Connected Stocks: Evidence from Tehran Stock Exchange

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- **Can the common ownership cause stock return comovement ?**
  - We connect stocks through the common ownership by blockholders (ownership $> 1\%$)
  - We focus on excess return comovement for a pair of the stocks
  - We use common ownership to forecast cross-sectional variation in the realized correlation of four-factor + industry residuals

Why does it matter?

- Covariance
  - Covariance is a key component of risk in many financial applications. (Portfolio selection, Risk management, Hedging and Asset pricing)
  - Covariance is a significant input in risk measurement models (Such as Value-at-Risk)
- Return predictability
  - If it's valid, we can build a profitable buy-sell strategy

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Common-ownership measurements

Model based measures

- $\text{HJL}_I^A(A,B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A}+\alpha_{i,B}}$
  Harford et al. (2011)
- $\text{MHHI} = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij}\nu_{ik}}{\sum_i \mu_{ij}\nu_{ij}}$
  Azar et al. (2018)
- $\text{Top5}_j = \frac{1}{n-1} \sum_i^5 \sum_{j \neq k} \nu_{ik}$
  Antón et al. (2020)
- $\kappa_{ij} = \cos(\nu_i, \nu_j).\sqrt{\frac{IHHI_j}{IHHI_i}}$
  Backus et al. (2020)
- $\text{GGL}^A(A,B) = \sum_{i=1}^I \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$
  Gilje et al. (2020) , Lewellen and Lewellen (2021)
- $\text{MHHI}_{\text{Delta}} =$
  $\sum_{j=1}^J \sum_{k \neq j}^K \frac{\sum_{i=1}^N w_j * w_k * \mu_{i,j} * \mu_{i,k}}{\sum_{i=1}^N \mu_{i,j} * \mu_{i,k}}$
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Ad-hoc measures

- $\mathrm{Overlap}_{AP}(A,B) =$
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  Anton and Polk (2014)
- $\mathrm{Overlap}_{Count}(A,B) = \sum_{i \in I^{A,B}} 1$
  He and Huang (2017),He et al. (2019)
- $\mathrm{Overlap}_{Min}(A,B) =$
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  Newham et al. (2018)
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  $\sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$
  Hansen and Lott Jr (1996) , Freeman (2019)

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Selected measure

We need a pair-level measure, which is bi-directional, so we use the AP measure.

Measues' detail

Main effect

Comovement effect

Papers

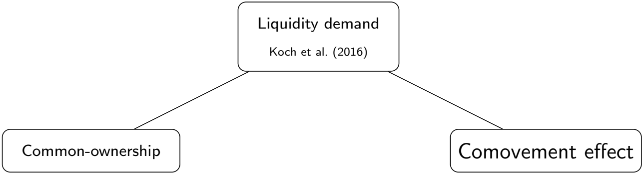
Main effect

Common-ownership

Comovement effect

Papers

Main effect



Papers

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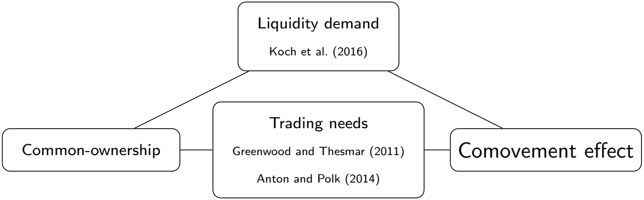

Papers

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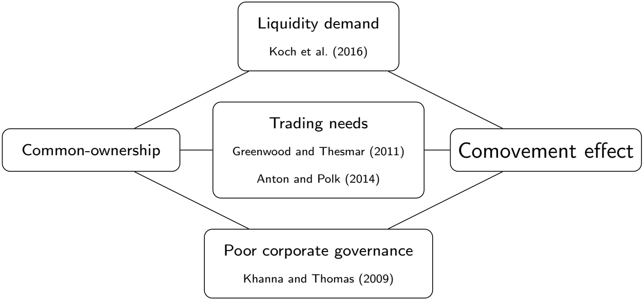

Papers

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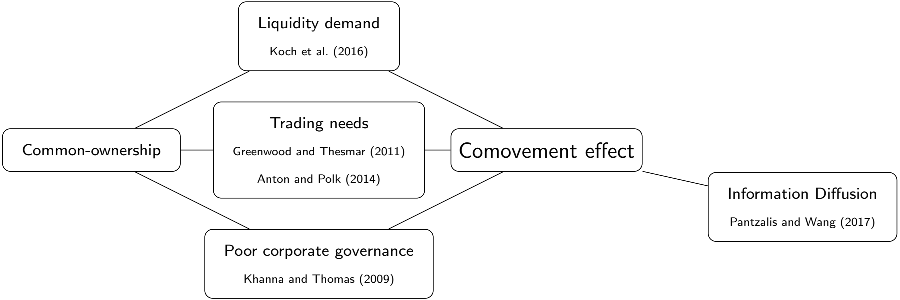

Papers

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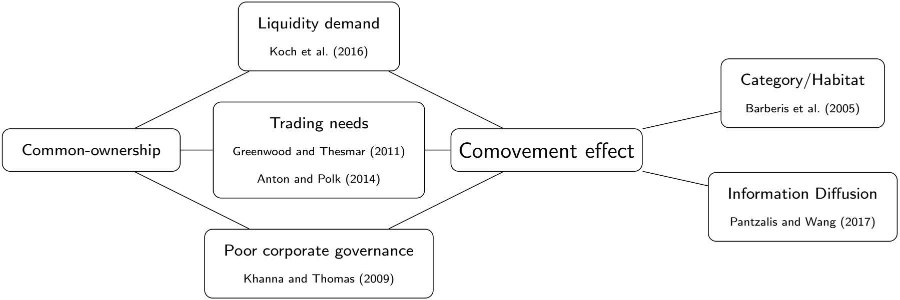

Papers

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Measuring Common-ownership

Anton and Polk (2014)

$$\boxed{FCAP_{ij,t} = \frac{\sum_{f=1}^{F}(S_{i,t}^{f}P_{i,t} + S_{j,t}^{f}P_{j,t})}{S_{i,t}Pi,t + S_{j,t}Pj,t}}$$

Measuring Common-ownership

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SQRT

$$\boxed{[\frac{\sum_{f=1}^{F}(\sqrt{S_{i,t}^{f}P_{i,t}} + \sqrt{S_{j,t}^{f}P_{j,t}})}{\sqrt{S_{i,t}Pi,t} + \sqrt{S_{j,t}Pj,t}}]^2}$$

Quadratic

$$\boxed{[\frac{\sum_{f=1}^{F}[(S_{i,t}^{f}P_{i,t})^2 + (S_{j,t}^{f}P_{j,t})^2]}{(S_{i,t}Pi,t)^2 + (S_{j,t}Pj,t)^2}]^{-1}}$$

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SQRT

$$\boxed{[\frac{\sum_{f=1}^{F}(\sqrt{S^f_{i,t}P_{i,t}} + \sqrt{S^f_{j,t}P_{j,t}})}{\sqrt{S_{i,t}Pi,t} + \sqrt{S_{j,t}Pj,t}}]^2}$$

Quadratic

$$\boxed{[\frac{\sum_{f=1}^{F}[(S^f_{i,t}P_{i,t})^2 + (S^f_{j,t}P_{j,t})^2]}{(S_{i,t}Pi,t)^2 + (S_{j,t}Pj,t)^2}]^{-1}}$$

