it-1} \\ & + \alpha_3 Log(Assets)_{it-1} + \alpha_4 Leverage_{t-1} + \alpha_5 Sales_{t-1} \\ & + \alpha_6 Cash_{t-1} + \alpha_7 Debt_{t-1} + \alpha_8 WorkCap_{t-1} + \boldsymbol{\gamma X} + \varepsilon_{it}, \end{aligned} \quad (2a)$$

$$\begin{aligned} Y_{it} = {} & \beta_0 + \beta_1 \widehat{Cash\ Flow}_{it} + \beta_2 Fixed\ Assets_{it-1} + \beta_3 Log(Assets)_{it-1} \\ & + \beta_4 Leverage_{t-1} + \beta_5 Sales_{t-1} + \beta_6 Cash_{t-1} \\ & + \beta_7 Debt_{t-1} + \beta_8 WorkCap_{t-1} + \boldsymbol{\delta X} + \epsilon_{it}, \end{aligned} \quad (2b)$$

- Y_{it} —— sush as credit line drawndowns, change in credit line limit, or change in cash
- County fixed effects —— control for the possibility that over our six-year sample period some counties had a string of bad weather
- Time-invariant firm-level heterogeneity by defining the dependent variable in terms of **within-firm changes** [100922→48762]

管理外生的现金流波动

（一）模型设定

模型一：2SLS

- **Warning !!!**
- 弱工具变量检验：Abnormal Snow is a significant enough predictor of corporate cash flows —— F统计量
- 识别假设：weather-induced shocks only affect the outcomes of interest through their effect on cash flows.
- Abnormal Snow的测度：①没有极端天气影响巨大；②将测度指标标准化处理→无自相关
- Examine the extent to which firms prepare for abnormal winter weather：→ **partition** the descriptive statistics on our instrument Abnormal Snow.

管理外生的现金流波动

（一）模型设定

模型一：2SLS

	Ave(T1)	P50(T1)	Ave(T2)	P50(T2)	Ave(T3)	P50(T3)	T3-T1
Total Assets	711.66	21.70	760.43	22.36	650.24	20.24	0.03
Cash Flow	0.16	0.12	0.16	0.12	0.16	0.12	0.00
Leverage	0.61	0.63	0.61	0.63	0.61	0.63	0.00
Fixed Assets	0.28	0.19	0.32	0.23	0.28	0.19	0.00
Sales	2.34	1.98	2.25	1.89	2.35	2.00	−0.04**
Cash	0.10	0.05	0.10	0.05	0.10	0.05	0.00
Debt	0.31	0.28	0.34	0.31	0.32	0.28	0.003*
WorkCap	0.10	0.08	0.09	0.06	0.10	0.08	0.00

- the borrower-years leading up to negative and positive weather shocks are **similar** along observable dimensions.
- To examine whether historical exposure to significant winter snowfall affects how firms use their credit lines —— Overall, exposure to severe winter weather does not appear to concentrate around a specifc type of firm or result in long-term changes in firms' liquidity management policies, which supports our identifying assumptions.

按行业展示信贷额度提取的变化和历史降雪量

支持识别假设

All unreported industries comprise less than 4% of our sample.

Tercile 1				
	Q1	Q2	Q3	Q4
BUSINESS SERVICES	0.00	0.02	0.00	0.02
CONSTRUCTION	0.00	0.03	0.00	0.01
EDUCATION & HEALTH	0.00	0.01	0.01	0.01
MANUFACTURING	0.02	0.03	0.00	0.00
REAL ESTATE	0.00	0.01	0.00	0.01
RETAIL	0.00	0.03	−0.01	0.07
TRANSPORTATION	0.00	0.03	0.00	0.02
WHOLESALE	0.01	0.04	0.01	0.01

Tercile 3				
	Q1	Q2	Q3	Q4
BUSINESS SERVICES	0.01	0.02	0.00	0.02
CONSTRUCTION	−0.00	0.06	−0.01	−0.01
EDUCATION & HEALTH	−0.01	0.00	0.01	0.02
MANUFACTURING	0.02	0.02	0.00	−0.01
REAL ESTATE	0.00	0.02	0.01	0.00
RETAIL	0.02	−0.00	−0.02	0.09
TRANSPORTATION	0.01	0.02	−0.00	0.00
WHOLESALE	0.02	0.04	0.00	−0.01

管理外生的现金流波动

（一）模型设定

模型二：简化形式——OLS

$$Y_{it} = \gamma_0 + \gamma_1 Abnormal\ Snow_{jt} + \boldsymbol{\theta X} + \varepsilon_{it},$$

