# Connected Stocks: Evidence from Tehran Stock Exchange

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# Motivation

## Research Question

- **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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# Main

- ## Common-ownership and comovement efect

  [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

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# Measuring Common Ownership

Sum

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

SQRT

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

Quadratic

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

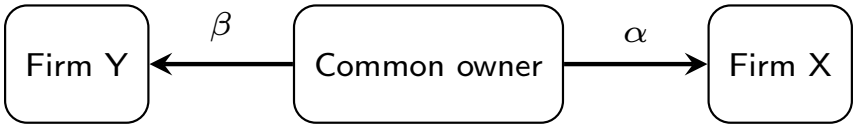
## Intuition

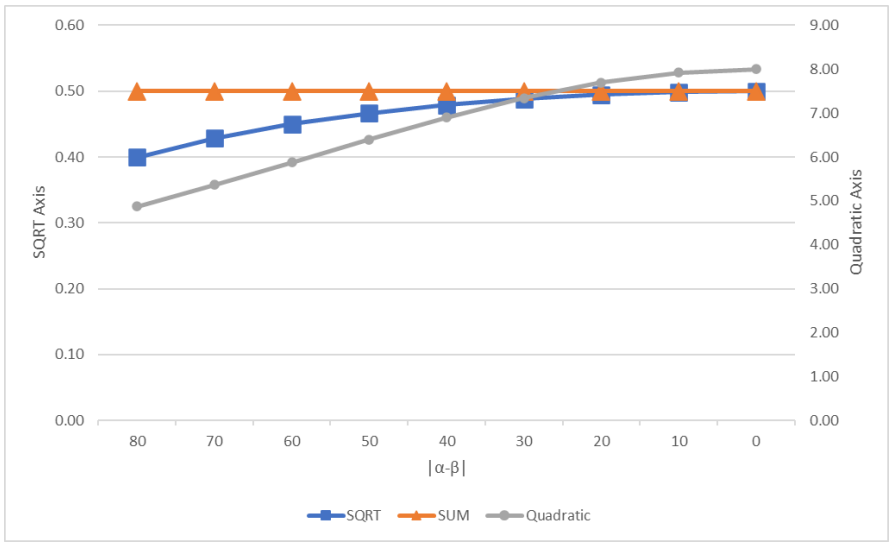
If for a pair of stocks with n mutual owners, all owners have even shares of each firm's market cap, then the proposed indexes will be equal to n. Proof

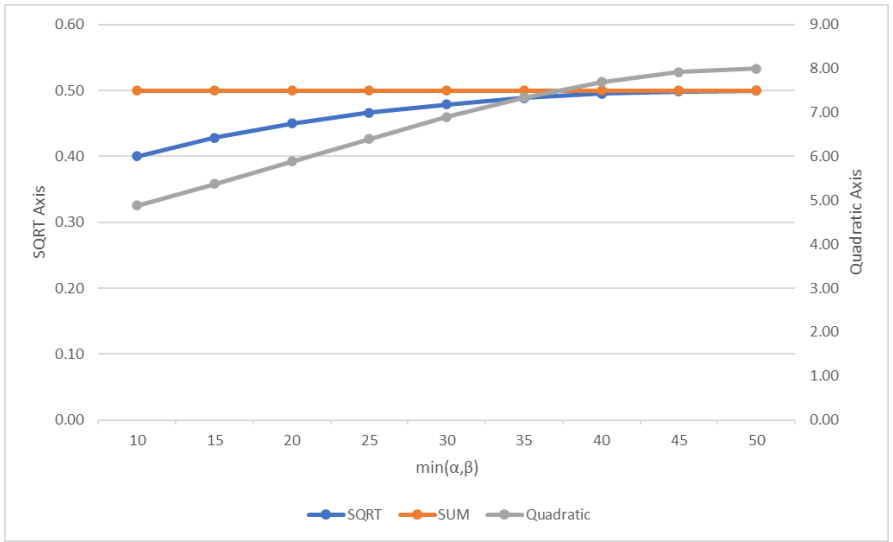
# Measuring Common Ownership

## Example

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



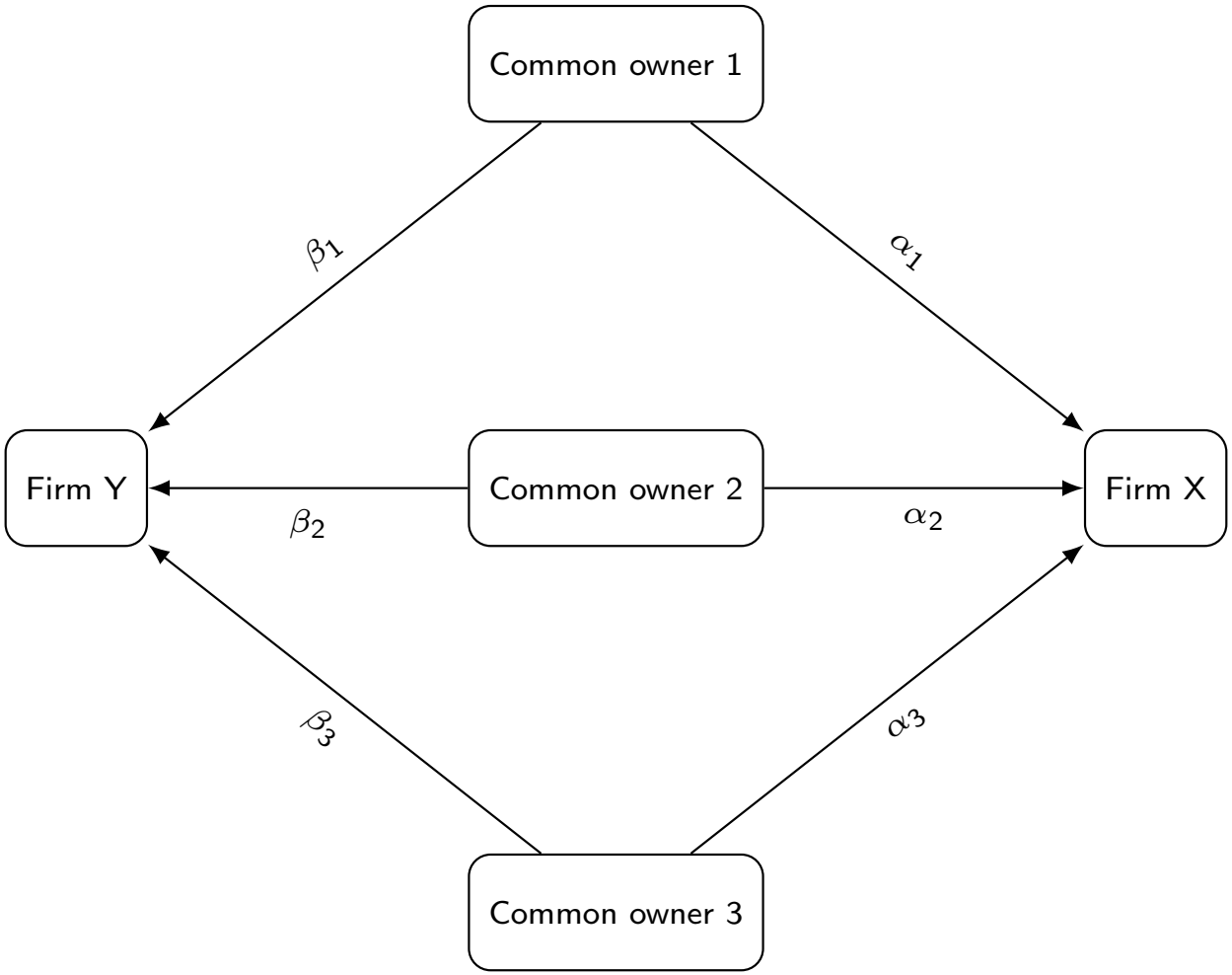




Comparison of three methods for calculating common ownership

# 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 |
|---|---|---|---|---|---|---|---|
| $\alpha_1$ | 1/3 | 10 | 20 | 5 | 10 | 20 | 1 |
| $\beta_1$ | 1/3 | 10 | 10 | 5 | 10 | 20 | 1 |
| $\alpha_2$ | 1/3 | 80 | 10 | 5 | 10 | 20 | 1 |
| $\beta_2$ | 1/3 | 80 | 20 | 5 | 10 | 20 | 1 |
| $\alpha_3$ | 1/3 | 10 | 70 | 5 | 10 | 20 | 1 |
| $\beta_3$ | 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

- Pairs consist of two firms with at least one common owner
  - 10310 unique pairs which is 18% of possible pairs ($\frac{340*399}{2} = 67830$)

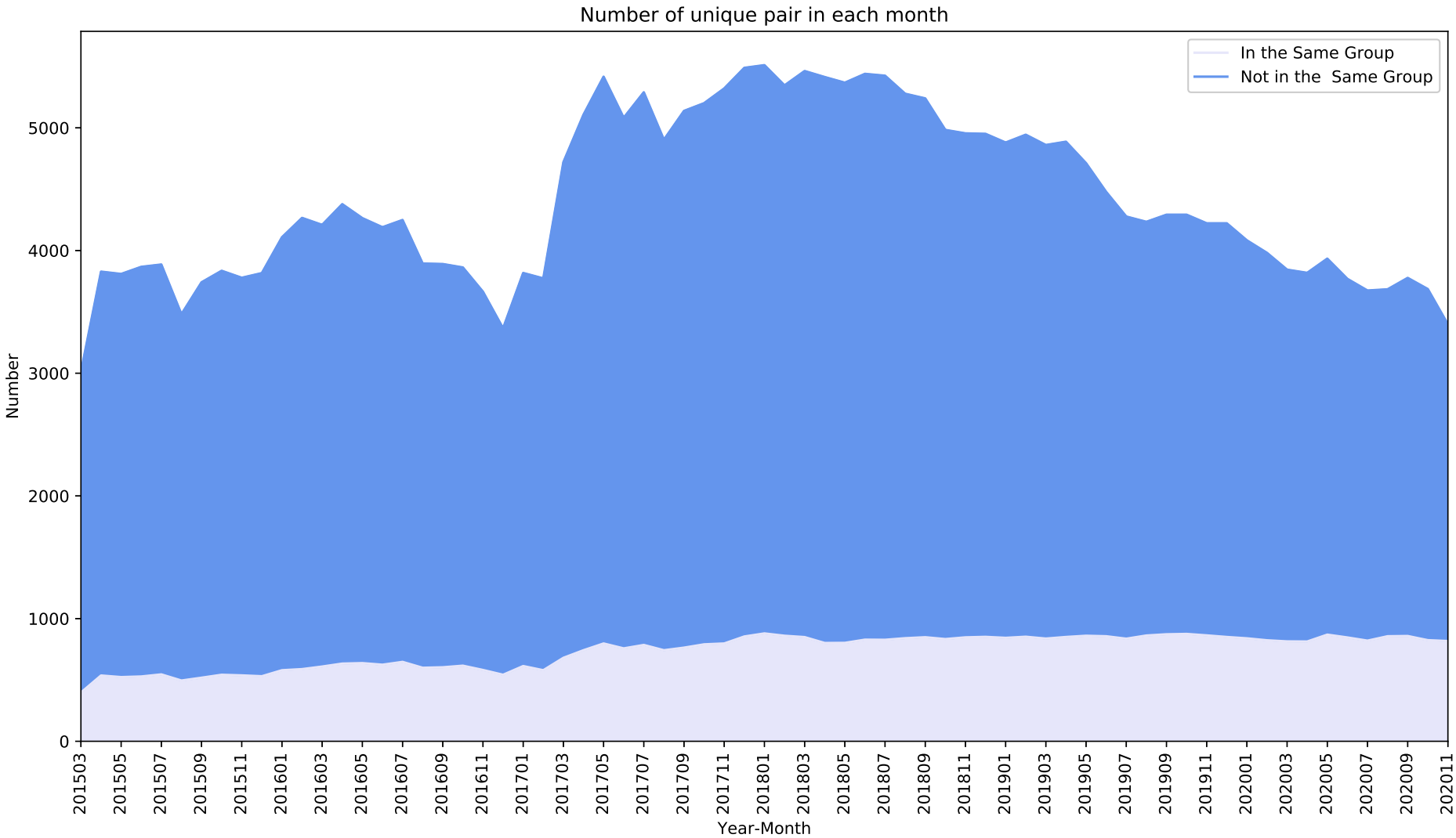
| Number of unique paris | mean | min | median | max |
|---|---|---|---|---|
| Monthly | 4397 | 3010 | 4247 | 5485 |

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Mean |
|---|---|---|---|---|---|---|---|
| No. of Pairs | 4259 | 5307 | 6297 | 6800 | 6197 | 4877 | 5623 |
| No. of Groups | 42 | 43 | 46 | 47 | 47 | 48 | 46 |
| No. of Pairs not in Groups | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. of Pairs in one Group | 591 | 697 | 930 | 999 | 977 | 946 | 857 |
| No. of Pairs not in one Group | 3668 | 4689 | 5524 | 5804 | 5220 | 3931 | 4806 |
| Avg. Number of Pairs in one Group | 21 | 21 | 23 | 23 | 23 | 23 | 22 |
| Med. Number of Pairs in one Group | 10 | 8 | 7 | 6 | 6 | 8 | 8 |
| Av. of each Owners' ownership | 18.8 | 19.3 | 19.4 | 19.4 | 19.1 | 19.1 | 19 |
| Med. of each Owners' ownership | 10.4 | 10.5 | 10.7 | 10.5 | 10.4 | 11.0 | 11 |
| Av. Number of Owners | 6.0 | 5.9 | 5.8 | 5.9 | 5.9 | 6.0 | 6 |
| Med. Number of Owners | 6.0 | 5.9 | 5.8 | 5.9 | 5.9 | 5.9 | 6 |
| Av. Block. Ownership | 81.0 | 81.9 | 82.4 | 83.3 | 83.7 | 83.6 | 83 |
| Med. Block. Ownership | 79.7 | 80.4 | 80.8 | 81.8 | 82.3 | 82.5 | 81 |

