Taking the Road Less Traveled? Market Misreaction and Firm Innovation Directions

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Paper Link

Personal Website

Motivation

- Kodak invented the world's first digital camera but didn't grab enough market attention
- Then it stopped innovating in digital tech and missed the chance to lead the new market

How do investors react to new technology? Does investors' reaction impact firms' future innovation directions?

Main Takeaways

Investors under-react (over-react) to novel (non-novel) patents

- Evidence is consistent with a non-risk-based novelty *mispricing* mechanism
- Model where bounded-rational investors cannot infer novelty at issuance, due to cognitive limits

Following disappointing returns, novel firms:

- Follow up less on their novel technology
- Conduct less novel innovations relative to copycatting

Novelty Measure

Text-based (Kelly et al., 2021):

$$\underbrace{BS_i^5}_{Novelty} = \sum_{j \in \mathcal{B}_{i,5}} \rho_{i,j}$$

$\rho_{i,j}$: pairwise cosine similarity of patents (i, j)

$\mathcal{B}_{i,5}$: the set of patents filed in the five years before i's filing

We sort patents into novelty deciles for each grant month based on ex-ante cutoffs

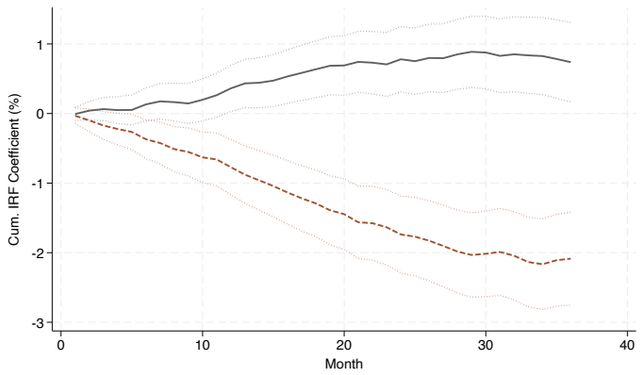
Innovation Directions

Sustaining Innovation: Number of self-citing patents filed / Total patents filed

Novelty Seeking: Novel patents filed (excl. self-citing) / Total patents filed (excl. self-citing)

How Do Investors React to New Technology?

$$r_{i,t+\tau} = \alpha_{ind,t} + \beta_{\tau,novel} 1\{i \in \text{Novel}_t\} + \beta_{\tau,non-novel} 1\{i \in \text{Non-Novel}_t\} + \gamma' X_{i,t} + \varepsilon_{i,t+\tau}$$



***Novel** patent issuance **positively** predicts future returns*

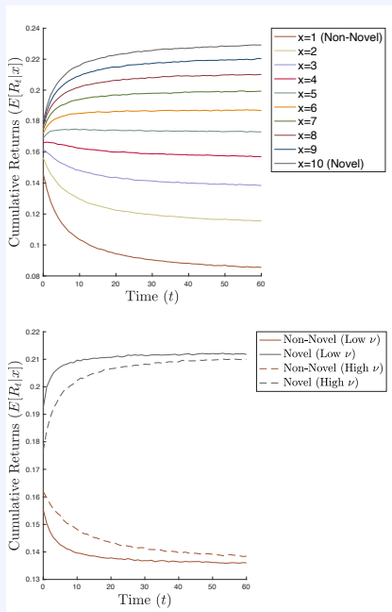
***Non-novel** patent issuance **negatively** predicts future returns*

A Model of Novelty Misreaction

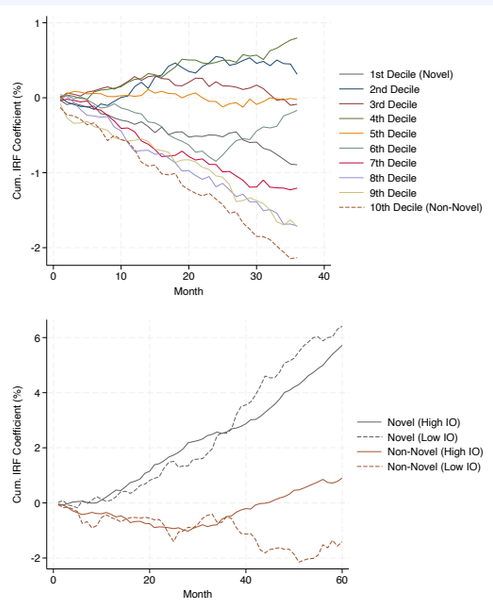
A bounded rationality model

- At patent issuance, investors are **unsure** about patent novelty due to **cognitive limits**
- Their perceived patent values **shrink to an intermediate prior**
- They receive **unbiased but noisy signals** later in each period ⇒ gradually **learn the true novelty**, and returns converge to the correct level