原因：使用财务报表信息会导致样本量大量减少，而且导致样本向大公司偏离

X —— 4位数行业×年-季度和**企业固定效应**

管理外生的现金流波动

（二）信贷额度——Credit Line Drawdowns 使用情况（**集约边际？**）

2SLS

Panel A: OLS and 2SLS

	$\Delta Draw_{it}$			
	OLS (1)	2SLS (2)	2SLS (3)	2SLS (4)
$Cash\ Flow_{it}$	−0.0000 (0.0028)	−0.407** (0.173)	−0.425** (0.189)	−0.524** (0.259)
$Log(Assets)_{it-1}$	−0.0022*** (0.0006)		−0.003*** (0.001)	−0.004*** (0.001)
$Fixed\ Assets_{it-1}$	−0.0132*** (0.0035)		0.026 (0.017)	0.035 (0.023)
$Leverage_{it-1}$	0.0023 (0.0030)		−0.031* (0.016)	−0.039 (0.024)
$Sales_{it-1}$	0.0018*** (0.0005)		0.016** (0.006)	0.020** (0.009)
$Cash_{it-1}$	−0.0231*** (0.0049)		0.072 (0.042)	0.093 (0.060)
$Debt_{it-1}$	0.0084 (0.0059)		0.010 (0.006)	0.010 (0.009)
$WorkCap_{it-1}$	−0.0033 (0.0023)		0.007 (0.005)	0.009 (0.006)
Industry × Year-Quarter FEs	YES	YES	YES	YES
County FE	YES	YES	YES	YES
R^2	0.115	.	.	.
Observations	102,742	102,742	102,742	102,742

(*Continued*)

管理外生的现金流波动

（二）信贷额度——Credit Line Drawdowns

简化形式

Table V—*Continued*

Panel B: Reduced Form

	$\Delta Draw_{it}$				
	(1)	(2)	(3)	(4)	(5)
$Abn.\ Snow_{it}$	0.031**	0.032	0.032**	0.027***	0.027*
	(0.014)	(0.021)	(0.014)	(0.008)	(0.016)
$Log(Assets)_{it-1}$			0.002***		
			(0.001)		
$Fixed\ Assets_{it-1}$			−0.009		
			(0.007)		
$Leverage_{it-1}$			0.007		
			(0.009)		
$Sales_{it-1}$			0.002***		
			(0.001)		
$Cash_{it-1}$			−0.081***		
			(0.011)		
$Debt_{it-1}$			−0.027***		
			(0.008)		
$WorkCap_{it-1}$			0.001		
			(0.008)		
Industry × Year-Quarter FEs	YES	YES	YES	YES	YES
County FE	YES	NO	YES	YES	NO
Firm FE	NO	YES	NO	NO	YES
R^2	0.105	0.374	0.107	0.091	0.310
Observations	100,424	75,876	100,424	189,312	164,603

管理外生的现金流波动

（二）信贷额度——Credit Line Drawdowns

稳健性检验：更换IV的测度——剔除大于Abnormal Snow3个标准差的样本；剔除前10年没有下雪的地区；使用公司固定效应

→ these robustness tests **mitigate** the concern that extreme weather events affecting investment opportunities or the population's expectations regarding future weather drive our findings. —— 间接支持了识别策略

	$\Delta Draw_{it}$		
	Snow < 3SD	Snow > 0	Firm FEs
	(1)	(2)	(3)
$Cash\ Flow_{it}$	−0.562**	−0.448**	−0.749
	(0.262)	(0.189)	(0.696)
Firm Controls	YES	YES	YES
Industry x Year-quarter FEs	YES	YES	YES
County FE	YES	YES	NO
Firm FE	NO	NO	YES
Observations	94,061	89,914	77,662

管理外生的现金流波动

（二）信贷额度——Credit Line Size Adjustments 规模（广延边际？）

Within our sample, credit line sizes are adjusted in **almost half** of firm-years.

