Commonality in analyst coverage and information diffusion

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Overview

Inter-firm linkages often guide economic interactions among firms.
Acemoglu et al. (2012); Ahern (2013); Ahern and Harford (2014)

This paper explores information-based linkages based on analyst coverage.

Analysts produce information that is relevant across firms.*
Degeorge et al. (2013); Muslu et al. (2014); Gomes et al. (2016)

Perhaps, analysts can facilitate information transfers in an inter-firm network.

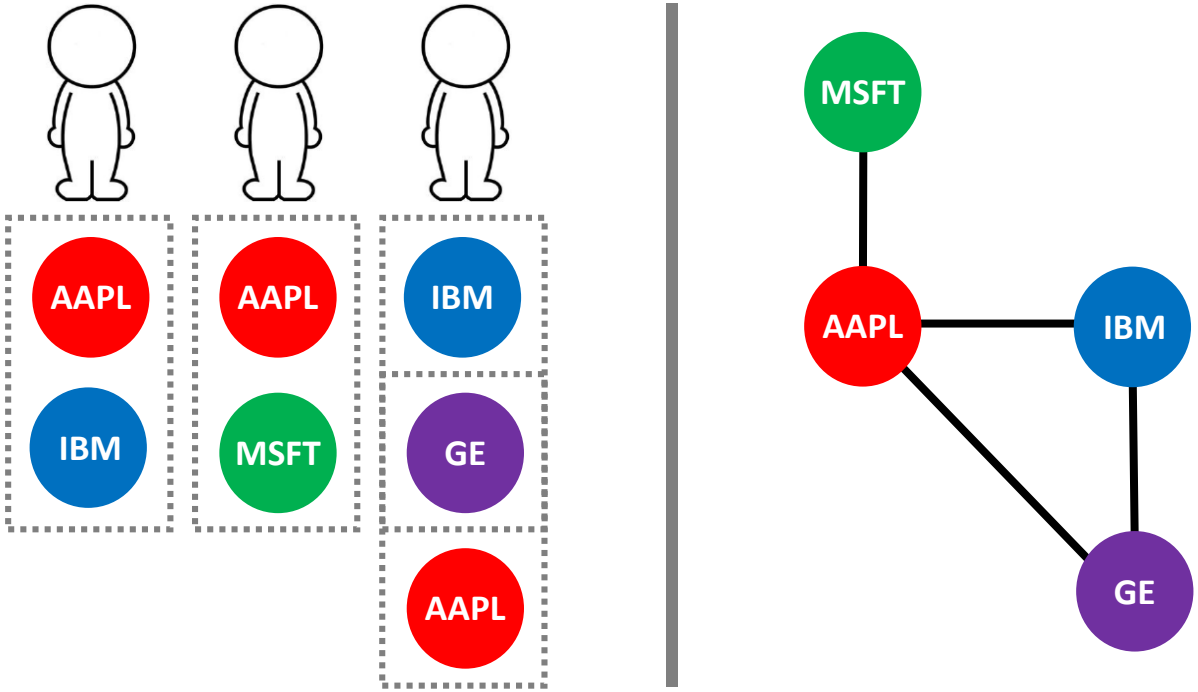
Using the friendship paradox, I show that firms' returns are led by their neighbors'.

Network structure of market can generate information diffusion.

