

Connected Stocks: Evidence from Tehran Stock Exchange

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March, 2021

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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 and comovement effect

[Antón 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

Papers' Detail

Commonownership measurements

Model-based measures

- $HJL_I^A(A, B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A} + \alpha_{i,B}}$ [Harford et al.-JFE-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
- $MHHI = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij} \nu_{ik}}{\sum_i \mu_{ij} \nu_{ij}}$ [Azar et al.-JF-2018]
 - Capture a specific type of externality
 - Measured at the industry level
 - Assumes that investors are fully informed about the externalities
- $GGL^A(A, B) = \sum_{i=1}^I \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$ [Erik et al.-JFE-2019]
 - Bi-directional
 - Less information
 - Not sensitive to the scope
 - Measure increases when the relative ownership of firm A increases

Commonownership measurements

Ad hoc common ownership measures

- $Overlap_{Count}(A, B) = \sum_{i \in I^{A,B}} 1$
[He and Huang -RFS(2017)] [He et al-JFE(2019)]

- $Overlap_{Min}(A, B) = \sum_{i \in I^{A,B}} \min\{\alpha_{i,A}, \alpha_{i,B}\}$
[Newham et al.(2018)]

- $Overlap_{AP}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{\nu}_A}{\bar{\nu}_A + \bar{\nu}_B} + \alpha_{i,B} \frac{\bar{\nu}_B}{\bar{\nu}_A + \bar{\nu}_B}$
[Antón and Polk -JF(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 -JGQA(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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Measuring Common Ownership

Antón and Polk -JF(2014)

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

SQRT

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

Quadratic

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

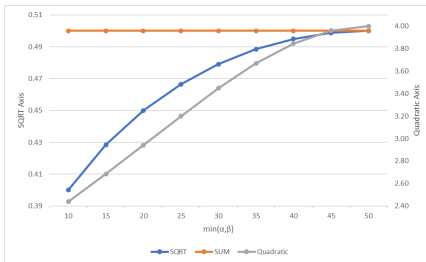
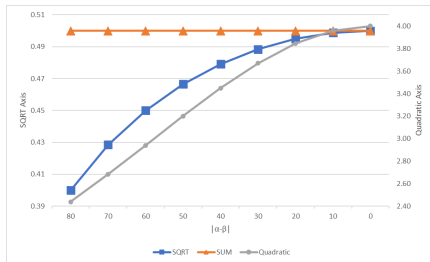
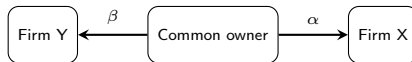
Intuition

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

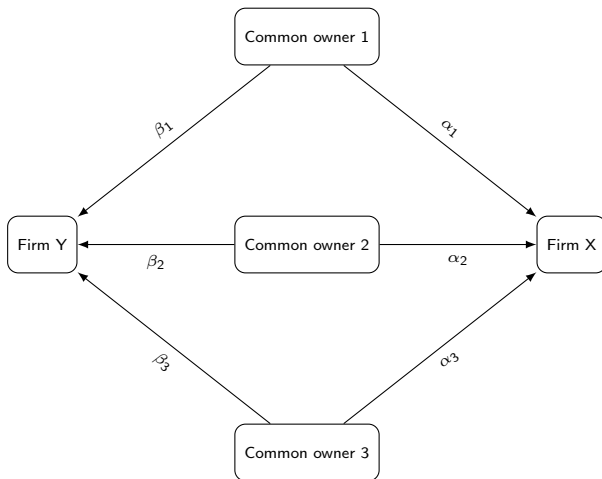
α and β are the percent of common owner's ownership from firms' market cap. For better observation, assume that $\alpha + \beta = 100$



Comparison of three methods for calculating common ownership

Measuring Common Ownership

Example of three common owner



Measuring Common Ownership

Example of three common owner

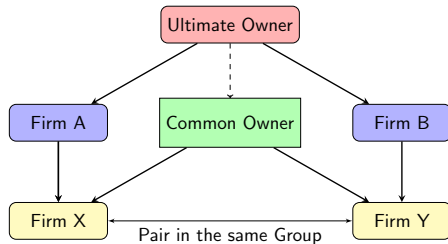
Ownership	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII
α_1	1/3	10	20	5	10	20	1
β_1	1/3	10	10	5	10	20	1
α_2	1/3	80	10	5	10	20	1
β_2	1/3	80	20	5	10	20	1
α_3	1/3	10	70	5	10	20	1
β_3	1/3	10	70	5	10	20	1
SQRT	3	2.33	2.56	0.45	0.9	1.8	0.09
SUM	1	1	1	0.15	0.3	0.6	0.03
Quadratic	3	1.52	1.85	133.33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

Conclusion

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

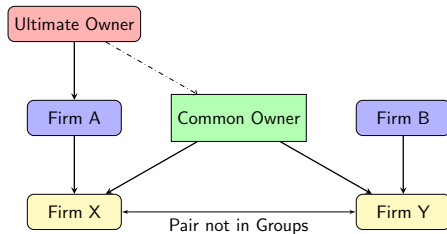
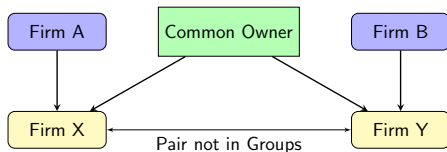
Pair Composition and Business Group

Pair in the Business Group



Pair Composition and Business Group

Pair not in any of Business Groups



Pair Composition

- Pairs consist of two firms with at least one common owner
 - 9976 unique pairs which is 17% of possible pairs ($\frac{342 \times 341}{2} = 58311$)

	mean	min	median	max
Number of unique paris	4201	2889	4099	5115

Year	2015	2016	2017	2018	2019	2020	Mean
No. of Pairs	4130	5113	5808	6221	5805	3971	5175
No. of Groups	41	42	45	45	45	46	44
No. of Pairs not in Groups	0	0	0	0	0	0	0
No. of Pairs in the same Group	633	755	968	1076	1116	832	897
No. of Pairs not in the same Group	3779	4836	5395	5720	5321	3246	4716
Avg. Number of Common owner	1.24	1.22	1.21	1.20	1.20	1.18	1.21
Med. Number of Common owner	1	1	1	1	1	1	1
Avg. Number of Pairs in one Group	23	24	25	28	29	22	25
Med. Number of Pairs in one Group	10	10	9	11	12	9	10
Av. Percent of each Blockholder	18.74	19.25	19.41	19.38	19.28	18.82	19.15
Medi. Percent of each Blockholder	10	10.08	10.31	10.17	10.48	10.79	10
Av. Number of Owners	6.06	5.93	5.8	5.91	5.94	6.06	5.95
Med. Number of Owners	6.08	5.96	5.82	5.92	5.92	6.02	5.95
Av. Block. Ownership	81.37	82.21	82.64	83.29	83.48	82.94	82.66
Med. Block. Ownership	80.03	80.6	80.74	81.48	81.63	81.28	80.96

By Group we mean Business Group

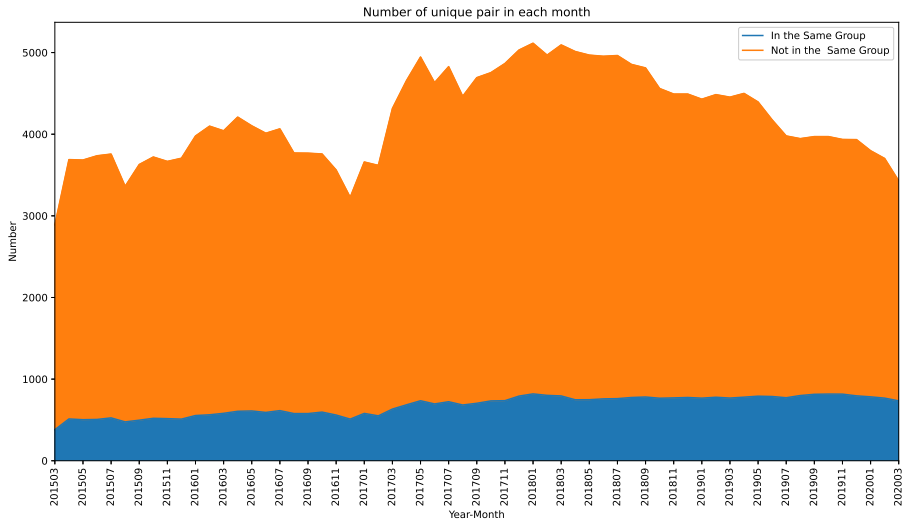
Data Summary

- 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 including 342 firm with common owners