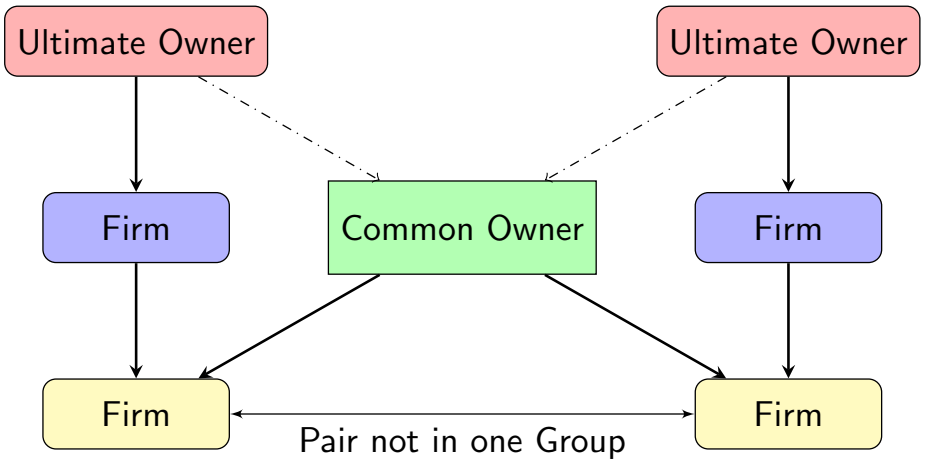
# Data Summary

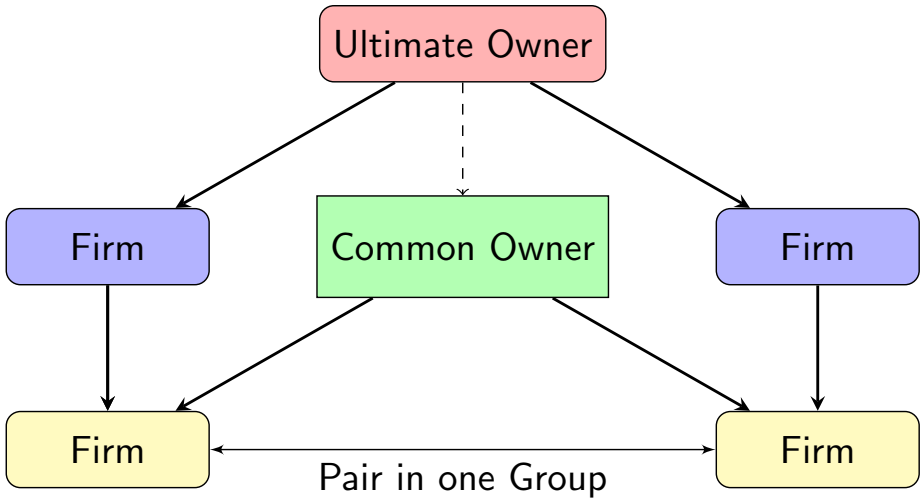
- We use blockholders' data from 2015/03/25 (1394/01/06) to 2020/11/16 (1399/08/26)
  - Includes of 1362 Day and 69 Month
  - Consists of 605 firm inculding 340 firm with common owners

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Mean |
|---|---|---|---|---|---|---|---|
| No. of Firms | 351 | 378 | 504 | 530 | 567 | 590 | 487 |
| No. of Holders | 719 | 870 | 1222 | 1305 | 1354 | 1347 | 1136 |
| No. of Groups | 42 | 43 | 47 | 48 | 48 | 48 | 46 |
| No. of Firms not in Groups | 109 | 120 | 183 | 181 | 216 | 240 | 175 |
| No. of Firms in Groups | 242 | 265 | 329 | 349 | 351 | 350 | 314 |
| Avg. Number of Members | 32 | 39 | 41 | 45 | 44 | 41 | 40 |
| Med. of Number of Members | 22 | 26 | 29 | 32 | 32 | 29 | 28 |
| Av. of each Owners' ownership | 20.9 | 21.5 | 20.5 | 23.1 | 25.6 | 25.2 | 23 |
| Med. of each Owners' ownership | 7.7 | 7.0 | 6.9 | 7.2 | 9.3 | 9.5 | 8 |
| Av. Number of Owners | 5 | 5 | 5 | 5 | 5 | 4 | 5 |
| Med. Number of Owners | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| Av. Block. Ownership | 72 | 71.7 | 68.6 | 78.1 | 78.5 | 69.2 | 73 |
| Med. Block. Ownership | 80.6 | 80.2 | 77.7 | 83.8 | 81.8 | 75.1 | 80 |


Number of unique pair in each month
In the Same Group
Not in the Same Group
Number
0
1000
2000
3000
4000
5000
Year-Month
201503
201505
201507
201509
201511
201601
201603
201605
201607
201609
201611
201701
201703
201705
201707
201709
201711
201801
201803
201805
201807
201809
201811
201901
201903
201905
201907
201909
201911
202001
202003
202005
202007
202009
202011

# Business Group



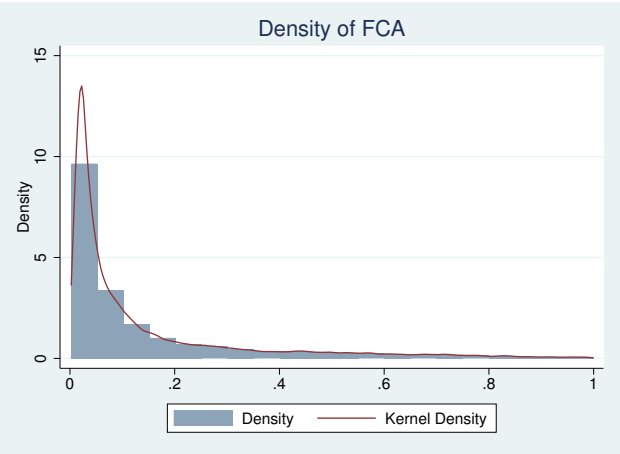
# FCA vs. FCAP Summary

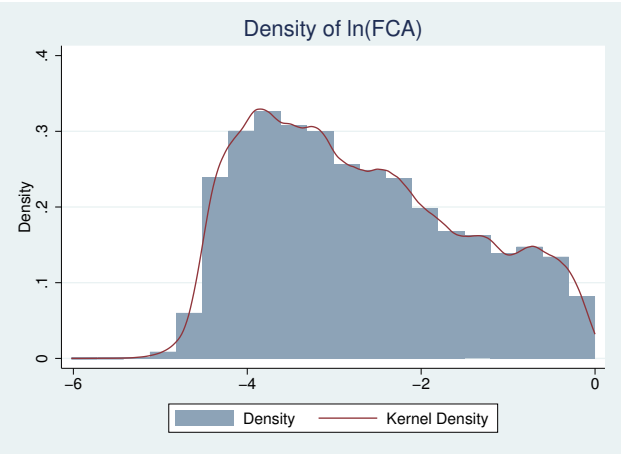
## Monthly

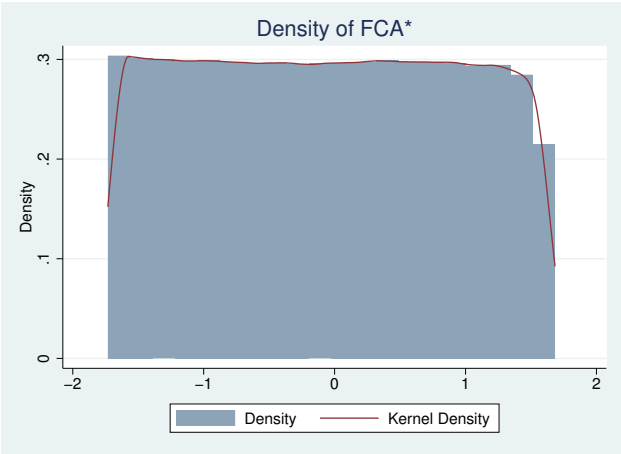
| | variable | count | mean | std | min | median | max |
|---|---|---|---|---|---|---|---|
| Total | FCA | 303419 | 0.168 | 0.269 | 0.002 | 0.059 | 4.342 |
| | FCAP | 303419 | 0.142 | 0.190 | 0.002 | 0.054 | 0.999 |
| Same Group | FCA | 50808 | 0.486 | 0.417 | 0.003 | 0.432 | 4.342 |
| | FCAP | 50808 | 0.391 | 0.259 | 0.004 | 0.400 | 0.999 |
| Not Same Group | FCA | 253163 | 0.104 | 0.165 | 0.002 | 0.045 | 2.813 |
| | FCAP | 253163 | 0.091 | 0.122 | 0.002 | 0.043 | 0.999 |
| Same Industry | FCA | 46797 | 0.379 | 0.419 | 0.007 | 0.243 | 4.342 |
| | FCAP | 46797 | 0.292 | 0.259 | 0.006 | 0.208 | 0.999 |
| Not Same Industry | FCA | 257174 | 0.129 | 0.210 | 0.002 | 0.049 | 2.869 |
| | FCAP | 257174 | 0.114 | 0.160 | 0.002 | 0.046 | 0.999 |

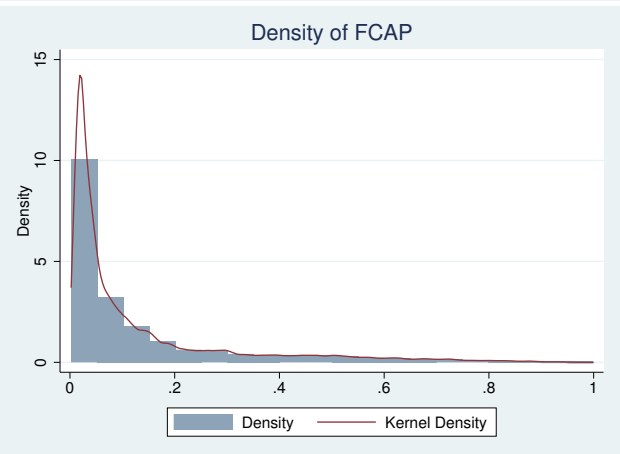
# FCA vs. FCAP Distributions

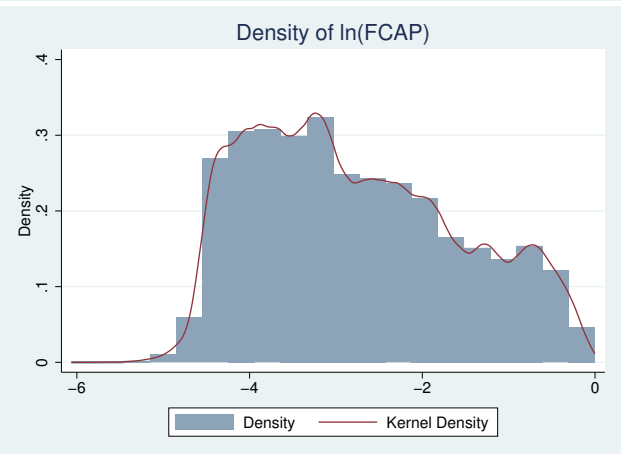
## Monthly

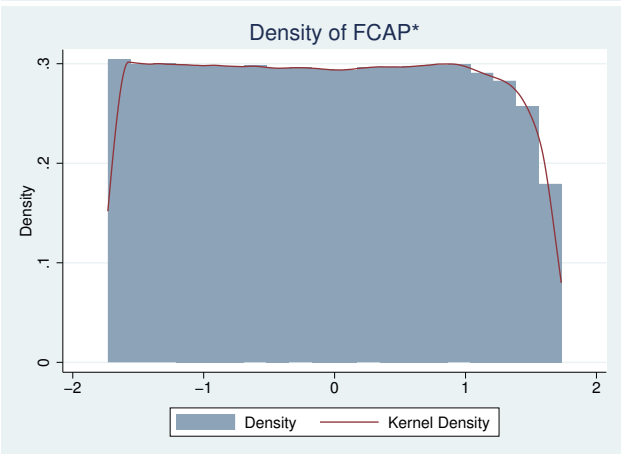



Fortnightly

# Correlation Calculation

## 4 Factor + Industry

1. Frist Step:
   Estimate each of these models for an entire period:
   - 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 | count | mean | std | min | max |
|---|---|---|---|---|---|
| SMB | 1374 | 0.19 | 1.47 | -5.64 | 19.52 |
| HML | 1374 | -0.12 | 1.39 | -4.90 | 23.20 |
| Winner − Loser | 1374 | 0.69 | 1.06 | -2.61 | 8.58 |
| Market | 1374 | 0.24 | 1.23 | -4.71 | 4.89 |

| $\rho_{ij,t}$ | count | mean | std | min | 25% | 50% | 75% | max |
|---|---|---|---|---|---|---|---|---|
| Monthly5 | 292895 | 0.015 | 0.326 | -1 | -0.19 | 0.01 | 0.22 | 1 |
| Monthly4 | 292895 | 0.057 | 0.345 | -1 | -0.17 | 0.05 | 0.28 | 1 |
| Monthly2 | 292895 | 0.016 | 0.327 | -1 | -0.19 | 0.01 | 0.22 | 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.

# Controls

- $\rho_t$ : 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 | 1142 | 9125 |
| | (11.1%) | (88.9%) |
| SameGroup | 1173 | 9094 |
| | (11.4%) | (88.6%) |
| ActiveHolder | 2819 | 7448 |
| | (27.5%) | (72.5%) |

| Variable | count | mean | std | min | 25% | 50% | 75% | max |
|---|---|---|---|---|---|---|---|---|
| Size1 | 303419 | 0.75 | 0.22 | 0.01 | 0.60 | 0.81 | 0.93 | 1 |
| Size2 | 303419 | 0.47 | 0.26 | 0.00 | 0.26 | 0.44 | 0.66 | 1.00 |
| SameSize | 303419 | -0.28 | 0.22 | -0.99 | -0.42 | -0.24 | -0.10 | 0.00 |
| BookToMarket1 | 303419 | 0.52 | 0.27 | 0.00 | 0.31 | 0.54 | 0.74 | 1.00 |
| BookToMarket2 | 303419 | 0.50 | 0.25 | 0.00 | 0.29 | 0.49 | 0.70 | 1.00 |
| SameBookToMarket | 303419 | -0.30 | 0.21 | -1.00 | -0.43 | -0.25 | -0.12 | 0.00 |

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# Regression Summary

- **Controls** : We use the percentile rank of a particular characteristic for each stock in regression.
- **Interaction** : We use the interaction between percentile rankings for a particular characteristic across a pair in regression.

