

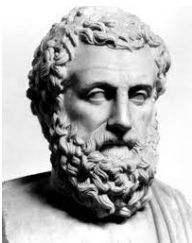
The Role of Social Networks in Financial Markets

Lin, PENG

Baruch College, City University of New York

IAQF Thalesians Seminar Series, June 2023

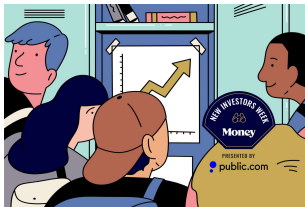




“Humans are, by nature, social animals”
– Aristotle

Shiller (1989, p. 7)

"[I]nvesting ... is a social activity. Investors spend a substantial part of their leisure time discussing investments, reading about investments, or gossiping about others' successes or failures in investing."



(Source: Sam Island)

Motivation

- Traditional rational and behavioral models of financial markets instead assume:
 - People form beliefs, make decisions asocially
 - Except for learning by observing prices or trading quantities
- Growing evidence that social interactions affect:
 - Investment decisions of retail and professional investors
 - Duflo & Saez (2002, 2003), Hong, Kubik & Stein (2004, 2005), Brown et al. (2008), Cohen, Frazini & Malloy (2008), Kaustia & Knüpfer (2012), Pool, Stoffman & Yonker (2015), Heimer (2016), Ahern (2017), Hong & Xu (2019), Cookson and Niessner (2020), Ouimet & Tate (2020), Huang, Hwang & Lou (2021), Cookson, Engelberg & Mullins (2022)
 - Sell-side analyst performance, entrepreneurial and managerial decisions
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A Basic Question

- How does social learning affect people's decisions?
 - Disseminates valuable information \Rightarrow Improves decisions
 - E.g., Ellison & Fudenberg (1995), Colla & Mele (2010)
 - Propagates incorrect beliefs or naive trading strategies; information cascades, informational free-riding, transmission bias
 - Bikhchandani, Hirshleifer & Welch (1992), DeMarzo, Vayanos & Zwiebel (2003), Han & Yang (2013), Jackson et al. (2021), Han, Hirshleifer & Walden (2022)
 - See Bikhchandani/Hirshleifer/Tamuz/Welch (2022, JEL) for a review
- The effect of social networks remains an open question and is likely context-specific

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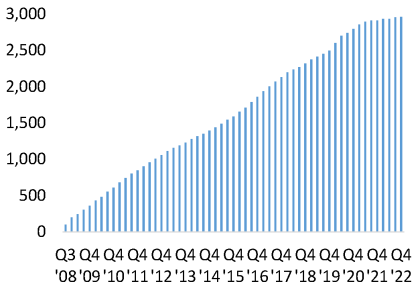
A New Paradigm

- Hirshleifer (2020) AFA presidential address
 - A missing chapter in our understanding of finance
 - The social processes that shape economic thinking, behavior
- A new intellectual paradigm: *Social Economics and Finance*

Social Networks Are Even More Crucial Today

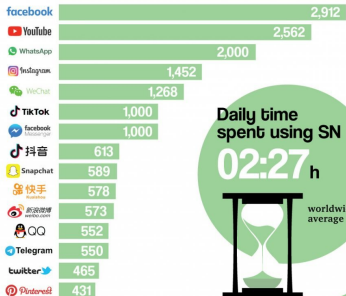
- Online social networks substantially more impactful in idea transmissions
 - 2.9 billion monthly active Facebook users, 36% world population (Jan. 2022)
 - Pew 2021 Survey
 - 69% US population uses FB, 73% visit daily
 - Users span a wide range of demographic groups

Facebook active users worldwide (Millions)



(Sources: statista and statisticsanddata)

Most popular social networks (in millions)



Social Networks Are Even More Crucial Today

- Social networks have a snowball effect on information transmission
- Information spreads to broad audiences at virtually zero marginal cost
- When overloaded with information, individuals more susceptible to peer influences
- The proliferation of online social media and social networking service companies raises the important question:

How do social networks influence social, political, and economic outcomes?

