Textual Analysis of Short-seller Research Reports, Stock Prices, and Real Investment

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Introduction

Big Picture

▶ Short-sell research has large effects on stock prices

▶ Short-selling research institutions such as Citron and Muddy Water issue public research reports and call other investors to short the firms that they target.

▶ They have earned outsize attention—and big windfalls—by shining a harsh light on companies.

▶ We study the effects on firm real activities and return expectations.

Main Findings Summary Returns

▶ Reports allocate a large percentage of the text commenting on accounting fraud and earnings mismanagement.

▶ There is a substantial decline in the realized returns following the report publication day.

▶ There is a substantial increase in expected returns and the cost of capital following the report publication day.

Main Findings Summary

- ▶ Cash-flow expectations remain relatively stable, but discount rate increases dramatically.

- ▶ Each report is associated with an average reduction of corporate investment equal to \$118 million and stock issuances equivalent to \$179 million.

- ▶ Firms that commit accounting frauds without short-seller research reports mentioning it do not have a significant price correction or a decrease in investment.

Data

Data

- ▶ Stock return data obtained from CRSP; Firm-level variables data are obtained from Compustat.

- ▶ I/B/E/S database: Analysts' earnings and price forecasts

- ▶ Short-selling firms like Hindenburg Research, Bonitas Research, Citron Research, Viceroy Research, J Capital Research, Bucephalus Research, Ontake Research, GMT Research, Ash Illuminations Research, GeoInvesting, Gotham City Research, and Muddy Waters amongst others
    - ▶ Web-scraping/manually downloading their public report in websites

- ▶ Investor attention
    - ▶ SEC download data/Google Searches/Factiva (News)

Related Literature

▶ Short-sell research and hedge-fund activism: Ljungqvist and Qian (2016), Lamont 2012, Chen (2016), Wong and Zhao 2017, Zhao (2020), Appel and Fos (2020), Paugam, Stolowy, and Gendron (2021), Brendel and Ryans (2021), Gillet and Renault (2018) Kovbasyuk and Pagano (2015)

▶ Short selling: Desai et al. (2002), Nagel (2005), Engelberg, Reed, and Ringgenberg (2012), Jiang, Habib, and Hasan (2020), Kelley and Tetlock (2017), Jones, Reed, and Waller (2016), Jank, Roling, and Smajlbegovic (2021)

▶ Real effect of stock markets: Stein (1996), Baker, Stein, and Wurgler (2003)Goldstein and Guembel (2008), Goldstein, Ozdenoren, and Yuan 2011, Goldstein, Ozdenoren, and Yuan (2013), Bond, Edmans, and Goldstein 2012, Warusawitharana and Whited 2016, Binsbergen and Opp (2019)

Example

- September 10, 2020: Hindenburg Research divulged that Nikola, the electric vehicle company, misled the public by showing a video of a truck cruising through the high desert outside Salt Lake City

- The short-seller research firm got a tip that the video was staged and "the truck wasn't traveling under its own power [...] it had been towed to the top of a hill. The person at the wheel then popped it into neutral and started it on its journey downhill—slowly at first, then accelerating."

Nikola: How to Parlay An Ocean of Lies Into a Partnership With the Largest Auto OEM in America

Published on September 10, 2020

(NASDAQ:NKLA)