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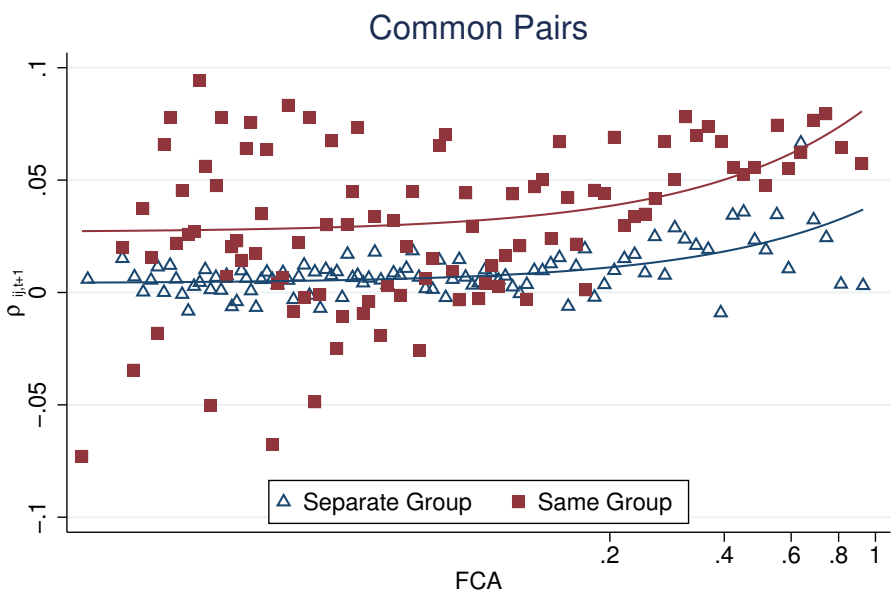
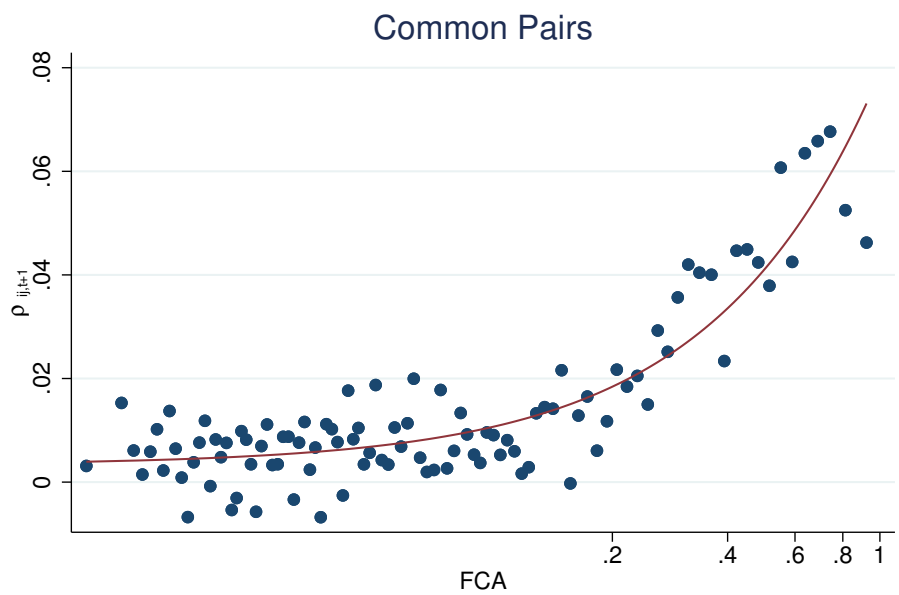
# Future Correlation via *FCA*

## 4 Factor + Industry (Monthly)




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




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

Fortnightly

# Fama MacBeth Estimation

## Monthly variables

| | Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| ln($FCA$) | 0.0107*** | 0.00890*** | 0.00510*** | 0.00328*** | 0.00892*** | 0.00800*** | 0.00170 | 0.000794 | 0.000794 | 0.000907 | 0.00106 |
| | (7.17) | (9.13) | (5.07) | (3.55) | (8.94) | (6.75) | (1.58) | (0.86) | (0.86) | (0.96) | (1.08) |
| $\rho_t$ | | 0.145*** | 0.144*** | 0.144*** | 0.145*** | 0.145*** | 0.143*** | 0.141*** | 0.141*** | 0.141*** | 0.143*** |
| | | (6.36) | (6.30) | (6.30) | (6.36) | (6.35) | (6.34) | (6.50) | (6.49) | (6.47) | (6.36) |
| SameGroup | | | 0.0273*** | 0.0454*** | | | 0.0386*** | 0.0338*** | 0.0337*** | 0.0343*** | 0.0397*** |
| | | | (9.78) | (9.14) | | | (7.97) | (6.27) | (6.26) | (6.43) | (8.37) |
| (ln($FCAP$)) × SameGroup | | | | 0.0102*** | | | 0.00973*** | 0.00818*** | 0.00821*** | 0.00831*** | 0.00965*** |
| | | | | (4.92) | | | (4.81) | (4.12) | (4.13) | (4.15) | (4.77) |
| ActiveHolder | | | | | 0.00606*** | 0.0175** | 0.0125* | 0.0136* | 0.0134* | 0.0129* | 0.0120* |
| | | | | | (3.63) | (3.09) | (2.22) | (2.42) | (2.41) | (2.31) | (2.15) |
| (ln($FCAP$)) × ActiveHolder | | | | | | 0.00391* | 0.00296 | 0.00397* | 0.00388* | 0.00388* | 0.00330* |
| | | | | | | (2.31) | (1.84) | (2.60) | (2.59) | (2.60) | (2.15) |
| SameIndustry | | | | | | | 0.0211*** | 0.0175*** | 0.0172*** | 0.0168*** | 0.0193*** |
| | | | | | | | (4.51) | (4.86) | (4.64) | (4.47) | (4.23) |
| SameSize | | | | | | | | | | 0.0411** | 0.0233*** |
| | | | | | | | | | | (3.12) | (3.99) |
| SameBookToMarket | | | | | | | | | | 0.00762* | 0.00827** |
| | | | | | | | | | | (2.43) | (2.82) |
| Constant | 0.0456*** | 0.0362*** | 0.0217*** | 0.0163*** | 0.0347*** | 0.0321*** | 0.00880* | 0.0390* | 0.0480** | 0.0336** | 0.0165*** |
| | (5.63) | (8.51) | (5.27) | (4.33) | (8.34) | (7.08) | (2.44) | (2.63) | (2.97) | (3.00) | (3.92) |
| Controls | No | No | No | No | No | | No | Yes | Yes | No | No |
| Interaction | No | No | No | No | No | No | No | No | Yes | Yes | No |
| N | 287509 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.00211 | 0.0380 | 0.0391 | 0.0396 | 0.0383 | 0.0386 | 0.0415 | 0.0449 | 0.0458 | 0.0447 | 0.0425 |

$t$ statistics in parentheses

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

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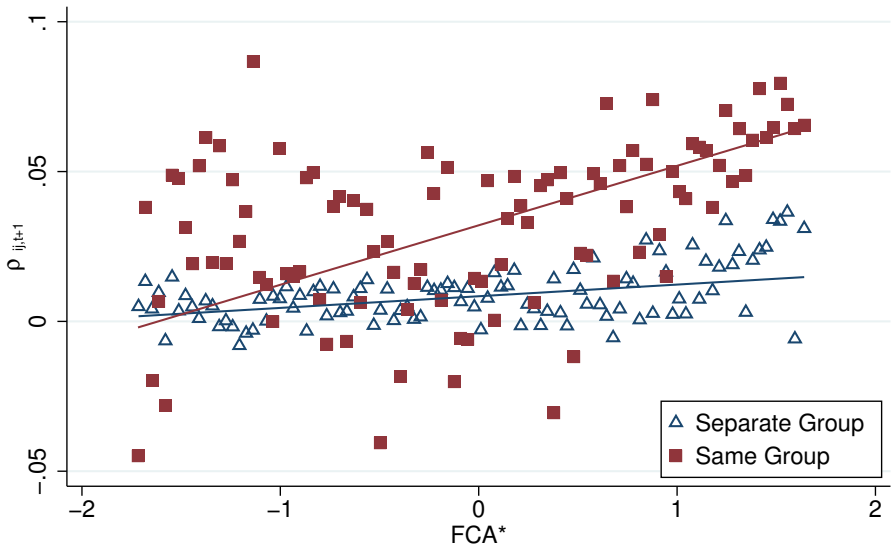
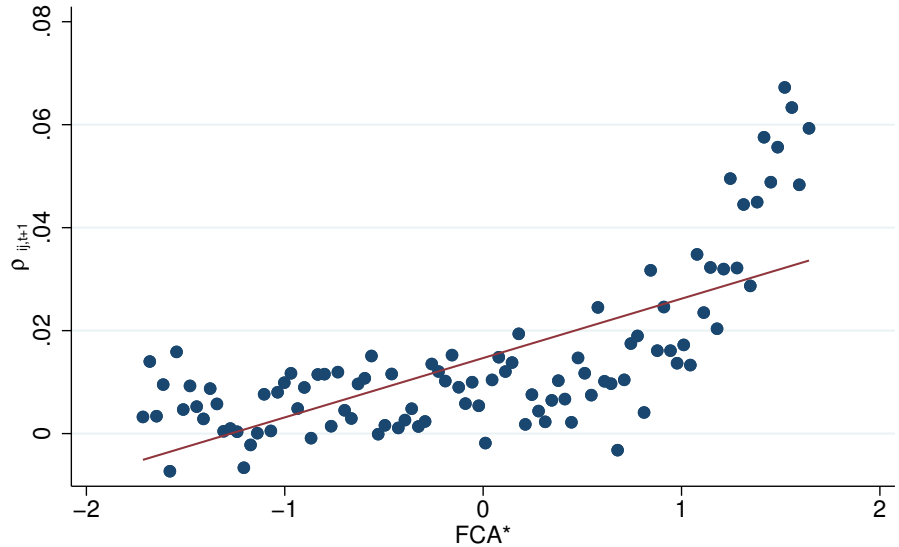
# Fama MacBeth Estimation

## Monthly variables




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

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Fortnightly

# Fama MacBeth Estimation

## Monthly variables

| | Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| FCA* | 0.0122*** | 0.0101*** | 0.00558*** | 0.00379*** | 0.0101*** | 0.00969*** | 0.00243 | 0.00105 | 0.00104 | 0.00117 | 0.00161 |
| | (6.13) | (7.85) | (4.50) | (3.47) | (7.71) | (6.15) | (1.99) | (1.05) | (1.04) | (1.16) | (1.48) |
| $\rho_t$ | | 0.145*** | 0.144*** | 0.144*** | 0.145*** | 0.145*** | 0.143*** | 0.141*** | 0.141*** | 0.141*** | 0.143*** |
| | | (6.36) | (6.30) | (6.30) | (6.36) | (6.36) | (6.35) | (6.51) | (6.50) | (6.48) | (6.37) |
| SameGroup | | | 0.0289*** | 0.0191*** | | | 0.0134*** | 0.0123** | 0.0122** | 0.0125** | 0.0147*** |
| | | | (10.39) | (6.04) | | | (3.89) | (3.28) | (3.25) | (3.35) | (4.38) |
| (FCA*) × SameGroup | | | | 0.0130*** | | | 0.0124*** | 0.0107*** | 0.0108*** | 0.0109*** | 0.0123*** |
| | | | | (5.75) | | | (5.64) | (5.16) | (5.18) | (5.15) | (5.59) |
| ActiveHolder | | | | | 0.00637*** | 0.00630*** | 0.00366* | 0.00211 | 0.00223 | 0.00166 | 0.00226 |
| | | | | | (3.85) | (3.79) | (2.18) | (1.13) | (1.21) | (0.90) | (1.29) |
| (FCA*) × ActiveHolder | | | | | | 0.00196 | 0.00146 | 0.00310* | 0.00300 | 0.00306* | 0.00196 |
| | | | | | | (1.17) | (0.89) | (2.00) | (1.99) | (2.03) | (1.26) |
| SameIndustry | | | | | | | 0.0213*** | 0.0176*** | 0.0173*** | 0.0168*** | 0.0193*** |
| | | | | | | | (4.51) | (4.87) | (4.66) | (4.48) | (4.23) |
| SameSize | | | | | | | | | | 0.0416** | 0.0235*** |
| | | | | | | | | | | (3.16) | (4.04) |
| SameBookToMarket | | | | | | | | | | 0.00770* | 0.00839** |
| | | | | | | | | | | (2.45) | (2.86) |
| Constant | 0.0178*** | 0.0129*** | 0.00817*** | 0.00776*** | 0.0113*** | 0.0112*** | 0.00453*** | 0.0375* | 0.0466** | 0.0317** | 0.0140*** |
| | (3.80) | (6.15) | (4.35) | (4.31) | (5.79) | (5.77) | (3.47) | (2.65) | (2.96) | (3.07) | (5.62) |
| Controls | No | No | No | No | No | No | No | Yes | Yes | No | No |
| Interaction | No | No | No | No | No | No | No | No | Yes | Yes | No |
| N | 287509 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.00184 | 0.0377 | 0.0390 | 0.0395 | 0.0381 | 0.0384 | 0.0414 | 0.0448 | 0.0457 | 0.0445 | 0.0424 |

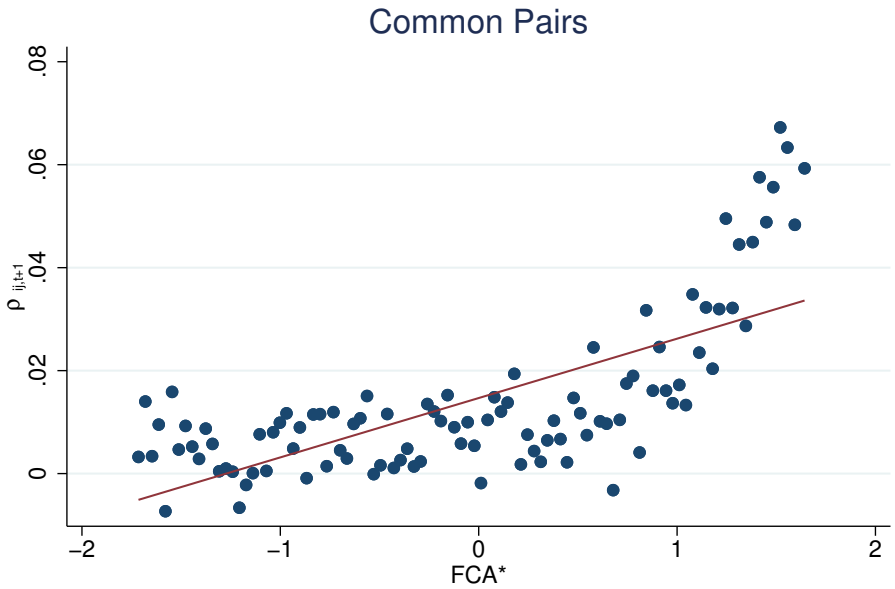
$t$ statistics in parentheses

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

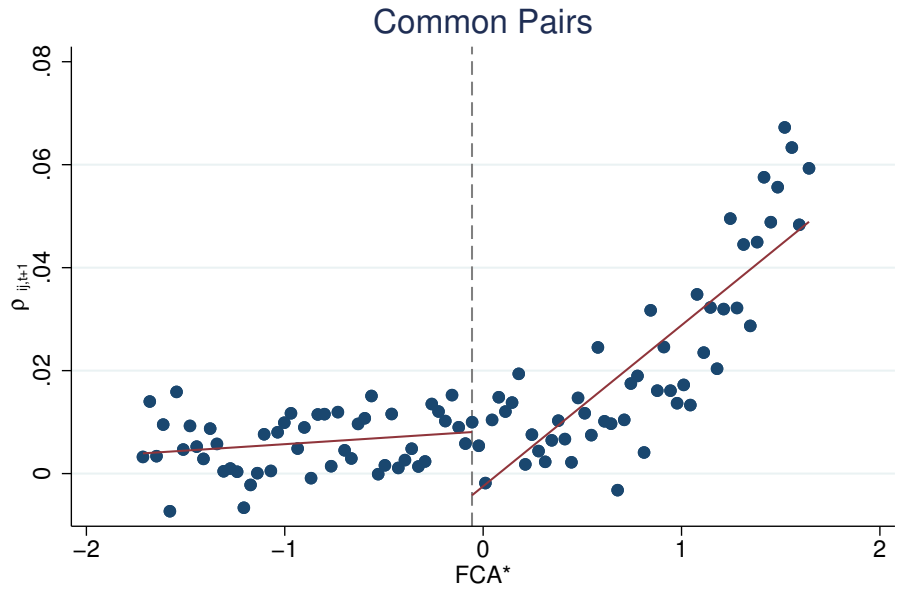
Fortnightly

# 4 Factor + Industry Future Correlation via *FCA**

## Normalized Rank Transformed for each cross section (Monthly)




This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against 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. Allow for discontinuity in median