Year	2015	2016	2017	2018	2019	2020	mean
No. of Firms	353	381	514	545	573	597	494
No. of Blockholders	721	886	1258	1367	1397	1369	1166
No. of Groups	41	42	46	46	46	46	45
No. of Firms not in Groups	112	124	189	195	219	244	181
No. of Firms in Groups	241	264	333	351	354	353	316
Avg. Number of Members	32	39	42	47	46	43	42
Med. of Number of Members	22	26	29	32	32	32	29
Av. Of each Blockholder's ownership	21	21.6	20.4	22.9	25.5	25.1	23
Med. of Owners' Percent	7.66	6.87	6.8	7.25	9.33	9.63	8
Av. Number of Blockholders	5	5	5	5	5	4	5
Med. Number of Owners	4	4	4	4	4	3	4
Av. Block. Ownership	71.9	71.8	68.5	77.9	78.7	69.3	73
Med. Block. Ownership	80.6	80.4	77.5	83.4	82	75.1	80

By Group we mean Business Group

Number of Pairs



FCA vs. FCAP Summary

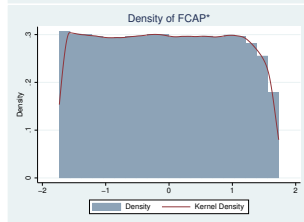
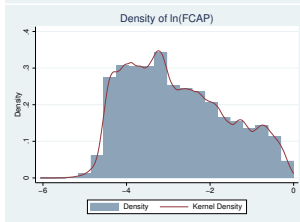
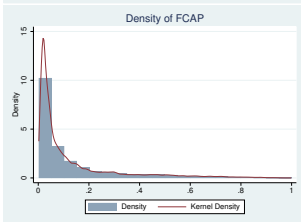
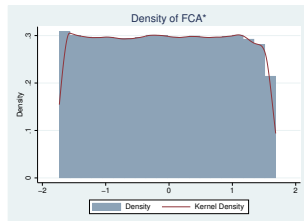
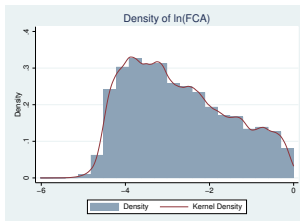
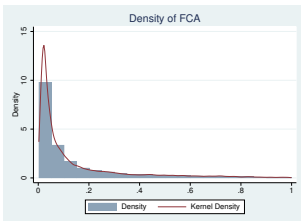
	variable	count	mean	std	min	25%	median	75%	max
Total	FCA	256296	0.164	0.266	0.002	0.024	0.057	0.174	3.893
	FCAP	256296	0.138	0.188	0.002	0.023	0.052	0.157	0.999
Same Group	FCA	41199	0.481	0.419	0.003	0.147	0.424	0.690	3.893
	FCAP	41199	0.388	0.264	0.004	0.124	0.394	0.605	0.999
Not Same Group	FCA	215097	0.104	0.166	0.002	0.022	0.045	0.112	2.813
	FCAP	215097	0.090	0.120	0.002	0.021	0.042	0.106	0.999
Same Industry	FCA	40009	0.375	0.416	0.007	0.059	0.233	0.567	3.893
	FCAP	40009	0.288	0.260	0.006	0.054	0.198	0.491	0.999
Not Same Industry	FCA	216287	0.125	0.205	0.002	0.023	0.048	0.128	2.869
	FCAP	216287	0.110	0.156	0.002	0.022	0.045	0.121	0.999

Results

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

FCA vs. FCAP Distributions

Monthly



Fortnightly

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 :

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

- 4 Factor + Industry (5 Factor) :

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

2 Second Step:

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

Correlation Calculation Results

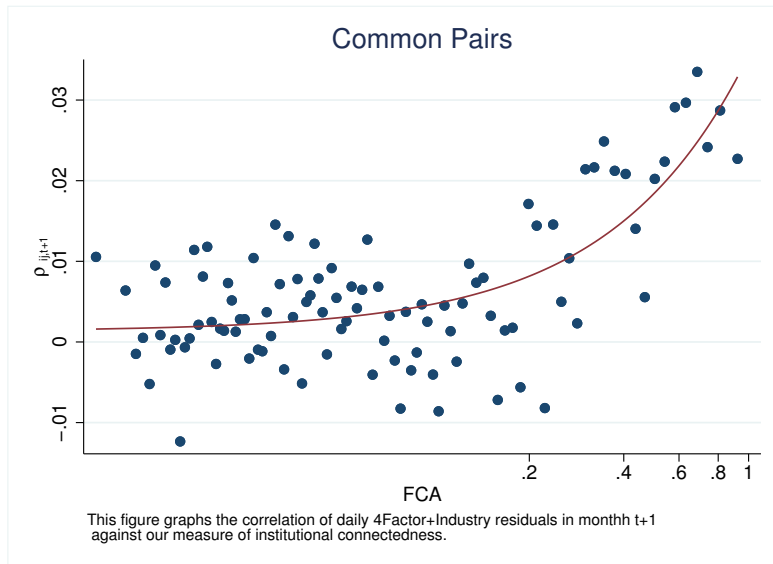
Factors	mean	std	min	max
SMB	0.19	1.47	-5.64	19.52
HML	-0.12	1.39	-4.90	23.20
Winner – Loser	0.69	1.06	-2.61	8.58
Market	0.24	1.23	-4.71	4.89

$\rho_{ij,t}$	count	mean	std	min	25%	50%	75%	max
CAPM	255222	0.008	0.324	-1	-0.192	0.007	0.206	1
4 Factor	255250	0.040	0.335	-1	-0.170	0.035	0.248	1
4 Factor + Industry	255239	0.006	0.322	-1	-0.192	0.005	0.204	1

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*



- ρ_t : Current period correlation
- **SameGroup** : Dummy variable for whether the two stocks belong to the same business group.
- **ActiveHolder** : Dummy variable for whether at least one of the holders is Active. (the active holder is the one whose average percentage change is greater than median)
- **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

Summary of Controls

Monthly

Type of Pairs	Yes	No
SameIndustry	1092 (11.7%)	8235 (88.3%)
SameGroup	1100 (11.8%)	8227 (88.2%)
ActiveHolder	2556 (27.4%)	6771 (72.6%)

	count	mean	std	min	25%	50%	75%	max
Size1	256296	0.75	0.21	0.01	0.62	0.81	0.93	1
Size2	256296	0.48	0.25	0.00	0.29	0.46	0.67	1.00
SameSize	256296	-0.27	0.21	-0.99	-0.41	-0.23	-0.10	0.00
BookToMarket1	256296	0.52	0.26	0.00	0.32	0.53	0.74	1.00
BookToMarket2	256296	0.50	0.24	0.00	0.31	0.49	0.69	1.00
SameBookToMarket	256296	-0.29	0.21	-1.00	-0.42	-0.25	-0.12	0.00

Fortnightly

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- Sum Factor

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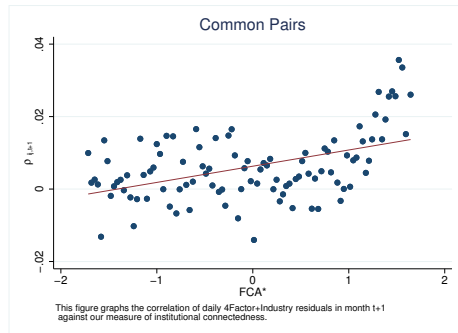
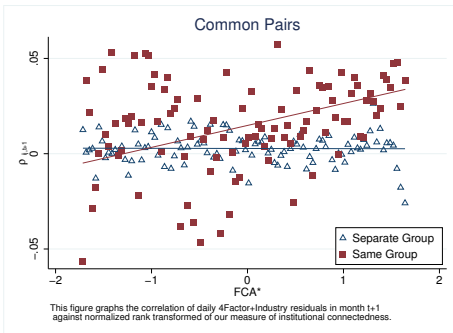
- Use Fama macbeth to estimate this model

$$\begin{aligned}\rho_{ij,t+1} = & \beta_0 + \beta_1 * tr(FCA_{ij,t}) + \beta_2 * SameGroup_{ij} \\ & + \beta_3 * tr(FCA_{ij,t}) * SameGroup_{ij} \\ & + \sum_{k=1}^n \alpha_k * Control_{ij,t} + \varepsilon_{ij,t+1}\end{aligned}$$