- Today, we reveal why we believe Nikola is an intricate fraud built on dozens of lies over the course of its Founder and Executive Chairman Trevor Milton's career.
- We have gathered extensive evidence—including recorded phone calls, text messages, private emails and behind-the-scenes photographs—detailing dozens of false statements by Nikola Founder Trevor Milton. We have never seen this level of deception at a public company, especially of this size.
- Trevor has managed to parlay these false statements made over the course of a decade into a ~$20 billion public company. He has inked partnerships with some of the top auto companies in the world, all desperate to catch up to Tesla and to harness the EV wave.
- We examine how Nikola got its early start and show how Trevor misled partners into signing agreements by falsely claiming to have extensive proprietary technology.
- We reveal how, in the face of growing skepticism over the functionality of its truck, Nikola staged a video called "Nikola One in Motion" which showed the semi-truck cruising on a road at a high rate of speed. Our investigation of the site and text messages from a former employee reveal that the video was an elaborate ruse—Nikola had the truck towed to the top of a hill on a remote stretch of road and simply filmed it rolling down the hill.
- In October 2019, Nikola announced it would revolutionize the battery industry. This was to be done through a pending acquisition, but the deal fell through when Nikola realized (a) the technology was vaporware and (b) the President of the battery company had been indicted months earlier over allegations that he conned NASA by using his expense account to procure numerous prostitutes.
- Nikola has never walked back claims relating to its battery technology. Instead, Trevor continued to publicly hype the technology even after becoming aware of the above issues. The revolutionary battery technology never existed – now, Nikola plans to use GM's battery technology instead.
- A spokesman for Volvo spin-off Powercell AB, a hydrogen fuel cell technology company that formerly partnered with Nikola, called Nikola's battery

Example

- Nikola defended itself the following day, saying that the article contained "false and misleading statements" hired counsel to "evaluate potential legal recourse

- September 21, 2020: Founder Trevor Milton 'voluntarily' steps down from his roles as executive chairman and a member of its board

- In a regulatory filing in November, the company revealed that the Justice Department had issued grand jury subpoenas against Nikola and its founder and executive chairman

Nikola Stock Price

Text Analysis

Text Analysis

- Dictionary Methods

- Topic Modeling

Dictionary Methods

▶ Over 60% of the reports contain direct allegations of fraud or financial misconduct

▶ We say that a report addresses fraud or financial misconduct if it has any of the following words or their grammatical variation: "false", "fake", "fraud", "earnings management", "illegal", "dubious", "accusation", "suspect", "questionable", "audit", "fail to disclose", "pump (the stock)".

Topic Modeling

▶ Topic Modeling to automatically summarize what are the documents talking about

▶ LDA

▶ Each document is a probability distribution over topics

▶ Each topic is a probability distribution over words

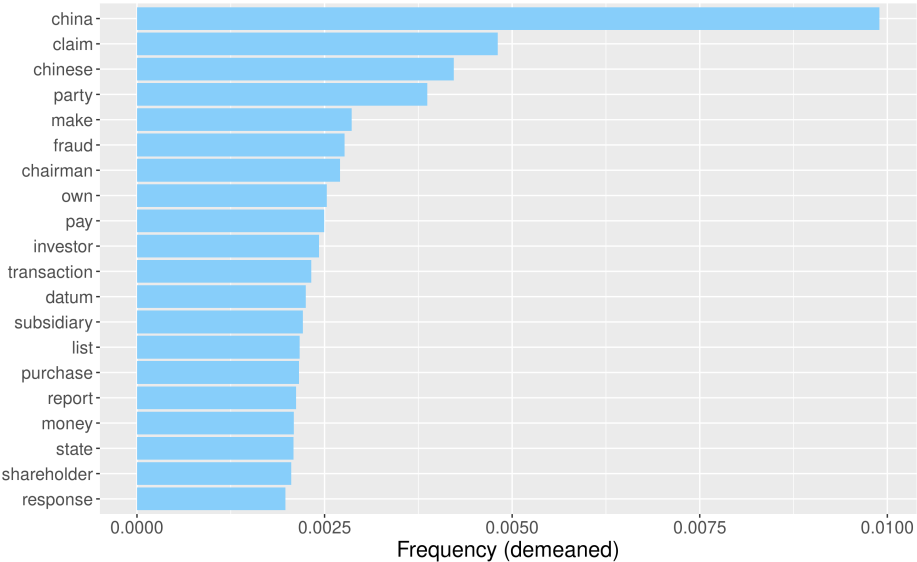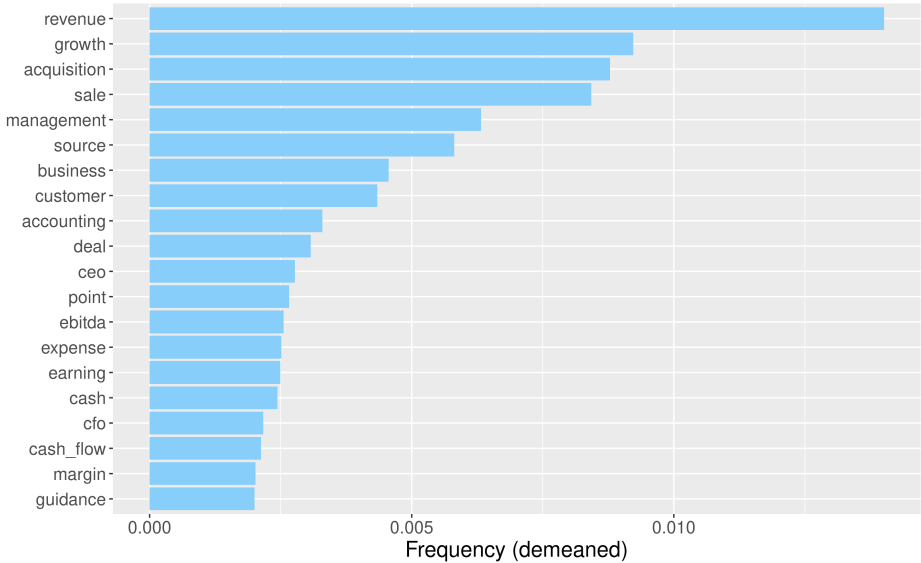▶ Topics are latent, so no automatic name but they can be read