Social Networks in Financial Markets

- Large-scale, representative, real-world social network data
- Social networks transmit valuable information and improve efficiency
 - Affect institutional investors portfolio allocation, firm valuation and liquidity
 - Kuchler, Li, Stroebe, Peng and Zhou (2022 RFS)
 - Increase price responsiveness to public news
 - Hirshleifer, Peng, and Wang (2019)
 - Information flow between firms, comovements in fundamentals and returns
 - Peng, Titman, Yonac, Zhou (2022)
 - More efficient online lending for both borrowers and lenders
 - Allen, Peng, and Shan (2021)
 - More efficient crowdfunding of creative projects
 - Peng and Zhang (2021)

Social Networks in Financial Markets, cont'd

- Social networks generate or amplify inefficiencies
 - Trigger excessive trading upon news and investor losses
 - Hirshleifer, Peng, and Wang (2021)
 - Amplify investors' attraction to lottery ("meme") stocks
 - Bali, Hirshleifer, Peng and Tang (2021)

Social Ties, Comovements, and Predictable Returns

Lin Peng, Sheridan Titman,
Muhammed Yönaç, Dexin Zhou

Motivation

- A growing body of literature highlights the interconnected nature of firms in the economy
 - Production networks propagate economic shocks
 - e.g., Acemoglu et al. (2012), McNerney et al. (2022)
- We study cross-firm linkages associated with social ties between locations
 - Recent research shows that social connections are associated with important economic exchanges between regions
 - Trade flows, migration patterns, knowledge spillovers
 - Breschi & Lenzi (2016), Cohen et al. (2017), Bailey et al. (2018, 2021)

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This Paper

- Open questions
 - (How) Do social connections influence firm fundamentals?
 - Do market participants understand these connections and their relevance?
- We examine the social tie-based cross-firm linkages and explore the comovement of firm fundamentals and stock returns

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Conceptual framework

- Strong social ties between HQ locations facilitate the flow of ideas
- Connected firms adopt similar strategies and technologies, etc.
- Fundamentals (and returns) of socially connected firms comove more strongly
- If investors neglect such linkages, asset prices fail to timely reflect relevant information for some firms
- Lead-lag return relationships

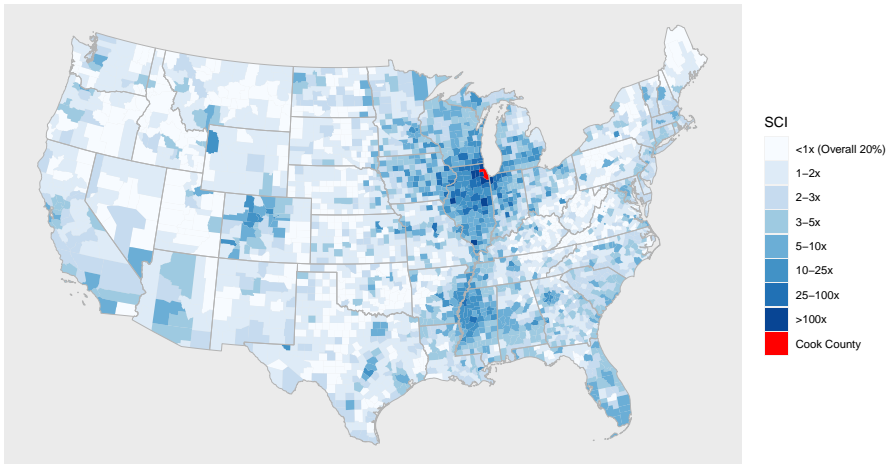
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Measuring Social Ties

- **Social Connectedness Index** (SCI, Bailey et al. 2018)
 - # of friendship links scaled by product of population sizes
 - Captures friendship probability
 - Representative of real-world social network in U.S.
 - The world's largest online social networking service (Facebook)
 - 243 million active users in the U.S. (as of 2018)
 - 2/3 adults use it, 70% visit daily
 - Bailey et al. (2019a,b,c,2021), Rehbein et al. (2020), Kuchler et al. (2022)
- Alternative measure: **geographic proximity**

