Wharton
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JACOBS LEVY EQUITY MANAGEMENT CENTER
FOR QUANTITATIVE FINANCIAL RESEARCH

A Tough Act to Follow: Contrast Effects in Financial Markets

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Contrast effects

Contrast effects: Value of previously-observed signal inversely biases perception of the next signal

Abundant experimental evidence in psychology

- Crimes viewed as less serious after exposure to more egregious crimes (Pepitone and DiNubile 1976)
- Men rate female students as less attractive if the men recently viewed pictures of very beautiful actresses (Kenrick and Gutierres 1980)

Contrast effects in popular culture

- "A tough act to follow" / "Pale in comparison"
- Literary foils
- "Ugly friend" makes you look hotter

Contrast effects in perception

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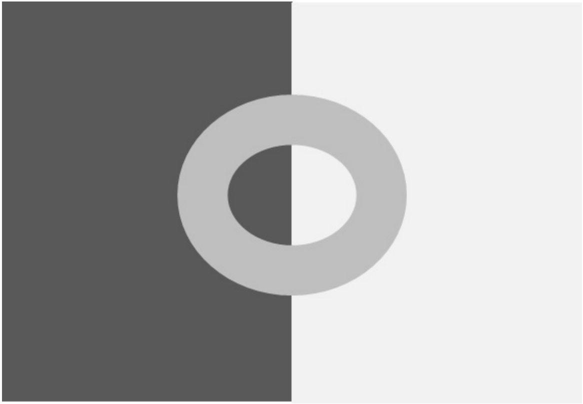
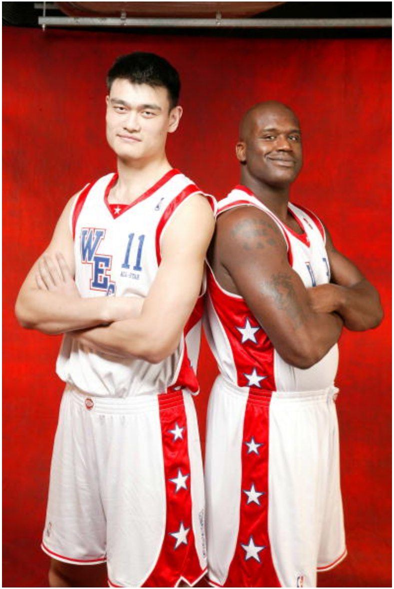


Contrast effects in perception



Contrast effects in perception

Potential real-world implications of contrast effects

Contrast effects could lead to mistakes in:

- Hiring and promotion decisions
- Investment decisions
  - Invest in a bad project because it looks better than the others
- Judicial decisions
- Household consumption, real estate, mate choice decisions

Hard to measure information and perception of information
Hard to tease contrast effects apart from quotas or resource constraints

Abundant lab evidence, but field evidence is very limited

- Bhargava and Fisman (2013): Speed dating
- Simonsohn and Loewenstein (2006): Housing choice

Contrast effects in financial markets

This paper: Do contrast effects matter for prices in financial markets?

Relative to existing laboratory and limited field evidence

- Full-time professionals making repeated decisions with high stakes
- Equilibrium prices determined through interactions among many investors

If contrast effects impact financial markets

- Implies that prices react not only to the absolute content of news, but also to the relative content of news

Contrast effects and earnings announcements

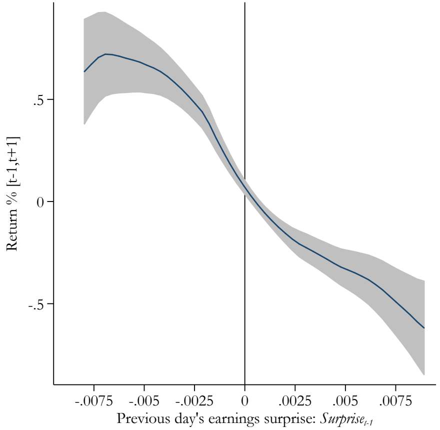
Quarterly earnings offers an ideal real world test of contrast effects

- Important salient news event
- Announcements are scheduled weeks in advance, so whether a firm announces following positive or negative ***surprises*** by others is likely to be uncorrelated with the firm's fundamentals

Contrast effects $\Longrightarrow$ **Negative** relation between yesterday's earnings surprise and the return reaction to today's earnings news, holding today's earnings news constant