Topics

Topics
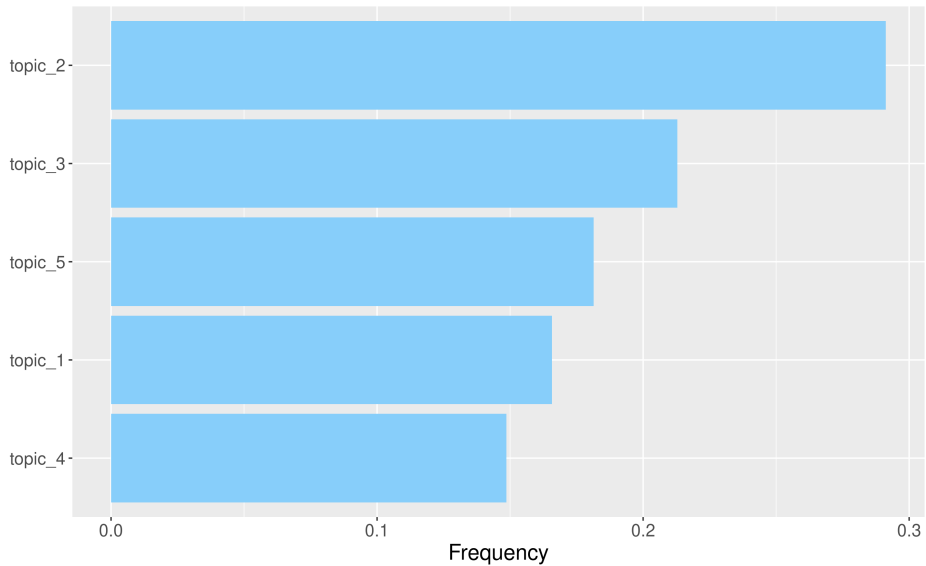
Topic 2: Fraud

Topic 4: Earnings and Guidance

Firm Type

Which firms are targeted?