*** Veldkamp, 2006; Degeorge et al., 2013; Muslu et al., 2014; Gomes et al., 2016**

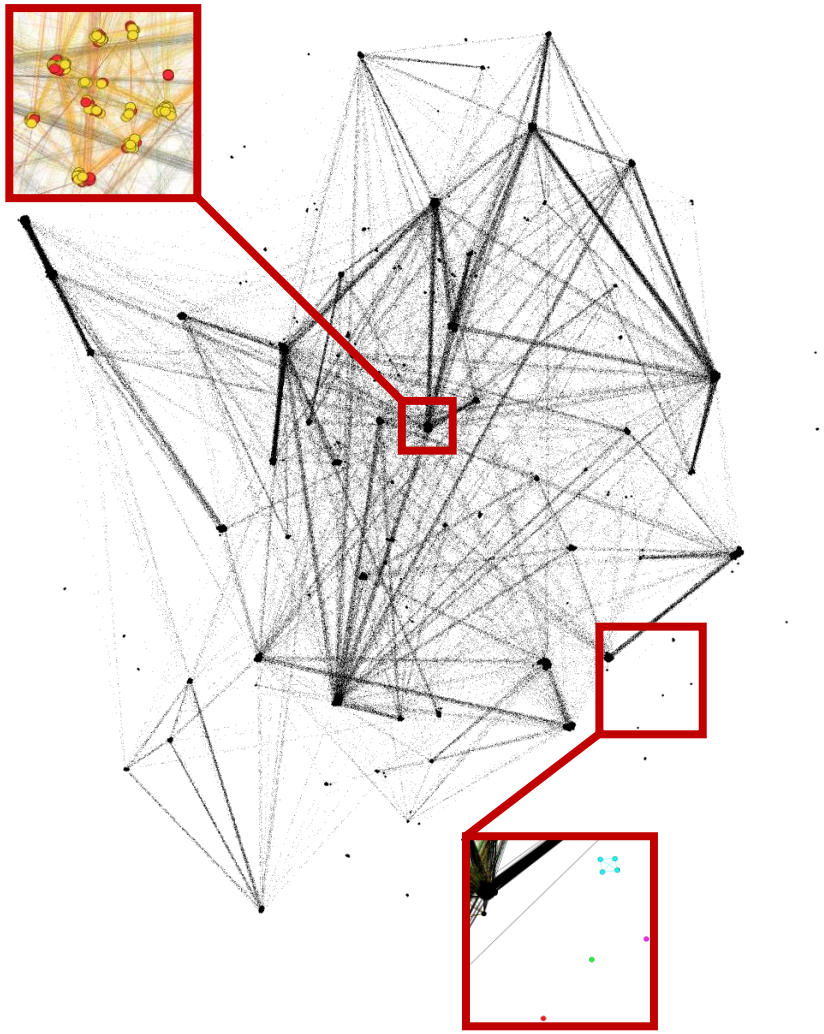
Network construction

Take a snapshot of network at the end of every calendar year:



Two stocks are linked if they are covered jointly by at least 1 analyst.

Network construction (cont'd)

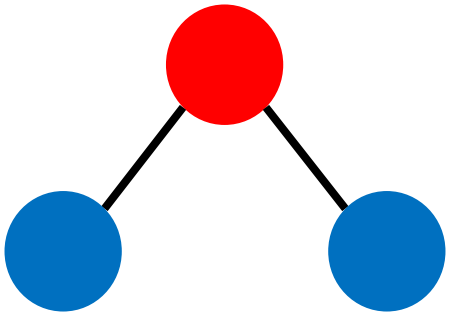


Average network statistics

Number of firms	4,302
Largest component	4,280
Avg. shortest path	3
Diameter	8
Transitivity	39.3%
Avg. degree	69

Information production

There are strategic complementarities in information production for a stock and its neighbors.



Information produced for: neighbors ↑ stock ↑

What can we say about the equilibrium information production for a stock in a network?

A stylized model*

For stock i, neighbor j in a network, preference θ, quadratic cost c, and strategic multiplier a, an analyst produces information x_i and derives utility of:

$$\theta_i x_i + a \cdot x_i \sum_{j \in N_i} x_j - \frac{c x_i^2}{2}$$

*** following theoretical framework of Jackson (2016)**

Imbalances in information production

Information production for a stock increases with its degree.

Avg. firm degree

$$\frac{1 + 2 + 1}{3} = 1.33$$

Avg. neighbor degree

$$\frac{2 + (1 + 1) + 2}{4} = 1.50$$

Friendship paradox (Feld, 1999): $\tilde{\mathbf{E}}[d] = \mathbf{E}[d] + \frac{\mathbf{Var}[d]}{\mathbf{E}[d]}$

Neighbor degree > Firm degree

Systematic imbalance in information production between firms and neighbors.

Main hypothesis

If we randomly select firms, and randomly select their neighbors:

Neighbor returns should lead firm returns, on average.