Intuition

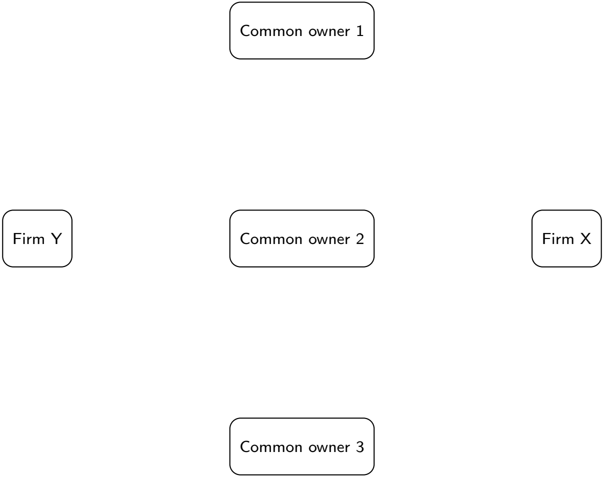
If for a pair of stocks with n mutual owners, all owners have even shares of each firm's market cap, then the proposed indexes will be equal to n. Proof

Measuring Common Ownership

Example of three common owner

Measuring Common Ownership

Example of three common owner



Measuring Common Ownership

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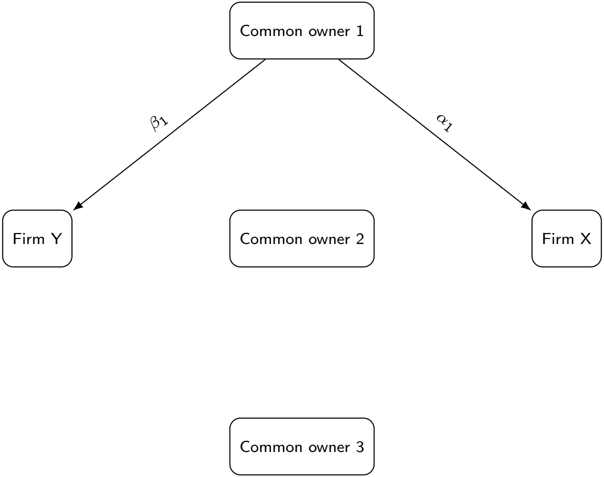

Measuring Common Ownership

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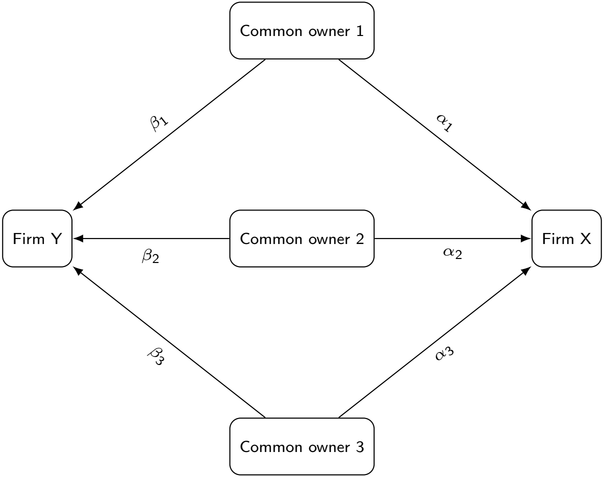


Measuring Common Ownership

Example of three common owner

Ownership	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII
α_1	1/3	20	10	20	10	5	1
β_1	1/3	10	10	20	10	5	1
α_2	1/3	10	80	20	10	5	1
β_2	1/3	20	80	20	10	5	1
α_3	1/3	70	10	20	10	5	1
β_3	1/3	70	10	20	10	5	1
SQRT	3	2.56	2.33	1.8	0.9	0.45	0.09
SUM	1	1	1	0.6	0.3	0.15	0.03
Quadratic	3	1.85	1.52	8.33	33.33	133.33	3333.33

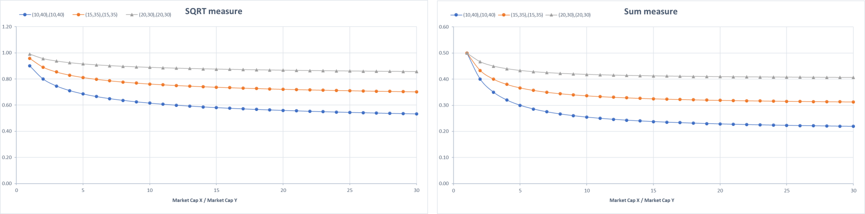
Measuring Common Ownership

Comparison

- For better comparison we relax previous assumptions:
  - Two Firms with different market caps.

	$(\alpha_1,\beta_1),(\alpha_2,\beta_2)$					
	(10,40),(10,40)		(15,35),(15,35)		(20,30),(20,30)	
$\frac{MarketCap_x}{MarketCap_y}$	SQRT	SUM	SQRT	SUM	SQRT	SUM
1	0.90	0.50	0.96	0.50	0.99	0.50
2	0.80	0.40	0.89	0.43	0.96	0.47
3	0.75	0.35	0.85	0.40	0.94	0.45
4	0.71	0.32	0.83	0.38	0.92	0.44
5	0.69	0.30	0.81	0.37	0.91	0.43
6	0.67	0.29	0.80	0.36	0.91	0.43
7	0.65	0.28	0.79	0.35	0.90	0.43
8	0.64	0.27	0.78	0.34	0.90	0.42
9	0.63	0.26	0.77	0.34	0.89	0.42
10	0.62	0.25	0.76	0.34	0.89	0.42

Measuring Common Ownership
Comparison



Comparison of two methods for calculating common ownership

Conclusion

We use the SQRT measure because it has an acceptable variation and has fair values at a lower level of aggregate common ownership.

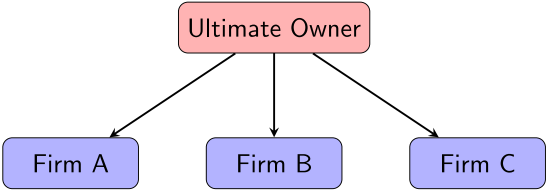
Pair Composition and Business Group

Business Group

Ultimate Owner

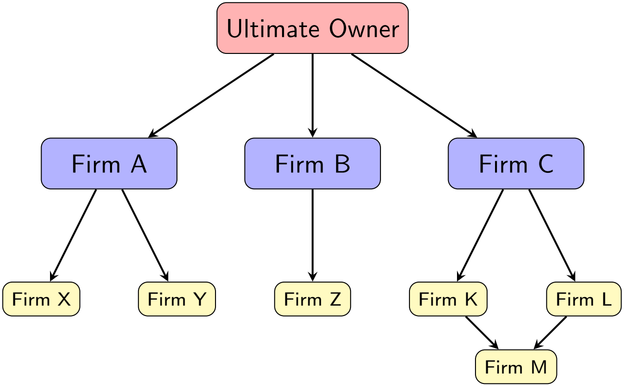
Pair Composition and Business Group

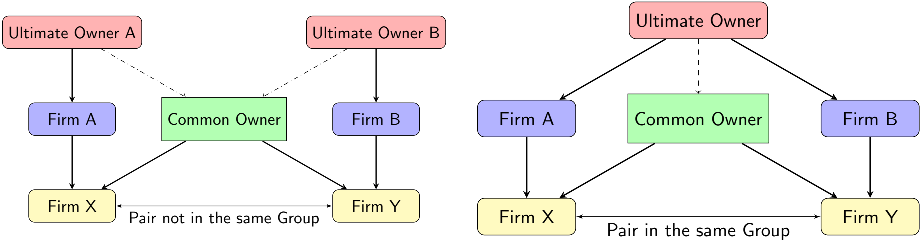
Business Group



Pair Composition and Business Group

Business Group

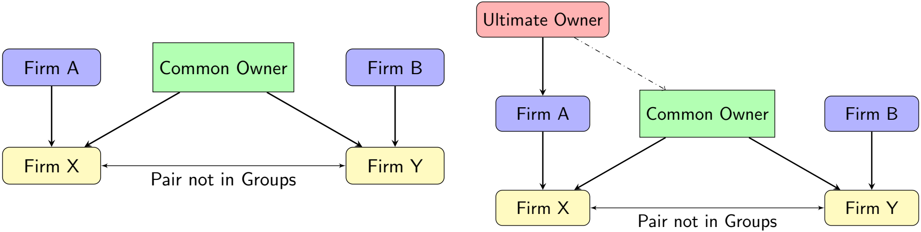




Ultimate Owner A
Ultimate Owner B
Firm A
Common Owner
Firm B
Firm X
Firm Y
Pair not in the same Group
Ultimate Owner
Firm A
Common Owner
Firm B
Firm X
Firm Y
Pair in the same Group