SCI Map: Social Ties to Cook County, IL



Next:

- Do social connectedness between firms lead to more strategic similarities?
 - 10-K based strategy similarity
 - Technological similarity (Lee et al. 2019)
 - Product market similarity (Hoberg, Phillips 2010)

Social Connectedness and Strategy Similarities

	<i>STRATSIM</i>	<i>STRATSIM^{TECH}</i>	<i>STRATSIM^{PROD}</i>
	(1)	(2)	(3)
SCI	0.046*** (6.368)	0.047*** (2.844)	0.049*** (12.466)
Year FE	Yes	Yes	Yes
County FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	10,415,430	1,505,475	11,052,778
R^2	0.092	0.059	0.147

- Empirical specification: $\text{Similarity}_{i,j,t} = \beta \text{SCI}_{i,j,t} + \epsilon_{i,j,t}$
- Social connectedness is positively associated with strategy similarity and technological similarity.
- Results are robust after controlling for same county indicator.

Next:

- Do focal firms comove more strongly with socially connected firms?
 - Fundamental
 - Returns

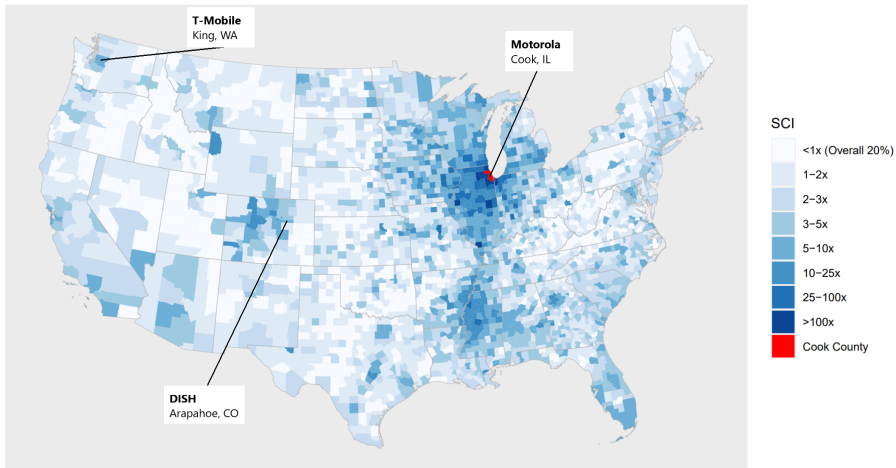
SCI-Weighted Industry Portfolios

- We construct specially tailored SCI-weighted industry portfolios for each firm
- SCI-weighted fundamentals of industry peers

$$\text{Fundamental}_{\text{Social Peer},i,t} = \frac{\sum_j \text{SCI}_{ij} \times \text{Fundamental}_{j,t}}{\sum_j \text{SCI}_{ij}}$$

- More weight on industry peers sharing strong social ties in headquarters locations
- Excluding same-state peers to differentiate from geographic proximity
- Benchmark: equal- (value-) weighted industry portfolio
- SCI-weighted returns of industry peers
 - SPFRET: past one-month return
 - SPFMOM: past one-year return [t-11:t-1]

SCI-Weighted Industry Portfolios for Cook County Firms



Comovement of Social Peer Firms

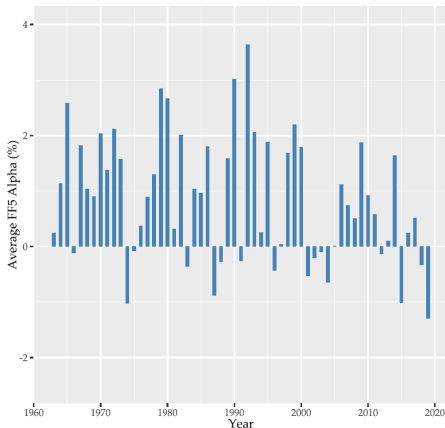
	Δ EPS	Δ Sales	Δ Employees	NewCapital	Returns
	(1)	(2)	(3)	(4)	(5)
SCI-Weighted	3.463*** (7.260)	26.496*** (7.096)	13.526*** (10.528)	36.495*** (8.409)	7.718*** (23.620)
Equal-Weighted	-1.283** (-2.517)	5.108** (2.387)	-0.183 (-0.179)	-1.371 (-0.469)	0.226 (1.284)
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	115,035	124,232	121,090	121,124	1,711,696
R^2	0.018	0.052	0.047	0.041	0.147