Fortnightly

# Fama MacBeth Estimation

## Monthly variables

| | Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| FCA* | 0.0122*** | -0.00227 | -0.00208 | -0.000828 | -0.00171 | -0.000472 | -0.00207 | -0.00213 | -0.00204 | -0.00119 |
| | (6.13) | (-1.51) | (-1.53) | (-0.67) | (-1.32) | (-0.41) | (-1.84) | (-1.90) | (-1.80) | (-1.09) |
| $(FCA^* > Median[FCA^*]) \times FCA^*$ | | 0.0302*** | 0.0253*** | 0.0145*** | 0.0246*** | 0.0138*** | 0.0123*** | 0.0123*** | 0.0125*** | 0.0112*** |
| | | (7.27) | (7.68) | (4.50) | (7.79) | (4.46) | (4.88) | (4.89) | (4.78) | (4.15) |
| $\rho_t$ | | | 0.145*** | 0.144*** | 0.145*** | 0.144*** | 0.141*** | 0.141*** | 0.141*** | 0.143*** |
| | | | (6.36) | (6.31) | (6.36) | (6.31) | (6.51) | (6.51) | (6.49) | (6.38) |
| SameGroup | | | | 0.0255*** | | 0.0255*** | 0.0175*** | 0.0174*** | 0.0178*** | 0.0214*** |
| | | | | (9.22) | | (9.24) | (4.87) | (4.85) | (4.98) | (7.26) |
| ActiveHolder | | | | | 0.00496** | 0.00486** | 0.00181 | 0.00188 | 0.00131 | 0.00211 |
| | | | | | (3.01) | (2.93) | (0.99) | (1.04) | (0.72) | (1.23) |
| SameIndustry | | | | | | | 0.0170*** | 0.0166*** | 0.0162*** | 0.0189*** |
| | | | | | | | (4.73) | (4.50) | (4.34) | (4.15) |
| SameSize | | | | | | | | | 0.0422** | 0.0233*** |
| | | | | | | | | | (3.26) | (4.00) |
| SameBookToMarket | | | | | | | | | 0.00776* | 0.00853** |
| | | | | | | | | | (2.48) | (2.91) |
| Constant | 0.0178*** | 0.00513 | 0.00224 | 0.00267 | 0.00127 | 0.00171 | 0.0347* | 0.0429** | 0.0284** | 0.0102*** |
| | (3.80) | (1.44) | (1.52) | (1.95) | (0.86) | (1.25) | (2.56) | (2.80) | (2.91) | (4.39) |
| Controls | No | No | No | No | No | No | Yes | Yes | No | No |
| Interaction | No | No | No | No | No | No | No | Yes | Yes | No |
| N | 287509 | 287509 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.00184 | 0.00268 | 0.0384 | 0.0394 | 0.0387 | 0.0397 | 0.0444 | 0.0453 | 0.0442 | 0.0420 |

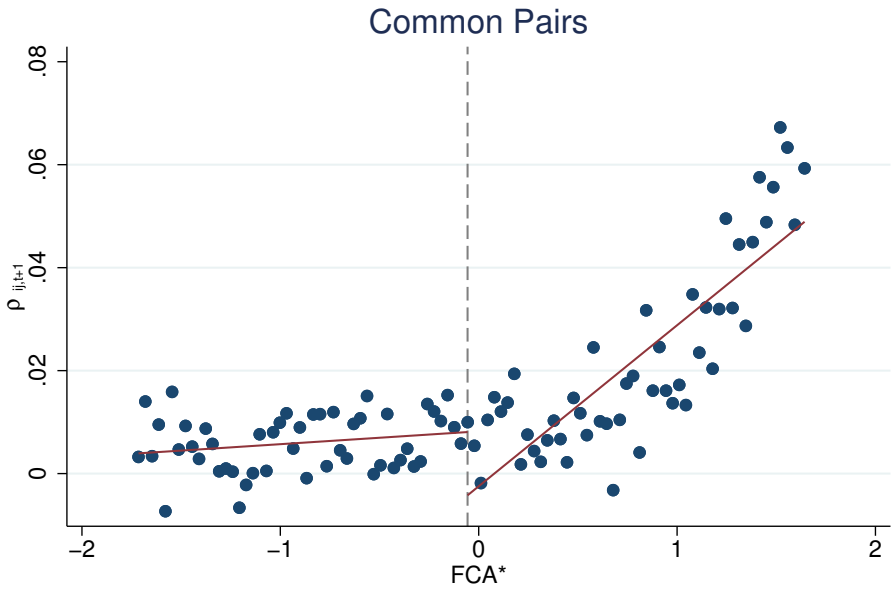
$t$ statistics in parentheses

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

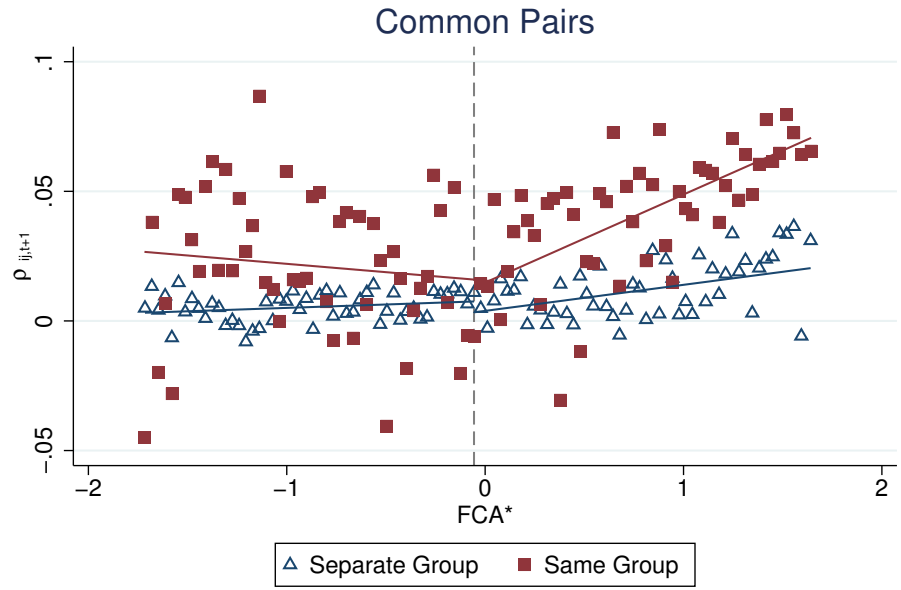
Fortnightly

# 4 Factor + Industry Future Correlation via *FCA**

## Normalized Rank Transformed for each cross section (Monthly)




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




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

Fortnightly

# Fama MacBeth Estimation

## Monthly variables

| | Future Monthly Correlation of 4F+Industry Residuals | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| FCA* | -0.00111 | 0.00161 | -0.00246 | 0.00104 |
| | (-0.88) | (1.48) | (-1.87) | (1.04) |
| $(FCA^* > Median[FCA^*]) \times FCA^*$ | 0.00666* | | 0.00866** | |
| | (2.63) | | (3.38) | |
| SameGroup | 0.0144*** | 0.0147*** | 0.0118** | 0.0122** |
| | (4.31) | (4.38) | (3.17) | (3.25) |
| $(FCA^*) \times SameGroup$ | 0.0107*** | 0.0123*** | 0.00857*** | 0.0108*** |
| | (5.06) | (5.59) | (3.99) | (5.18) |
| ActiveHolder | 0.00199 | 0.00226 | 0.00186 | 0.00223 |
| | (1.13) | (1.29) | (1.01) | (1.21) |
| $(FCA^*) \times ActiveHolder$ | 0.00196 | 0.00196 | 0.00301* | 0.00300 |
| | (1.29) | (1.26) | (2.05) | (1.99) |
| $\rho_t$ | 0.143*** | 0.143*** | 0.141*** | 0.141*** |
| | (6.37) | (6.37) | (6.50) | (6.50) |
| Constant | 0.0116*** | 0.0140*** | 0.0436** | 0.0466** |
| | (4.86) | (5.62) | (2.82) | (2.96) |
| Controls | No | No | Yes | Yes |
| Interaction | No | No | Yes | Yes |
| N | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.0426 | 0.0424 | 0.0459 | 0.0457 |

$t$ statistics in parentheses

$^*$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

# Fama MacBeth Estimation

## Monthly variables (Grouped by size)

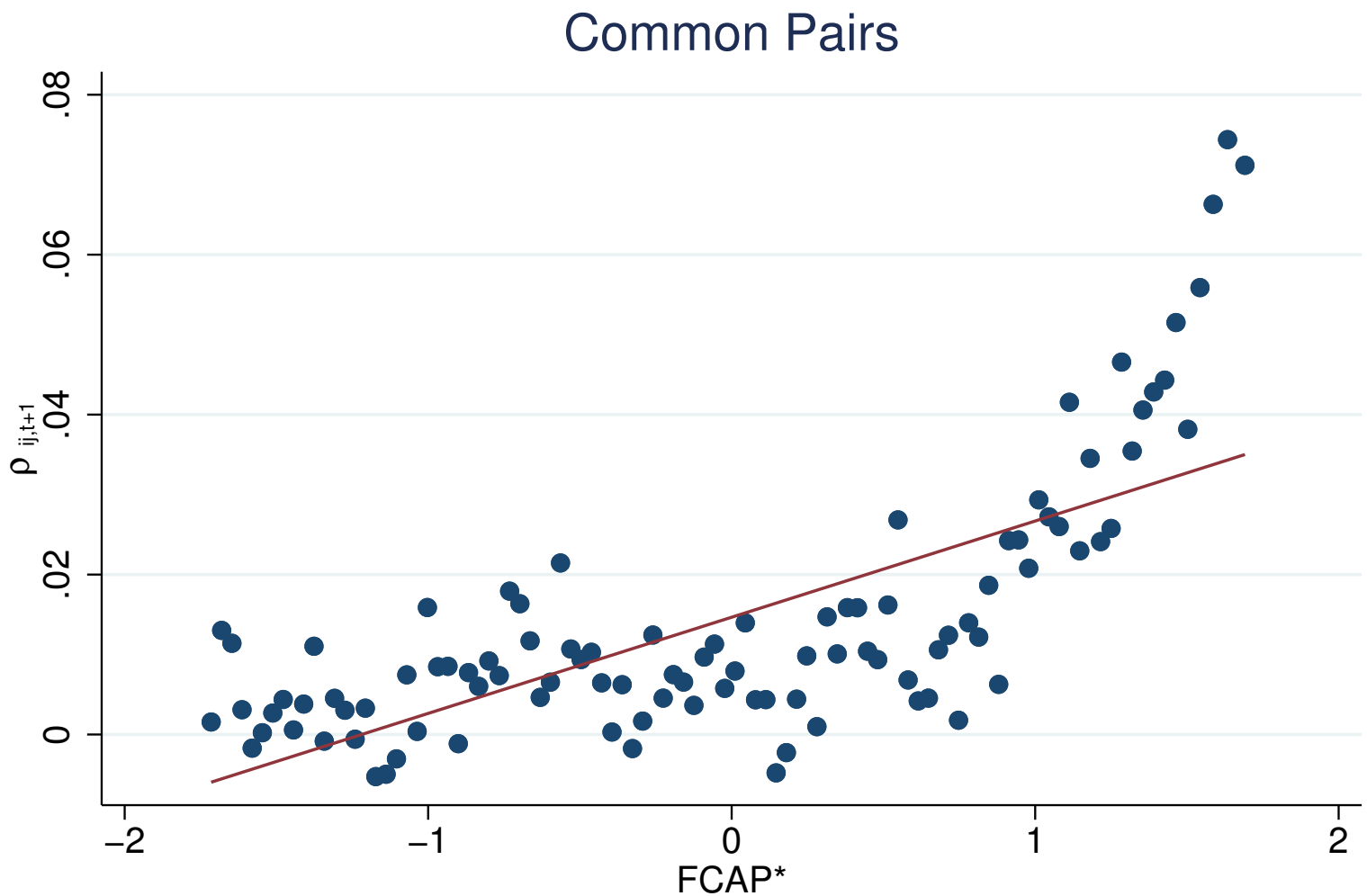
| | All Firms | | Big Firms | | Big & Small Firms | | Small Firms | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| FCA* | -0.00125 | -0.00267 | -0.00164 | -0.00250 | 0.00112 | 0.0000565 | -0.00474 | -0.00272 |
| | (-0.87) | (-1.85) | (-0.84) | (-1.24) | (0.57) | (0.03) | (-1.15) | (-0.67) |
| $(FCA^* > Median[FCA^*]) \times FCA^*$ | 0.00675* | 0.00995*** | 0.0108** | 0.0143*** | -0.00603 | -0.00536 | 0.0166 | 0.0147 |
| | (2.36) | (3.43) | (2.81) | (3.64) | (-1.70) | (-1.45) | (1.73) | (1.59) |
| SameGroup | 0.0158*** | 0.0139*** | 0.00497 | 0.00356 | 0.0207*** | 0.0199*** | 0.0121 | 0.0104 |
| | (6.09) | (5.35) | (1.09) | (0.79) | (4.31) | (4.45) | (1.79) | (1.45) |
| $(FCA^*) \times SameGroup$ | 0.0113*** | 0.00883*** | 0.0125*** | 0.0103** | 0.0103** | 0.00994** | 0.00589 | 0.00544 |
| | (4.93) | (3.82) | (3.50) | (2.94) | (2.92) | (2.77) | (0.93) | (0.85) |
| ActiveHolder | 0.00342* | 0.00380* | 0.00340* | -0.000301 | 0.00619 | 0.00637 | 0.0000826 | -0.000577 |
| | (2.34) | (2.57) | (2.27) | (-0.18) | (1.70) | (1.79) | (0.02) | (-0.11) |
| $(FCA^*) \times ActiveHolder$ | 0.00182 | 0.00237 | 0.00190 | 0.00175 | 0.00510* | 0.00514* | 0.00192 | 0.00118 |
| | (1.27) | (1.65) | (0.94) | (0.84) | (2.15) | (2.18) | (0.70) | (0.39) |
| $\rho_t$ | 0.125*** | 0.124*** | 0.112*** | 0.111*** | 0.130*** | 0.130*** | 0.184*** | 0.181*** |
| | (54.44) | (54.24) | (6.59) | (6.54) | (5.60) | (5.58) | (6.08) | (5.99) |
| Constant | 0.0120*** | 0.0338*** | 0.0104*** | -0.160* | 0.00757 | 0.0546*** | 0.0237** | 0.0911*** |
| | (6.71) | (6.37) | (3.97) | (-2.24) | (1.33) | (3.44) | (2.96) | (4.16) |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes |
| Interaction | No | Yes | No | Yes | No | Yes | No | Yes |
| N | 265656 | 265656 | 97793 | 97793 | 123391 | 123391 | 65494 | 65494 |
| $R^2$ | 0.0199 | 0.0203 | 0.0378 | 0.0424 | 0.0418 | 0.0458 | 0.0667 | 0.0735 |