- ▶ Target firms are younger and larger

- ▶ Issue more stocks

- ▶ Higher profitability and higher real investment

- ▶ Growth firms

Type of firms: Comparison to the cross-sectional mean

Variable	Mean	Std	P5	P10	Q1	Median	Q3	P90	P95	N	*t*-stat
Age	-77.444	145.475	-200.833	-194.115	-178.059	-133.685	-10.235	87.138	212.657	320.0	-9.523
LNsize	0.812	1.521	-1.665	-1.088	-0.252	0.690	1.853	2.877	3.494	318.0	9.516
Ret12_1	0.476	1.396	-0.622	-0.479	-0.223	0.142	0.618	1.435	2.956	274.0	5.644
NSI	0.019	0.155	-0.112	-0.092	-0.062	-0.041	0.051	0.199	0.320	258.0	1.997
GP	0.118	0.283	-0.208	-0.163	-0.060	0.058	0.228	0.524	0.749	286.0	7.023
ROA	-0.508	3.411	-0.787	-0.254	0.016	0.115	0.206	0.300	0.427	284.0	-2.508
ROE	0.175	0.925	-0.854	-0.328	-0.010	0.136	0.270	0.703	1.215	285.0	3.194
LNbeme	-0.681	0.986	-2.343	-2.008	-1.321	-0.611	-0.047	0.395	0.818	273.0	-11.42...
IA	0.340	0.850	-0.305	-0.251	-0.116	0.086	0.454	1.144	1.875	276.0	6.633
IG	0.212	1.855	-1.142	-0.941	-0.599	-0.244	0.255	1.590	2.933	268.0	1.872
PIA	0.053	0.153	-0.078	-0.056	-0.034	-0.005	0.080	0.241	0.363	265.0	5.595
SG	0.270	0.560	-0.276	-0.191	-0.047	0.103	0.432	0.991	1.220	266.0	7.866

Type of Firms: Comparison to the cross-sectional median

Variable	Mean	Std	P5	P10	Q1	Median	Q3	P90	P95	N	t-stat
Age	-32.474	146.168	-156.000	-151.000	-134.250	-87.500	35.000	128.500	262.000	320.0	-3.974
LNsize	0.897	1.514	-1.543	-1.001	-0.120	0.789	1.932	2.941	3.577	318.0	10.558
Ret12_1	0.526	1.421	-0.576	-0.413	-0.182	0.182	0.692	1.441	2.970	274.0	6.130
NSI	0.076	0.157	-0.066	-0.030	-0.004	0.016	0.106	0.264	0.380	258.0	7.811
GP	0.151	0.283	-0.176	-0.131	-0.031	0.095	0.262	0.562	0.784	286.0	9.019
ROA	0.006	0.270	-0.522	-0.287	-0.040	0.041	0.144	0.243	0.394	284.0	0.391
ROE	0.108	0.925	-0.974	-0.402	-0.084	0.067	0.207	0.638	1.144	285.0	1.970
LNbeme	-0.716	0.984	-2.399	-2.039	-1.355	-0.642	-0.081	0.352	0.765	273.0	-12.035
IA	0.467	0.853	-0.170	-0.094	0.015	0.195	0.578	1.250	1.965	276.0	9.088
IG	0.644	1.858	-0.679	-0.514	-0.158	0.141	0.670	2.047	3.402	268.0	5.676
PIA	0.081	0.154	-0.042	-0.031	-0.006	0.022	0.109	0.274	0.385	265.0	8.558
SG	0.360	0.558	-0.195	-0.085	0.035	0.195	0.515	1.071	1.306	266.0	10.530

Price Impacts

Abnormal Returns on Publication Dates of Short-sell Research Reports
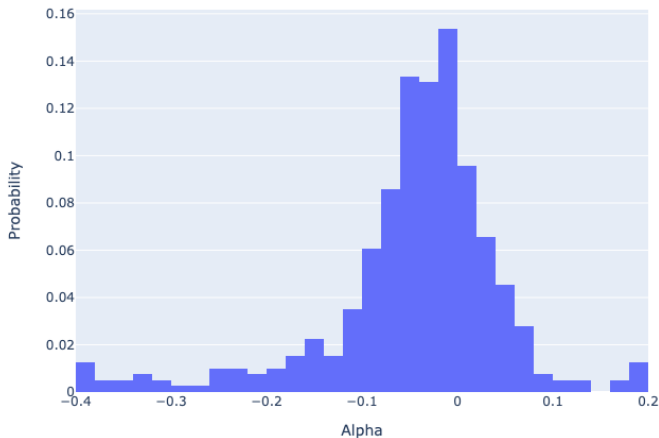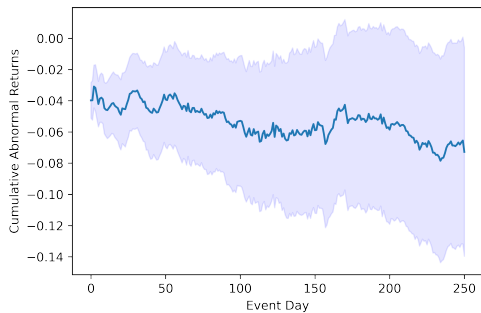