- A high surprise yesterday makes *any* surprise today look slightly worse than the same surprise today would appear if yesterday's surprise had been lower

The paper in one picture



Returns of firms that announced earnings today vs. average earnings surprise of large firms that announced yesterday (conditional on own earnings surprise)

Preview of results

Contrast effects have a large predictable impact on price reactions

- 53 basis points from lowest to highest decile
  - Trading strategy yields 7-15% annual abnormal returns
- Strong effects even in recent years and for large firms
- Greater lags and leads do not have a similar impact
- Applies within the same day (afternoon vs. morning announcements)
- Mispricing reverses over time

Very unlikely to be explained by **information transmission**

- Use cumulative returns starting before $t-1$ for firm announcing on t
- $t-1$ surprise does not predict t surprise or return reaction on $t-1$
- Much more...

Outline

1. Empirical methodology
2. Baseline results
3. Potential alternative explanations
4. Unconditional results and trading strategy
5. Heterogeneity and robustness

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Measuring earnings surprise

Earnings surprise: Difference between announced earnings and investor expectations

$$surprise_{it} = \frac{actual\ earnings_{it} - median\ forecast_{i,[t-15,t-2]}}{price_{i,t-3}}$$

Multiple firms may release earnings in $t-1$, so which ones are salient?

- Large firms ($\geq$ NYSE 90th percentile of market cap), value-weighted

$$surprise_{t-1} = \frac{\sum_{i=1}^{N} MktCap_{i,t-4} \cdot surprise_{i,t-1}}{\sum_{i=1}^{N} MktCap_{i,t-4}}$$

Alternative measure: returns reaction of firms announcing on $t-1$

Baseline specification

How are returns to an announcement on day t impacted by the salient surprise from $t-1$?

$$ret_{i,[t-1,t+1]} = \beta_0 + \beta_1 surprise_{t-1} + own\ surprise\ bin + \delta_{ym} + \varepsilon_{it}$$

- *own surprise bin*: 20 bins for own announced surprise on day t
- δ_{ym}: Year-month fixed effects
- Value-weighted and standard errors clustered by date
- $ret_{i,[t-1,t+1]}$: **Cumulative $t-2$ market close to $t+1$ market close**
  - Characteristic adjusted, exclude firm announcing on t or $t-1$ from characteristic portfolio

Outline

Baseline results

$$ret_{i,[t-1,t+1]} = \beta_0 + \beta_1 surprise_{t-1} + own\ surprise\ bin + \delta_{ym} + \varepsilon_{it}$$

	Return $[t-1, t+1]$					
	(1)	(2)	(3)	(4)	(5)	(6)
$Surprise_{t-1}$ of largest firm	-0.617***	-0.422**				
	(0.179)	(0.188)				
$Surprise_{t-1}$ large firms, EW mean			-1.075***	-0.944***		
			(0.255)	(0.277)		
$Surprise_{t-1}$ large firms, VW mean					-0.945***	-0.887***
					(0.225)	(0.244)
Own $surprise_{it}$ controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	No	Yes	No	Yes
R^2	0.0587	0.0833	0.0592	0.0838	0.0591	0.0838
Observations	75923	75923	75923	75923	75923	75923

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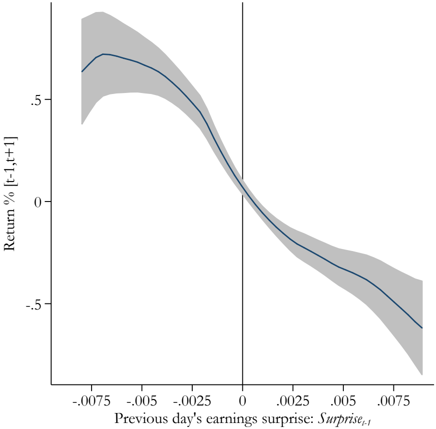
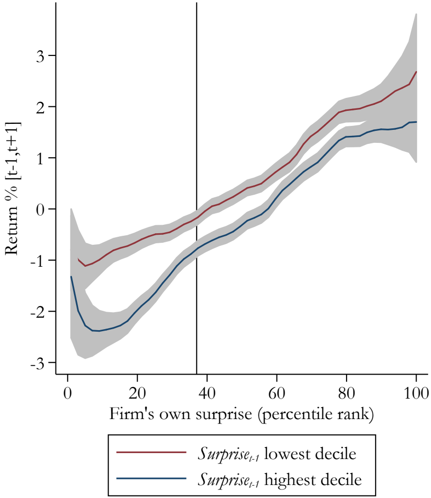
Column 6: A change in yesterday's earnings surprise from the lowest to highest decile $\Longrightarrow$ 53 bp lower return response to today's earnings announcement