- $tr()$ is transform function
- Estimate that model on a monthly frequency

Future Correlation via *FCA*

Normalized Rank-Transformed



Fortnightly

Model Estimation

Normalized Rank-Transformed

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCA*	0.00494*** (4.97)	0.00405*** (5.50)	0.00148 (1.80)	0.000149 (0.17)	0.00403*** (5.39)	0.00384*** (4.09)	0.000268 (0.28)	-0.0000289 (-0.03)
ρ_t		0.127*** (4.73)	0.126*** (4.71)	0.126*** (4.70)	0.126*** (4.73)	0.127*** (4.73)	0.126*** (4.70)	0.126*** (4.70)
SameGroup			0.0177*** (7.43)	0.0102*** (4.32)			0.0114*** (4.60)	0.0121*** (4.89)
(FCA*) \times SameGroup				0.0102*** (4.13)			0.0104*** (4.13)	0.0102*** (4.06)
ActiveHolder					0.00192 (1.30)	0.00190 (1.29)	0.00102 (0.66)	0.000517 (0.34)
(FCA*) \times ActiveHolder						0.000737 (0.55)	-0.0000357 (-0.03)	0.000174 (0.13)
SameIndustry							-0.00372 (-1.83)	-0.00478* (-2.29)
SameSize								0.0115*** (4.34)
SameBookToMarket								0.00765* (2.02)
Constant	0.00652*** (8.54)	0.00554*** (8.54)	0.00282*** (4.46)	0.00255*** (3.95)	0.00498*** (7.40)	0.00495*** (7.31)	0.00249*** (3.60)	0.00793*** (7.03)
Observations	242577	241839	241839	241839	241839	241839	241839	241839
R^2	0.001	0.034	0.035	0.035	0.035	0.035	0.036	0.037

t statistics in parentheses

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

Model Estimation

Normalized Rank-Transformed (Down Market)

	Future Corr. of 4F+Ind. Residuals		
	(1)	(2)	(3)
FCA*	-0.0000289 (-0.03)	-0.0000289 (-0.03)	0.000582 (0.61)
(FCA*) \times SameGroup	0.0102*** (4.06)	0.0102*** (4.06)	
(FCA*) \times ActiveHolder	0.000174 (0.13)	0.000174 (0.13)	0.000288 (0.21)
Down Market \times SameGroup		0.000121 (1.05)	0.000121 (1.05)
(FCA*) \times Down Market \times SameGroup			0.00533** (2.84)
Observations	241839	241839	241839
R^2	0.037	0.037	0.037

t statistics in parentheses

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

Business Group Dummy

- We use group dummies and its interaction with FCA^*

$$\begin{aligned}\rho_{ij,t+1} = & \beta_0 + \beta_1 * FCA_{ij,t}^* \\ & + \beta_2 * \text{SameGroup}_{ij} + \beta_3 * FCA_{ij,t}^* * \text{SameGroup}_{ij} \\ & + \sum_{g=1}^G \lambda_{1,g} * \delta_{ij,g} \\ & + \sum_{g=1}^G \lambda_{2,g} * \delta_{ij,g} * FCA_{ij,t}^* \\ & + \sum_{k=1}^n \alpha_k * \text{Control}_{ij,t} + \varepsilon_{ij,t+1}\end{aligned}$$

- $\delta_{ij,g} = \text{SameGroup}_{ij} * \gamma_g$ which γ_g is a business group dummy

Significant lambdas are

Coef.	t-stat	Uo
0.037	2.41	Retirement
-0.017	-2.13	Melli bank
-0.024	-2.53	Sakt Inv.
-0.025	-2.64	TIPICO
-0.030	-2.94	Setad ejraee Imam
-0.031	-3.48	SITA
-0.036	-3.98	Mostazafan
-0.039	-2.01	Alipour Family
-0.056	-2.3	TORKOIS partners
-0.057	-3.69	Sepal Bank
-0.066	-3.37	Tejarat Bank
-0.086	-3.18	Edalat
-0.156	-5.71	Fars
-0.376	-2.11	Tamin

Effective Business Group

Check banking and Investment

- We define three types of groups
 - **Bank's Group:** Groups that ,at least, consist of one bank
 - **Bank In Group:** Groups that their ultimate owner is bank
 - **Inv. In Group:** Groups that ,at least, consist of one investment firm
- Estimated model:

$$\begin{aligned}\rho_{ij,t+1} = & \beta_0 + \beta_1 * FCA_{ij,t}^* + \beta_2 * SameGroup_{ij} \\ & + \beta_3 * FCA_{ij,t}^* * SameGroup_{ij} \\ & + \beta_4 * Bank's\ Group_{ij,g} + \beta_5 * Bank's\ Group_{ij,g} * FCA_{ij,t}^* \\ & + \beta_6 * Bank\ In\ Group_{ij,g} + \beta_7 * Bank\ In\ Group_{ij,g} * FCA_{ij,t}^* \\ & + \beta_8 * Inv.\ In\ Group_{ij,g} + \beta_9 * Inv.\ In\ Group_{ij,g} * FCA_{ij,t}^* \\ & + \sum_{k=1}^n \alpha_k * Control_{ij,t} + \varepsilon_{ij,t+1}\end{aligned}$$

- All dummies of each type define by interaction with SameGroup_{ij}

Effective Business Group

Check banking and Investment

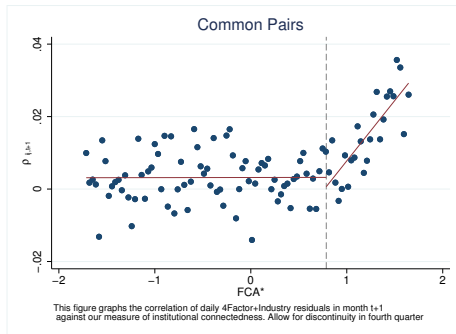
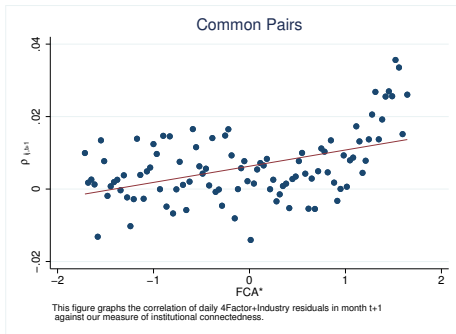
	De. Variable: Future Monthly Correlation of 4F+Industry Residuals				
	(1)	(2)	(3)	(4)	(5)
FCA*	-0.000142 (-0.15)	-0.000151 (-0.16)	0.000226 (0.25)	-0.0000291 (-0.03)	0.00000405 (0.00)
SameGroup	0.0122*** (4.90)	0.0108*** (3.83)	0.0160*** (5.41)	0.0145*** (4.39)	0.0151*** (3.58)
(FCA*) × SameGroup	0.0102*** (4.08)	0.00905** (3.37)	0.0119*** (4.53)	0.0101*** (3.91)	0.00776** (2.68)
(FCA*) × Bank's group × SameGroup		0.00865* (2.22)			0.0110** (2.72)
(FCA*) × Bank in group × SameGroup			-0.0202* (-2.37)		-0.0342** (-3.43)
(FCA*) × Inv. in group × SameGroup				0.00392 (0.80)	0.0185** (2.67)
Observations	241839	241839	241839	241839	241839
R ²	0.037	0.037	0.038	0.037	0.039

t statistics in parentheses

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

Future Correlation via *FCA*

Discontinuity



Fortnightly

Fama MacBeth Estimation

Discontinuity

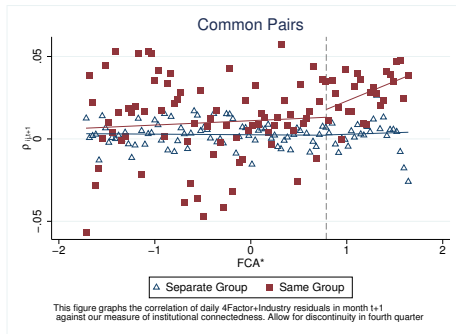
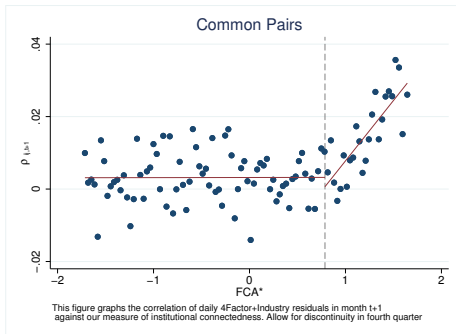
	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	0.00494*** (4.97)	-0.0000967 (-0.07)	-0.000489 (-0.39)	-0.000777 (-0.63)	-0.000468 (-0.37)	-0.000764 (-0.62)	-0.000848 (-0.72)
(FCA* > Q3[FCA*]) × FCA*		0.0119*** (5.85)	0.0107*** (5.13)	0.00601** (3.06)	0.0106*** (5.06)	0.00596** (2.98)	0.00589** (2.89)
ρ_t			0.126*** (4.72)	0.126*** (4.71)	0.126*** (4.72)	0.126*** (4.71)	0.126*** (4.70)
SameGroup				0.0156*** (7.06)		0.0157*** (7.15)	0.0177*** (7.40)
ActiveHolder					0.000723 (0.46)	0.000491 (0.31)	0.000168 (0.11)
SameIndustry							-0.00511* (-2.43)
SameSize							0.0112*** (4.22)
SameBookToMarket							0.00758 (2.00)
Constant	0.00652*** (8.54)	0.00264* (2.66)	0.00205* (2.37)	0.00117 (1.35)	0.00176 (1.95)	0.000897 (0.99)	0.00657*** (5.04)
Observations	242577	242577	241839	241839	241839	241839	241839
R ²	0.001	0.001	0.035	0.035	0.035	0.036	0.037