$$\text{abr}_{i,t} = \text{ret}_{i,t} - (\hat{\beta} \times \text{mktrf}_t)$$

Cumulative Abnormal Returns

Pre-Event
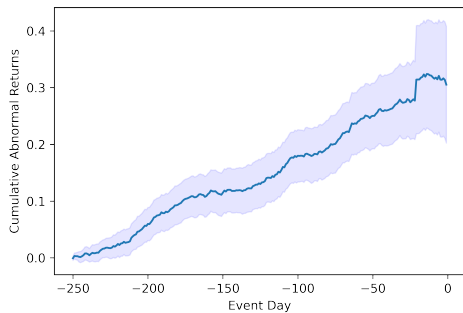
Post-Event

Are Reports Cash Flow or Discount Rate Shocks?

▶ Gordon growth model:

$$P_t = \frac{E_t[CF_{t+1}]}{r - g} \tag{1}$$

▶ The negative shock to targets' firms price must come from:
  ▶ a decrease in the short-term expected cash flows as reports reveal accounting frauds/earnings managements
  ▶ a decrease in the long-term growth rate of cash flows
  ▶ increases in the discount rate if investors are more risk averse and require higher returns for target firms (but idiosyncratic...)

▶ Generalized in Campbell 1991

  ▶ $r_{i,t+1} - E_t[r_{i,t+1}] = \underbrace{(E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{i,t+j+1}}_{\text{Cash Flow News}} - \underbrace{(E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{i,t+j+1}}_{\text{Discount Rate News}}$

Changes in Expected Returns
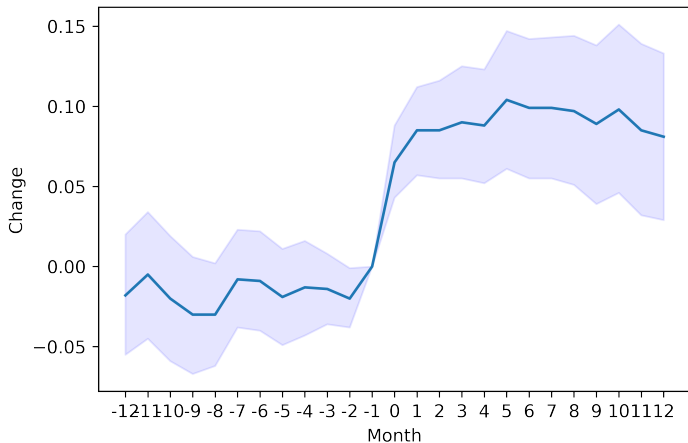
$E_t[r] = \frac{E_t[P_{t+1}] + E_t[D_{t+1}]}{P_t}$, where $E[P_{t+1}]$ and $E[D_{t+1}]$ are analysts' consensus forecasts price targets and dividend forecasts, respectively.
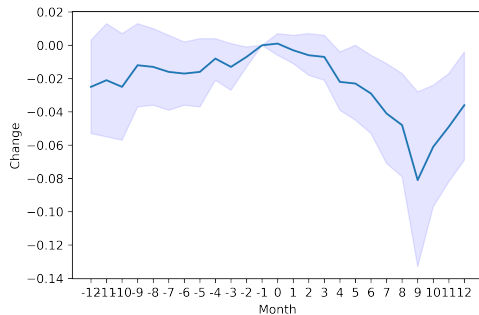
Cash flows