	$\Delta Line\ Size_{it}$			
	OLS (1)	2SLS (2)	Red. Form (3)	Red. Form (4)
$Cash\ Flow_{it}$	0.0195*** (0.0050)	−0.526** (0.246)		
$Abn.\ Snow_{it}$			0.0709*** (0.0129)	0.0722*** (0.0203)
$Log(Assets)_{it-1}$	−0.0022*** (0.0005)	−0.0037*** (0.0010)		
$Fixed\ Assets_{it-1}$	−0.0206*** (0.0041)	0.0300 (0.0217)		
$Leverage_{it-1}$	0.0064* (0.0037)	−0.0361 (0.0240)		
$Sales_{it-1}$	0.0029*** (0.0005)	0.0213** (0.0084)		
$Cash_{it-1}$	−0.0419*** (0.0049)	0.0793 (0.0563)		
$Debt_{it-1}$	0.0117*** (0.0039)	0.0134 (0.0141)		
$WorkCap_{it-1}$	−0.0064** (0.0028)	0.0062 (0.0068)		
Industry × Year-Quarter FEs	YES	YES	YES	YES
County FE	YES	YES	YES	NO
Firm FE	NO	NO	NO	YES
R^2	0.151	.	0.144	0.378
Observations	102,742	102,742	189,312	164,603

管理外生的现金流波动

（二）信贷额度——Credit Line Size Adjustments 规模（**广延边际？**）

稳健性检验：

	$\Delta Line\ Size_{it}$				
	P95 IV	Snow < 3SD	Snow > 0	No Controls	Firm FEs
	(1)	(2)	(3)	(4)	(5)
$Cash\ Flow_{it}$	−0.841**	−0.701**	−0.572**	−0.495**	−0.869
	(0.384)	(0.308)	(0.244)	(0.224)	(1.081)
Firm Controls	YES	YES	YES	NO	YES
Ind.-Year-Qtr.	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	NO
Firm FE	NO	NO	NO	NO	YES
Observations	102,742	94,061	89,914	102,742	77,662

- use Abnormal Snow 95 to instrument for cash flows; drop areas experiencing extremely large snow shocks; drop areas that did not experience any snow cover over the previous decade; remove the firm-level control variables; control firm FEs（不显著，原因同上）

管理外生的现金流波动

（二）信贷额度

综上：Bank-borrowing firms use their credit lines to manage nonfundamental liquidity shocks.

Not only do these firms use **existing credit line capacity** when faced with weather-induced cash flow shocks, but they are also able to work with their lender to **expand available credit**.

可能的原因：The reason firms seek this additional credit is to **maintain sufficient liquidity** as ther draw their existing credit line.

实证方法：以年初未使用的信贷额度与总额度承诺比率的25分位数为界划分Low Slack和Slack组进行分组回归

—— there is a positive and statistically significant association between Abnormal Snow and credit line draws and line size changes only in the subsample of firms with Low Slack.

其他解释：Firms that use credit lines to manage weather-induced cash flow shocks also actively use their credit lines **in response to other liquidity shocks**, whereas firms with ample credit line slack have credit lines in place for investment purposes, such as mergers and acquisitions.

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管理外生的现金流波动

（二）信贷额度

Panel A: County Fixed Effects

	$\Delta Drawn$		$\Delta Line\ Size$	
	Low Slack (1)	Slack (2)	Low Slack (3)	Slack (4)
Abn. Snow	0.0594***	0.0084	0.1007***	−0.0008
	(0.0180)	(0.0100)	(0.0279)	(0.0182)
Observations	32,489	100,139	32,489	100,139
R^2	0.1855	0.0829	0.2549	0.0845
Industry × Year-Qtr FE	YES	YES	YES	YES
County FE	YES	YES	YES	YES

Panel B: Firm Fixed Effects

	$\Delta Drawn$		$\Delta Line\ Size$	
	Low Slack (1)	Slack (2)	Low Slack (3)	Slack (4)
Abn. Snow	0.0542*	0.0152	0.0918***	0.0027
	(0.0275)	(0.0167)	(0.0336)	(0.0240)
Observations	22,319	83,941	22,319	83,941
R^2	0.4727	0.3414	0.5588	0.3862
Industry × Year-Qtr FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES

管理外生的现金流波动

（三）其他流动性管理工具

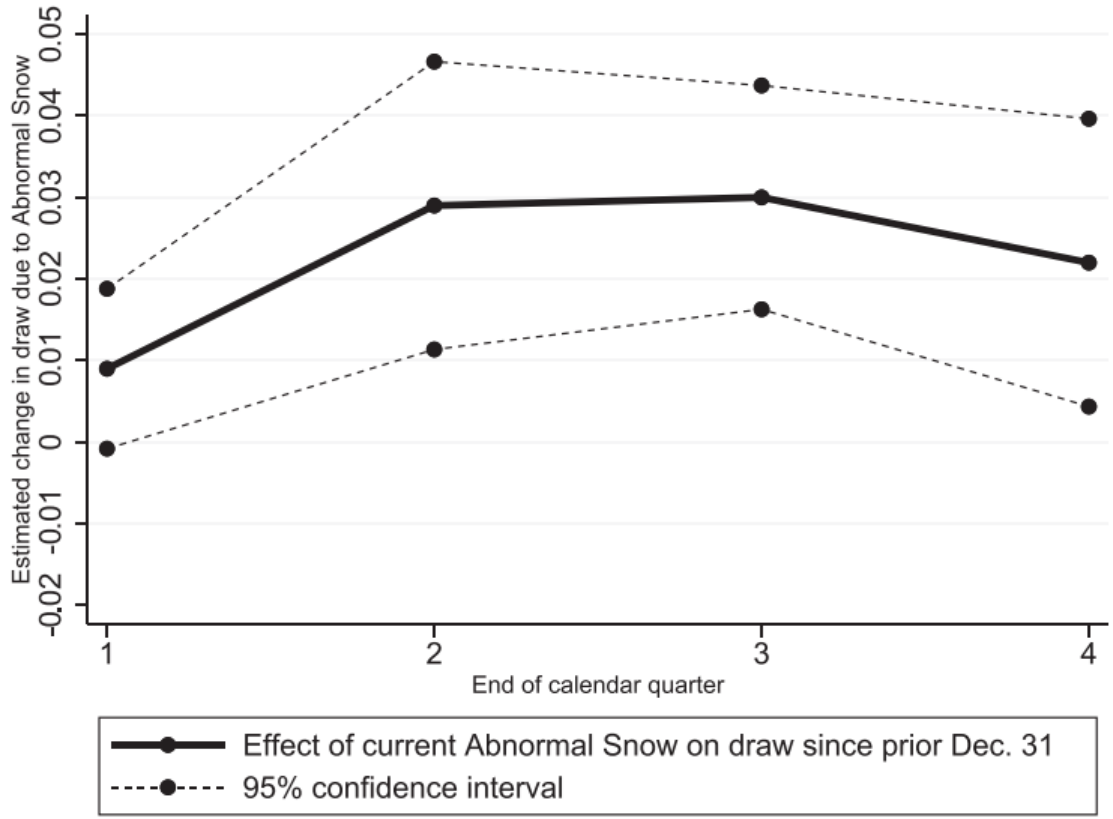
Cash balances; Fixed assets; Trade credit; Total debt; Reduce corporate payouts; Increase equity issuance; Use financial hedges; Cut costs (in forms unrelated to operating cash flows.)

	$\Delta Cash_{it}$ (1)	$\Delta FixedAssets_{it}$ (2)	$\Delta TradeCred_{it}$ (3)	$\Delta Total\ Debt_{it}$ (4)
$Cash\ Flow_{it}$	0.181	0.059	0.012	−0.354*
	(0.119)	(0.168)	(0.098)	(0.203)
$Log(Assets)_{it-1}$	−0.0005	0.001	−0.0006**	−0.0005
	(0.0004)	(0.001)	(0.0003)	(0.0008)
$Fixed\ Assets_{it-1}$	−0.015	−0.017	−0.005	0.028
	(0.012)	(0.015)	(0.009)	(0.021)
$Leverage_{it-1}$	−0.001	−0.019	0.003	−0.006
	(0.010)	(0.016)	(0.008)	(0.019)
$Sales_{it-1}$	−0.004	−0.0005	−0.002	0.014**
	(0.004)	(0.006)	(0.003)	(0.007)
$Cash_{it-1}$	−0.131***	−0.024	0.006	0.021
	(0.027)	(0.036)	(0.023)	(0.046)
$Debt_{it-1}$	−0.017**	−0.003	−0.004*	−0.105***
	(0.008)	(0.003)	(0.002)	(0.018)
$WorkCap_{it-1}$	0.005	−0.019***	−0.009***	−0.013*
	(0.004)	(0.004)	(0.003)	(0.007)
Industry × Year-Qtr FE	YES	YES	YES	YES
County FE	YES	YES	YES	YES
Observations	102,742	102,742	102,679	102,742

管理外生的现金流波动

（四）政策持续时间

To examine the relation between **severe first-quarter snow** and **credit line activity on a quarterly basis**. —— credit line draw