Pair Composition and Business Group

Pair not in any of Business Groups



Data Summary

- We use blockholders' data from 2015/03/25 (1394/01/06) to 2020/03/18 (1398/12/28)
  - Includes of 1203 Days and 60 Months
  - Consists of 600 firm inculding 548 firm with common owners

Year	1393	1394	1395	1396	1397	1398
No. of Firms	365	376	447	552	587	618
No. of Blockholders	777	803	984	1297	1454	1458
No. of Groups	38	41	43	44	40	43
No. of Firms not in Groups	116	108	147	216	241	243
No. of Firms in Groups	249	268	300	336	346	375
Mean Number of Members	7	7	7	8	9	9
Med. of Number of Members	5	5	5	6	6	5
Mean Of each Blockholder's ownership	21	22	22	21	22	23
Med. of Owners' Percent	7	8	8	8	8	9
Mean Number of Owners	5	5	5	5	5	5
Med. Number of Owners	4	4	4	4	5	4
Mean Block. Ownership	76	77	75	75	75	71
Med. Block. Ownership	82	82	81	80	80	77

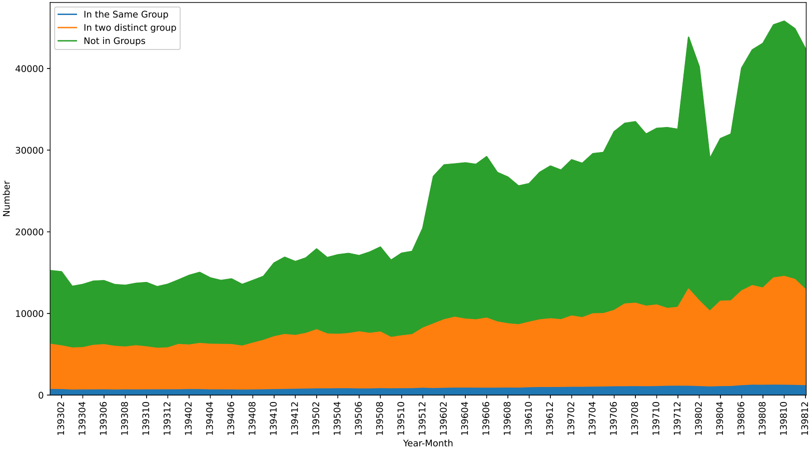
Pair Composition

- Pairs consist of two firms with at least one common owner
  - 18692 unique pairs which is 10% of possible pairs ($\frac{548*547}{2} = 149878$)

	mean	min	Median	max
Number of unique paris	24139	13272	23024	45795

year	1393	1394	1395	1396	1397	1398
No. of Pairs	20876	21187	27784	41449	47234	67232
No. of Groups	37	40	42	43	39	43
No. of Pairs not in Groups	11452	11192	15351	26530	29182	43433
Number of Pairs not in the same Group	7962	8731	10971	12916	15366	20745
Number of Pairs in the same Group	923	955	1099	1260	1536	1774
Mean Number of Common owner	1	1	1	1	1	1
Med. Number of Common owner	1	1	1	1	1	1
Mean Percent of each blockholder	19	19	19	19	19	20
Med. Percent of each blockholder	13	12	12	12	12	14
Mean Number of Pairs in one Group	31	30	30	34	39	44
Med. Number of Pairs in one Group	8	10	8	10	9	10
Mean Number of Owners	5	5	5	5	4	5
Med. Number of Owners	5	5	5	5	4	5
Mean Block. Ownership	73	73	72	70	70	70
Med. Block. Ownership	73	73	73	71	71	71

Number of Pairs



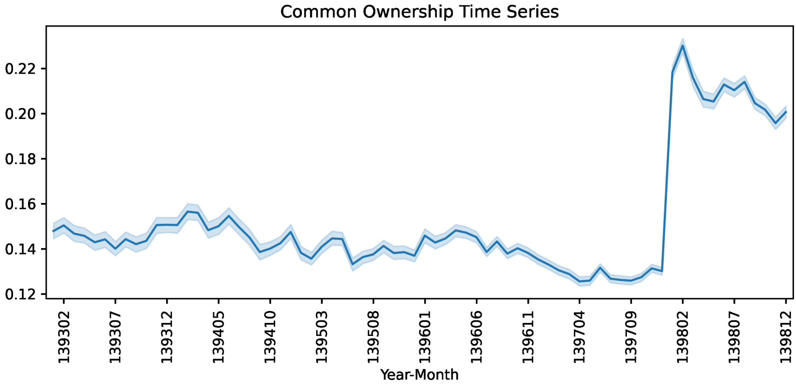
FCA vs. FCAP Summary

index	variable	mean	std	min	25%	50%	75%	max
All	FCA	0.158	0.234	0.002	0.031	0.079	0.191	12.650
	FCAP	0.144	0.166	0.002	0.030	0.077	0.193	1.000
Same Group	FCA	0.474	0.478	0.005	0.096	0.367	0.691	6.174
	FCAP	0.346	0.265	0.004	0.081	0.321	0.561	1.000
Not Same Group	FCA	0.087	0.154	0.003	0.020	0.038	0.087	6.184
	FCAP	0.072	0.102	0.003	0.020	0.037	0.078	0.998
Same Industry	FCA	0.274	0.383	0.003	0.044	0.126	0.351	6.262
	FCAP	0.207	0.215	0.003	0.041	0.120	0.314	0.999
Not Same Industry	FCA	0.150	0.217	0.002	0.030	0.077	0.183	12.650
	FCAP	0.140	0.161	0.002	0.029	0.074	0.187	1.000

Results

- By the proposed measurement, common ownership increases
- Common ownership is greater in pairs that are in the same business group and insutry

FCA's time series



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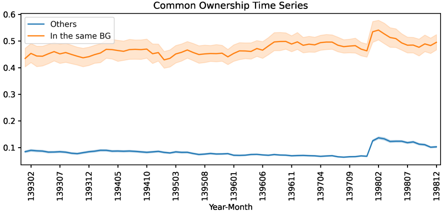
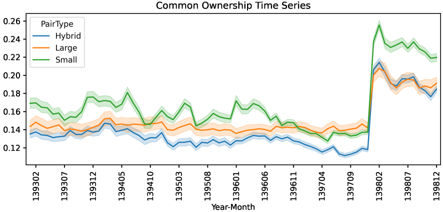
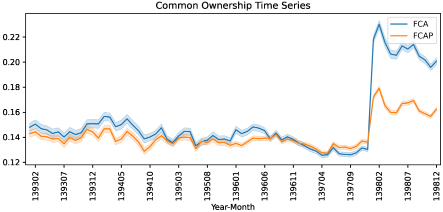
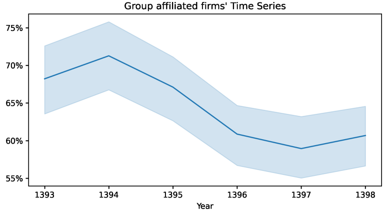
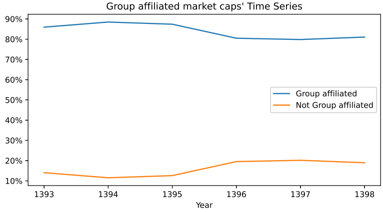