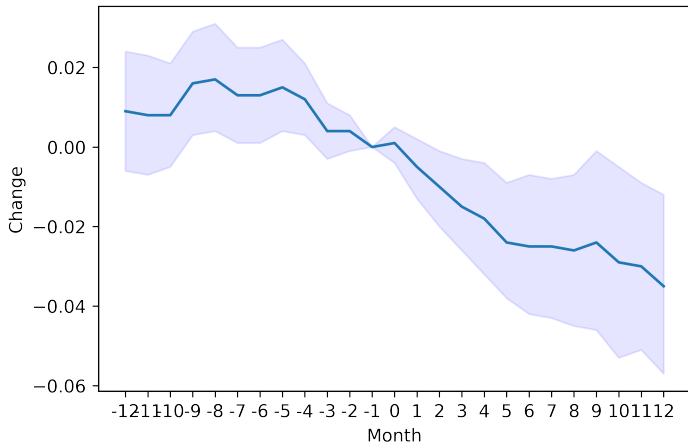# Changes in Expected Return on Equity
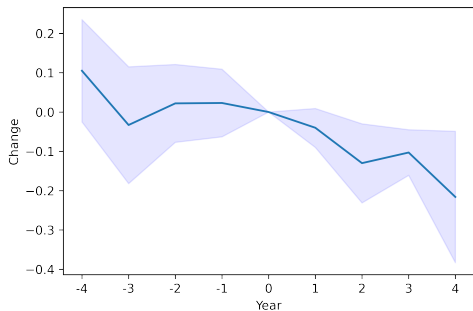
One-year-ahead Forecast
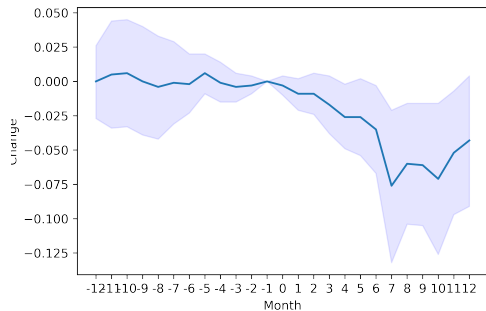
Two-years-ahead Forecast

$E_t[roe] = log(1 + \frac{E_t[earnings_{t+i}]}{BE_{t-1}})$, where $E_t[earnings_{t+i}]$ denote analysts' earnings forecasts at horizon i

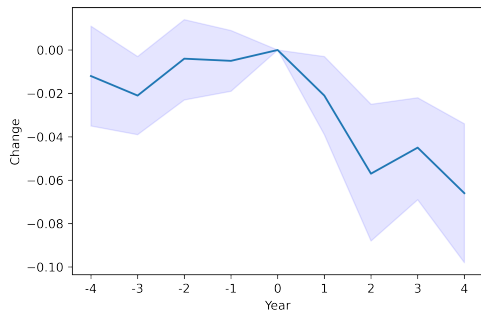# Changes in Long-term Earnings Growth Expectation

Changes in Realized Earnings on Equity and Assets
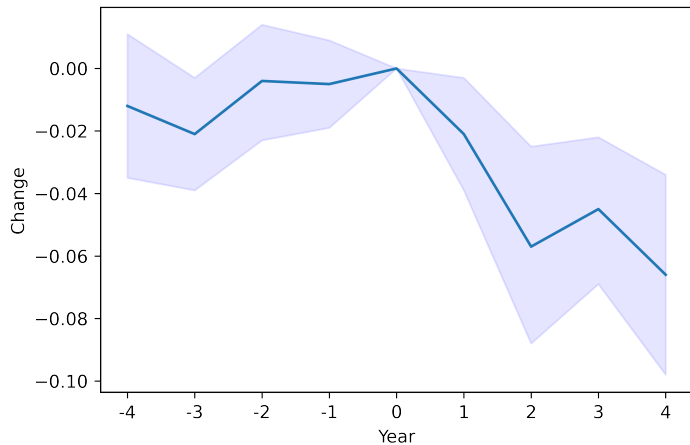

Return on Equity   Earnings-to-Asset

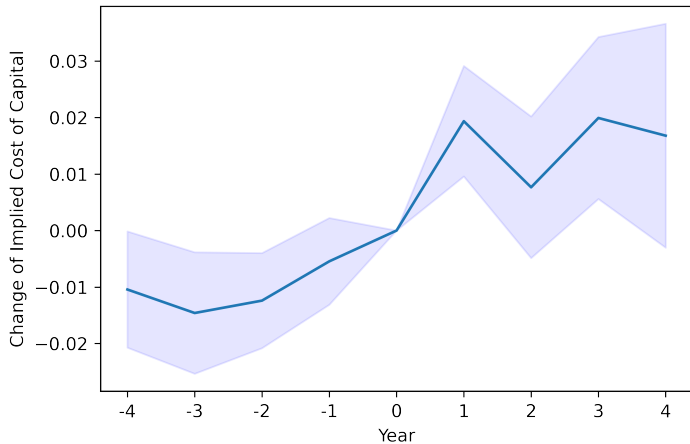# Changes in Gross Profitability to Assets