Baseline graph



Returns of firms that announced earnings today vs. average earnings surprise of large firms that announced yesterday (conditional on own earnings surprise)

Reaction to own surprise, conditional on *surprise*$_{t-1}$



Potential interaction effects

	Return $[t-1, t+1]$		
	(1)	(2)	(3)
$Surprise_{t-1}$	-0.935***	-1.482***	-1.502**
	(0.256)	(0.525)	(0.677)
$Surprise_{t-1}$ x own surprise	17.79		
	(38.11)		
$Surprise_{t-1}$ x own surprise (20 bins)		0.0660	
		(0.0483)	
$Surprise_{t-1}$ x own surprise quintile 2			0.296
			(0.877)
$Surprise_{t-1}$ x own surprise quintile 3			0.811
			(0.903)
$Surprise_{t-1}$ x own surprise quintile 4			0.986
			(0.811)
$Surprise_{t-1}$ x own surprise quintile 5			0.849
			(1.023)
Year-month FE	Yes	Yes	Yes
R^2	0.0375	0.0809	0.0801
Observations	75923	75923	75923

- No significant interaction between yesterday's and today's surprise
- Simple directional effect: higher $surprise_{t-1}$ makes *any* surprise today look slightly worse than it would appear if $surprise_{t-1}$ had been lower

Longer lags and leads

Experimental studies of contrast effects suggest that individuals react more strongly to more recent observations

For earnings surprises, we expect that the $t-1$ salient surprise will matter more than:

- Lags $t-2$ and $t-3$
- Leads $t+1$ and $t+2$

We extend the return window to cover the entire period examined

Longer lags and leads

	Longer lags and leads	
	(1)	(2)
$Surprise_{t-3}$	-0.332	
	(0.215)	
$Surprise_{t-2}$	0.124	
	(0.268)	
$Surprise_{t-1}$	-0.841***	-0.875***
	(0.272)	(0.310)
$Surprise_{t+1}$		0.199
		(0.387)
$Surprise_{t+2}$		-0.101
		(0.394)
p-value: (t-3) = (t-1)	0.0931	
p-value: (t-2) = (t-1)	0.00591	
p-value: (t+1) = (t-1)		0.0260
p-value: (t+2) = (t-1)		0.118
Own $surprise_{it}$ controls	Yes	Yes
Year-month FE	Yes	Yes
R^2	0.0824	0.0727
Observations	75870	75885

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- Strong contrast effect for $t-1$

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- Weak and inconsistent effects at prior lags

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Year-month FE	Yes	Yes
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Observations	75870	75885

- Strong contrast effect for $t-1$
- Weak and inconsistent effects at prior lags
- Weak and inconsistent effects further in the future

Same day contrast effects

Most earnings announcements are made either shortly before market open (AM) or shortly after market close (PM)

- Some firms do not preschedule the exact announcement time, so we present this as supplementary analysis

Salient AM surprises should negatively impact the return response for firms that announce later in the afternoon

In theory, salient PM surprises could also negatively impact the (2-day) return response for firms that announced earlier in the AM

- But, would require investors to revise their initial perceptions of AM announcements in light of subsequent PM announcements

Same day contrast effects

	Own PM announcement	Own AM announcement
	(1)	(2)
AM surprise of others	-1.472**	
	(0.673)	
PM surprise of others		-0.417
		(0.312)
Own $surprise_{it}$ controls	Yes	Yes
Year-month FE	Yes	Yes
R^2	0.161	0.107
Observations	19346	17874

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- AM surprises distort return reactions to PM announcements

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Own $surprise_{it}$ controls	Yes	Yes
Year-month FE	Yes	Yes
R^2	0.161	0.107
Observations	19346	17874

- AM surprises distort return reactions to PM announcements
- PM surprises do not significantly affect return reactions to AM announcements