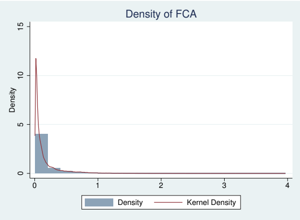


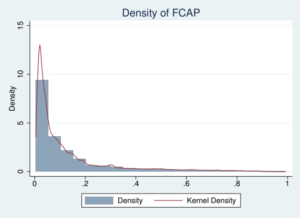
Group affiliated firm's time series





FCA vs. FCAP Distributions
Monthly





FCA vs. FCAP Distributions

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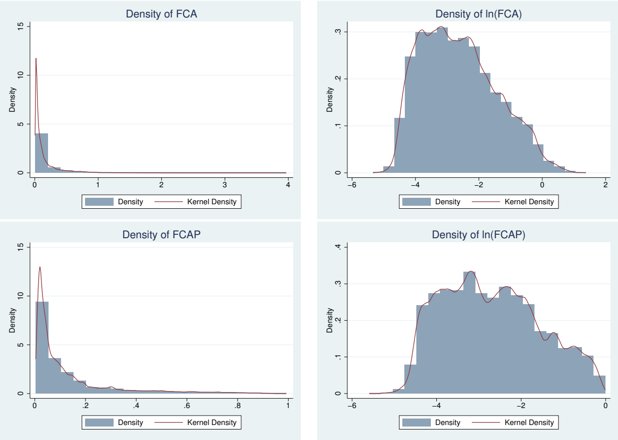

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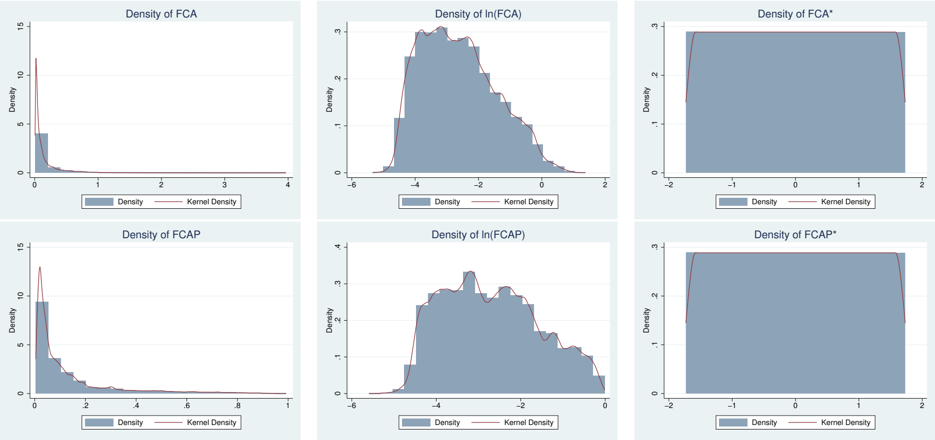


Correlation Calculation

4 Factor + Industry

1. Frist Step:

   Estimate each of these models on periods of three month:

   - CAPM + Industry (2 Factor):

   $$R_{i,t} = \alpha_i + \beta_{mkt,i} R_{M,t} + \beta_{Ind,i} R_{Ind,t} + \boxed{\varepsilon_{i,t}}$$

   - 4 Factor :

   $$\begin{aligned} R_{i,t} = \alpha_i + \beta_{mkt,i} R_{M,t} + \\ + \beta_{HML,i} HML_t + \beta_{SMB,i} SMB_t + \beta_{UMD,i} UMD_t + \boxed{\varepsilon_{i,t}} \end{aligned}$$

   - 4 Factor + Industry (5 Factor) :

   $$\begin{aligned} R_{i,t} = \alpha_i + \beta_{mkt,i} R_{M,t} + \beta_{Ind,i} R_{Ind,t} \\ + \beta_{HML,i} HML_t + \beta_{SMB,i} SMB_t + \beta_{UMD,i} UMD_t + \boxed{\varepsilon_{i,t}} \end{aligned}$$

2. Second Step:

   Calculate monthly correlation of each stock pair's daily abnormal returns (residuals)

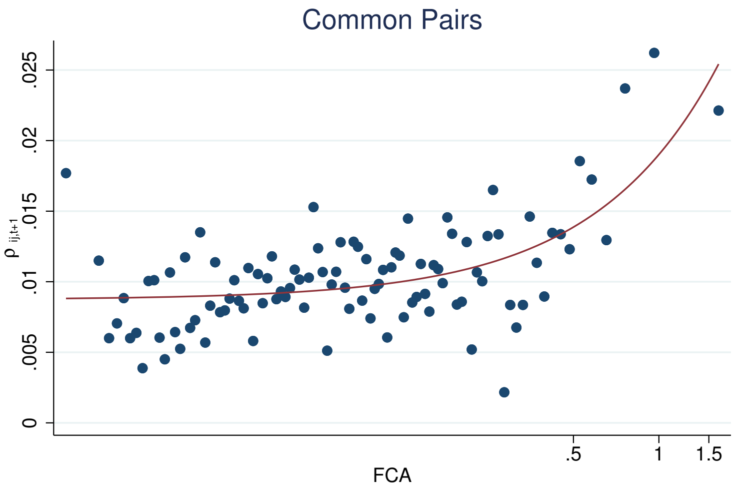
Correlation Calculation Results

	mean	std	min	25%	50%	75%	max
CAPM + Industry	0.021	0.200	-1.0	-0.047	0.016	0.084	1.0
4 Factor	0.032	0.202	-1.0	-0.040	0.025	0.096	1.0
4 Factor + Industry	0.016	0.199	-1.0	-0.051	0.010	0.076	1.0
4 Factor + Industry (With Lag)	0.015	0.198	-1.0	-0.051	0.010	0.076	1.0

Conclusion

We use the 4 Factor + Industry model to control for exposure to systematic risk because it almost captures all correlations between two firms in each pair.

Future Correlation via *FCA*



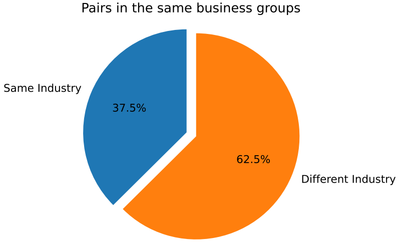
This figure graphs the correlation of daily 4Factor+Industry residuals in monthh t+1 against our measure of institutional connectedness.

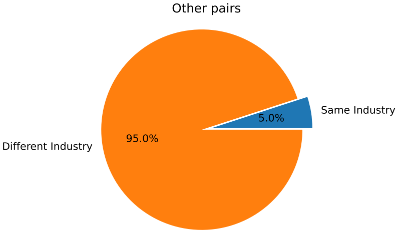
Controls

- ρ_t : Current period correlation
- **SameGroup** : Dummy variable for whether the two stocks belong to the same business group.
- **SameIndustry** : Dummy variable for whether the two stocks belong to the same Industry.
- **SameSize** : The negative of absolute difference in percentile ranking of size across a pair
- **SameBookToMarket** :The negative of absolute difference in percentile ranking of the book to market ratio across a pair
- **CrossOwnership**: The maximum percent of cross-ownership between two firms

Industry & Business group

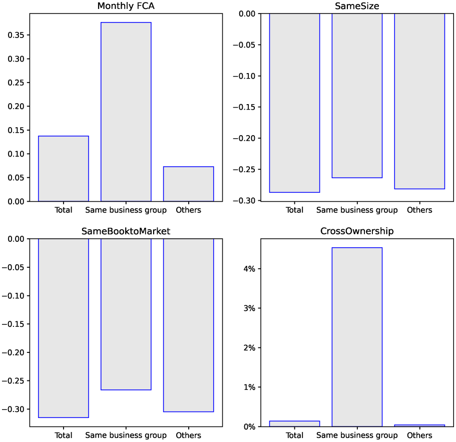
	Yes	No
SameIndustry	753806 (5.7%)	12422942 (94.3%)
SameGroup	304444 (6.3%)	4508062 (93.7%)
SameGroup & SameIndustry	115536 (0.9%)	13176748 (99.1%)





Business group

Pairs' characteristic



Summary of Controls

Variables' distribution

	mean	std	min	25%	50%	75%	max
sgroup	0.06	0.23	0.00	0.00	0.00	0.00	1.00
sBgroup	0.06	0.24	0.00	0.00	0.00	0.00	1.00
Monthlysize1	0.58	0.23	0.01	0.40	0.58	0.77	1.00
Monthlysize2	0.30	0.20	0.00	0.13	0.25	0.41	0.99
MonthlySameSize	-0.29	0.20	-0.97	-0.41	-0.24	-0.13	-0.00
MonthlyB/M1	0.54	0.25	0.00	0.36	0.57	0.75	1.00
MonthlyB/M2	0.55	0.24	0.00	0.36	0.56	0.75	1.00
MonthlySameB/M	-0.32	0.20	-0.99	-0.44	-0.27	-0.16	-0.00
MonthlyCrossOwnership	0.14	2.59	0.00	0.00	0.00	0.00	95.77

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Fama-MacBeth Estimation

- Fama-MacBeth regression analysis is implemented using a two-step procedure.
  - The first step is to run periodic cross-sectional regression for dependent variables using data of each period.
  - The second step is to analyze the time series of each regression coefficient to determine whether the average coefficient differs from zero.