Real Effects

Implied Cost of Capital

We use a finite-horizon model with 15-year to estimate the implied ICC,

$$P_{i,t} = \sum_{k=1}^{15} \frac{FE_{i,t+k}(1 - b_{i,t+k})}{(1 + r_{i,e})^k} + \frac{FE_{i,t+16}}{r_{i,e}(1 + r_{i,e})^{15}} \tag{2}$$

where $FE_{i,t+k}$ and $b_{i,t+k}$ denote the earnings forecasts and the plowback rate for firm i at time $t + k$, respectively

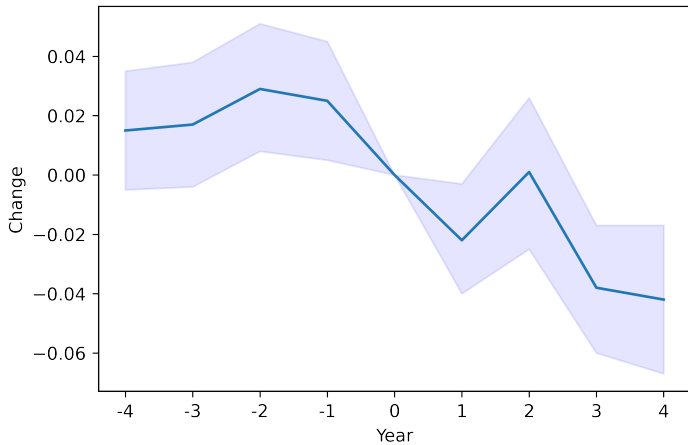# Changes in the Implied Cost of Capital
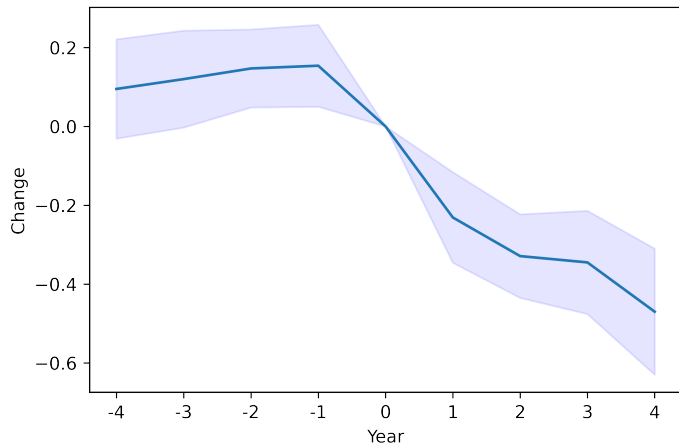
Changes in the Implied Cost of Capital

$$ICC_{i,t} = \beta_1 D_{1,i,t} + \beta_2 D_{2,i,t} + \beta_3 D_{3,i,t} + \beta_4 D_{4,i,t} + Year_t + Firm_i + Control_{i,t} + \epsilon_{i,t}$$