Long run reversals

Contrast effects are a bias in information processing

If prices eventually converge to fundamentals

- We expect to see the contrast effect reverse over time

	$[t-1, t+10]$	$[t-1, t+20]$	$[t-1, t+30]$	$[t-1, t+40]$	$[t-1, t+50]$
	(1)	(2)	(3)	(4)	(5)
$Surprise_{t-1}$	-0.837**	-0.831**	-0.317	-0.0945	0.493
	(0.405)	(0.409)	(0.497)	(0.561)	(0.686)
Own $surprise_{it}$ controls	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
R^2	0.0616	0.0465	0.0375	0.0373	0.0359
Observations	75736	75567	75362	74995	74149

	$[t+1, t+10]$	$[t+1, t+20]$	$[t+1, t+30]$	$[t+1, t+40]$	$[t+1, t+50]$
	(1)	(2)	(3)	(4)	(5)
$Surprise_{t-1}$	0.00969	0.0371	0.472	0.755	1.327*
	(0.340)	(0.371)	(0.482)	(0.559)	(0.677)
Own $surprise_{it}$ controls	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
R^2	0.0228	0.0215	0.0215	0.0247	0.0272
Observations	75783	75607	75397	75028	74179

Long run reversals

Contrast effects are a bias in information processing

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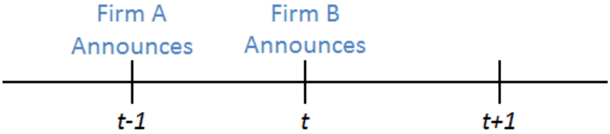
Own *surprise*$_{it}$ controls	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes
R^2	0.0228	0.0215	0.0215	0.0247	0.0272
Observations	75783	75607	75397	75028	74179

Outline

Ruling out an information transmission story



Suppose **A** announces a positive surprise on $t-1$ and **B** will announce on t

Empirically, we find **B** has a low return, conditional on its own earnings

Can information transmission explain **B**'s low return?

A's positive surprise is GOOD news for **B**?

Most finance/accounting research looks at positively correlated news transmission by "bellwether" firms

A's positive surprise increases expectations for **B**'s prospects / earnings $\Rightarrow$

- Higher returns for **B** on $t-1$
- Lower returns for **B** on t for a given level of earnings

A's surprise should not *negatively* affect **B**'s cumulative return from $t-1$ to $t+1$

Our results can't be explained by positive correlation in news, because we use **B**'s cumulative returns (starting at market close on $t-2$)

A's positive surprise is BAD news for **B?**

A's earnings surprise is not negatively correlated with **B**'s surprise

- Positively correlated news without controlling for time trends
- No correlation after accounting for slower-moving time trends with year-month FE

	$Surprise_{it}$		Open-to-open ret $[t-1]$	
	(1)	(2)	(3)	(4)
$Surprise_{t-1}$	0.157***	0.0115	0.128	0.0655
	(0.0603)	(0.0602)	(0.155)	(0.145)
Own $surprise_{it}$ controls	No	No	No	No
Year-month FE	No	Yes	No	Yes
R^2	0.00204	0.0324	0.000153	0.0253
Observations	75923	75923	61732	61732

A's positive surprise is BAD news for **B?**

A's earnings surprise is not negatively correlated with **B**'s surprise

- Positively correlated news without controlling for time trends
- No correlation after accounting for slower-moving time trends with year-month FE

Maybe **A**'s good news is bad *non-earnings* news for **B**

- If so, **B**'s price should dip on $t-1$
- Market does not respond as if information is transmitted

	$Surprise_{it}$		Open-to-open ret $[t-1]$	
	(1)	(2)	(3)	(4)
$Surprise_{t-1}$	0.157***	0.0115	0.128	0.0655
	(0.0603)	(0.0602)	(0.155)	(0.145)
Own $surprise_{it}$ controls	No	No	No	No
Year-month FE	No	Yes	No	Yes
R^2	0.00204	0.0324	0.000153	0.0253
Observations	75923	75923	61732	61732

A's positive surprise is BAD news for **B?**

We estimate close-to-zero information transmission *on average*

- Maybe there's a subsample with negatively correlated information transmission that drives the results
- If information explains our results, we should find no negative relation after limiting to subsamples in which the market reacted as if no information was released in $t-1$

	$\lvert Ret_{t-1}\rvert < 0.01$	$\lvert Ret_{t-1}\rvert < 0.005$	No neg corr info transmission $[t-1]$
	(1)	(2)	(3)
$Surprise_{t-1}$	-0.915**	-0.868**	-1.454***
	(0.362)	(0.410)	(0.335)
Return type	Open-open	Open-open	Open-open
Own $surprise_{it}$ controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
R^2	0.115	0.162	0.0900
Observations	25907	14043	31137

Delayed response?