Fama-MacBeth (1973)

- Two Step Regression
  - First Step

$$
\begin{aligned}
Y_{i1} &= \delta_{0,1} + \delta^{1}_{1,1} X^{1}_{i,1} + \cdots + \delta^{k}_{k,1} X^{k}_{i,1} + \varepsilon_{i,1} \\
&\vdots \\
Y_{iT} &= \delta_{0,1} + \delta^{1}_{1,T} X^{1}_{i,T} + \cdots + \delta^{k}_{k,T} X^{k}_{i,T} + \varepsilon_{i,T}
\end{aligned}
$$

  - Second Step

$$
\begin{bmatrix} \bar{Y}_1 \\ \vdots \\ \bar{Y}_T \end{bmatrix}_{T\times 1} = \begin{bmatrix} 1 & \delta^0_1 & \delta^1_1 & \dots & \delta^k_1 \\ \vdots & \vdots & \vdots & \dots & \vdots \\ 1 & \delta^0_T & \delta^1_T & \dots & \delta^k_T \end{bmatrix}_{T\times(k+2)} \times \begin{bmatrix} \lambda \\ \lambda_0 \\ \lambda_1 \\ \vdots \\ \lambda_k \end{bmatrix}_{(k+2)\times 1}
$$

- Fama-MacBeth technique was developed to account for correlation between observations on different firms in the same period

Calculating standard errors

- In most cases, the standard errors are adjusted following Newey and West (1987).
  - Newey and West (1987) adjustment to the results of the regression produces a new standard error for the estimated mean that is adjusted for autocorrelation and heteroscedasticity.
  - Only input is the number of lags to use when performing the adjustment

    $$Lag = 4(T/100)^{\frac{2}{9}}$$

    where T is the number of periods in the time series

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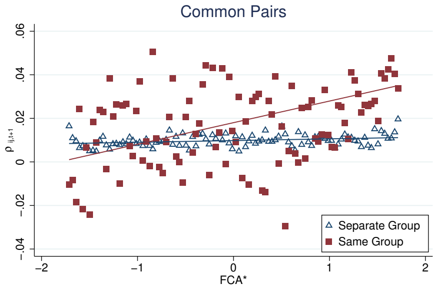
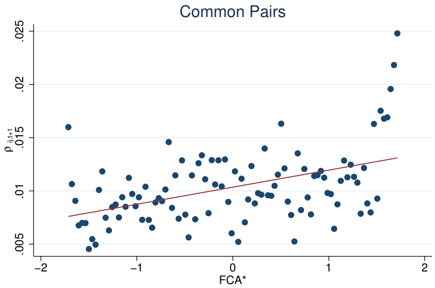
Future Correlation via *FCA*

Normalized Rank-Transformed



This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against normalized rank transformed of our measure of institutional connectedness.



This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against our measure of institutional connectedness.

Estimation model

- Use Fama-MacBeth to estimate this model

$$
\begin{aligned}
\rho_{ij,t+1} = {} & \beta_0 + \beta_1 * \mathrm{FCA}^*_{ij,t} + \beta_2 * \mathrm{SameGroup}_{ij} \\
& + \beta_3 * \mathrm{FCA}^*_{ij,t} \times \mathrm{SameGroup}_{ij} \\
& + \sum_{k=1}^{n} \alpha_k * \mathrm{Control}_{ij,t} + \varepsilon_{ij,t+1}
\end{aligned} \tag{1}
$$

- Estimate the model on a monthly frequency
- Adjust standard errors by Newey and West adjustment with 4 lags $(4(70/100)^{\frac{2}{9}} = 3.69 \sim 4)$

Model Estimation

Normalized Rank-Transformed

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Same Group	0.0166***	0.0153***			0.0147***			0.00624***	0.00549**
	(8.54)	(7.90)			(6.97)			(2.81)	(2.27)
FCA*			0.00150***	0.00112**	0.000736	0.00944***	0.000397	0.000377	-0.0000113
			(2.90)	(2.11)	(1.33)	(7.24)	(0.68)	(0.65)	(-0.02)
(FCA*) × SameGroup								0.00992***	0.0107***
								(6.49)	(6.97)
Observations	1665996	1665996	1665996	1665996	1665996	58337	1607659	1665996	1665996
Sub-sample	All	All	All	All	All	SameGroup	Others	All	All
Group Effect	No	No	No	No	No	No	No	No	Yes
Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.000180	0.000637	0.000170	0.000652	0.000804	0.0112	0.000577	0.000898	0.00575

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All non-common owner pairs

regression

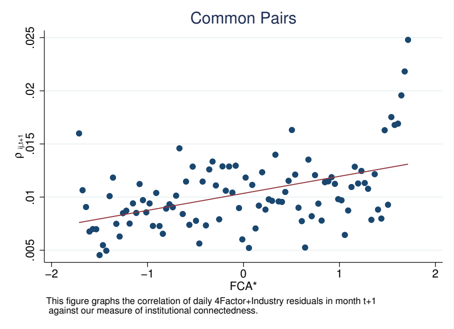
	Future Monthly Correlation of 4F+Industry Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
$(\text{FCA} > Q3[\text{FCA}])$		0.00543***	0.00549***	0.00695*		0.00539***
		(4.12)	(4.17)	(2.10)		(4.04)
SameGroup	0.0122***		0.0124***			0.00901*
	(5.81)		(5.97)			(2.62)
$(\text{FCA} > Q3[\text{FCA}]) \times$ SameGroup						0.00392
						(1.20)
FCA*					0.00174*	
					(2.43)	
Observations	5148109	5148109	5148109	76240	76240	5148109
Sub Sample	Total	Total	Total	SameGroups	SameGroups	Total
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.000455	0.000457	0.000501	0.0133	0.0135	0.000512

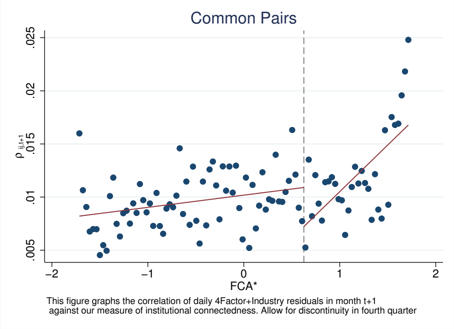
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Future Correlation via *FCA*