$t$ statistics in parentheses

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

# 4 Factor + Industry Future Correlation via *FCAP**

Normalized Rank Transformed for each cross section (Monthly)




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

# Fama MacBeth Estimation

## Monthly variables

| | Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| FCAP* | 0.0128*** | 0.0106*** | 0.00620*** | 0.00442*** | 0.0107*** | 0.0100*** | 0.00316* | 0.00119 | 0.00117 | 0.00128 | 0.00212 |
| | (5.91) | (7.52) | (4.42) | (3.45) | (7.45) | (5.95) | (2.31) | (1.19) | (1.17) | (1.26) | (1.79) |
| $\rho_t$ | | 0.145*** | 0.144*** | 0.144*** | 0.145*** | 0.145*** | 0.143*** | 0.141*** | 0.141*** | 0.141*** | 0.143*** |
| | | (6.37) | (6.31) | (6.30) | (6.37) | (6.37) | (6.35) | (6.50) | (6.50) | (6.47) | (6.37) |
| SameGroup | | | 0.0282*** | 0.0186*** | | | 0.0128*** | 0.0120** | 0.0119** | 0.0122** | 0.0140*** |
| | | | (10.06) | (5.90) | | | (3.70) | (3.30) | (3.26) | (3.36) | (4.18) |
| (FCAP*) × SameGroup | | | | 0.0127*** | | | 0.0119*** | 0.0105*** | 0.0105*** | 0.0107*** | 0.0120*** |
| | | | | (4.91) | | | (4.73) | (4.22) | (4.23) | (4.27) | (4.77) |
| ActiveHolder | | | | | 0.00717*** | 0.00730*** | 0.00419* | 0.00255 | 0.00266 | 0.00211 | 0.00277 |
| | | | | | (4.30) | (4.30) | (2.47) | (1.37) | (1.44) | (1.14) | (1.58) |
| (FCAP*) × ActiveHolder | | | | | | 0.00322 | 0.00186 | 0.00366* | 0.00357* | 0.00360* | 0.00246 |
| | | | | | | (1.76) | (1.07) | (2.26) | (2.26) | (2.29) | (1.52) |
| SameIndustry | | | | | | | 0.0210*** | 0.0176*** | 0.0173*** | 0.0169*** | 0.0192*** |
| | | | | | | | (4.53) | (4.89) | (4.67) | (4.50) | (4.25) |
| SameSize | | | | | | | | | | 0.0409** | 0.0229*** |
| | | | | | | | | | | (3.12) | (4.00) |
| SameBookToMarket | | | | | | | | | | 0.00777* | 0.00848** |
| | | | | | | | | | | (2.49) | (2.90) |
| Constant | 0.0177*** | 0.0129*** | 0.00831*** | 0.00793*** | 0.0111*** | 0.0111*** | 0.00468*** | 0.0370* | 0.0463** | 0.0313** | 0.0140*** |
| | (3.82) | (6.13) | (4.30) | (4.26) | (5.72) | (5.73) | (3.47) | (2.62) | (2.93) | (3.04) | (5.57) |
| Controls | No | No | No | No | No | No | No | Yes | Yes | No | No |
| Interaction | No | No | No | No | No | No | No | No | Yes | Yes | No |
| N | 287509 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.00204 | 0.0379 | 0.0391 | 0.0396 | 0.0382 | 0.0385 | 0.0415 | 0.0448 | 0.0457 | 0.0446 | 0.0425 |

$t$ statistics in parentheses

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

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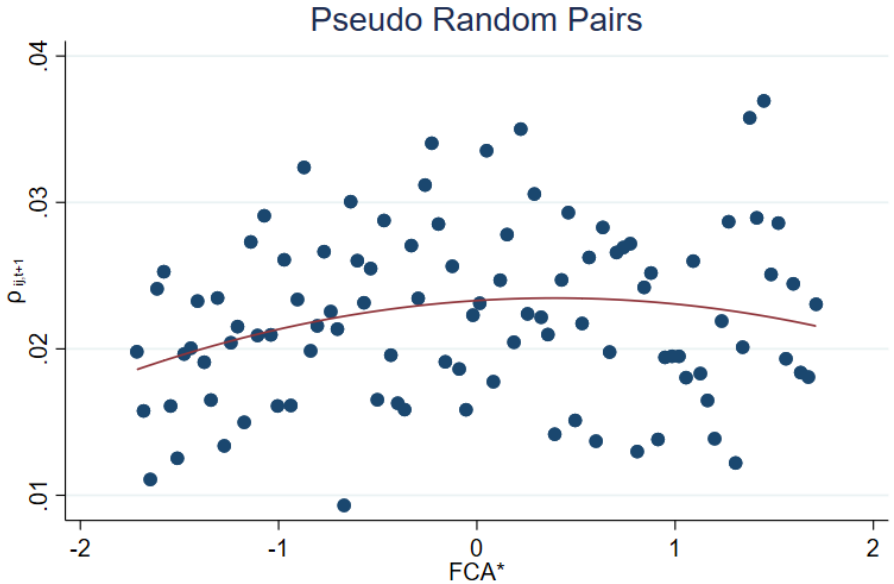
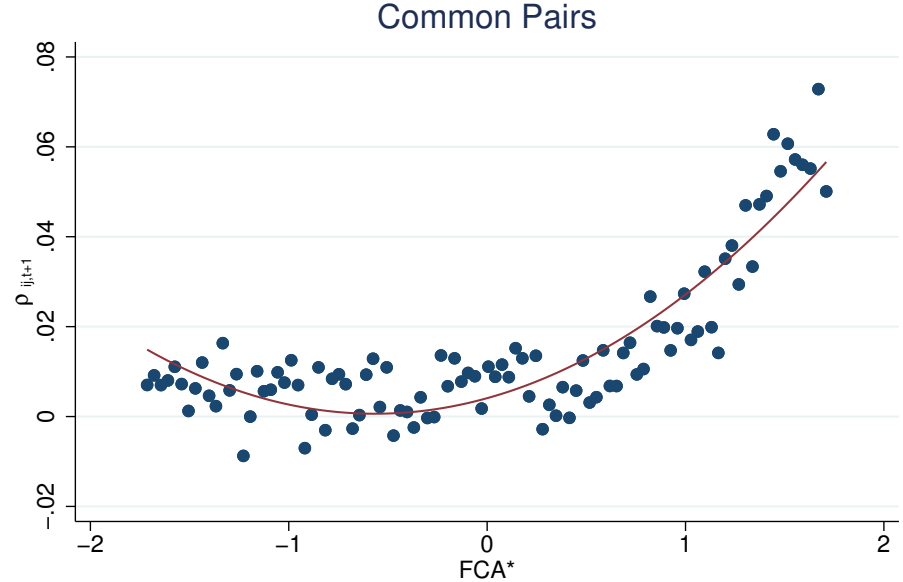
# Random Pairs




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




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

# Fama MacBeth Estimation for pseudo pairs

## Fortnightly variables for Random group

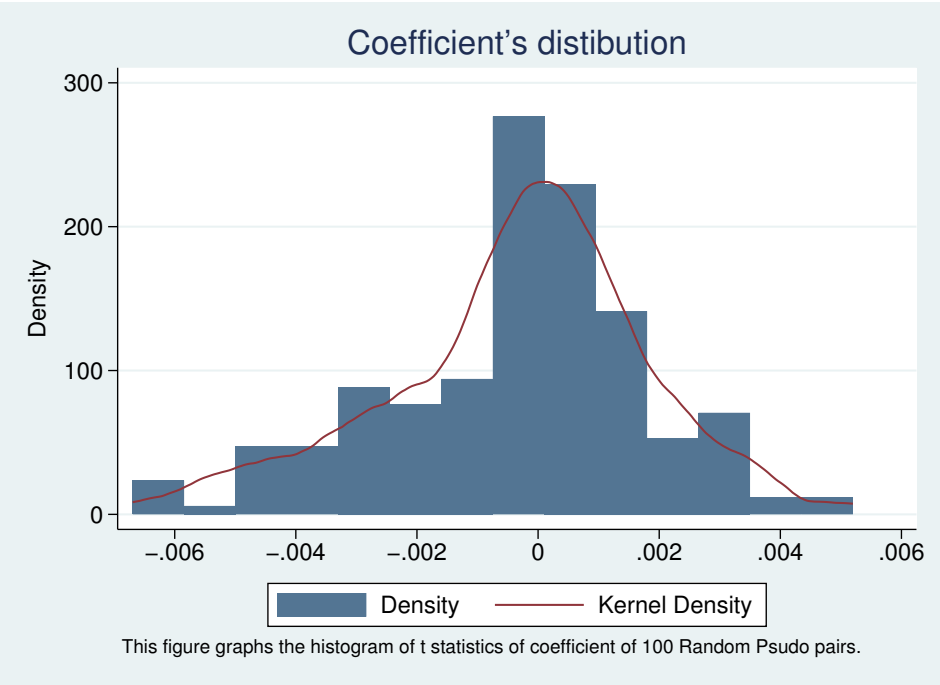
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| FCA* | 0.000606 | 0.00333** | 0.00261** | 0.00206* | 0.00244* | 0.00202* | 0.00190 |
| | (0.99) | (2.60) | (2.71) | (2.11) | (2.49) | (2.04) | (1.94) |
| (FCA* > *Median*[FCA*]) × FCA* | | -0.00559* | -0.00427* | -0.00316 | -0.00377* | -0.00314 | -0.00274 |
| | | (-2.57) | (-2.56) | (-1.84) | (-2.19) | (-1.82) | (-1.63) |
| ActiveHolder | | | 0.0000628 | -0.000258 | -0.000307 | -0.000319 | 0.0000163 |
| | | | (0.06) | (-0.23) | (-0.27) | (-0.28) | (0.01) |
| Constant | 0.0219*** | 0.0243*** | 0.0173*** | 0.0666*** | 0.121*** | 0.0508*** | 0.0299*** |
| | (5.27) | (5.75) | (6.82) | (11.33) | (18.46) | (10.35) | (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

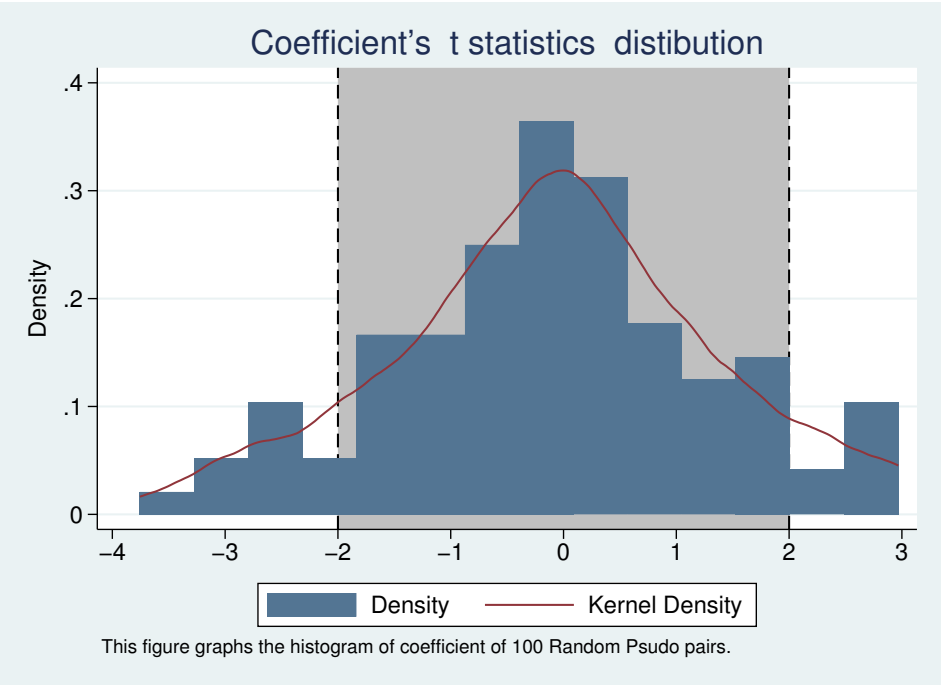
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

# Random Pairs

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

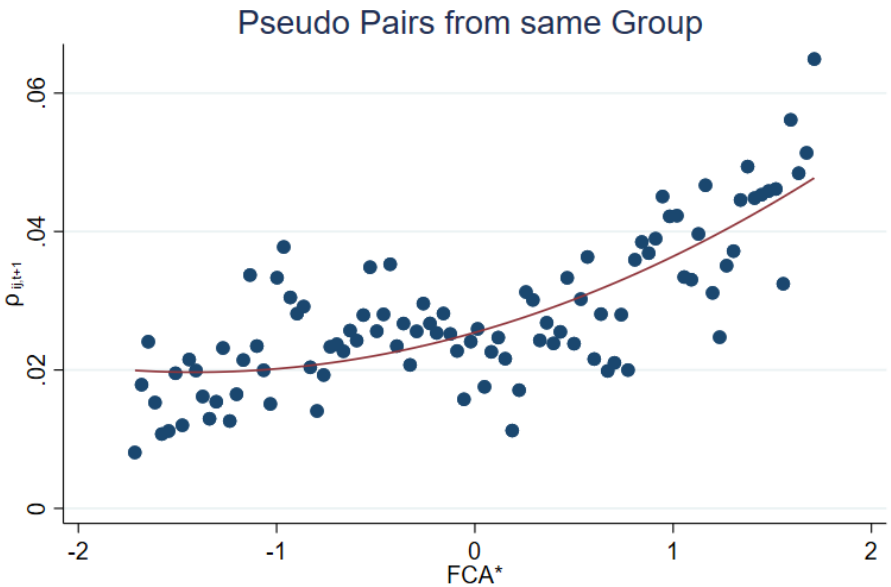



This figure graphs the histogram of t statistics of coefficient of 100 Random Psudo pairs.