Theory

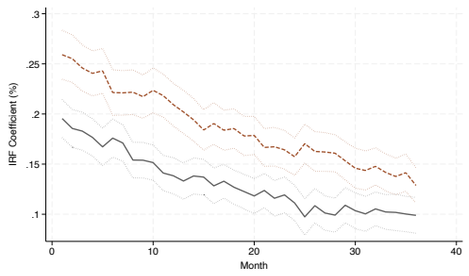


Empirical



Firms with novel patents are less risky ⇒ Not rational risk-based return predictability

Realized Volatility



Investors are too pessimistic in earnings expectations for firms with novel patents

	One-year		Two-year	
	(1)	(2)	(3)	(4)
	$(\pi_{t+1} - F_t\pi_{t+1})/P_{t-1}$		$(\pi_{t+2} - F_t\pi_{t+2})/P_{t-1}$	
Novel Patent Issuance$_{t-1}$	0.0274***	0.0205**	0.0584*	0.0452
	(2.79)	(2.51)	(1.89)	(1.68)
Non-Novel Patent Issuance$_{t-1}$	-0.0031	-0.0058	-0.0419	-0.0184
	(-0.36)	(-1.10)	(-1.29)	(-1.02)
R^2	0.000	0.002	0.000	0.006
Controls	No	Yes	No	Yes
Observations	97884	82783	80885	69007

Does Investors' Reaction Impact Firms' Future Innovation Direction?

First stage:

$$r_{i,d\to d+2,t} = \beta \,\text{Distraction}_{d\to d+2,t} + \gamma' Z_{i,t} + \alpha_i + \varepsilon_{i,d\to d+2,t}$$

Second stage:

$$\text{Future Inno}_{i,t+1\to t+\tau} = \beta \widehat{r_{i,d\to d+2,t}} + \gamma' Z_{i,t} + \alpha_i + \varepsilon_{i,d\to d+2,t}$$

Sustaining Innovation

	(1)	(2)	(3)	(4)	(5)	(6)
	$\tau = 4$	FS	$\tau = 12$	FS	$\tau = 20$	FS
$r_{i,d\to d+2,t}$	0.0995***		0.0621***		0.0663***	
	(3.89)		(3.76)		(3.11)	
Sensational News$_{d\to d+2,t}$		-0.0190***		-0.0239***		-0.0183***
		(-5.89)		(-7.24)		(-5.31)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample Period	1975-2021	1975-2021	1975-2019	1975-2019	1975-2017	1975-2017
Effective F-stats		35		52		28
Observations	382448	382448	376881	376881	360341	360341

*Firms **follow up less** on their own innovations, **following lower returns***

Novelty Seeking

	(1)	(2)	(3)	(4)	(5)	(6)
	$\tau = 4$	FS	$\tau = 12$	FS	$\tau = 20$	FS
$r_{i,d\to d+2,t}$	0.1138***		0.0932***		0.1113***	
	(2.68)		(3.12)		(2.93)	
Sensational News$_{d\to d+2,t}$		-0.0187***		-0.0238***		-0.0182***
		(-5.80)		(-7.20)		(-5.29)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample Period	1975-2021	1975-2021	1975-2019	1975-2019	1975-2017	1975-2017
Effective F-stats		34		52		28
Observations	381169	381169	376231	376231	359897	359897

	High-novelty			Low-novelty		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\tau = 4$	$\tau = 12$	$\tau = 20$	$\tau = 4$	$\tau = 12$	$\tau = 20$
$r_{i,d\to d+2,t}$	0.0681*	0.0776***	0.1007***	0.0612	0.0295	0.0255
	(1.80)	(2.63)	(2.85)	(0.76)	(0.63)	(0.39)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample Period	1975-2021	1975-2019	1975-2017	1975-2021	1975-2019	1975-2017
Observations	219186	216881	207778	161594	158970	151727

Novel** firms conduct **fewer novel** innovations relative to non-novel ones, **following lower returns

Implications

Financial market misreaction pushes innovations into suboptimal directions

- Novel techs have higher economic and social values
- Firms exploit techs with low remaining value but give up higher-value novel innovations

For more discussions, please also join us at the regular session, *Belief Formation and Economic Implications*, at 10:15am-12:15pm, Sat Jan 4, Marriott Marquis Yerba Buena Salon 8

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