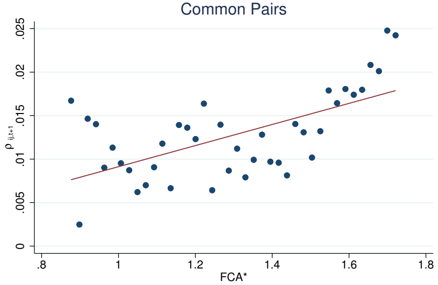
Discontinuity



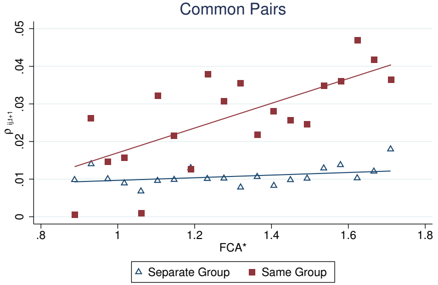


4 Factor + Industry Future Correlation via FCA^*

Discontinuity & Business Groups

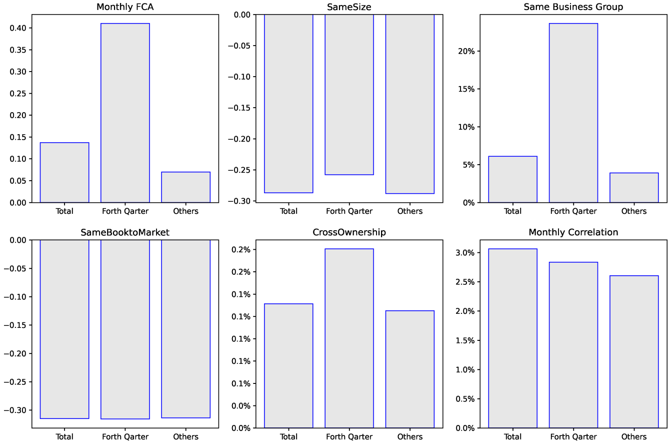


This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against our measure of institutional connectedness. Allow for discontinuity in fourth quarter



This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against our measure of institutional connectedness. Allow for discontinuity in fourth quarter

Forth quarter summary



Fama-MacBeth Estimation

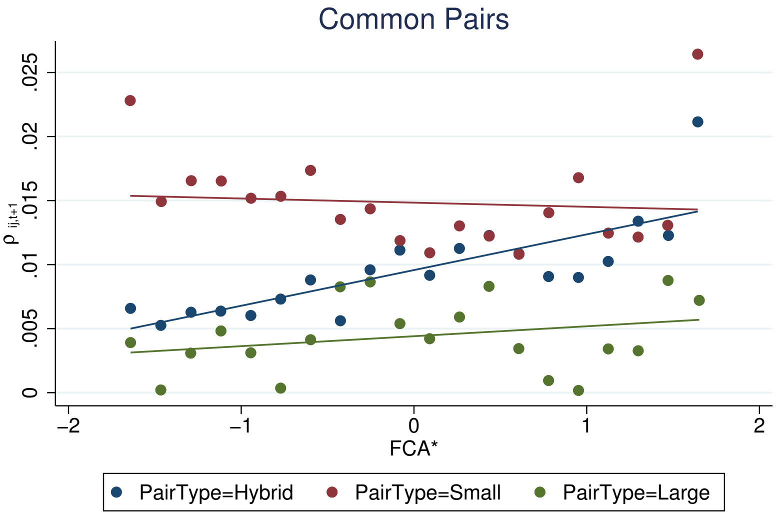
Discontinuity (sub-sample)

	Dependent Variable: Future Monthly Correlation of 4F+Ind. Res.					
	(1)	(2)	(3)	(4)	(5)	(6)
FCA*	0.0122**	0.0103*	0.00494	0.00485	0.00270	0.00194
	(3.11)	(2.60)	(1.18)	(1.17)	(0.60)	(0.46)
SameIndustry		0.00976***	0.00367	0.00277	0.00232	0.00404
		(4.62)	(1.67)	(1.20)	(0.97)	(1.62)
Same Group			0.0206***	0.0195***	-0.0230*	-0.0201
			(7.28)	(7.24)	(-2.21)	(-1.94)
(FCA*) × SameGroup					0.0287***	0.0269**
					(3.55)	(3.42)
SameSize				0.00282	0.00233	0.00385
				(0.78)	(0.66)	(1.03)
SameBookToMarket				0.0104***	0.0103***	0.0113***
				(3.55)	(3.54)	(4.04)
CrossOwnership				0.0360	0.0402	0.0487
				(1.46)	(1.62)	(1.99)
Observations	416514	416514	416514	416514	416514	416514
Group FE	No	No	No	No	No	Yes
R^2	0.000353	0.000822	0.00151	0.00232	0.00253	0.0150

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Grouped by size



This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against our measure of institutional connectedness.

Model Estimation

Grouped by size

	Dependent Variable: Future Monthly Correlation of 4F+Ind. Res.							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCA*	0.000377	0.000698	-0.000175	0.00199***	0.00177**	-0.00151	-0.00177	-0.0000771
	(0.65)	(1.25)	(-0.31)	(3.56)	(3.00)	(-1.58)	(-1.84)	(-0.14)
Same Group	0.00624**	0.0102***	-0.00153	0.0117***	0.00661*	0.0366***	0.0268***	0.00750***
	(2.81)	(3.95)	(-0.53)	(3.76)	(2.15)	(10.31)	(6.57)	(3.53)
(FCA*) $\times$ SameGroup	0.00992***		0.0134***		0.00599*		0.0123***	0.0105***
	(6.49)		(4.80)		(2.34)		(4.17)	(6.72)
Observations	1665996	346170	346170	693728	693728	626098	626098	1665996
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sub-sample	All Firms	Large Firms	Large Firms	Hybrid Firms	Hybrid Firms	Small Firms	Small Firms	All Firms
Pair Size FE	No	No	No	No	No	No	No	Yes
R^2	0.000898	0.00193	0.00232	0.00135	0.00149	0.00180	0.00198	0.00130

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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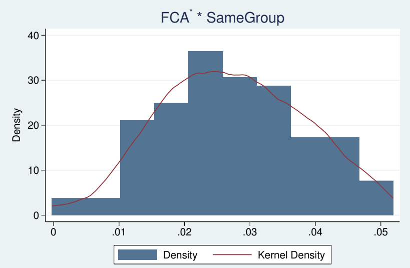
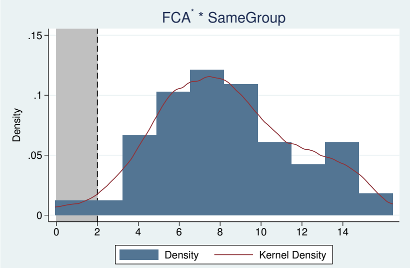
Random Pairs from Same Business Group

β_3 in model 1



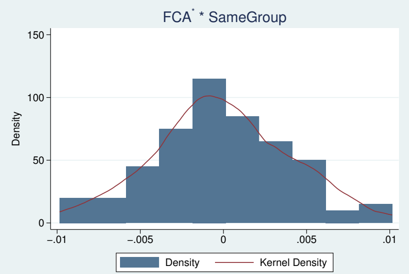
This figure graphs the histogram of coefficient of 100 Random Psudo pairs from same Business Group.



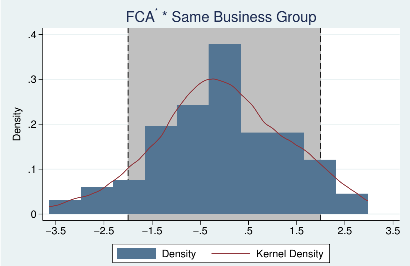
This figure graphs the histogram of t statistics of coefficient of 100 Random Psudo pairs from same Business Group.

Random Pairs from Same Size

β_3 in model 1



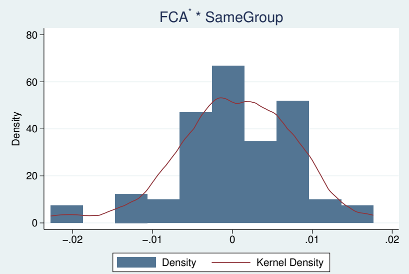
This figure graphs the histogram of coefficient of 100 Random Psudo pairs from same Size.



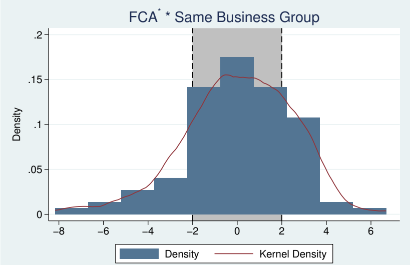
This figure graphs the histogram of t statistics of coefficient of 100 Random Psudo pairs from same Size.