A's $t-1$ surprise is bad news for **B**, but market does not react until t

- Rational investors should react on $t-1$ because **A**'s good news *on average* predicts negative returns for **B**
- Boundedly rational investors may wait until t when **B** is featured in the news as it announces earnings

However:

- If previous announcements convey information, we should see similar effects from earlier surprises on $t-2$ and $t-3$
- Information transmission (with or without delayed response) should not lead to a long-run reversal

Remaining (very complex) information story

1. **A**'s $t-1$ positive surprise must contain ***negative*** information for **B**
2. Information relates to **B**'s prospects other than **B**'s earnings
3. Rational investors should not wait until day t to react
4. Nevertheless, the market does react until day t, and it reacts in a biased manner, leading to a long run reversal
5. The relevant information for **B** is only in $t-1$ surprises, but not earlier surprises released on $t-2$ or $t-3$

Expectations vs. Perceptions

Expectational error: Exposure to a previous signal biases beliefs and expectations about the quality of the next signal

- Large literature on extrapolative beliefs or gambler's fallacy
- Predicts that **B**'s price should change on $t-1$

Perception error: Previous signal biases perception of the next signal – Occurs only after viewing the next signal

- Predicts a biased return reaction to **B**'s announcement only after the announcement occurs

Lack of return reaction on $t-1$ shows that contrast effects is an **error in perceptions** rather than an **error in expectations**

Strategic manipulation

Firms may manipulate the timing or magnitude of their earnings announcements (DellaVigna 2009, So 2015)

Will only bias our results if firms alter their earnings announcements as a function of $surprise_{t-1}$

Unlikely, because earnings are scheduled at least two weeks beforehand

- Would need to know what the other firm's surprise will be in order to strategically schedule
- Hard to manipulate earnings quickly as a reaction to $t-1$ surprises

Similar results restricting the sample to firms that announce on the same day as previous year

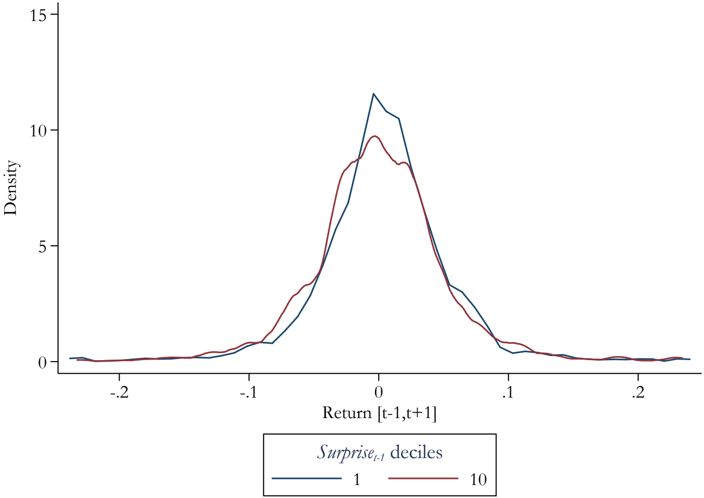
Strategic manipulation

	Return $[t-1, t+1]$	
	(1)	(2)
$\mathit{Surprise}_{t-1}$ x abs(Δ date)<=5	-0.896***	
	(0.267)	
$\mathit{Surprise}_{t-1}$ x abs(Δ date)>5	-0.723	
	(0.704)	
$\mathit{Surprise}_{t-1}$ x Δ date<-5		0.913
		(0.845)
$\mathit{Surprise}_{t-1}$ x abs(Δ date)<=5		-0.903***
		(0.267)
$\mathit{Surprise}_{t-1}$ x Δ date>5		-1.334
		(0.918)
Own $\mathit{surprise}_{it}$ controls	Yes	Yes
Year-month FE	Yes	Yes
R^2	0.0850	0.0854
Observations	70135	70135