t statistics in parentheses

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

4 Factor + Industry Future Correlation via FCA^*

Discontinuity & Business Groups



Fortnightly

Fama MacBeth Estimation

Discontinuity & Business Groups

	Future Monthly Correlation of 4F+Industry Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
FCA*	-0.000848 (-0.72)	-0.0000289 (-0.03)	-0.00109 (-0.94)	-0.0000194 (-0.02)	-0.000512 (-0.44)	-0.000664 (-0.59)
$(FCA^* > Q3[FCA^*]) \times FCA^*$	0.00589** (2.89)		0.00315 (1.38)		0.00173 (0.74)	0.00193 (0.85)
$(FCA^*) \times \text{SameGroup}$		0.0102*** (4.06)	0.00925*** (3.46)	0.00115 (0.27)		0.00180 (0.44)
$(FCA^* > Q3[FCA^*]) \times (FCA^*) \times \text{SameGroup}$				0.0136* (2.60)	0.0137*** (3.96)	0.0117* (2.41)
Observations	241839	241839	241839	241839	241839	241839
R^2	0.037	0.037	0.037	0.037	0.037	0.037

t statistics in parentheses

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

Fortnightly

Model Estimation

Grouped by size

	All Firms			Big Firms			Big & Small Firms			Small Firms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FCA*	-0.0000289 (-0.03)	-0.000848 (-0.71)	-0.000664 (-0.59)	0.000912 (0.83)	-0.000353 (-0.28)	-0.000295 (-0.21)	-0.000927 (-0.62)	-0.000872 (-0.54)	-0.000218 (-0.13)	-0.00297 (-1.20)	-0.00393 (-1.08)	-0.00511 (-1.49)
$(FCA^* > Q3[FCA^*]) \times FCA^*$		0.00589** (2.87)	0.00193 (0.85)		0.00536* (2.17)	0.00384 (1.63)		0.00201 (0.63)	-0.00287 (-0.59)		0.0129* (2.10)	0.00425 (0.72)
SameGroup	0.0121*** (4.64)	0.0177*** (7.23)	0.00746* (2.56)	0.00670* (2.16)	0.00780* (2.29)	0.00121 (0.30)	0.0153** (3.23)	0.0181*** (3.91)	0.0106* (2.01)	0.00663 (0.85)	0.0222** (3.19)	0.00500 (0.50)
$(FCA^*) \times \text{SameGroup}$	0.0102*** (4.14)		0.00180 (0.44)	0.00360 (1.45)		-0.00529 (-1.11)	0.00518 (1.24)		-0.00344 (-0.60)	0.0225*** (4.04)		0.0198 (1.50)
$(FCA^* > Q3[FCA^*]) \times (FCA^*) \times \text{SameGroup}$			0.0117* (2.41)			0.0122 (1.87)			0.0147 (1.97)			0.00249 (0.14)
SameIndustry	-0.00478* (-2.47)	-0.00511* (-2.62)	-0.00503* (-2.35)	-0.0214*** (-7.41)	-0.0217*** (-7.48)	-0.0216*** (-7.36)	0.00415 (1.33)	0.00393 (1.29)	0.00433 (1.38)	0.00862 (1.93)	0.00718 (1.50)	0.00833 (1.72)
Observations	241839	241839	241839	110944	110944	110944	97637	97637	97637	33258	33258	33258
R ²	0.037	0.037	0.037	0.032	0.031	0.033	0.045	0.045	0.047	0.084	0.083	0.088

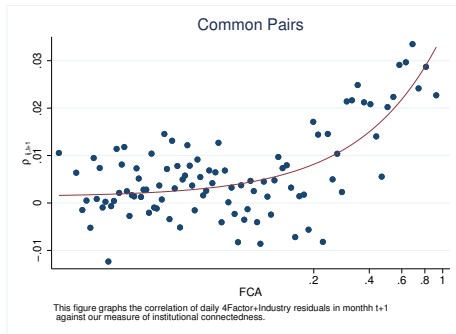
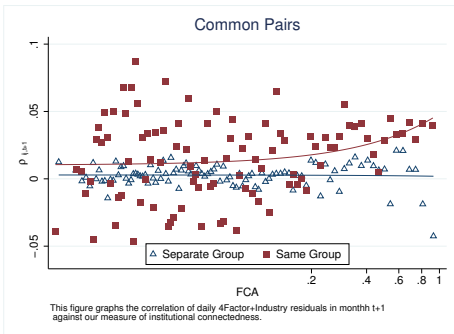
t statistics in parentheses

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

Fortnightly

Future Correlation via *FCA*

Logaritmic Transformation



Fortnightly

Fama MacBeth Estimation

Logarithmic Transformation

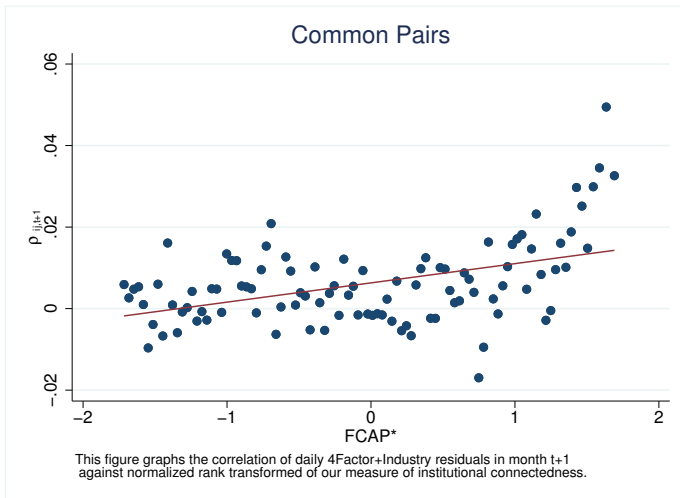
	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln(FCA)$	0.00451*** (6.17)	0.00377*** (6.76)	0.00151* (2.32)	0.0000861 (0.12)	0.00375*** (6.54)	0.00366*** (4.83)	0.000213 (0.26)	-0.0000327 (-0.04)
ρ_t		0.126*** (4.73)	0.126*** (4.71)	0.126*** (4.70)	0.126*** (4.72)	0.126*** (4.72)	0.126*** (4.70)	0.126*** (4.70)
SameGroup			0.0171*** (7.14)	0.0307*** (6.54)			0.0323*** (6.44)	0.0328*** (6.61)
$(\ln(FCA)) \times \text{SameGroup}$				0.00792*** (4.41)			0.00803*** (4.40)	0.00793*** (4.36)
ActiveHolder					0.00164 (1.07)	0.00243 (0.73)	0.000685 (0.19)	0.000567 (0.16)
$(\ln(FCA)) \times \text{ActiveHolder}$						0.000315 (0.30)	-0.0000937 (-0.09)	0.0000572 (0.05)
SameIndustry							-0.00391 (-1.92)	-0.00495* (-2.36)
SameSize								0.0113*** (4.23)
SameBookToMarket								0.00764* (2.03)
Constant	0.0183*** (8.35)	0.0155*** (9.15)	0.00681** (3.44)	0.00259 (1.18)	0.0149*** (8.08)	0.0147*** (6.17)	0.00294 (1.13)	0.00769** (3.11)
Observations	242577	241839	241839	241839	241839	241839	241839	241839
R^2	0.001	0.034	0.035	0.035	0.035	0.035	0.036	0.037