- Significant comovement between social peers and focal firms
- Lowest-to-highest (0-to-1) \uparrow social peers' fundamentals (returns)
 - \uparrow Δ EPS by 346 bps (283% of the mean)
 - \uparrow Δ Sales by 26.5 ppt
 - \uparrow Δ Employees by 13.5 ppt
 - \uparrow NewCapital by 36.5 ppt
 - \uparrow Returns by 7.7% per month

Next:

- Do prices fully reflect social-tie information?
- We exam long-short portfolios based on *SPFRET*
 - Long position in firms with high SPFRET
 - Short position in firms with low SPFRET
- If prices fully and timely incorporate such information
 - The L/S portfolios would not generate abnormal profits
- If investors fail to fully incorporate these linkages
 - The L/S portfolios could generate significant alphas

Monthly Alpha of L/S Portfolios Based on SPFRET (vw)

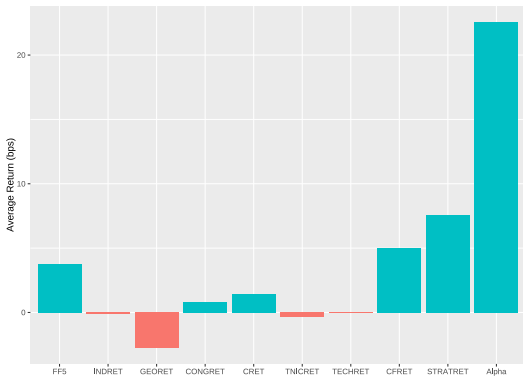


- Average 1-month-ahead alpha: 84 bps (vw), 157 (ew)
- Positive and significant L/S alpha for most years

SPFRET and Other Predictive Variables

- Other return predictors
 - Industry momentum
 - Additional cross-firm predictors: geographic momentum of stocks from same economic area, customer return, pseudo-conglomerate return, technology-linked peer return, analyst-linked peer return
 - Firm Characteristics: Short-term reversal, beta, BM, size, momentum, illiquidity, IVOL, max, skewness, coskewness
- Next: can other predictive variables explain our results?
 - Time series spanning tests
 - Cross-sectional Fama-MacBeth regressions
 - Machine-learning (PLS)-based tests

Time Series Spanning Tests: Explaining the L/S Alpha



- Decomposing SPFRET-based alpha:
 - Existing factors: 21% (shared analyst coverage is the strongest)
 - Strategy similarity: 20%
 - Substantial alpha remains, at 23 bps per month

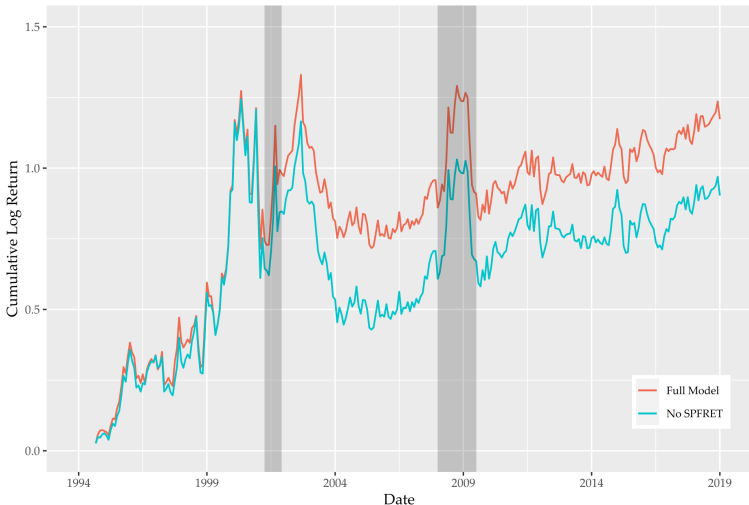
Cross-sectional FM Regressions: SPFRET and Returns