Data

I/B/E/S, Compustat, CRSP
analyst forecast data*, financial variables, stock returns

Python library – Networkx, Gephi
network analysis and visualization

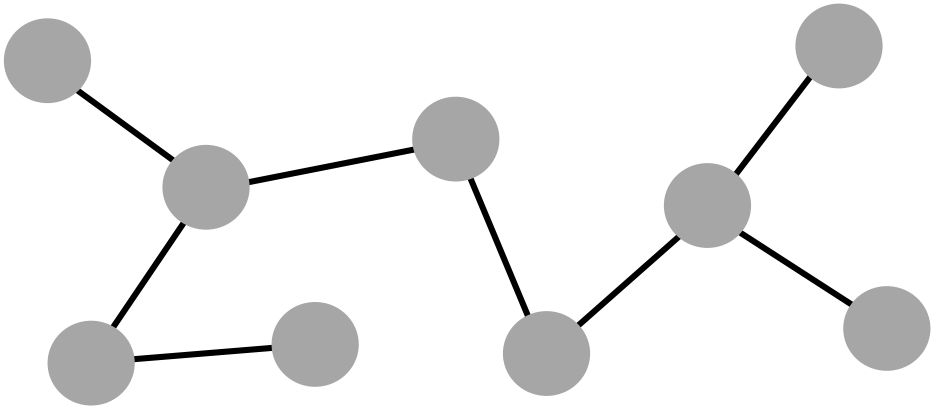
Filters
stock price > $5

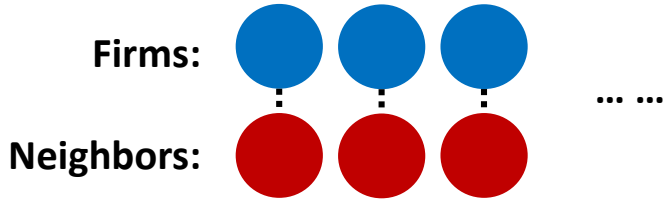
- **20 snapshots of network over 1995 to 2015**
- **4301 firms annually on average**
- **average stock degree is 69**
- **neighbors' degrees are 26.6% higher than firms'**

*** 3rd October 2016 vintage**

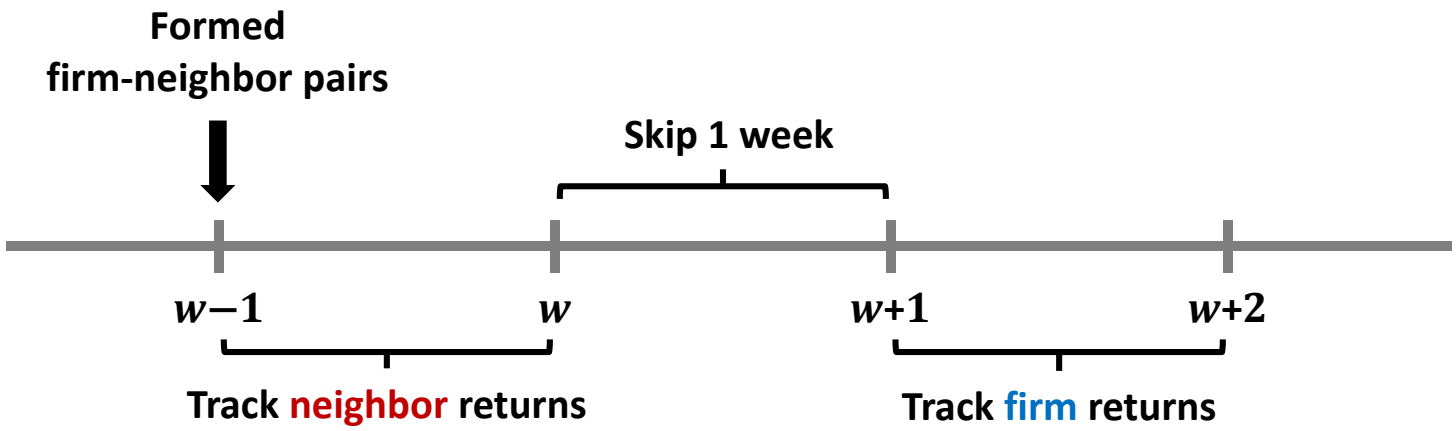
Portfolio strategy

Given known network at beginning of week w:





Portfolio strategy (cont'd)



Key findings

Long-short strategy yields 94 b.p. per week

- **robust to standard risk adjustments**

Small neighbors' returns can lead firms' returns

- **not rehash of classical big-leads-small effect**

Not completely driven by industry effects

- **compatible but distinct from industry momentum**

Stronger when imbalances are more acute

- **consistent with theoretical mechanism**

Short-lived and does not exhibit reversals

- **diffusion of fundamentally-important information**

Single-sorts

Baseline: single-sort on neighbors' returns

Neighbor returns	Weekly returns	Degree ratio	Number of firms	Firm size ($'mil)	Firm B/M	(t-4, t-1) returns
Low	0.205	1.209	587	4520.1	1.777	0.854
N2	0.262	1.291	588	4846.6	1.933	0.967
N3	0.276	1.309	588	4936.5	1.902	0.999
N4	0.283	1.304	588	4898.8	1.875	1.025
High	0.299	1.225	589	4592.2	1.770	1.060
High minus Low	0.094***					
Fisher χ^2 (x 10^3)	6.234					

Placebo: single-sort on pseudo-neighbors' returns

Neighbor returns	Weekly returns	Degree ratio	Number of firms	Firm size ($'mil)	Firm B/M	(t-4, t-1) returns
Low	0.266	0.847	584	4751.5	1.835	0.985
N2	0.266	0.965	585	4750.8	1.836	0.983
N3	0.265	0.996	585	4749.3	1.835	0.984
N4	0.265	0.986	585	4750.0	1.834	0.984
High	0.265	0.873	585	4751.0	1.836	0.985
High minus Low	-0.001					
Fisher χ^2 (x 10^3)	0.958					

Portfolio alphas

Portfolio alphas

	3-factor		4-factor		6-factor	
Portfolio	Alpha (%)	R^2	Alpha (%)	R^2	Alpha (%)	R^2
Low neighbor returns	-0.037	0.941	-0.005	0.953	0.009	0.951
	(1.640)		(0.350)		(0.482)	
N2	0.026	0.963	0.049***	0.970	0.044***	0.970
	(1.647)		(3.398)		(3.041)	
N3	0.045***	0.965	0.065***	0.972	0.055***	0.971
	(3.038)		(4.797)		(4.119)	
N4	0.053***	0.966	0.073***	0.972	0.065***	0.971
	(3.578)		(5.300)		(4.758)	
High neighbor returns	0.068***	0.953	0.092***	0.960	0.100***	0.959
	(3.622)		(5.205)		(5.647)	
High minus Low	0.106***		0.097***		0.090***	
	(3.548)		(3.262)		(3.005)	
GRS test statistic	5.594		9.730		9.206	

Information leadership of small neighbors

Double-sort on neighbor returns and neighbor sizes

	Neighbor size quintiles				
	Small	S2	S3	S4	Big
Neighbor returns	Mean returns				
Low	0.222	0.208	0.200	0.191	0.206
N2	0.259	0.255	0.259	0.264	0.263
N3	0.281	0.274	0.274	0.277	0.277
N4	0.286	0.277	0.281	0.286	0.288
High	0.295	0.312	0.304	0.299	0.276
High minus Low	0.073***	0.105***	0.105***	0.108***	0.070***
Fisher χ^2 (x 10^3)	4.192	5.992	4.728	4.071	1.877

Even small neighbors can have information leadership.*

***e.g. Cohen and Lou (2012) and Scherbina and Schlusche (2015a; 2015b)**

Control for industry effects

Method 1

- Constrain algorithm to pick neighbors NOT IN firms' industries
- Global sort

Method 2

- Constrain algorithm to pick neighbors IN firms' industries.
- Sort within industries
- Average L-S returns across industries

Method 3

- Constrain algorithm to pick neighbors IN firms' industries.
- Global sort
- Industry-adjusted returns

Control for industry effects (cont'd)