t statistics in parentheses

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

Future Correlation via $FCAP^*$

Normalized Rank Transformed



Fama MacBeth Estimation

Normalized Rank Transformed

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCAP*	0.00523*** (5.35)	0.00428*** (5.99)	0.00175* (2.22)	0.000292 (0.35)	0.00429*** (5.95)	0.00397*** (4.23)	0.000408 (0.43)	-0.0000130 (-0.01)
ρ_t		0.127*** (4.73)	0.126*** (4.71)	0.126*** (4.70)	0.126*** (4.73)	0.127*** (4.73)	0.126*** (4.70)	0.126*** (4.70)
SameGroup			0.0174*** (7.51)	0.00936*** (3.98)			0.0106*** (4.45)	0.0114*** (4.71)
(FCAP*) \times SameGroup				0.0108*** (3.98)			0.0109*** (3.94)	0.0108*** (3.91)
ActiveHolder					0.00216 (1.46)	0.00213 (1.44)	0.00103 (0.67)	0.000516 (0.34)
(FCAP*) \times ActiveHolder						0.00137 (1.02)	0.0000999 (0.07)	0.000380 (0.28)
SameIndustry							-0.00380 (-1.87)	-0.00483* (-2.30)
SameSize								0.0113*** (4.28)
SameBookToMarket								0.00772* (2.03)
Constant	0.00651*** (8.55)	0.00554*** (8.52)	0.00286*** (4.52)	0.00257*** (3.97)	0.00492*** (7.34)	0.00489*** (7.27)	0.00252*** (3.69)	0.00792*** (7.07)
Observations	242577	241839	241839	241839	241839	241839	241839	241839
R ²	0.001	0.034	0.035	0.036	0.035	0.035	0.036	0.037

t statistics in parentheses

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

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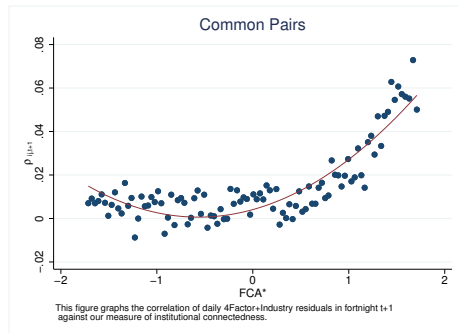
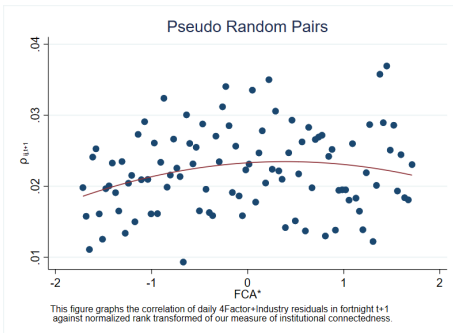
4 Results

5 Robustness Check

- Random Pairs
- Random Pairs from Same Business Group
- Random Pairs from Same Size

6 Conclusion

Random Pairs



Fama MacBeth Estimation for pseudo pairs

Fortnightly variables for Random group

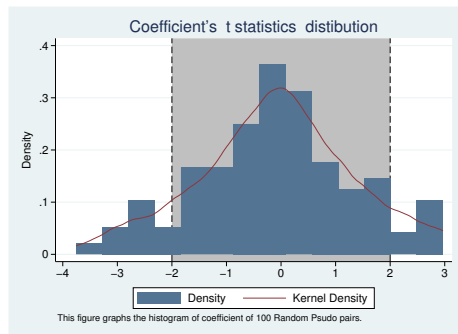
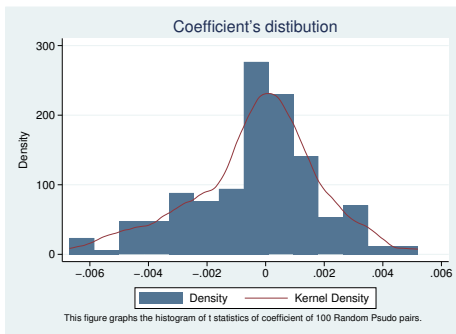
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	0.000606 (0.99)	0.00333** (2.60)	0.00261** (2.71)	0.00206* (2.11)	0.00244* (2.49)	0.00202* (2.04)	0.00190 (1.94)
$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$		-0.00559* (-2.57)	-0.00427* (-2.56)	-0.00316 (-1.84)	-0.00377* (-2.19)	-0.00314 (-1.82)	-0.00274 (-1.63)
ActiveHolder			0.0000628 (0.06)	-0.000258 (-0.23)	-0.000307 (-0.27)	-0.000319 (-0.28)	0.0000163 (0.01)
Constant	0.0219*** (5.27)	0.0243*** (5.75)	0.0173*** (6.82)	0.0666*** (11.33)	0.121*** (18.46)	0.0508*** (10.35)	0.0299*** (8.12)
Main	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	Yes	Yes	No
N	1105543	1105543	1067554	1067554	1067554	1067554	1067554
r2	0.000237	0.000448	0.223	0.227	0.228	0.226	0.225

t statistics in parentheses

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

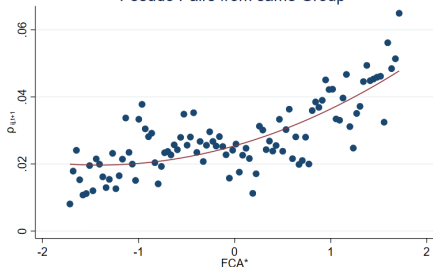
Random Pairs

$$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$$

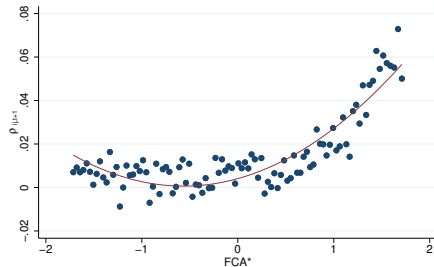


Random Pairs from Same Business Group

Pseudo Pairs from same Group

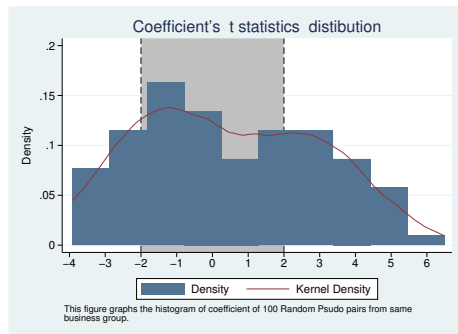
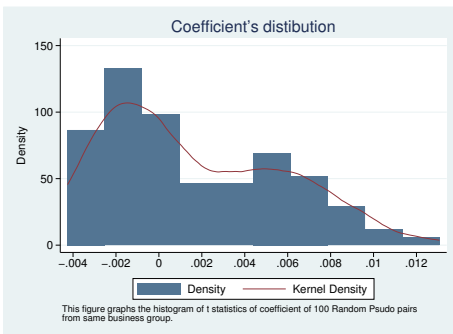


Common Pairs



Random Pairs from Same Business Group

$$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$$



Fama MacBeth Estimation for pseudo pairs

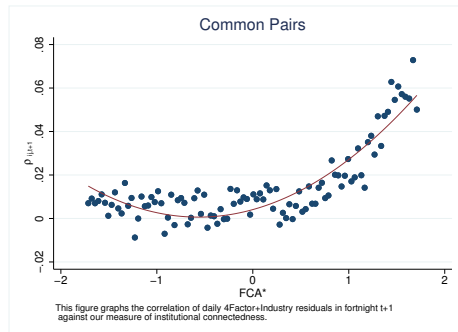
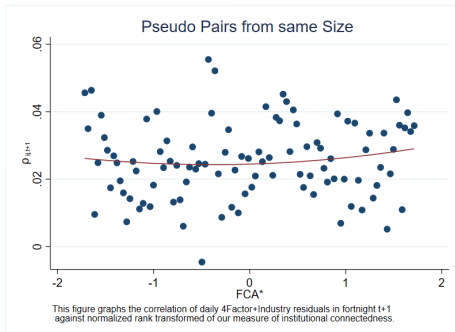
Fortnightly variables for Random group from Same Business Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	0.00808*** (10.59)	0.00365* (2.37)	0.00230 (1.88)	-0.000386 (-0.31)	-0.000628 (-0.50)	-0.000128 (-0.11)	0.000500 (0.42)
$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$		0.00932** (3.24)	0.00691** (3.18)	0.000962 (0.46)	0.00104 (0.49)	-0.000242 (-0.12)	-0.00233 (-1.18)
ActiveHolder			0.00648*** (5.09)	0.00223 (1.87)	0.0000493 (0.04)	0.00285* (2.52)	0.00325** (2.86)
Constant	0.0288*** (8.08)	0.0248*** (6.62)	0.0160*** (6.88)	0.115*** (15.79)	0.232*** (26.40)	0.0821*** (14.10)	0.0418*** (11.86)
Main	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	Yes	Yes	No
N	1111129	1111129	1073214	1073214	1073214	1073214	1073214
r2	0.000515	0.000796	0.226	0.235	0.240	0.234	0.231

t statistics in parentheses

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

Random Pairs from Same Size



Fama MacBeth Estimation for pseudo pairs

Fortnightly variables for Pseudo group from Same Size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	0.000524 (0.47)	-0.00205 (-0.68)	-0.00126 (-0.61)	-0.00335 (-1.71)	-0.000312 (-0.17)	-0.00314 (-1.61)	-0.00114 (-0.55)
$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$		0.00510 (0.99)	0.00375 (1.04)	0.000580 (0.17)	-0.00431 (-1.26)	0.00113 (0.33)	0.000589 (0.17)
ActiveHolder			-0.00180 (-0.69)	0.00129 (0.53)	0.00294 (1.18)	0.0000404 (0.02)	-0.00154 (-0.60)
Constant	0.0240*** (8.56)	0.0217*** (5.65)	0.0167*** (6.25)	0.116*** (14.36)	0.255*** (19.32)	0.0792*** (11.49)	0.0347*** (9.81)
Main	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	Yes	Yes	No
N	442279	442279	426218	426218	426218	426218	426218
r ²	0.000653	0.00125	0.224	0.238	0.243	0.236	0.232

t statistics in parentheses

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

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- We derive a measure that captures the extent to which 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
 - Business groups of banks affect more than normal business groups