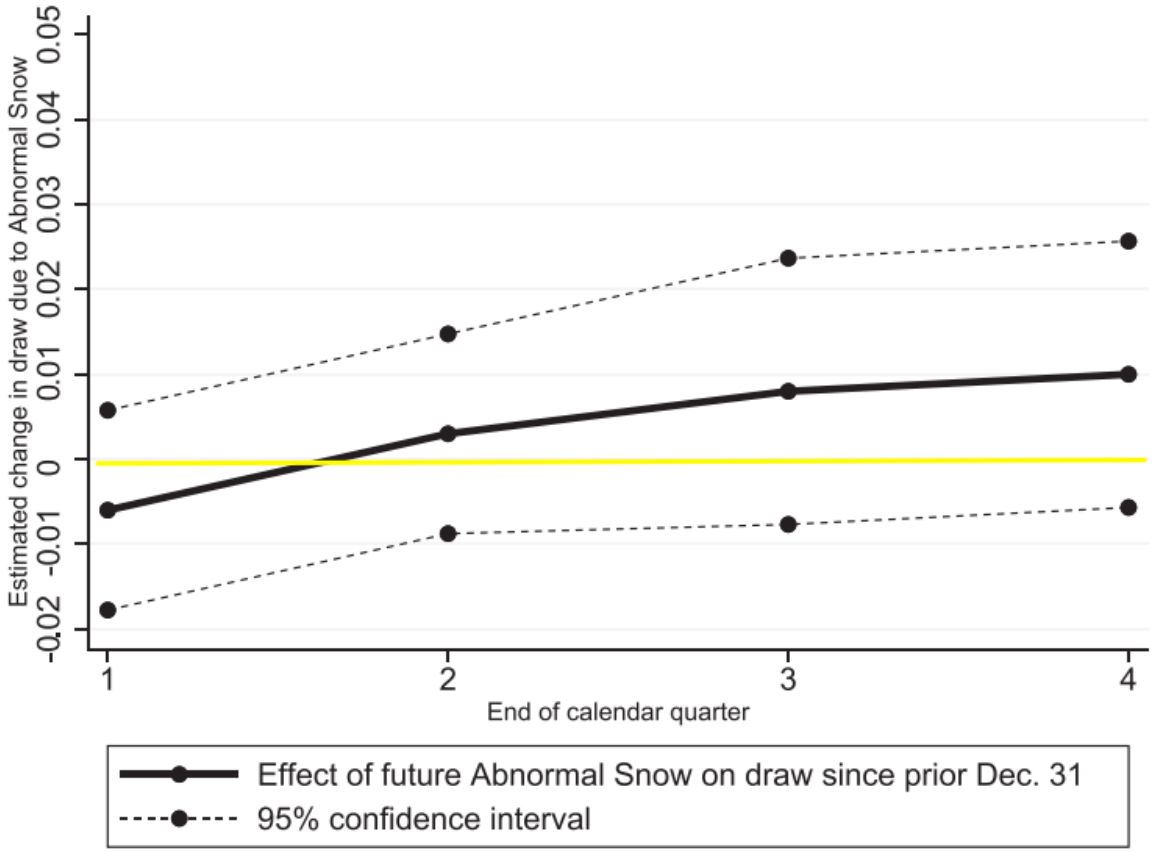


(a) Line Draw and Current Year's Abnormal Snow

管理外生的现金流波动

（四）政策持续时间

To examine the relation between **severe first-quarter snow** and **credit line activity on a quarterly basis**. —— credit line draw