Single-sort with controls for industry effects

	2-digit SIC industries			FF-49 industries		
Method	(1)	(2)	(3)	(1)	(2)	(3)
Neighbor returns	Mean returns					
Low	0.225	0.230	-0.195	0.225	0.233	-0.191
N2	0.264	0.259	-0.130	0.265	0.258	-0.129
N3	0.274	0.269	-0.117	0.273	0.267	-0.119
N4	0.279	0.277	-0.115	0.283	0.277	-0.115
High	0.285	0.287	-0.104	0.287	0.291	-0.100
High minus Low	0.060***	0.057***	0.091***	0.062***	0.058***	0.092***
Fisher χ^2 (x 10^3)	0.782	1.233	2.128	0.841	1.134	1.901

Industry effects account up to 40% of baseline strategy profitability.

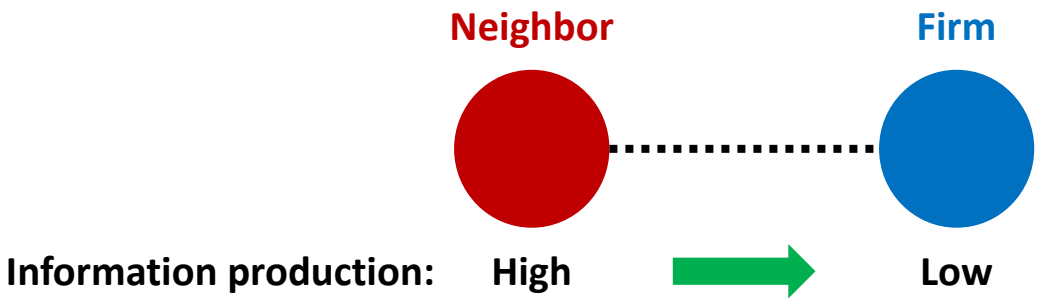
Vector autoregressions

Vector autoregressions of weekly returns (1 lag)

Firm size quintile	Dep. var	Firm returns $_{t-1}$	Neighbor returns $_{t-1}$	Granger causality χ^2 (x 10^3)	Cross-equation χ^2 (x 10^3)
Small	Firm returns $_t$	-0.104***	0.179***	3.63***	3.34***
	Neighbor returns $_t$	-0.130***	0.086***	1.77***	
Q2	Firm returns $_t$	-0.263***	0.278***	3.10***	3.90***
	Neighbor returns $_t$	-0.247***	0.227***	3.19***	
Q3	Firm returns $_t$	-0.176***	0.153***	1.11***	1.64***
	Neighbor returns $_t$	-0.107	0.081	0.91	
Q4	Firm returns $_t$	0.047	-0.102	0.89	0.52
	Neighbor returns $_t$	0.100	-0.138***	0.91	
Big	Firm returns $_t$	0.173***	-0.239***	2.62***	0.08
	Neighbor returns $_t$	0.243***	-0.267***	2.29***	

Information leadership is stronger among smaller firms.

Mechanism



Effect should be stronger when imbalances are more acute.

$$\text{Revision rate ratio}_{i,j,y} = \frac{\text{\# revisions per analyst}_{j,y-1}}{\text{\# revisions per analyst}_{i,y-1}}$$