	RET _{t+1}								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SPFRET	1.276*** (5.222)	0.710*** (3.808)	0.703*** (3.737)	0.697*** (3.710)	0.686*** (3.732)	0.601*** (3.637)	0.602*** (3.794)	0.387*** (2.689)	0.431*** (2.900)
INDRET		0.829*** (3.873)	0.830*** (3.914)	0.834*** (3.884)	0.827*** (3.837)	0.692*** (3.530)	0.695*** (3.555)	0.514*** (2.807)	0.535*** (2.932)
GEORET			0.304*** (2.706)	0.305*** (2.710)	0.297*** (2.657)	0.268** (2.477)	0.271** (2.574)	0.230* (2.215)	0.229** (2.212)
CONGRET				-0.028 (-0.232)	-0.037 (-0.312)	-0.083 (-0.682)	-0.076 (-0.598)	-0.199 (-1.526)	-0.182 (-1.383)
CRET					0.433*** (3.327)	0.385*** (3.075)	0.398*** (3.250)	0.314*** (2.633)	0.312*** (2.641)
TNICRET						0.687*** (3.801)	0.692*** (3.878)	0.474*** (3.328)	0.473*** (3.311)
TECHRET							-0.077 (-0.437)	-0.229 (-1.297)	-0.218 (-1.219)
CFRET								1.187*** (6.002)	1.200*** (6.094)
STRATRET									-0.187 (-1.623)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Periods	305	305	305	305	305	305	305	305	305
# Stocks	3,689	3,689	3,689	3,689	3,689	3,689	3,689	3,689	3,689
R ²	0.059	0.061	0.062	0.062	0.063	0.064	0.065	0.067	0.068

- Lowest-to-highest \uparrow SPFRET \rightarrow 43 bps RET_{t+1} \uparrow

Contribution to a Composite PLS-Based Predictor

Panel A: Cumulative Log Returns of PLS-Based Long-Short Portfolios



- SPFRET significantly improves strategy performance, by 86% over 25 years
- Among the most important cross-firm contributors to the composite predictor

Next:

- So far: *SPFRET* is a robust predictor and cannot be subsumed by lead-lag effects in prior literature
- This predictability may be driven by two types of biases
 - **Underreaction**: *SPFRET* captures fundamental information related to focal firms, but market participants fail to incorporate them in prices
 - **Overreaction**: investors may overreact to information in social peer firms in the following months

Predictability Heterogeneity

	Size	Inst. Own.	Analyst Cov.		Ind. Cluster
Low	1.811*** (6.815)	1.397*** (3.727)	1.218*** (3.827)	Out	1.263*** (6.150)
High	0.571*** (3.773)	0.760*** (2.649)	0.670*** (2.836)	In	0.646*** (4.011)

- Predictability stronger for
 - less visible (below median) stocks
 - off-industry center firms.
- Consistent with investor inattention and slow information diffusion

Long-Run Return Predictability

	Month 1	Months 2-3	Months 4-6	Months 7-12	Months 13-24
SPFRET (EW)	1.568*** (7.052)	0.236 (1.238)	0.262* (1.674)	0.279*** (2.597)	0.110 (1.636)
SPFRET (VW)	0.840*** (5.203)	-0.069 (-0.351)	0.045 (0.299)	0.213** (2.161)	0.076 (1.280)
SPFMOM (EW)	0.694*** (2.907)	0.611*** (2.866)	0.550*** (2.760)	0.300* (1.921)	0.117 (0.743)
SPFMOM (VW)	0.299 (1.353)	0.405** (2.069)	0.382** (2.272)	0.225* (1.810)	0.052 (0.426)

- Predictability lasts for up-to-one year with no reversal
- Prices under-react to information of socially-connected industry peers

Next:

- Social peer returns and firms' future fundamentals
 - Do social peer returns predict future earnings growth?
 - Do analysts incorporate such information into their forecasts?
 - Can social peer returns predict earning announcement returns?