Changes in risk or trading frictions

- We use characteristic adjusted returns to account for fixed firm-specific loadings on known risk factors
- For risk or trading frictions to explain our results, it must be that a more negative earnings surprise yesterday increases the daily loadings on risk factors, tail risk, illiquidity, or volatility of firms announcing today
    - **Don't find any evidence for these quantities changing**
- A limited capital explanation predicts low volume following high $surprise_{t-1}$ – No evidence of this in data
    - High $surprise_{t-1}$ does not predict low returns for non-announcing firms
    - Price correction occurs slowly

Distribution of returns by $surprise_{t-1}$



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Contrast effects without conditioning on today's surprise

Returns clearly respond to the firms' own earning surprise

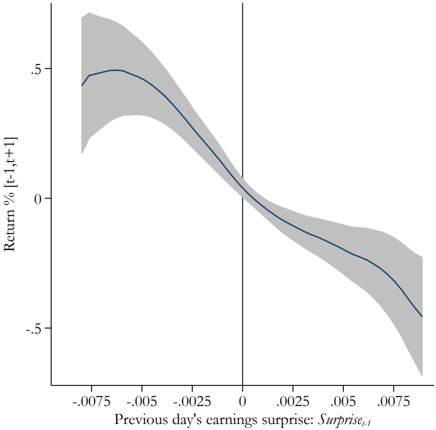
- Hence, baseline specification controls for own surprise

But, $surprise_{t-1}$ is uncorrelated with $surprise_{it}$, after controlling for slow-moving time trends

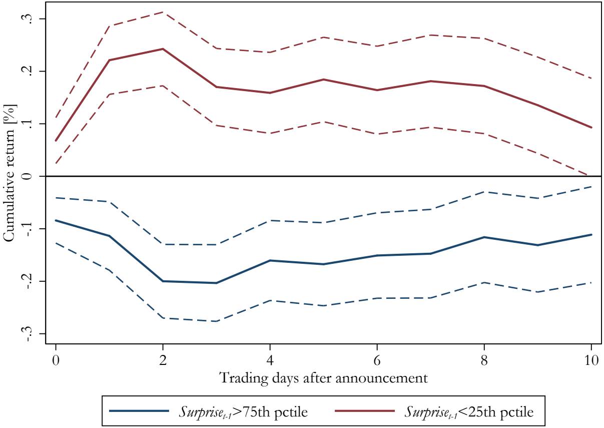
- High $surprise_{t-1}$ will lead to low returns in expectation for firms scheduled to announce the next day

- If we don't condition on the firm's own surprise, can trade based upon $t-1$ news

Unconditional relationship



Cumulative unconditional returns



Trading strategy

Long: Firms announcing earnings at t if $surprise_{t-1}$ was low

- Short the market

Short: Firms announcing earnings at t if $surprise_{t-1}$ was high

- Long the market

Strategy

- Trade only firms in top quintile of size
- Hold for announcement day t and $t+1$

Fama-French 4-factor regressions

- $ret_t = \alpha + \beta_1 MktRf + \beta_2 SMB + \beta_3 HML + \beta_4 UMD$

Trading strategy

	5 or More Stocks		Any Number of Stocks	
	(1)	(2)	(3)	(4)
Alpha [%]	0.0985**	0.216***	0.0855*	0.182***
	(0.0447)	(0.0532)	(0.0487)	(0.0556)
MktRf	-0.0233	0.00119	-0.0877**	-0.0489
	(0.0353)	(0.0392)	(0.0405)	(0.0451)
SMB	0.0868	-0.0555	0.136*	0.0729
	(0.0675)	(0.0767)	(0.0779)	(0.0871)
HML	-0.0539	-0.133*	-0.0234	-0.180**
	(0.0708)	(0.0771)	(0.0757)	(0.0825)
UMD	0.0503	0.0380	-0.0179	-0.00971
	(0.0478)	(0.0537)	(0.0538)	(0.0591)
Long Cutoff	$Surprise_{t-1}$<0	$Surprise_{t-1}$<25th Pctile	$Surprise_{t-1}$<0	$Surprise_{t-1}$<25th Pctile
Short Cutoff	$Surprise_{t-1}$>0	$Surprise_{t-1}$>75th Pctile	$Surprise_{t-1}$>0	$Surprise_{t-1}$>75th Pctile
Observations	1275	837	2150	1525
Annual Return[%]	6.48	9.47	9.62	14.9