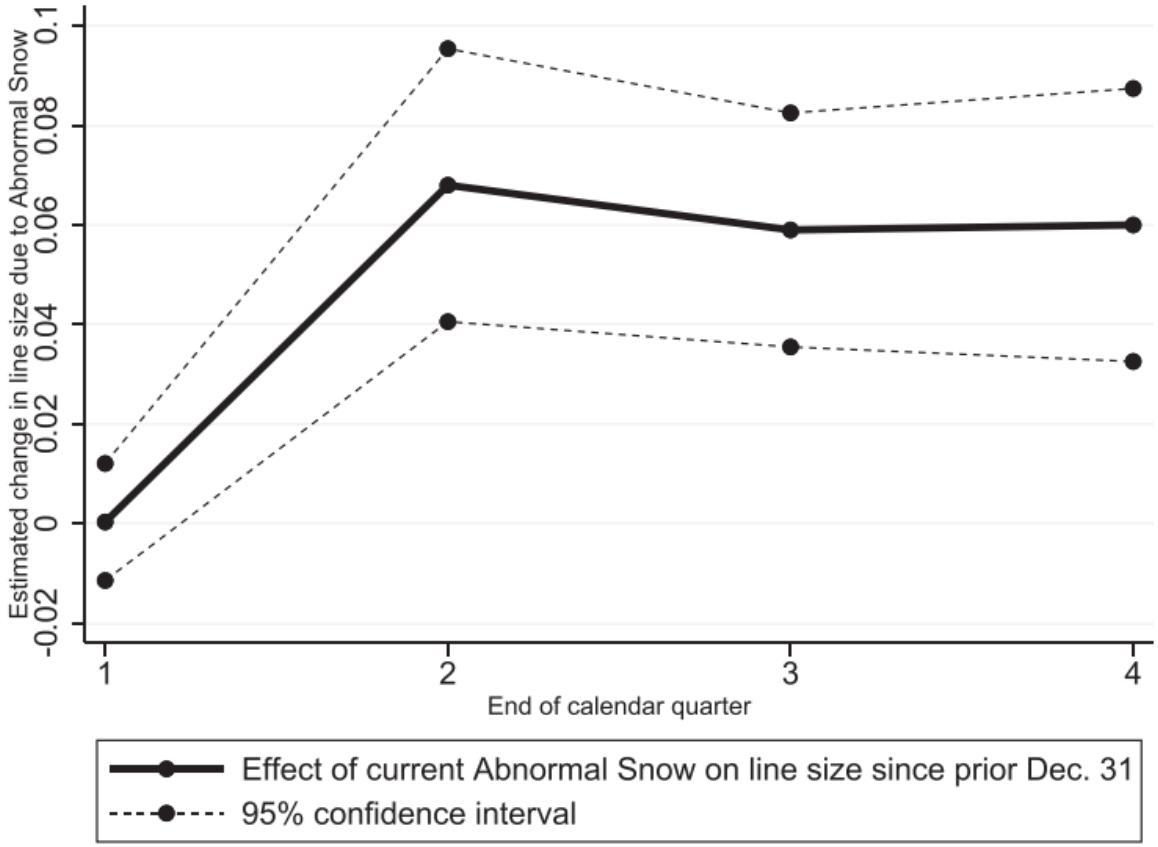


(b) Line Draw and Next Year's Abnormal Snow

管理外生的现金流波动

（四）政策持续时间

To examine the relation between **severe first-quarter snow** and **credit line activity on a quarterly basis**. —— credit line size