Random Pairs from Same Industry

β_3 in model 1



This figure graphs the histogram of coefficient of 100 Random Psudo pairs from same Industry.



This figure graphs the histogram of t statistics of coefficient of 100 Random Psudo pairs from same Industry.

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	Dep. Var.: Future Monthly Cor. of 4F+Ind. Res.		
	(1)	(2)	(3)
Same Group	0.00637*		0.0172*
	(2.22)		(2.40)
FCA*	-0.000339	0.0123***	-0.000292
	(-0.80)	(3.50)	(-0.69)
(FCA*) $\times$ SameGroup	0.0120***		0.00898**
	(7.57)		(3.27)
ρ_t(Turnover)	0.00515***	0.0204***	0.00454***
	(8.45)	(4.88)	(7.28)
ρ_t	0.0246***	0.0911***	0.0221***
	(17.07)	(12.29)	(14.58)
Observations	1459585	45678	1413907
Controls	Yes	Yes	Yes
Pari Size FE	Yes	Yes	Yes
SubSample	All	Same Big Groups	Others
R^2	0.00241	0.0444	0.00195

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Ins Imbalance

$$\text{InsImbalance}_i = \frac{\text{InsBuy} - \text{InsSell}}{\text{InsBuy} + \text{InsSell}}$$

	Future Monthly Corr. of 4F+Ind. Residuals						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	0.000736	0.000725	0.000652		0.00957***	0.000408	0.000280
	(1.33)	(1.44)	(1.30)		(6.50)	(0.80)	(0.59)
Same Group	0.0147***	0.0147***	0.00553*	0.00595**		0.00543*	0.00560*
	(6.97)	(7.02)	(2.33)	(2.65)		(2.29)	(2.40)
Low Imbalance std		0.0000868	-0.000798	-0.00106	0.0239***	-0.000882	0.000795
		(0.09)	(-0.83)	(-0.98)	(6.21)	(-0.92)	(0.54)
Low Imbalance std × SameGroup			0.0250***	0.0253***		0.0108*	0.00880*
			(7.17)	(7.23)		(2.54)	(2.26)
Observations	1665996	1665996	1665996	1665996	58337	1665996	1665996
Group Effect	No	No	No	No	No	No	Yes
Sub-sample	Total	Total	Total	Total	Same Groups	Total	Total
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.000804	0.000924	0.00104	0.000886	0.0147	0.00115	0.00600

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TrunOver

$$\Delta \text{TurnOver} = \ln\left(\frac{\text{TurnOver}_{i,t}}{\text{TurnOver}_{i,t-1}}\right) = \ln\left(\frac{\text{volume}_{i,t}}{\text{MarketCap}_{i,t}}\right) - \ln\left(\frac{\text{volume}_{i,t-1}}{\text{MarketCap}_{i,t-1}}\right)$$

	Dependent Variable: $\Delta \text{TurnOver}_i$					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \text{TurnOver}_{\text{Market}}$	0.405***	0.396***	0.360***	0.425***	0.388***	0.448***
	(12.25)	(10.74)	(7.62)	(12.08)	(8.23)	(12.20)
$\Delta \text{TurnOver}_{\text{Group}}$			0.222***	0.229***	0.253**	0.268***
			(3.46)	(4.09)	(3.28)	(3.82)
$\Delta \text{TurnOver}_{\text{Industry}}$	0.120**	0.0205	-0.0156	-0.0237	-0.0833	-0.0999
	(3.25)	(0.24)	(-0.23)	(-0.42)	(-1.04)	(-1.46)
Observations	293264	292179	184699	183442	184699	183442
Weight	-	-	MC × CR	MC × CR	MC	MC
Control	No	Yes	No	Yes	No	Yes
R^2	0.129	0.168	0.246	0.286	0.247	0.286

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Cross-sectional analyze of Group trunover

	Dependent Variable: β_{Group}													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Excess	0.310***	0.417***												
	(3.58)	(4.76)												
ExcessDummy			-0.00418	0.0907*										
			(-0.10)	(2.24)										
ExcessDiff					0.638***	0.840***								
					(4.65)	(6.22)								
ExcessHigh							0.287***	0.323***						
							(4.17)	(4.42)						
Low Imbalance std									0.216***	0.0975*				
									(4.82)	(2.26)				
Position											-0.0103	0.0176		
											(-0.54)	(0.93)		
Centrality													0.618***	0.0662
													(3.31)	(0.37)
Observations	1153	1153	1168	1168	1153	1153	1168	1168	1145	1145	1153	1153	1113	1113
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.0178	0.0884	0.00206	0.0665	0.0313	0.109	0.0278	0.0923	0.0203	0.0687	0.00239	0.0645	0.00825	0.0562

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Pairwise correlations in trunover

	Dependent Variable: Future Monthly Correlation of Delta turnover						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Same Group	0.0349***	0.0216***			0.0227***	0.0183***	0.0181***
	(11.20)	(7.04)			(7.18)	(5.97)	(6.08)
FCA*			0.000871	-0.000427	-0.00108	-0.00130	-0.00165
			(0.63)	(-0.34)	(-0.84)	(-0.98)	(-1.40)
(FCA*) $\times$ SameGroup						0.00589*	0.00602*
						(2.37)	(2.33)
Observations	1447955	1341445	1447955	1341445	1341445	1341445	1341445
Group Effect	No	No	No	No	No	No	Yes
Controls	No	Yes	No	Yes	Yes	Yes	Yes
R^2	0.000465	0.00308	0.000461	0.00329	0.00354	0.00364	0.0148

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Amihud

$$\Delta \text{Amihud} = \ln\left(\frac{\text{Amihud}_{i,t}}{\text{Amihud}_{i,t-1}}\right) = \ln\left(\frac{|\text{Return}_{i,t}|}{\text{volume}_{i,t}}\right) - \ln\left(\frac{|\text{Return}_{i,t-1}|}{\text{volume}_{i,t-1}}\right)$$

	Dependent Variable: ΔAmihud$_i$					
	(1)	(2)	(3)	(4)	(5)	(6)
ΔAmihud$_{\text{Market}}$	0.290***	0.298***	0.365***	0.234***	0.373***	0.244***
	(9.76)	(3.38)	(11.12)	(5.29)	(11.48)	(5.70)
ΔAmihud$_{\text{Group}}$			0.182***	0.167***	0.161**	0.148**
			(3.58)	(3.86)	(2.93)	(3.11)
ΔAmihud$_{\text{Industry}}$	0.0687*	0.144	0.00964	-0.0107	0.0162	-0.00565
	(2.02)	(1.59)	(0.19)	(-0.25)	(0.30)	(-0.12)
Observations	293264	291933	184699	183301	184699	183301
Weight	-	-	MC $\times$ CR	MC $\times$ CR	MC	MC
Control	No	Yes	No	Yes	No	Yes
R^2	0.118	0.223	0.219	0.320	0.224	0.324

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Cross-sectional analyze of Group Amihud

	Dependent Variable: β_{Group}													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Excess	0.174*	0.354***												
	(2.55)	(4.78)												
ExcessDummy			-0.0190	0.0764*										
			(-0.48)	(1.99)										
ExcessDiff					0.285**	0.554***								
					(2.86)	(5.59)								
ExcessHigh							0.242***	0.346***						
							(4.39)	(5.52)						
Low Imbalance std									0.126**	0.0471				
									(3.15)	(1.20)				
Position											-0.0102	0.0312		
											(-0.62)	(1.81)		
Centrality													0.684***	0.271
													(4.02)	(1.58)
Observations	1153	1153	1168	1168	1153	1153	1168	1168	1145	1145	1153	1153	1113	1113
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.00898	0.0857	0.00196	0.0607	0.0102	0.0882	0.0266	0.104	0.0107	0.0648	0.00260	0.0641	0.0117	0.0438