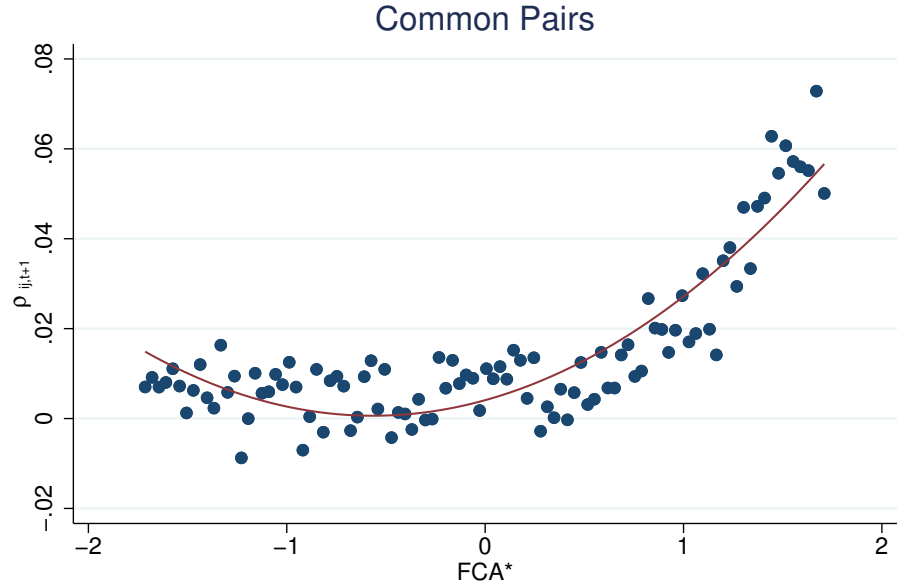



This figure graphs the histogram of coefficient of 100 Random Psudo pairs.

# Random Pairs from Same Business Group



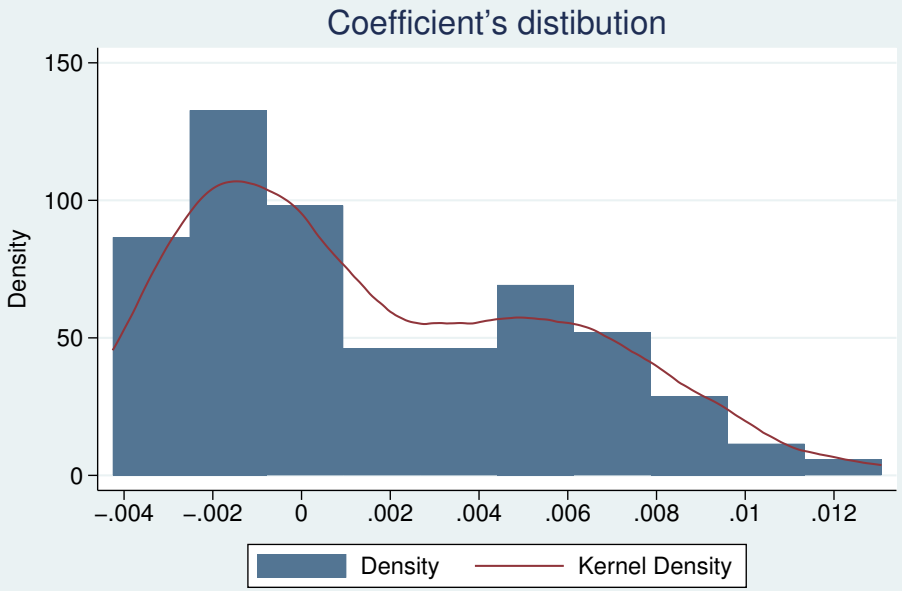

This figure graphs the correlation of daily 4Factor+Industry residuals in fortnight t+1 against normalized rank transformed of our measure of institutional connectedness.



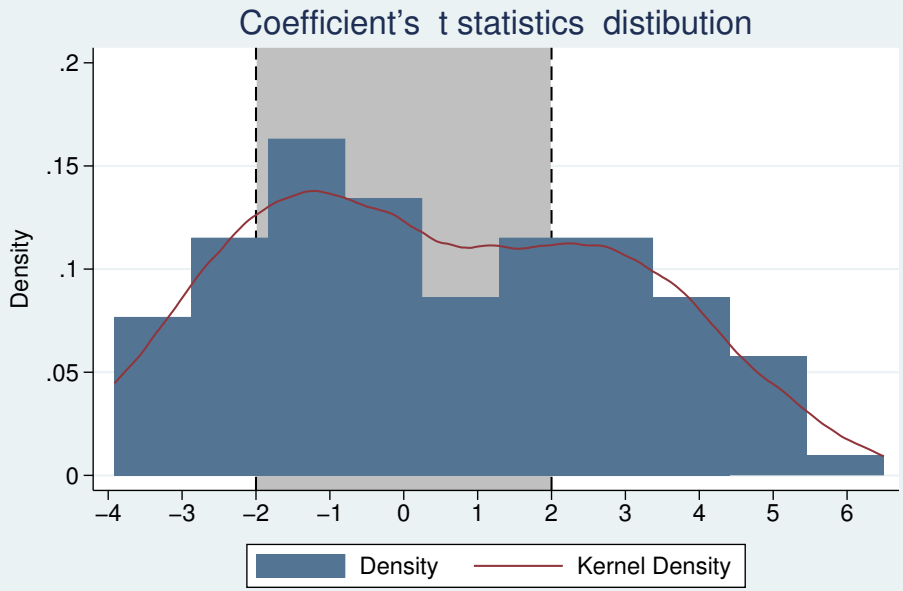

This figure graphs the correlation of daily 4Factor+Industry residuals in fortnight t+1 against our measure of institutional connectedness.

# Random Pairs from Same Business Group

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




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




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

# Fama MacBeth Estimation for pseudo pairs

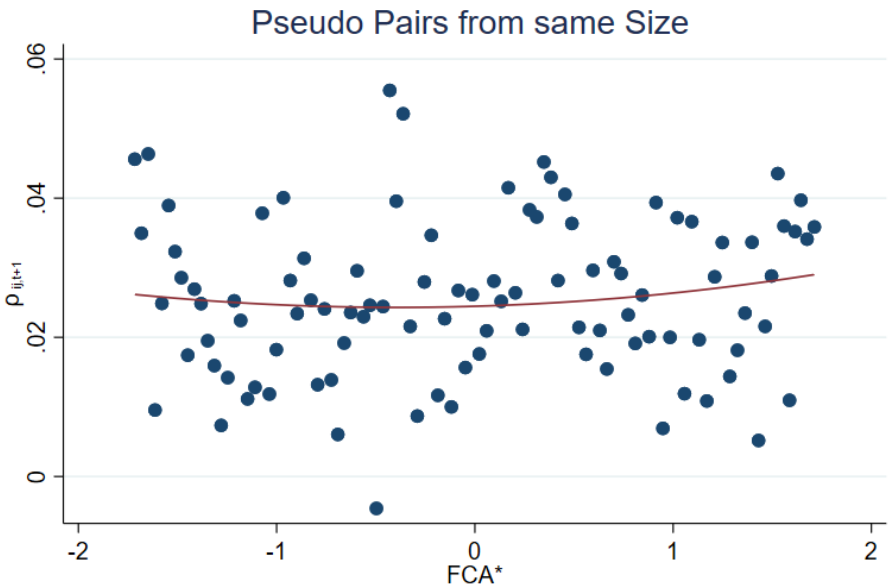
## Fortnightly variables for Random group from Same Business Group

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| FCA* | 0.00808*** | 0.00365* | 0.00230 | -0.000386 | -0.000628 | -0.000128 | 0.000500 |
| | (10.59) | (2.37) | (1.88) | (-0.31) | (-0.50) | (-0.11) | (0.42) |
| (FCA* > *Median*[FCA*]) × FCA* | | 0.00932** | 0.00691** | 0.000962 | 0.00104 | -0.000242 | -0.00233 |
| | | (3.24) | (3.18) | (0.46) | (0.49) | (-0.12) | (-1.18) |
| ActiveHolder | | | 0.00648*** | 0.00223 | 0.0000493 | 0.00285* | 0.00325** |
| | | | (5.09) | (1.87) | (0.04) | (2.52) | (2.86) |
| Constant | 0.0288*** | 0.0248*** | 0.0160*** | 0.115*** | 0.232*** | 0.0821*** | 0.0418*** |
| | (8.08) | (6.62) | (6.88) | (15.79) | (26.40) | (14.10) | (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 |

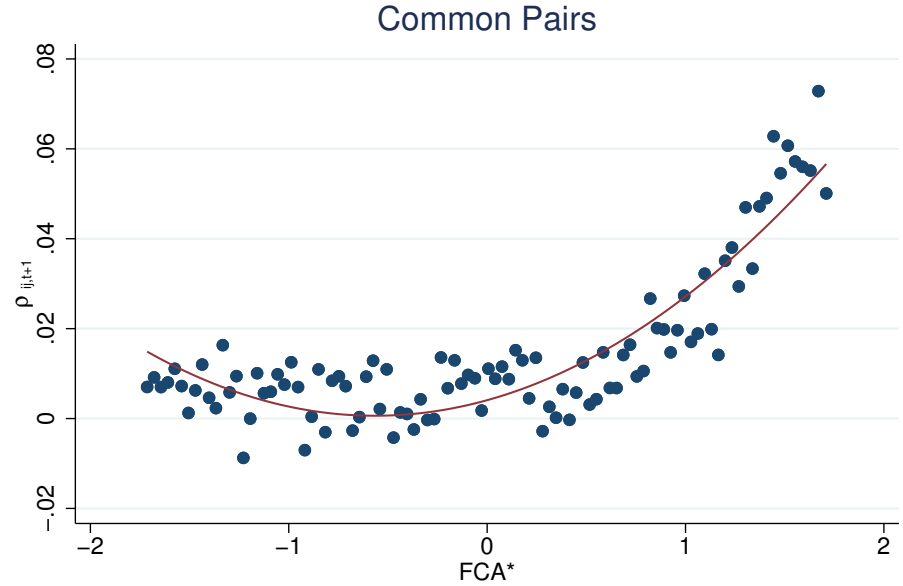
*t* statistics in parentheses

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

# Random Pairs from Same Size




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




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

# Fama MacBeth Estimation for pseudo pairs

## Fortnightly variables for Pseudo group from Same Size

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| FCA* | 0.000524 | -0.00205 | -0.00126 | -0.00335 | -0.000312 | -0.00314 | -0.00114 |
| | (0.47) | (-0.68) | (-0.61) | (-1.71) | (-0.17) | (-1.61) | (-0.55) |
| (FCA* > *Median*[FCA*]) × FCA* | | 0.00510 | 0.00375 | 0.000580 | -0.00431 | 0.00113 | 0.000589 |
| | | (0.99) | (1.04) | (0.17) | (-1.26) | (0.33) | (0.17) |
| ActiveHolder | | | -0.00180 | 0.00129 | 0.00294 | 0.0000404 | -0.00154 |
| | | | (-0.69) | (0.53) | (1.18) | (0.02) | (-0.60) |
| Constant | 0.0240*** | 0.0217*** | 0.0167*** | 0.116*** | 0.255*** | 0.0792*** | 0.0347*** |
| | (8.56) | (5.65) | (6.25) | (14.36) | (19.32) | (11.49) | (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 |
| r2 | 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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# Identification

- Possible Events
  - The Sepah bank Merge
  - Fixed Income Rule change
  - Mutual funds Limit extension
  - Dara 1 and Palayeshi 1
  - Goverment Transfer to Banks
  - Portfolio adjustments

# Portfolio adjustments

| | OLS-Robust | | | | FM | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| FCA* | -0.00125 | 0.00206 | -0.00267 | 0.000160 | -0.00132 | 0.00154 | -0.00261 | -0.000578 |
| | (-0.87) | (0.39) | (-1.85) | (0.03) | (-0.88) | (0.63) | (-1.69) | (-0.24) |
| (FCA* > *Median*[FCA*]) × FCA* | 0.00675* | -0.00337 | 0.00995*** | 0.00167 | 0.00745* | -0.00343 | 0.00919** | 0.00188 |
| | (2.36) | (-0.31) | (3.43) | (0.15) | (2.63) | (-0.59) | (3.25) | (0.35) |
| SameGroup | 0.0158*** | 0.00392 | 0.0139*** | 0.00213 | 0.0150*** | 0.00640 | 0.0124*** | 0.00365 |
| | (6.09) | (0.41) | (5.35) | (0.22) | (4.70) | (0.52) | (3.79) | (0.28) |
| (FCA*) × SameGroup | 0.0113*** | 0.0208* | 0.00883*** | 0.0176* | 0.00979*** | 0.0225*** | 0.00778** | 0.0186*** |
| | (4.93) | (2.44) | (3.82) | (2.05) | (3.90) | (9.14) | (3.08) | (11.12) |
| ActiveHolder | 0.00342* | -0.00836 | 0.00380* | -0.00981 | 0.00283 | -0.00876 | 0.00281 | -0.0103 |
| | (2.34) | (-1.56) | (2.57) | (-1.80) | (1.81) | (-2.18) | (1.73) | (-2.51) |
| (FCA*) × ActiveHolder | 0.00182 | 0.00594 | 0.00237 | 0.00674 | 0.00171 | 0.00518 | 0.00274 | 0.00647 |
| | (1.27) | (1.15) | (1.65) | (1.30) | (1.10) | (1.26) | (1.75) | (1.81) |
| $\rho_t$ | 0.125*** | 0.111*** | 0.124*** | 0.111*** | 0.145*** | 0.114* | 0.143*** | 0.114* |
| | (54.44) | (12.00) | (54.24) | (11.98) | (8.82) | (4.14) | (8.76) | (4.19) |
| Constant | 0.0120*** | 0.00834 | 0.0338*** | 0.0233 | 0.0120*** | 0.00651 | 0.0450*** | 0.0251 |
| | (6.71) | (1.26) | (6.37) | (1.18) | (5.44) | (0.95) | (4.04) | (1.88) |
| Controls | No | No | Yes | Yes | No | No | Yes | Yes |
| Interaction | No | No | Yes | Yes | No | No | Yes | Yes |
| EndOfYear | No | Yes | No | Yes | No | Yes | No | Yes |
| N | 265656 | 21022 | 265656 | 21022 | 265656 | 21022 | 265656 | 21022 |
| $R^2$ | 0.0199 | 0.0133 | 0.0203 | 0.0138 | 0.0444 | 0.0195 | 0.0478 | 0.0219 |

*t* statistics in parentheses

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


Anton, Polk, *Connected Stocks* ,Jornal 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

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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 $\alpha_1$ and $\alpha_2$:
  - So for each holder of firms we have $S^f_{i,t} P_{i,t} = \alpha_i$
  - 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