Anton, Polk, *Connected Stocks*, Journal of Finance 2014



Andrew Koch, Stefan Ruenzi, Laura Starks , *Commonality in Liquidity A Demand-Side Explanation* ,The Review of Financial Studies 2016



Pastor, L., and R. Stambaugh , *Liquidity risk and expected stock returns* ,Journal of Political Economy 2003



Acharya, V., and L. Pedersen , *Asset pricing with liquidity risk* , Journal of Financial Economics 2005



Khanna, T., Thomas, C., *Synchronicity and firm interlocks in an emerging market* , Journal of Financial Economics 2009



Boubaker, S., Mansali, H., Rjiba, H.-*Large controlling shareholders and stock price synchronicity* , Journal of Banking and finance 2014



Morck, R., Yeung, B., Yu, W., *The information content of stock markets: Why do emerging markets have synchronous stock price*, Journal of Financial Economics 2000



Harford, J., Jenter, D., Li, K., *Institutional cross-holdings and their effect on acquisition decisions* . Journal of Financial Economics 2011



AZAR, J., SCHMALZ, M. C., TECU, I., *Anticompetitive Effects of Common Ownership*, Journal of Financial 2018



He,Jie (Jack) Huang,Jiekun ,Zhao,Shanc,*Internalizing governance externalities The role of institutional cross-ownership* . Journal of Financial 2019

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Measuring Common Ownership

Proof

- 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 $S_{i,t}^f P_{i,t} = \alpha_i$
 - SQRT

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

- Quadratic

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

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- Synchronicity and firm interlocks
- Large controlling shareholder and stock price synchronicity
- Connected Stocks

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Synchronicity and firm interlocks

JFE-2009-Khanna

- Three types of network

- 1 Equity network
- 2 Director network
- 3 Owner network

- Dependent variables

Using detrended weekly return for calculation

- 1 Pairwise returns synchronicity = $\frac{\sum_t (n_{i,j,t}^{up} n_{i,j,t}^{down})}{T_{i,j}}$

- 2 Correlation = $\frac{Cov(i,j)}{\sqrt{Var(i).Var(j)}}$

- Tobit estimation of

$$f_{i,j}^d = \alpha l_{i,j} + \beta(1 * N_{i,j}) + \gamma Ind_{i,j} + \varepsilon_{i,j}$$

being in the same director network has a significant effect

Large controlling shareholder and stock price synchronicity

JBF-2014-Boubaker

- Stock price synchronicity:

$$SYNCH = \log\left(\frac{R_{i,t}^2}{1 - R_{i,t}^2}\right)$$

where $R_{i,t}^2$ 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

$$\begin{aligned} SYNCH_{i,t} = & \beta_0 + \beta_1 Excess_{i,t} + \beta_2 UCF_{i,t} + \sum_k \beta_k Control_{i,t}^k \\ & + IndustryDummies + YearDummies + \varepsilon_{i,t} \end{aligned}$$

- 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
 - $FCAP_{ij,t} = \frac{\sum_{f=1}^F (S_{i,t}^f P_{i,t} + S_{j,t}^f P_{j,t})}{S_{i,t} P_{i,t} + S_{j,t} P_{j,t}}$
 - Using normalized rank-transformed as $FCAP_{ij,t}^*$
- $\rho_{ij,t}$: within-month realized correlation of each stock pair's daily four-factor returns

•

$$\rho_{ij,t+1} = a + b_f \times FCAP_{ij,t}^* + \sum_{k=1}^n CONTROL_{ij,t,k} + \varepsilon_{ij,t+1}$$

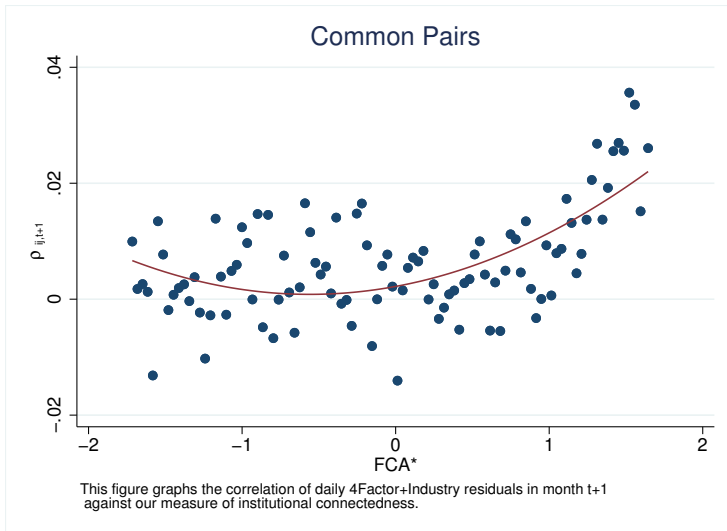
Estimate these regressions monthly and report the time-series average as in Fama and MacBeth

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4 Factor + Industry Future Correlation via FCA^*

Normalized Rank Transformed for each cross section (Monthly)



Fama MacBeth Estimation

Monthly variables

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCA*	0.00494*** (4.97)	0.00405*** (5.50)	0.00148 (1.80)	0.000149 (0.17)	0.00403*** (5.39)	0.00384*** (4.09)	0.000268 (0.28)	-0.0000289 (-0.03)
ρ_t		0.127*** (4.73)	0.126*** (4.71)	0.126*** (4.70)	0.126*** (4.73)	0.127*** (4.73)	0.126*** (4.70)	0.126*** (4.70)
SameGroup			0.0177*** (7.43)	0.0102*** (4.32)			0.0114*** (4.60)	0.0121*** (4.89)
(FCA*) \times SameGroup				0.0102*** (4.13)			0.0104*** (4.13)	0.0102*** (4.06)
ActiveHolder					0.00192 (1.30)	0.00190 (1.29)	0.00102 (0.66)	0.000517 (0.34)
(FCA*) \times ActiveHolder						0.000737 (0.55)	-0.0000357 (-0.03)	0.000174 (0.13)
SameIndustry							-0.00372 (-1.83)	-0.00478* (-2.29)
SameSize								0.0115*** (4.34)
SameBookToMarket								0.00765* (2.02)
Constant	0.00652*** (8.54)	0.00554*** (8.54)	0.00282*** (4.46)	0.00255*** (3.95)	0.00498*** (7.40)	0.00495*** (7.31)	0.00249*** (3.60)	0.00793*** (7.03)
Observations	242577	241839	241839	241839	241839	241839	241839	241839
R^2	0.001	0.034	0.035	0.035	0.035	0.035	0.036	0.037

t statistics in parentheses

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

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7 Appendix I

8 Appendix II

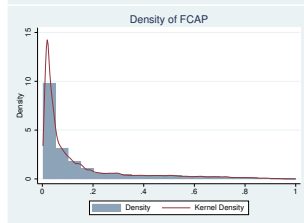
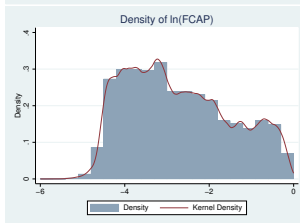
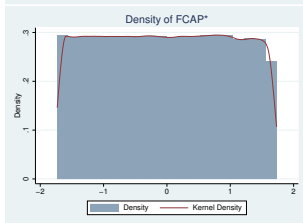
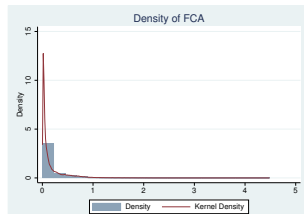
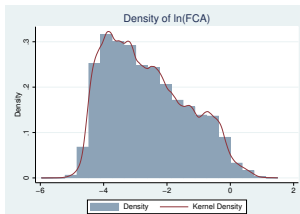
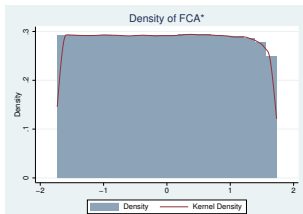
9 Appendix III