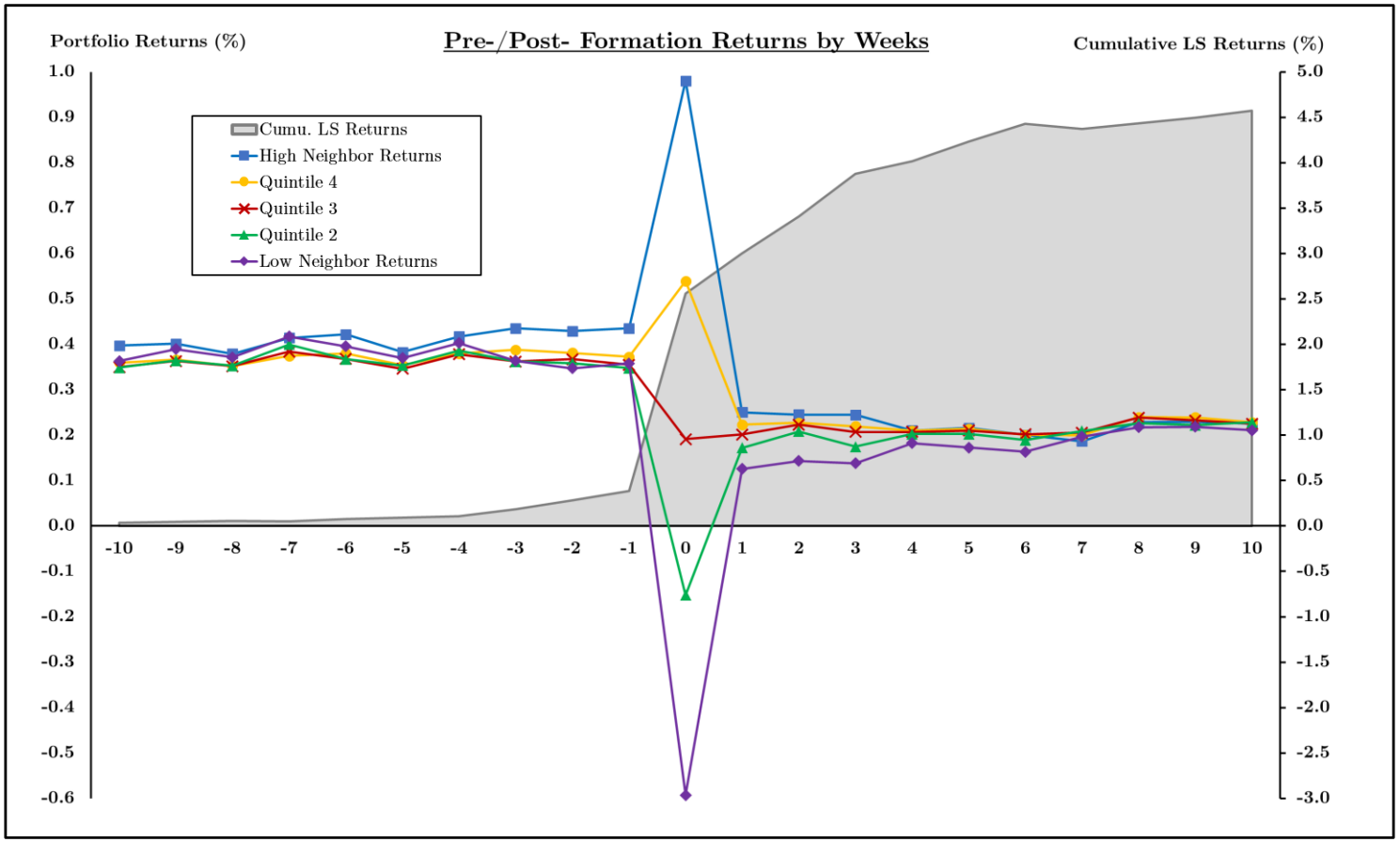
Mechanism (cont'd)

Triple sorts on firm size, revision rate ratio, and neighbor returns

		Firm size					
		Small		Medium		Big	
	Revision rate ratio	Low	High	Low	High	Low	High
		Mean returns					
Neighbor returns	Low	0.230	0.214	0.247	0.214	0.244	0.215
	Medium	0.284	0.284	0.288	0.268	0.268	0.250
	High	0.320	0.321	0.309	0.288	0.261	0.247
	High – Low	0.090***	0.107***	0.062***	0.074***	0.017	0.033***
	Fisher χ^2 (x 10^3)	0.921	1.460	0.557	0.712	0.145	0.245

The returns of the biggest firms can be led when imbalances are very acute.

Performance trends



Non-reversals suggest the diffusion of fundamentally-important information.

Conclusions

The network structure of the equity market can generate information diffusion.

1. **Under strategic complementarities in information production, neighbors have information leadership over firms.**
2. **Even small neighbors have information leadership.**
3. **Findings are not completely driven by industry effects.**
4. **Information under diffusion is likely to be fundamentally-relevant.**