## 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

# Large controlling shareholder and stock price synchronicity

JBF-2014-Boubaker

- 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

# Connected Stocks

## JF-2014-Anton Polk

- 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 and MacBeth

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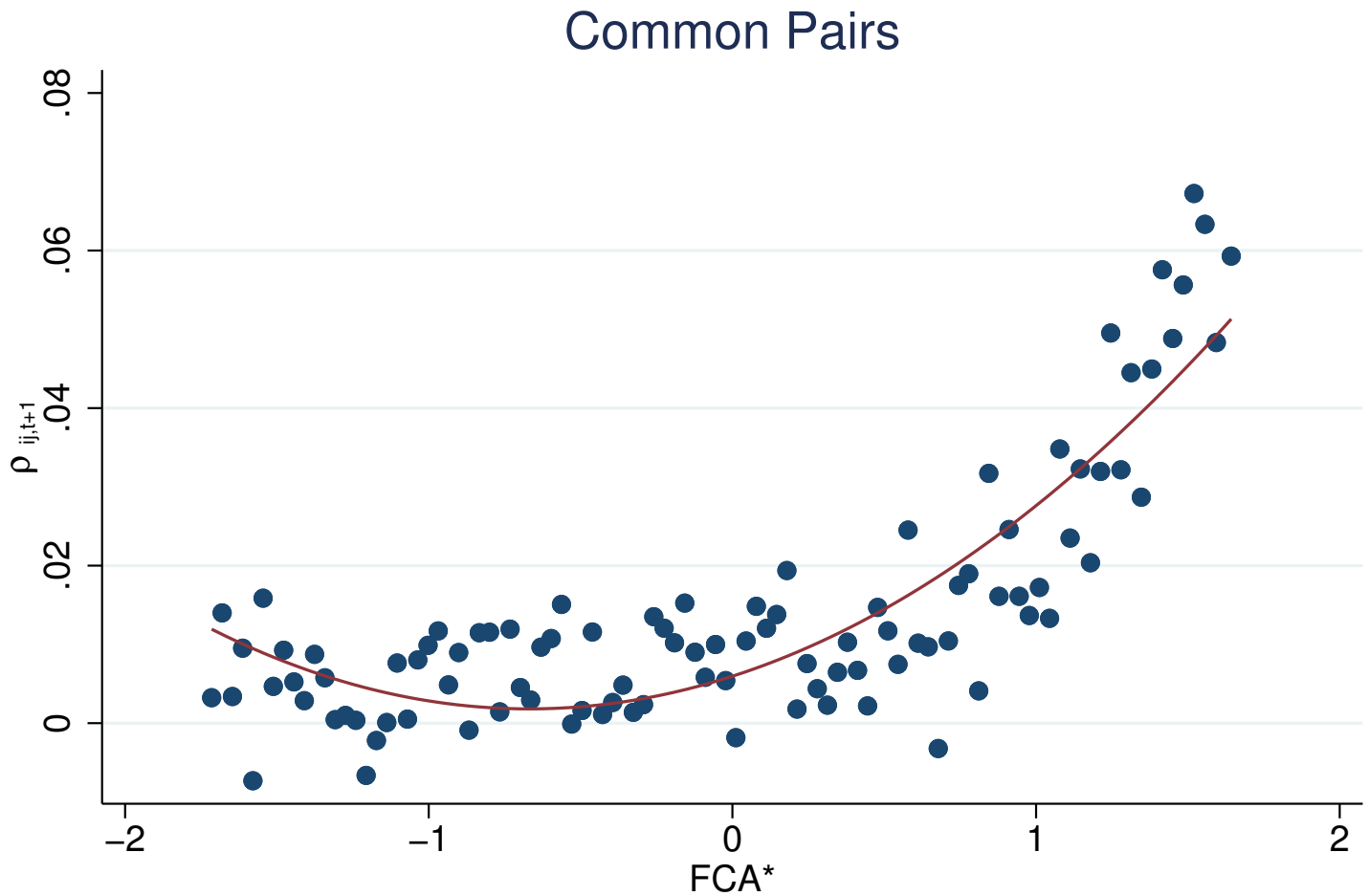
# 4 Factor + Industry Future Correlation via $FCA^*$

## Normalized Rank Transformed for each cross section (Monthly)




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

# Fama MacBeth Estimation

## Monthly variables

| | Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| FCA* | 0.0122*** | 0.0101*** | 0.00558*** | 0.00379*** | 0.0101*** | 0.00969*** | 0.00243 | 0.00105 | 0.00104 | 0.00117 | 0.00161 |
| | (6.13) | (7.85) | (4.50) | (3.47) | (7.71) | (6.15) | (1.99) | (1.05) | (1.04) | (1.16) | (1.48) |
| $\rho_t$ | | 0.145*** | 0.144*** | 0.144*** | 0.145*** | 0.145*** | 0.143*** | 0.141*** | 0.141*** | 0.141*** | 0.143*** |
| | | (6.36) | (6.30) | (6.30) | (6.36) | (6.36) | (6.35) | (6.51) | (6.50) | (6.48) | (6.37) |
| SameGroup | | | 0.0289*** | 0.0191*** | | | 0.0134*** | 0.0123** | 0.0122** | 0.0125** | 0.0147*** |
| | | | (10.39) | (6.04) | | | (3.89) | (3.28) | (3.25) | (3.35) | (4.38) |
| (FCA*) × SameGroup | | | | 0.0130*** | | | 0.0124*** | 0.0107*** | 0.0108*** | 0.0109*** | 0.0123*** |
| | | | | (5.75) | | | (5.64) | (5.16) | (5.18) | (5.15) | (5.59) |
| ActiveHolder | | | | | 0.00637*** | 0.00630*** | 0.00366* | 0.00211 | 0.00223 | 0.00166 | 0.00226 |
| | | | | | (3.85) | (3.79) | (2.18) | (1.13) | (1.21) | (0.90) | (1.29) |
| (FCA*) × ActiveHolder | | | | | | 0.00196 | 0.00146 | 0.00310* | 0.00300 | 0.00306* | 0.00196 |
| | | | | | | (1.17) | (0.89) | (2.00) | (1.99) | (2.03) | (1.26) |
| SameIndustry | | | | | | | 0.0213*** | 0.0176*** | 0.0173*** | 0.0168*** | 0.0193*** |
| | | | | | | | (4.51) | (4.87) | (4.66) | (4.48) | (4.23) |
| SameSize | | | | | | | | | | 0.0416** | 0.0235*** |
| | | | | | | | | | | (3.16) | (4.04) |
| SameBookToMarket | | | | | | | | | | 0.00770* | 0.00839** |
| | | | | | | | | | | (2.45) | (2.86) |
| Constant | 0.0178*** | 0.0129*** | 0.00817*** | 0.00776*** | 0.0113*** | 0.0112*** | 0.00453*** | 0.0375* | 0.0466** | 0.0317** | 0.0140*** |
| | (3.80) | (6.15) | (4.35) | (4.31) | (5.79) | (5.77) | (3.47) | (2.65) | (2.96) | (3.07) | (5.62) |
| Controls | No | No | No | No | No | No | No | Yes | Yes | No | No |
| Interaction | No | No | No | No | No | No | No | No | Yes | Yes | No |
| N | 287509 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 | 286678 |
| $R^2$ | 0.00184 | 0.0377 | 0.0390 | 0.0395 | 0.0381 | 0.0384 | 0.0414 | 0.0448 | 0.0457 | 0.0445 | 0.0424 |

$t$ statistics in parentheses

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

Fortnightly

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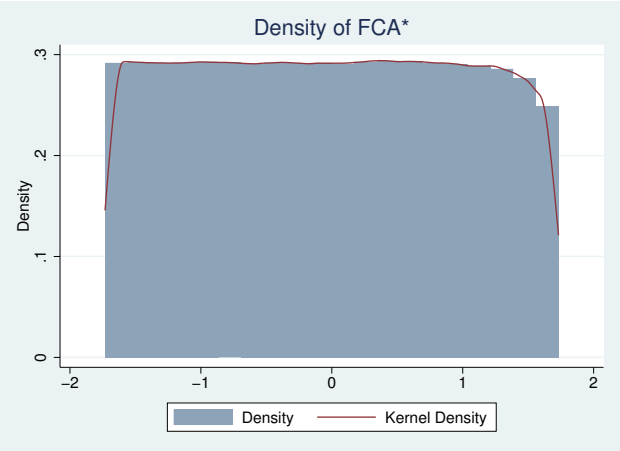
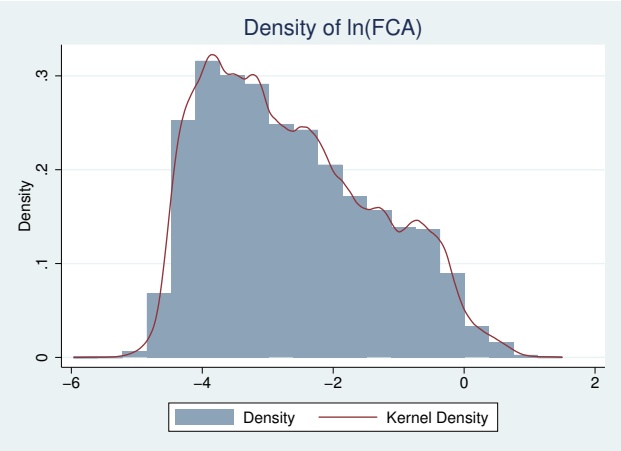
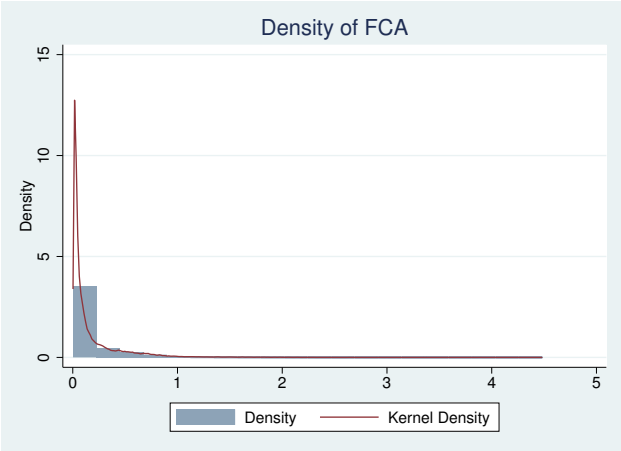
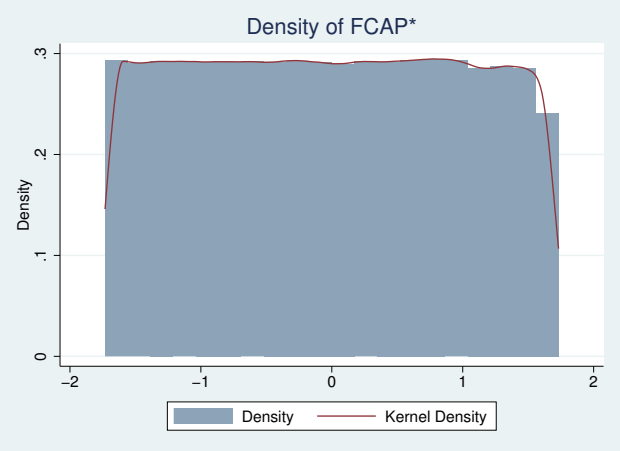
# FCA vs. FCAP Distributions

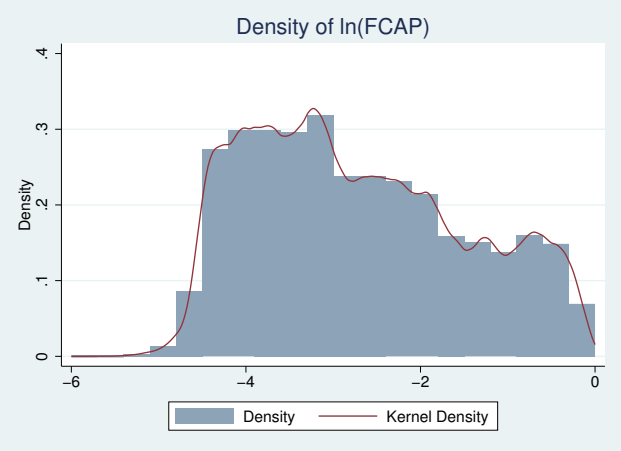
## Fortnightly

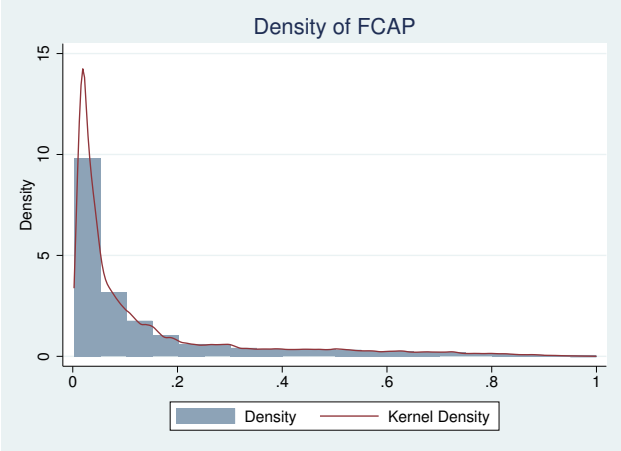



Monthly

# Summary of Controls

## Fortnightly

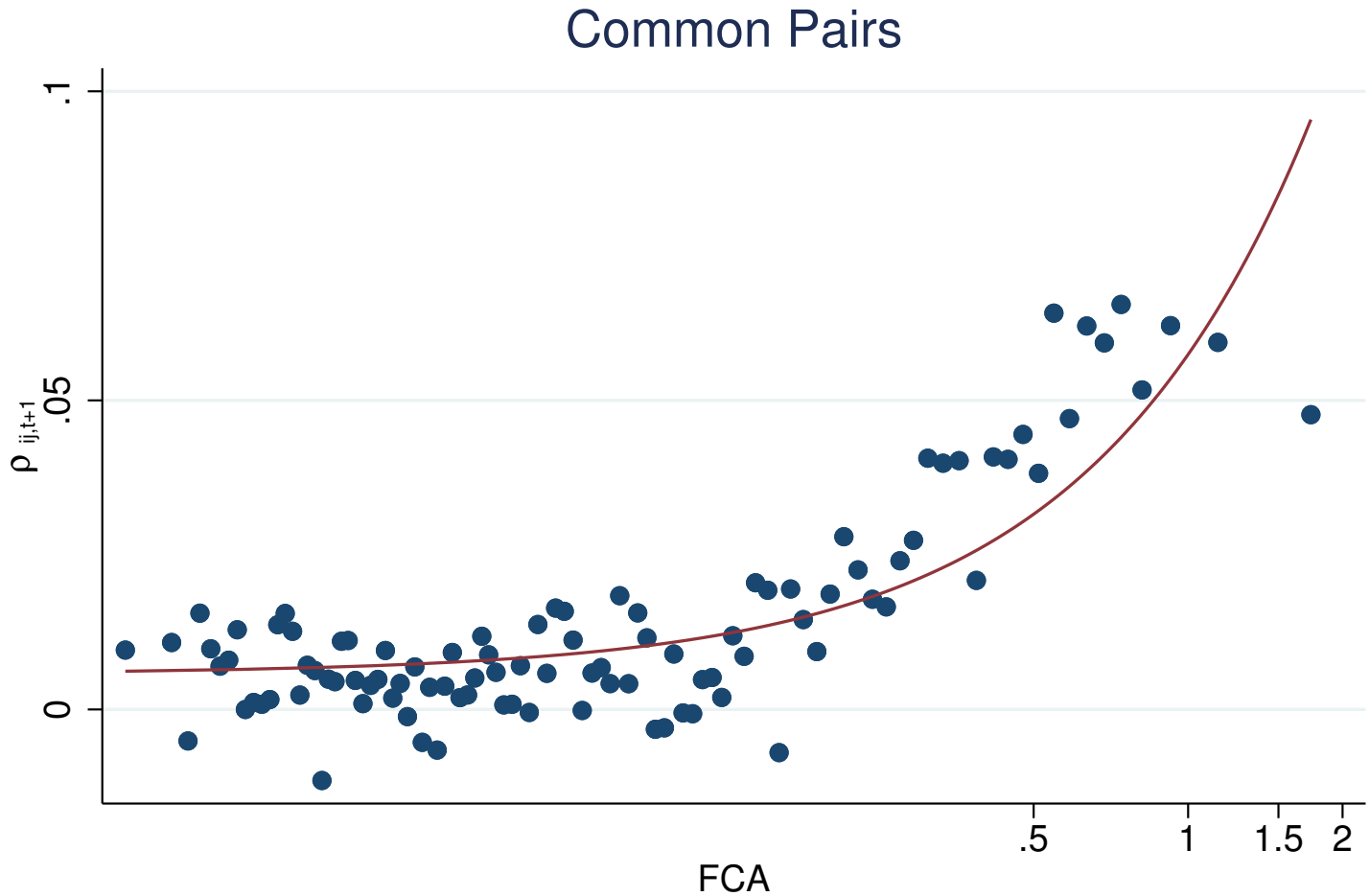
| Type of Pairs | Yes | No |
|---|---|---|
| SameIndustry | 1142 | 9125 |
| | (11.1%) | (88.9%) |
| SameGroup | 1173 | 9094 |
| | (11.4%) | (88.6%) |
| ActiveHolder | 2819 | 7448 |
| | (27.5%) | (72.5%) |

| 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)