10 Appendix IV

- Measuring Common Ownership
- Controls
- Logaritmic
- Discontinuity
- Business Group
- Other

FCA vs. FCAP Distributions

Fortnightly



Monthly

Summary of Controls

Fortnightly

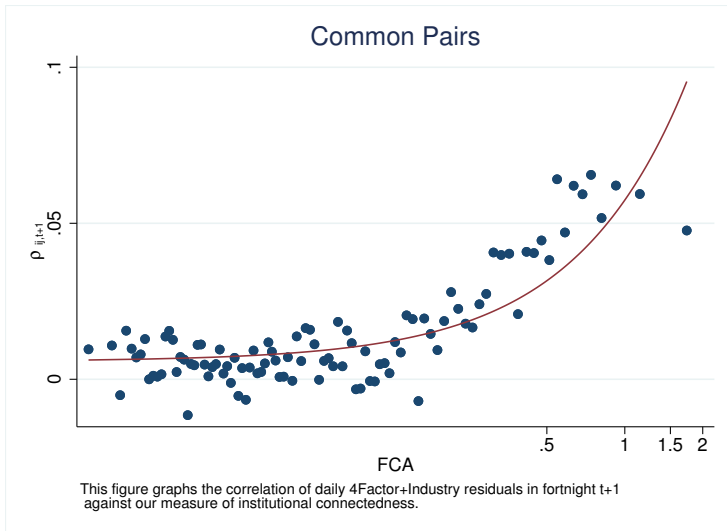
Type of Pairs	Yes	No
SameIndustry	1142 (11.1%)	9125 (88.9%)
SameGroup	1173 (11.4%)	9094 (88.6%)
ActiveHolder	2819 (27.5%)	7448 (72.5%)

Variable	count	mean	std	min	25%	50%	75%	max
Size1	636641	0.75	0.21	0.01	0.61	0.81	0.93	1
Size2	636641	0.47	0.26	0.00	0.26	0.45	0.67	1.00
SameSize	636641	-0.28	0.22	-0.99	-0.42	-0.24	-0.10	0.00
BookToMarket1	636641	0.52	0.27	0.00	0.31	0.54	0.74	1.00
BookToMarket2	636641	0.50	0.25	0.00	0.29	0.49	0.70	1.00
SameBookToMarket	636641	-0.29	0.21	-1.00	-0.43	-0.25	-0.12	0.00

Monthly

Future Correlation via *FCA*

4 Factor + Industry (Fortnightly)



Fama MacBeth Estimation

Fortnightly variables

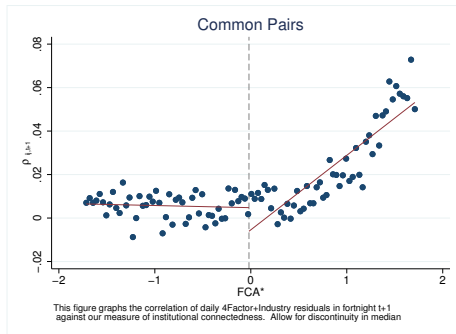
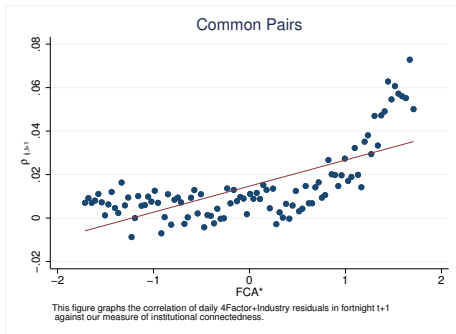
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln(FCA)$	0.0108*** (8.48)	0.00989*** (9.12)	0.00964*** (8.81)	0.00511*** (5.15)	0.00499*** (4.95)	0.00271*** (4.12)	0.00276*** (4.07)	0.00281*** (4.16)	0.00297*** (3.78)
ρ_{-t}		0.0740*** (5.50)	0.0739*** (5.49)	0.0734*** (5.44)	0.0733*** (5.44)	0.0710*** (5.36)	0.0708*** (5.34)	0.0711*** (5.36)	0.0723*** (5.39)
ActiveHolder			0.00970*** (6.05)		0.00810*** (5.06)	0.00425* (2.35)	0.00416* (2.40)	0.00356 (1.94)	0.00410* (2.41)
SameGroup				0.0329*** (10.98)	0.0322*** (10.80)	0.0216*** (7.32)	0.0214*** (7.29)	0.0218*** (7.47)	0.0247*** (9.32)
SameIndustry						0.0275*** (7.00)	0.0267*** (6.73)	0.0264*** (6.55)	0.0288*** (6.45)
SameSize								0.0403*** (3.53)	0.0235*** (4.35)
SameBookToMarket								0.0127** (3.22)	0.0146*** (4.34)
Constant	0.0432*** (8.14)	0.0395*** (8.73)	0.0363*** (8.10)	0.0214*** (5.32)	0.0191*** (4.71)	0.0396** (3.13)	0.0504** (3.20)	0.0372*** (4.04)	0.0225*** (5.91)
Value	No	No	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	No	No	Yes	Yes	No
N	613875	613875	613875	613875	613875	613875	613875	613875	613875
r ²	0.00152	0.0127	0.0131	0.0137	0.0141	0.0184	0.0193	0.0183	0.0164

t statistics in parentheses

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

4 Factor + Industry Future Correlation via FCA^*

Normalized Rank Transformed for each cross section (Fortnightly)



Monthly

Fama MacBeth Estimation

Fortnightly variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FCA*	0.0124*** (7.43)	-0.00545*** (-3.99)	-0.00518*** (-3.90)	-0.00450*** (-3.44)	-0.00440*** (-3.40)	-0.00408** (-3.19)	-0.00537*** (-4.06)	-0.00420** (-3.22)	-0.00526*** (-3.98)	-0.00448*** (-3.49)
(FCA* > Median[FCA*]) × FCA*		0.0360*** (9.80)	0.0332*** (10.20)	0.0314*** (9.78)	0.0240*** (8.68)	0.0232*** (8.29)	0.0228*** (9.37)	0.0156*** (5.83)	0.0231*** (9.14)	0.0231*** (8.17)
$\rho_{\Delta t}$			0.0738*** (5.50)	0.0737*** (5.49)	0.0727*** (5.42)	0.0727*** (5.41)	0.0711*** (5.38)	0.0708*** (5.34)	0.0712*** (5.38)	0.0724*** (5.41)
ActiveHolder				0.00792*** (4.85)		0.00494** (2.98)	0.00362 (1.94)	0.00322 (1.81)	0.00284 (1.49)	0.00354* (2.02)
SameIndustry					0.0363*** (8.06)	0.0357*** (7.91)	0.0315*** (7.93)	0.0261*** (6.60)	0.0303*** (7.47)	0.0339*** (7.54)
SameGroup								0.0191*** (6.14)		
SameSize									0.0416*** (3.67)	0.0213*** (3.91)
SameBookToMarket									0.0128** (3.24)	0.0147*** (4.36)
Constant	0.0150*** (6.31)	-0.000422 (-0.25)	-0.000591 (-0.38)	-0.00187 (-1.19)	-0.00234 (-1.70)	-0.00312* (-2.19)	0.0300* (2.59)	0.0375* (2.50)	0.0258** (3.22)	0.00782*** (3.56)
Value	No	No	No	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	No	No	No	Yes	Yes	No
N	613875	613875	613875	613875	613875	613875	613875	613875	613875	613875
r ²	0.00132	0.00208	0.0132	0.0136	0.0149	0.0151	0.0182	0.0196	0.0181	0.0162

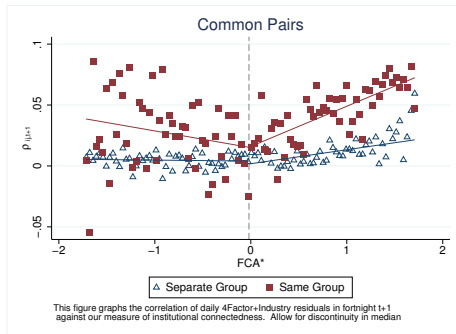
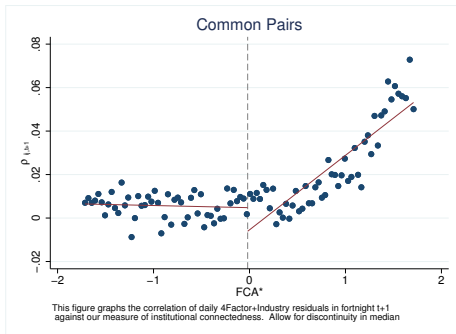
t statistics in parentheses