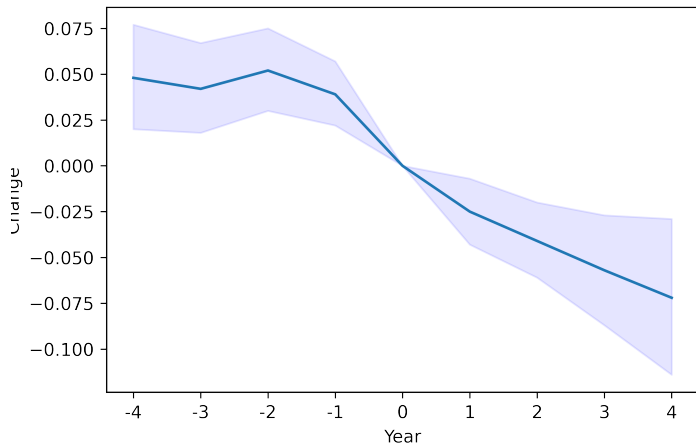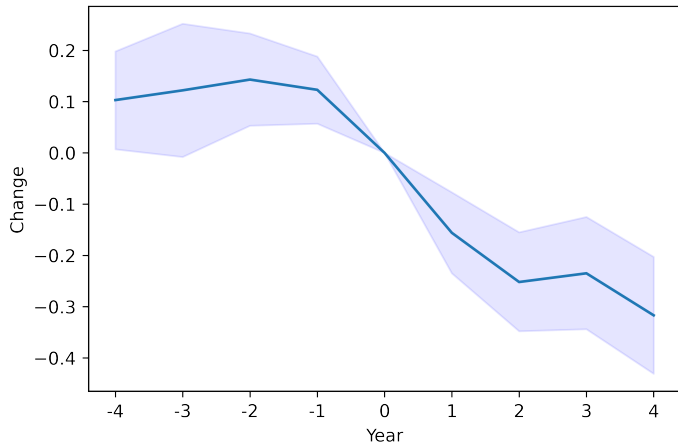|		
D_1	0.017	0.016
	(2.045)	(1.972)
D_2	0.003	0.012
	(0.507)	(1.478)
D_3	0.011	0.011
	(2.306)	(1.319)
D_4	0.011	0.007
	(1.366)	(1.058)
Adj R-sqr(%)	0.036	1.321
N	47534.0	36835.0
Firm Fixed Effect	YES	YES
Time Fixed Effect	YES	YES
Control Variables	NO	YES

Changes in Net Stock Issuance

Changes in Investment to Assets

Changes in Capital and R&D Expenditure to Assets

Changes in Sales Growth

Panel OLS of Real Activities

$$Real\_activity_{i,t} = \beta_1 D_{1,i,t} + \beta_2 D_{2,i,t} + \beta_3 D_{3,i,t} + \beta_4 D_{4,i,t} + \gamma_i' Controls_i + Year_t + Firm_i + \epsilon_{i,t}$$

	NSI	IA	PIA	SG	CAP_RD
D_1	-0.035	-0.252	-0.025	-0.118	-0.02
	(-4.434)	(-5.923)	(-2.499)	(-2.519)	(-2.317)
D_2	-0.006	-0.296	-0.016	-0.172	-0.017
	(-0.655)	(-7.576)	(-2.302)	(-3.676)	(-1.569)
D_3	-0.032	-0.246	-0.021	-0.097	-0.018
	(-4.375)	(-6.308)	(-3.143)	(-1.451)	(-1.689)
D_4	-0.031	-0.229	0.003	-0.157	-0.018
	(-4.789)	(-10.958)	(0.264)	(-6.486)	(-1.982)
ShortInt	-0.038	-0.474	-0.064	0.02	-0.152
	(-0.534)	(-1.972)	(-2.854)	(0.236)	(-2.696)
LNsize	0.007	0.112	0.029	0.106	0.03
	(1.493)	(9.128)	(6.977)	(9.038)	(10.796)
LNat	-0.0	0.18	0.025	0.017	-0.039
	(-0.066)	(4.282)	(4.58)	(0.898)	(-8.303)
Adj R-sqr(%)	0.055	5.068	4.363	2.139	1.933
N	65276.0	67697.0	56837.0	65009.0	35117.0
Firm Fixed Effect	YES	YES	YES	YES	YES
Time Fixed Effect	YES	YES	YES	YES	YES

Conclusion

Conclusion

- Firms mentioned in short-sell research reports significantly reduce their real investment and stock issuances

- Average reduction of corporate investment equal to \$118 million and stock issuances equivalent to \$179 million

- Reports allocate a large percentage of the text commenting on accounting fraud and earnings mismanagement

- Target firms earn average abnormal returns of -4% on the publication day, and the subsequent price revisions equal -8% in 12-months horizon

- Cash-flow expectations decrease even sluggishly, increasing the cost of capital