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- Daily alphas of 9 to 21 basis points
  - Not possible to implement strategy everyday

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- Daily alphas of 9 to 21 basis points
  - Not possible to implement strategy everyday
- Trading strategy yields 7-15% abnormal returns per year

Outline

1. Empirical methodology
2. Baseline results
3. Potential alternative explanations
4. Unconditional results and trading strategy
5. Heterogeneity and robustness

Heterogeneity: Size & Analyst Coverage

	Return $[t-1, t+1]$	
	(1)	(2)
$Surprise_{t-1}$ x size quintile 1	-0.393	
	(0.485)	
$Surprise_{t-1}$ x size quintile 2	-0.398	
	(0.478)	
$Surprise_{t-1}$ x size quintile 3	-0.391	
	(0.430)	
$Surprise_{t-1}$ x size quintile 4	0.200	
	(0.324)	
$Surprise_{t-1}$ x size quintile 5	-0.997***	
	(0.265)	
$Surprise_{t-1}$ x (num analysts = 1)		0.0726
		(0.587)
$Surprise_{t-1}$ x (num analysts = 2)		-0.793*
		(0.477)
$Surprise_{t-1}$ x (num analysts >= 3)		-1.027***
		(0.279)
Own $surprise_{it}$ controls	Yes	Yes
Year-month FE	Yes	Yes
R^2	0.0842	0.0842
Observations	75923	75923

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- Effect driven by the largest quintile of firms
- Effect largest for firms covered by at least 3 analysts

Heterogeneity: By Decade

	Return $[t-1, t+1]$
	(1)
$Surprise_{t-1}$ x 1980s	-0.663
	(0.419)
$Surprise_{t-1}$ x 1990s	-0.912
	(0.743)
$Surprise_{t-1}$ x 2000s	-0.883**
	(0.344)
$Surprise_{t-1}$ x 2010s	-0.997**
	(0.487)
Own $surprise_{it}$ controls	Yes
Year-month FE	Yes
R^2	0.0839
Observations	75923

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Own $surprise_{it}$ controls	Yes
Year-month FE	Yes
R^2	0.0839
Observations	75923

- Effect stronger in more recent years

Heterogeneity: Day of Week

	Baseline sample		Year>=2000	
	(1) Mondays	(2) Other	(3) Mondays	(4) Other
$Surprise_{t-1}$	0.0759	-0.724***	-0.272	-0.767***
	(1.147)	(0.249)	(0.927)	(0.289)
p-value: Mondays = Other		0.490		0.605
Own $surprise_{it}$ controls	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes
R^2	0.186	0.0865	0.208	0.0958
Observations	7815	68108	3926	41317

Industry match

	Full sample			Small firms		Large firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Surprise_{t-1}$ same ind	-0.418**	-0.334***	-0.417**	-0.565**	-0.662***	-0.417**	-0.417**
	(0.168)	(0.122)	(0.178)	(0.226)	(0.236)	(0.173)	(0.183)
$Surprise_{t-1}$ dif ind	-0.425**	-0.0365	-0.180	-0.151	-0.0545	-0.436**	-0.189
	(0.178)	(0.117)	(0.197)	(0.224)	(0.290)	(0.183)	(0.202)
Both $surprise_{t-1}$ non-missing	No	No	Yes	No	Yes	No	Yes
Regression weights	Value	Equal	Value	Value	Value	Value	Value
p-value: same=dif	0.978	0.112	0.386	0.232	0.129	0.944	0.421
Own $surprise_{it}$ controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.0840	0.0749	0.0879	0.0974	0.104	0.0854	0.0896
Observations	75923	75923	49300	33861	20829	42062	28471

- Contrast effects for large firms can operate across industries, but only when a same industry comparison is unavailable
- Contrast effects for small firms operate primarily within industry

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Conclusion

Show that contrast effects are robust outside of the lab, in a setting with market prices set by professionals facing high stakes

May provide psychological basis for preferences such as **internal habits**

- Value gains in consumption relative to previous experience

Lack of return reaction on $t-1$ shows that contrast effects is an **error in perceptions** rather than an **error in expectations**

For identification, we picked a setting with pre-scheduled news releases

- Firms may take advantage of contrast effects to release bad news immediately after other firms release bad news