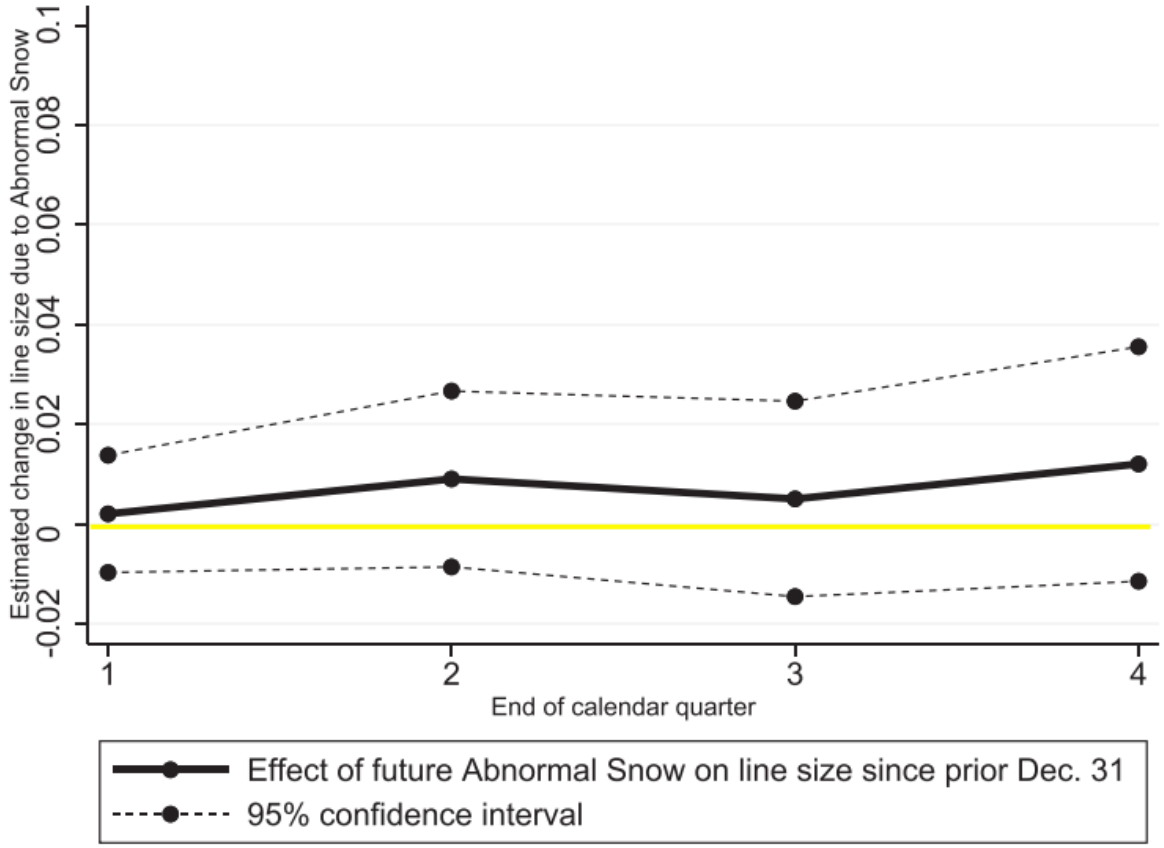


(a) Line Size and Current Year's Abnormal Snow

管理外生的现金流波动

（四）政策持续时间

To examine the relation between **severe first-quarter snow** and **credit line activity on a quarterly basis**. —— credit line size



(b) Line Size and Next Year's Abnormal Snow

支持or反对

（一）利率

To examine the relation between cash flows and interest rates charged both **on credit lines** and **on all loans to a given borrower**. Investigating all loans gives a more complete picture of how the cost of credit changes, as the borrower and lender are likely to renegotiate all credit facilities **at the same times**.

	$\Delta Line\ Rt$	$\Delta Rate$	$\Delta Line\ Rate$		$\Delta Rate$	
	(1) 2SLS	(2)	(3)	(4)简化形式	(5)	(6)
$Cash\ Flow_{it}$	−0.051*	−0.024**				
	(0.026)	(0.012)				
Abn. Snow			0.0008**	0.0012***	0.0005**	0.0006*
			(0.0003)	(0.0004)	(0.0002)	(0.0003)
Firm Controls	YES	YES	NO	NO	NO	NO
Ind.-Year-Qtr.	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	NO	YES	NO
Firm FE	NO	NO	NO	YES	NO	YES
R^2			0.143	0.383	0.091	0.342
Observations	40,959	78,601	91,529	77,442	149,648	126,586

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支持or反对

（二）贷款期限

Shorter in maturity

Panel A: Loan Maturity			
	$\Delta Maturity_{it}$		
	2SLS (1)	Red. Form (2)	Red. Form (3)
$Cash\ Flow_{it}$	29.25***		
	(10.31)		
$Abn.\ Snow$		−0.740***	−0.894***
		(0.183)	(0.263)
Firm Controls	YES	NO	NO
Industry × Year-Quarter FEs	YES	YES	YES
County FE	YES	YES	NO
Firm FE	NO	NO	YES
R^2	.	0.084	0.276
Observations	100,422	189,310	164,603

支持or反对

（三）利率类型

Less likely to have fixed interest rates

Panel B: Fixed Rate Loan

	$\Delta FixedRate_{it}$		
	2SLS	Red. Form	Red. Form
	(1)	(2)	(3)
$Cash\ Flow_{it}$	1.150***		
	(0.374)		
$Abn.\ Snow$		−0.019***	−0.022***
		(0.005)	(0.006)
Firm Controls	YES	NO	NO
Industry × Year-Quarter FEs	YES	YES	YES
County FE	YES	YES	NO
Firm FE	NO	NO	YES
R^2	.	0.067	0.321
Observations	100,422	189,310	164,603

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支持or反对

（四）是否有担保

More likely to be secured by accounts receivable or inventory

Panel C: Secured Loan

	$\Delta Secured_{it}$		
	2SLS	Red.Form	Red. Form
	(1)	(2)	(3)
$Cash\ Flow_{it}$	−3.728***		
	(1.306)		
Abn. Snow		0.120***	0.124***
		(0.020)	(0.030)
Firm Controls	YES	NO	NO
Industry × Year-Quarter FEs	YES	YES	YES
County FE	YES	YES	NO
Firm FE	NO	NO	YES
R^2	.	0.216	0.380
Observations	100,422	189,310	164,603

异质性

（一）公司规模

Partition the sample based on whether the borrower has over $100 million in total assets. We treat firms that do not report total assets as having less than $100 million in total assets, but the results are qualitatively similar if we exclude firms from the analysis.