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Pairwise correlations in liquidity

	Dependent Variable: Future Monthly Correlation of Delta Amihud						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Same Group	0.0116**	-0.00482			-0.00853*	-0.00595	-0.00739
	(2.76)	(-1.64)			(-2.49)	(-1.32)	(-1.85)
FCA*			0.00650***	0.00303***	0.00363***	0.00384***	0.00289**
			(6.09)	(4.52)	(4.31)	(4.26)	(2.89)
(FCA*) × SameGroup						-0.00274	-0.00162
						(-1.10)	(-0.70)
Observations	377863	369768	377863	369768	369768	369768	369768
Group Effect	No	No	No	No	No	No	Yes
Controls	No	Yes	No	Yes	Yes	Yes	Yes
R^2	0.000586	0.00615	0.000681	0.00610	0.00654	0.00673	0.0220

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Trading

- Antón et al. (2018):

$$CQ_{ijt} = \sum_{d=1}^{D_t} \omega_{dt} corr(NQ_{idt}, NQ_{jdt})$$

$$\omega_{dt} = \frac{\min(TQ_{idt}, TQ_{jdt})}{\sum_{d=1}^{D} \min(TQ_{idt}, TQ_{jdt})}$$

- Ivashina and Sun (2011):

$$\frac{1}{N} \sum_{i=1}^{N} \frac{\sum_{j=1}^{M_i} D_{ji} CAR_i}{M_i}$$

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Conclusion

- We derive a measure that captures the extent of common ownership distribution.
- The common ownership comovement effect with a extra explanation:
  - Common ownership that crosses a threshold affect on comovement
  - Be in the same business group has a major effect on comovement

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- If two stocks in pair have n mutual owner, which total market cap divides them equally, the mentioned indexes equal n.
  - Each holder owns $1/n$ of each firm.
  - Firm's market cap is α_1 and α_2:
  - So for each holder of firms we have $S^f_{i,t} P_{i,t} = \alpha_i$
  - SQRT

$$[\frac{\sum_{f=1}^{n} \sqrt{\alpha_1/n} + \sum_{f=1}^{n} \sqrt{\alpha_2/n}}{\sqrt{\alpha_1} + \sqrt{\alpha_2}}]^2 = [\frac{\sqrt{n}(\sqrt{\alpha_1} + \sqrt{\alpha_2})}{\sqrt{\alpha_1} + \sqrt{\alpha_2}}]^2 = n$$

  - Quadratic

$$[\frac{\sum_{f=1}^{n} (\alpha_1/n)^2 + \sum_{f=1}^{n} (\alpha_2/n)^2}{\alpha_1^2 + {\alpha_2}^2}]^{-1} = [\frac{\alpha_1^2 + \alpha_2^2}{n(\alpha_1^2 + \alpha_2^2)}]^{-1} = n$$

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Main Effect

- Common-ownership and comovement effect
  [Anton and Polk (2014)]
  Stocks sharing many common investors tend to comove more strongly with each other in the future than otherwise similar stocks.
- Common-ownership and liquidity demand
  [Koch et al. (2016), Pastor and Stambaugh (2003), Acharya and Pedersen (2005)]
  Commonality in stock liquidity is likely driven by correlated trading among a given stock's investors. Commonality in liquidity is important because it can influence expected returns
- Trading needs and comovement
  [Greenwood and Thesmar (2011)]
  If the investors of mutual funds have correlated trading needs, the stocks that are held by mutual funds can comove even without any portfolio overlap of the funds themselves
- Stock price synchronicity and poor corporate governance
  [Boubaker et al. (2014), Khanna and Thomas (2009), Morck et al. (2000)]
  Stock price synchronicity has been attributed to poor corporate governance and a lack of firm-level transparency. On the other hand, better law protection encourages informed trading, which facilitates the incorporation of firm-specific information into stock prices, leading to lower synchronicity

Grapgh

Synchronicity and firm interlocks

JFE-2009-Khanna

- Three types of network
  1. Equity network
  2. Director network
  3. Owner network
- Dependent variables

  Using deterended weekly return for calculation
  1. Pairwise returns synchronicity $= \frac{\sum_t (n^{up}_{i,j,t} n^{down}_{i,j,t})}{T_{i,j}}$
  2. Correlation $= \frac{Cov(i,j)}{\sqrt{Var(i).Var(j)}}$
- Tobit estimation of

$$f^d_{i,j} = \alpha I_{i,j} + \beta(1 * N_{i,j}) + \gamma Ind_{i,j} + \varepsilon_{i,j}$$

being in the same director network has a significant effect

- Stock price synchronicity:

$$SYNCH = \log(\frac{R^2_{i,t}}{1 - R^2_{i,t}})$$

where $R^2_{i,t}$ is the R-squared value from

$$RET_{i,w} = \alpha + \beta_1 MKRET_{w-1} + \beta_2 MKRET_w + \beta_3 INDRET_{i,w-1} + \beta_4 INDRET_{i,w} + \varepsilon_{i,w}$$

- OLS estimation of

$$SYNCH_{i,t} = \beta_0 + \beta_1 Excess_{i,t} + \beta_2 UCF_{i,t} + \sum_k \beta_k Control^k_{i,t} + IndustryDummies + YearDummies + \varepsilon_{i,t}$$

- Stock price synchronicity increases with excess control
- Firms with substantial excess control are more likely to experience stock price crashes

- Common active mutual fund owners
- Measuring Common Ownership
  - $FCAP_{ij,t} = \frac{\sum_{f=1}^{F}(S_{i,t}^{f}P_{i,t}+S_{j,t}^{f}P_{j,t})}{S_{i,t}Pi,t+S_{j,t}Pj,t}$
  - Using normalized rank-transformed as $FCAP_{ij,t}^{*}$
- $\rho_{ij,t}$: within-month realized correlation of each stock pair's daily four-factor returns
-
$$\rho_{ij,t+1} = a + b_f \times FCAPF_{ij,t}^{*} + \sum_{k=1}^{n} CONTROL_{ij,t,k} + \varepsilon_{ij,t+1}$$

  Estimate these regressions monthly and report the time-series average as in Fama-MacBeth

- $\mathrm{HJL}_I^A(A,B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A}+\alpha_{i,B}}$ Harford et al. (2011)
    - Bi-directional
    - Pair-level measure of common ownership
    - Its potential impact on managerial incentives
    - Measure not necessarily increases when the relative ownership increases
    - Accounts only for an investor's relative holdings
- $\mathrm{MHHI} = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij}\nu_{ik}}{\sum_i \mu_{ij}\nu_{ij}}$ Azar et al. (2018)
    - Capture a specific type of externality
    - Measured at the industry level
    - Assumes that investors are fully informed about the externalities
- $\mathrm{GGL}^A(A,B) = \sum_{i=1}^{I} \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$ Gilje et al. (2020)
    - Bi-directional
    - Less information
    - Not sensitive to the scope
    - Measure increases when the relative ownership of firm A increases

- $Overlap_{Count}(A, B) = \sum_{i \in I^{A,B}} 1$
  He and Huang (2017),He et al. (2019)
- $Overlap_{Min}(A, B) = \sum_{i \in I^{A,B}} min\{\alpha_{i,A}, \alpha_{i,B}\}$
  Newham et al. (2018)
- $Overlap_{AP}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{\nu}_A}{\bar{\nu}_A + \bar{\nu}_B} + \alpha_{i,B} \frac{\bar{\nu}_B}{\bar{\nu}_A + \bar{\nu}_B}$
  Anton and Polk (2014)
- $Overlap_{HL}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$
  Hansen and Lott Jr (1996) , Freeman (2019)
- Unappealing properties
  - Unclear is whether any of these measures represents an economically meaningful measure of common ownership's impact on managerial incentives.
  - Both Overlap$_{Count}$ and Overlap$_{AP}$ are invariant to the decomposition of ownership between the two firms, which leads to some unappealing properties.

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