Predicting Future Earnings Growth

	Q1 (1)	Q2 (2)	Q3 (3)	Q4 (4)
SPFMOM	34.067*** (21.318)	25.649*** (16.372)	18.217*** (11.822)	11.812*** (7.753)
SPFRET	10.925*** (9.823)	12.916*** (11.968)	11.340*** (9.986)	9.178*** (8.031)
Month FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	1,457,322	1,462,274	1,467,432	1,472,775
R^2	0.174	0.175	0.175	0.174

- SPFMOM and SPFRET strongly predict earnings growth for up to a year
- Social peer firm returns contain information about firm's future fundamentals

Analyst Forecast Errors

	Q1 (1)	Q2 (2)	Q3 (3)	Q4 (4)
SPFMOM	14.655*** (7.151)	14.286*** (6.212)	14.327*** (6.076)	11.194*** (5.109)
SPFRET	4.830*** (3.412)	3.588** (2.296)	5.874*** (3.486)	5.741*** (3.504)
Month FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	817,742	737,599	673,727	621,535
R^2	0.132	0.151	0.161	0.169

- SPFMOM and SPFRET strongly predicts the FE up to four quarters ahead
- Professional analysts underreacted to the the information in social peer firm returns in forming forecasts

Stock Returns Around Future Earnings Announcements

	Q1 (1)	Q2 (2)	Q3 (3)	Q4 (4)
SPFMOM	0.141*** (2.819)	0.096* (1.850)	-0.003 (-0.053)	-0.018 (-0.338)
SPFRET	0.140*** (3.315)	0.013 (0.325)	0.046 (1.077)	-0.0004 (-0.009)
Month FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	1,490,579	1,463,703	1,438,009	1,412,416
R^2	0.052	0.056	0.059	0.058

- SPFMOM and SPFRET strongly predicts CAR around future earnings announcements
- Markets fail to fully incorporating this information; surprised at future earnings announcements

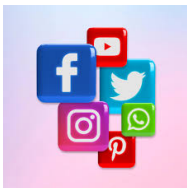
Robustness Checks

- 2000/01–2019/11 sample: L/S alpha is robust at 75 bps
- Alternative specifications
 - Measuring social-ties with geographic distance
 - Panel regression analysis
 - Alternative standardization of explanatory variables
 - Measuring locations at the zip code level
- Further controlling for industry effects
 - Bivariate portfolio sort
 - Residual SPFRET
 - TNIC-based industry classifications
 - Value-weighted industry portfolios
- Accounting for other possible explanations
 - Beyond headquarters locations: firms' economic presence
 - Homophily: socioeconomic similarity between locations

Conclusion

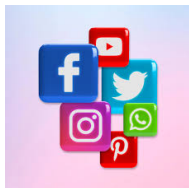
- Social connections between firms foster strategic similarities
 - Firms in the same industry that are located in socially connected places exhibit strong co-movement in fundamentals and stock returns
- Information about a firm's social peers is not immediately reflected in its stock prices
 - Strong lead-lag effects in returns of connected firms
 - Known economic channels can only partially explain this
- Social-peer firm returns predict focal firms' earnings growth, analyst forecast errors and earnings announcement returns
- The sphere of a city's influence may go beyond its borders
 - Social networks may contribute to the propagation of ideas and shocks across the economy.

Future Work: **Many Open Questions**



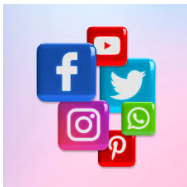
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 - public news (e.g., financial, Covid, climate change)
 - private information
 - fake news, AI-generated contents
- Effects on economic outcomes
 - decisions of retail and professional investors
 - firm decisions: corporate strategies, innovations, etc.
 - viral bank runs
 - inequality, social mobility
- Implications on policies and platform design choices
 - harness the power of social networks while mitigating their potential risks

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Thank You!



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