Panel A: Borrower Total Assets Partition

	$\Delta Draw_{it}$				$\Delta Line\ Size_{it}$			
	Small		Large		Small		Large	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Abn. Snow	0.035***	0.041**	0.007	−0.021	0.083***	0.083***	0.063	0.049
	(0.009)	(0.019)	(0.023)	(0.033)	(0.014)	(0.024)	(0.044)	(0.062)
Ind.-Year-Qtr.	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	NO	YES	NO	YES	NO	YES	NO
Firm FE	NO	YES	NO	YES	NO	YES	NO	YES
R^2	0.102	0.322	0.130	0.359	0.165	0.400	0.166	0.404
Observations	149,326	126,829	38,829	33,717	149,326	126,829	38,829	33,717

- **Small firms** rely more heavily on credit lines to manage weather-induced cash flow shocks.

异质性

（一）公司规模

进一步分析

	$\Delta Cash_{it}$			
	Small		*Large*	
	(1)	(2)	(3)	(4)
Abn. Snow	−0.002	−0.003	−0.020**	−0.014
	(0.004)	(0.008)	(0.008)	(0.011)
Industry x Year-qtr FE	YES	YES	YES	YES
County FE	YES	NO	YES	NO
Firm FE	NO	YES	NO	YES
R-Squared	0.058	0.354	0.140	0.411
Observations	77,599	56,609	23,971	18,948

- These findings raise the possibility that larger firms manage parts of nonfundamental cash flow shocks in ways not observed in the data such as **reduced equity payouts, increased equity issuances, or financial hedges**.

异质性

（一）公司规模

稳健性检验——2SLS

	$\Delta Draw_{it}$		$\Delta Line\ Size_{it}$		$\Delta Cash_{it}$	
	Small	*Large*	*Small*	*Large*	*Small*	*Large*
	(1)	(2)	(3)	(4)	(5)	(6)
$Cash\ Flow_{it}$	−0.827*	0.007	−0.992*	−0.095	0.115	0.378**
	(0.424)	(0.126)	(0.518)	(0.147)	(0.200)	(0.171)
Industry x Year-qtr FE	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Observations	77,599	23,971	77,599	23,971	77,559	23,971

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异质性

（二）地理邻近性

Partition the sample based on whether the average distance between the borrower and the syndicated lending office of their lead managers is less than 100 miles.

Panel B: Distance to Lender Partition

	$\Delta Draw_{it}$				$\Delta Line\ Size_{it}$			
	Near		Far		Near		Far	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Abn. Snow	0.119***	0.078**	−0.003	−0.004	0.301***	0.186**	0.004	0.018
	(0.024)	(0.036)	(0.013)	(0.017)	(0.059)	(0.084)	(0.022)	(0.025)
Ind.-Year-Qtr.	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	NO	YES	NO	YES	NO	YES	NO
Firm FE	NO	YES	NO	YES	NO	YES	NO	YES
R^2	0.123	0.343	0.115	0.328	0.152	0.394	0.179	0.411
Observations	54,012	46,522	99,536	87,024	54,012	46,522	99,536	87,024

- The use of credit lines to manage weather-induced cash flow shocks is also concentrated in firms with close proximity to their lenders.

异质性

（三）借款人信用等级

Partition the sample on the borrower's credit quality.

Panel C: Loan Rating Partition

	$\Delta Draw_{it}$				$\Delta Line\ Size_{it}$			
	BB or Better		B or Worse		BB or Better		B or Worse	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Abn. Snow	0.032***	0.025	0.007	−0.042	0.084***	0.084***	0.004	−0.059
	(0.010)	(0.017)	(0.020)	(0.041)	(0.014)	(0.020)	(0.035)	(0.067)
Ind.-Year-Qtr.	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	NO	YES	NO	YES	NO	YES	NO
Firm FE	NO	YES	NO	YES	NO	YES	NO	YES
R^2	0.101	0.337	0.148	0.427	0.161	0.409	0.174	0.473
Observations	153,667	129,746	34,133	21,360	153,667	129,746	34,133	21,360

- The use of credit lines to manage nonfundamental cash flow shocks is concentrated in the approximately 82% of borrower-years with credit ratings of BB or higher.

Main Conclusion

- These firms rely **extensively** on credit lines as a source of external finance.
- Firms manage negative cash flow shocks primarily by **drawing on their credit lines** rather than tapping cash reserves or adjusting real activities.
- Negative cash flow shocks are also accompanied by significant **increases in the size** of the firm's overall credit line, indicating that banks accommodate borrowers faced with unexpected cash flow shortfalls.
- These credit line adjustments occur within one calendar quarter and persist through the end of the year.
- Banks charge borrowers for this liquidity provision via **increased interest rates** and **less borrower-friendly loan provisions**.

谢谢大家！