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

Monthly

4 Factor + Industry Future Correlation via FCA^*

Normalized Rank Transformed for each cross section (Fortnightly)



Monthly

Fama MacBeth Estimation

Monthly variables

	(1)	(2)
FCA*	-0.00370** (-2.79)	-0.00472*** (-3.39)
$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$	0.0128*** (4.34)	0.0141*** (5.15)
ρ_{-t}	0.0722*** (5.39)	0.0708*** (5.35)
ActiveHolder	0.00140 (0.73)	0.000470 (0.22)
$(FCA^* > \text{Median}[FCA^*]) \times \text{ActiveHolder}$	0.00338 (1.17)	0.00522 (1.75)
SameGroup	0.0117** (3.29)	0.0106** (2.87)
$(FCA^* > \text{Median}[FCA^*]) \times \text{SameGroup}$	0.0139*** (4.05)	0.0109** (3.14)
Constant	0.00973*** (4.57)	0.0380* (2.51)
Value	No	Yes
Interaction	No	Yes
N	613875	613875
r ²	0.0173	0.0202

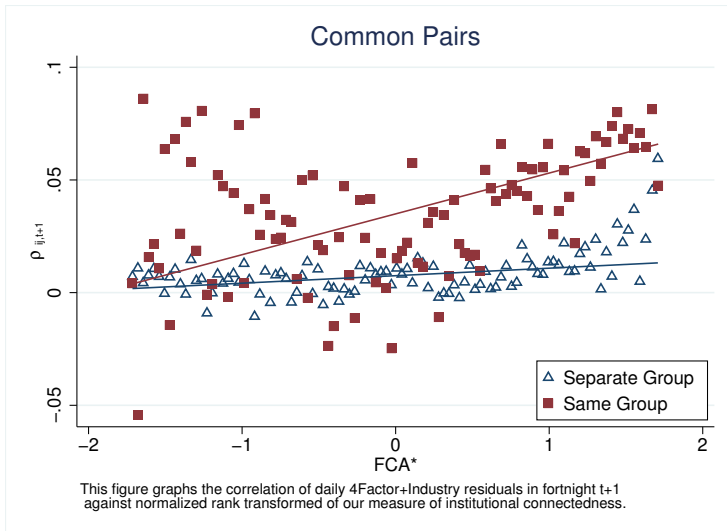
t statistics in parentheses

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

Monthly

Future Correlation via FCA^*

4 Factor + Industry (by Business Group)



Fama MacBeth Estimation

Fortnightly variables for subset of Same Business Group

	(1)	(2)	(3)	(4)	(5)	(6)
FCA*	0.0183*** (7.04)	-0.0127* (-2.13)	0.0100*** (5.21)	-0.00219 (-0.39)	0.00842*** (5.37)	-0.00535 (-0.98)
$(FCA^* > \text{Median}[FCA^*]) \times FCA^*$		0.0460*** (4.63)		0.0186* (2.08)		0.0210* (2.53)
ActiveHolder			0.0162*** (3.41)	0.0149** (3.07)	0.0188*** (4.00)	0.0174*** (3.61)
SameIndustry			0.0336*** (7.85)	0.0333*** (7.78)	0.0330*** (7.95)	0.0327*** (7.83)
SameSize			0.0340** (3.17)	0.0318** (3.03)		
SameBookToMarket			0.0609*** (5.97)	0.0605*** (5.90)		
Constant	0.0344*** (9.76)	0.0149** (3.01)	0.0399*** (8.38)	0.0314*** (5.53)	0.104*** (5.71)	0.0941*** (5.16)
Value	No	No	No	No	Yes	Yes
Interaction	No	No	No	No	Yes	Yes
N	103914	103914	103914	103914	103914	103914
r2	0.00281	0.00488	0.0390	0.0407	0.0494	0.0511

t statistics in parentheses

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

Fama MacBeth Estimation

Fortnightly variables for subset of Different Business Group

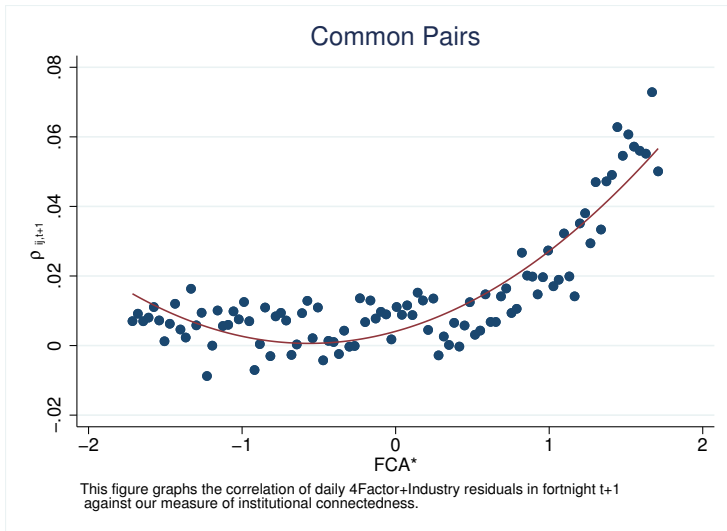
	(1)	(2)	(3)	(4)	(5)	(6)
FCA*	0.00422** (3.11)	-0.00178 (-1.37)	0.00194* (1.98)	-0.00210 (-1.75)	0.00172 (1.93)	-0.00290* (-2.26)
(FCA* > Median[FCA*]) × FCA*		0.0146*** (4.22)		0.00996*** (3.48)		0.0115*** (3.82)
ActiveHolder			0.000676 (0.48)	0.000186 (0.13)	-0.000437 (-0.30)	-0.00102 (-0.70)
SameIndustry			0.0238*** (4.34)	0.0231*** (4.23)	0.0211*** (4.23)	0.0202*** (4.05)
SameSize			0.0217*** (3.94)	0.0217*** (3.94)		
SameBookToMarket			0.00482 (1.49)	0.00477 (1.48)		
Constant	0.00831*** (4.07)	0.00285 (1.67)	0.0124*** (5.03)	0.00886*** (4.03)	0.0240 (1.53)	0.0202 (1.32)
Value	No	No	No	No	Yes	Yes
Interaction	No	No	No	No	Yes	Yes
N	509961	509961	509961	509961	509961	509961
r2	0.000490	0.000899	0.0120	0.0124	0.0148	0.0152

t statistics in parentheses

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

4 Factor + Industry Future Correlation via FCA^*

Normalized Rank Transformed for each cross section (Fortnightly)



Fama MacBeth Estimation

Fortnightly variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FCA*	0.0124*** (7.43)	0.0126*** (7.54)	0.0114*** (8.09)	0.0112*** (7.90)	0.00613*** (8.02)	0.00618*** (7.89)	0.00634*** (8.12)	0.00717*** (7.01)
FCA* ²		0.0109*** (10.30)	0.0101*** (10.52)	0.00959*** (10.08)	0.00697*** (9.59)	0.00700*** (9.97)	0.00701*** (9.37)	0.00710*** (8.49)
ρ_{-t}			0.0737*** (5.49)	0.0736*** (5.48)	0.0711*** (5.37)	0.0709*** (5.36)	0.0712*** (5.38)	0.0724*** (5.41)
ActiveHolder				0.00761*** (4.62)	0.00345 (1.84)	0.00331 (1.84)	0.00267 (1.40)	0.00336 (1.90)
SameIndustry					0.0310*** (7.85)	0.0301*** (7.57)	0.0299*** (7.40)	0.0334*** (7.46)
SameSize							0.0416*** (3.66)	0.0214*** (3.91)
SameBookToMarket							0.0126** (3.19)	0.0146*** (4.29)
Constant	0.0150*** (6.31)	0.00429* (2.35)	0.00372* (2.24)	0.00224 (1.35)	0.0330** (2.82)	0.0428** (2.85)	0.0288*** (3.52)	0.0108*** (4.76)
Value	No	No	No	No	Yes	Yes	No	No
Interaction	No	No	No	No	No	Yes	Yes	No
N	613875	613875	613875	613875	613875	613875	613875	613875
r ²	0.00132	0.00215	0.0133	0.0136	0.0183	0.0191	0.0182	0.0162

t statistics in parentheses

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