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

# Fama MacBeth Estimation

## Fortnightly variables

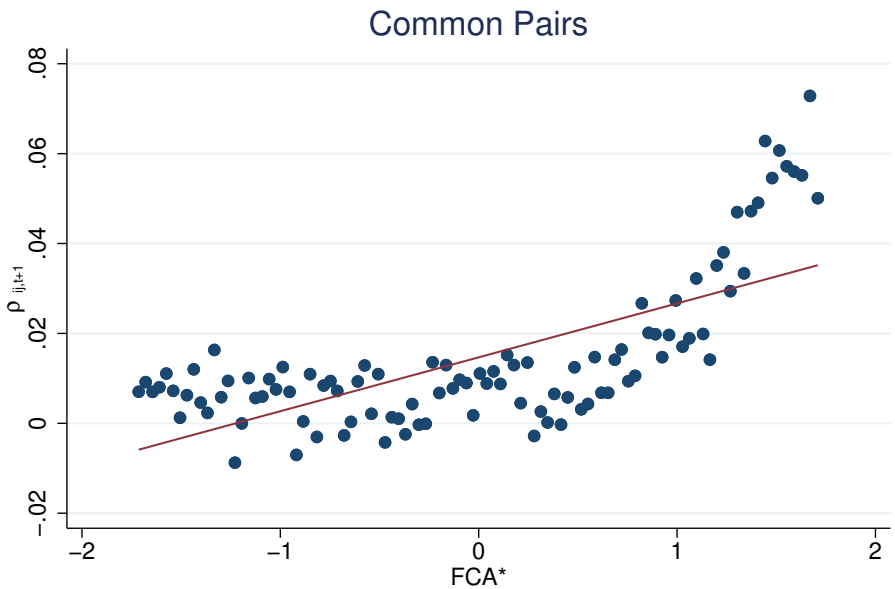
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| ln($FCA$) | 0.0108*** | 0.00989*** | 0.00964*** | 0.00511*** | 0.00499*** | 0.00271*** | 0.00276*** | 0.00281*** | 0.00297*** |
| | (8.48) | (9.12) | (8.81) | (5.15) | (4.95) | (4.12) | (4.07) | (4.16) | (3.78) |
| $\rho\_t$ | | 0.0740*** | 0.0739*** | 0.0734*** | 0.0733*** | 0.0710*** | 0.0708*** | 0.0711*** | 0.0723*** |
| | | (5.50) | (5.49) | (5.44) | (5.44) | (5.36) | (5.34) | (5.36) | (5.39) |
| ActiveHolder | | | 0.00970*** | | 0.00810*** | 0.00425* | 0.00416* | 0.00356 | 0.00410* |
| | | | (6.05) | | (5.06) | (2.35) | (2.40) | (1.94) | (2.41) |
| SameGroup | | | | 0.0329*** | 0.0322*** | 0.0216*** | 0.0214*** | 0.0218*** | 0.0247*** |
| | | | | (10.98) | (10.80) | (7.32) | (7.29) | (7.47) | (9.32) |
| SameIndustry | | | | | | 0.0275*** | 0.0267*** | 0.0264*** | 0.0288*** |
| | | | | | | (7.00) | (6.73) | (6.55) | (6.45) |
| Samesize | | | | | | | | 0.0403*** | 0.0235*** |
| | | | | | | | | (3.53) | (4.35) |
| SameBookToMarket | | | | | | | | 0.0127** | 0.0146*** |
| | | | | | | | | (3.22) | (4.34) |
| Constant | 0.0432*** | 0.0395*** | 0.0363*** | 0.0214*** | 0.0191*** | 0.0396** | 0.0504** | 0.0372*** | 0.0225*** |
| | (8.14) | (8.73) | (8.10) | (5.32) | (4.71) | (3.13) | (3.20) | (4.04) | (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 |
| r2 | 0.00152 | 0.0127 | 0.0131 | 0.0137 | 0.0141 | 0.0184 | 0.0193 | 0.0183 | 0.0164 |

$t$ statistics in parentheses

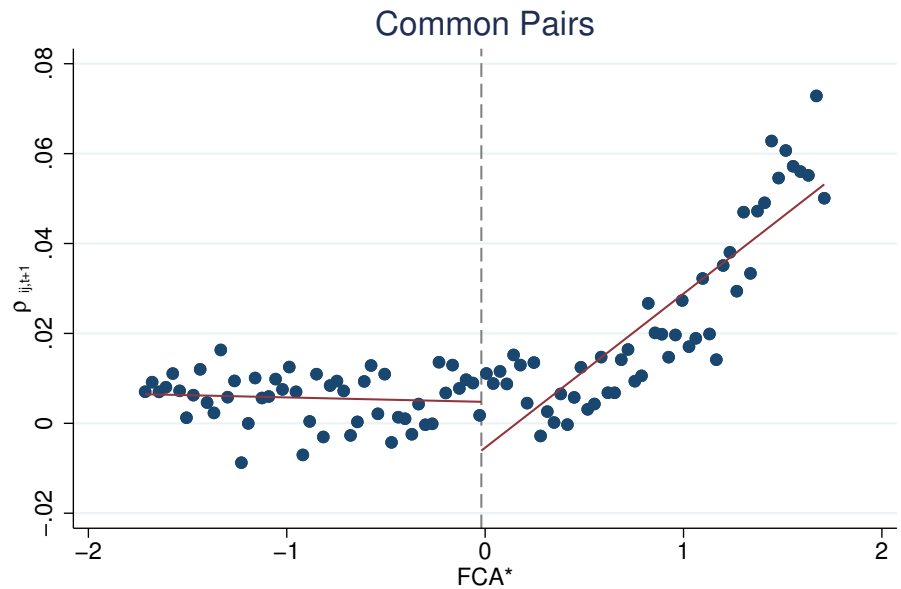
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

# 4 Factor + Industry Future Correlation via *FCA**

## Normalized Rank Transformed for each cross section (Fortnightly)




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




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

Monthly

# Fama MacBeth Estimation

## Fortnightly variables

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| FCA* | 0.0124*** | -0.00545*** | -0.00518*** | -0.00450*** | -0.00440*** | -0.00408** | -0.00537*** | -0.00420** | -0.00526*** | -0.00448*** |
| | (7.43) | (-3.99) | (-3.90) | (-3.44) | (-3.40) | (-3.19) | (-4.06) | (-3.22) | (-3.98) | (-3.49) |
| (FCA* > *Median*[FCA*]) × FCA* | | 0.0360*** | 0.0332*** | 0.0314*** | 0.0240*** | 0.0232*** | 0.0228*** | 0.0156*** | 0.0231*** | 0.0231*** |
| | | (9.80) | (10.20) | (9.78) | (8.68) | (8.29) | (9.37) | (5.83) | (9.14) | (8.17) |
| $\rho\_t$ | | | 0.0738*** | 0.0737*** | 0.0727*** | 0.0727*** | 0.0711*** | 0.0708*** | 0.0712*** | 0.0724*** |
| | | | (5.50) | (5.49) | (5.42) | (5.41) | (5.38) | (5.34) | (5.38) | (5.41) |
| ActiveHolder | | | | 0.00792*** | | 0.00494** | 0.00362 | 0.00322 | 0.00284 | 0.00354* |
| | | | | (4.85) | | (2.98) | (1.94) | (1.81) | (1.49) | (2.02) |
| SameIndustry | | | | | 0.0363*** | 0.0357*** | 0.0315*** | 0.0261*** | 0.0303*** | 0.0339*** |
| | | | | | (8.06) | (7.91) | (7.93) | (6.60) | (7.47) | (7.54) |
| SameGroup | | | | | | | | 0.0191*** | | |
| | | | | | | | | (6.14) | | |
| Samesize | | | | | | | | | 0.0416*** | 0.0213*** |
| | | | | | | | | | (3.67) | (3.91) |
| SameBookToMarket | | | | | | | | | 0.0128** | 0.0147*** |
| | | | | | | | | | (3.24) | (4.36) |
| Constant | 0.0150*** | -0.000422 | -0.000591 | -0.00187 | -0.00234 | -0.00312* | 0.0300* | 0.0375* | 0.0258** | 0.00782*** |
| | (6.31) | (-0.25) | (-0.38) | (-1.19) | (-1.70) | (-2.19) | (2.59) | (2.50) | (3.22) | (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 |
| r2 | 0.00132 | 0.00208 | 0.0132 | 0.0136 | 0.0149 | 0.0151 | 0.0182 | 0.0196 | 0.0181 | 0.0162 |

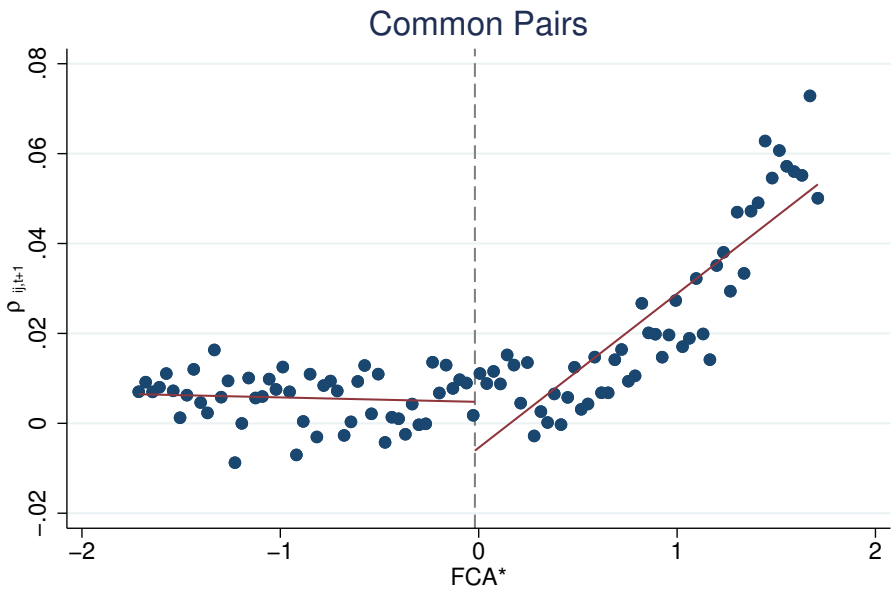
*t* statistics in parentheses

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

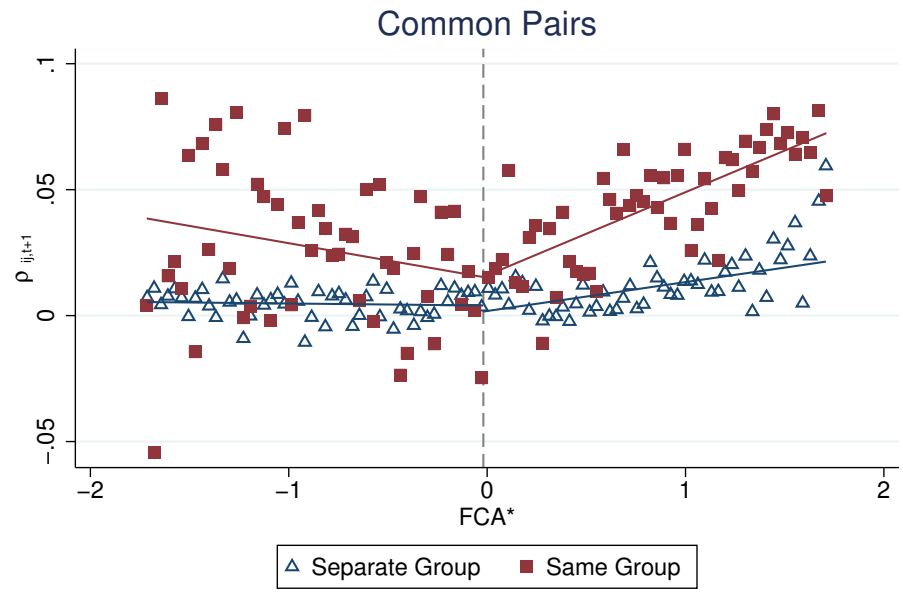
Monthly

# 4 Factor + Industry Future Correlation via *FCA**

## Normalized Rank Transformed for each cross section (Fortnightly)




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




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

Monthly

# Fama MacBeth Estimation

## Monthly variables

| | (1) | (2) |
|---|---|---|
| FCA* | -0.00370** | -0.00472*** |
| | (-2.79) | (-3.39) |
| (FCA* > *Median*[FCA*]) × FCA* | 0.0128*** | 0.0141*** |
| | (4.34) | (5.15) |
| $\rho\_t$ | 0.0722*** | 0.0708*** |
| | (5.39) | (5.35) |
| ActiveHolder | 0.00140 | 0.000470 |
| | (0.73) | (0.22) |
| (FCA* > *Median*[FCA*]) × ActiveHolder | 0.00338 | 0.00522 |
| | (1.17) | (1.75) |
| SameGroup | 0.0117** | 0.0106** |
| | (3.29) | (2.87) |
| (FCA* > *Median*[FCA*]) × SameGroup | 0.0139*** | 0.0109** |
| | (4.05) | (3.14) |
| Constant | 0.00973*** | 0.0380* |
| | (4.57) | (2.51) |
| Value | No | Yes |
| Interaction | No | Yes |
| N | 613875 | 613875 |
| r2 | 0.0173 | 0.0202 |

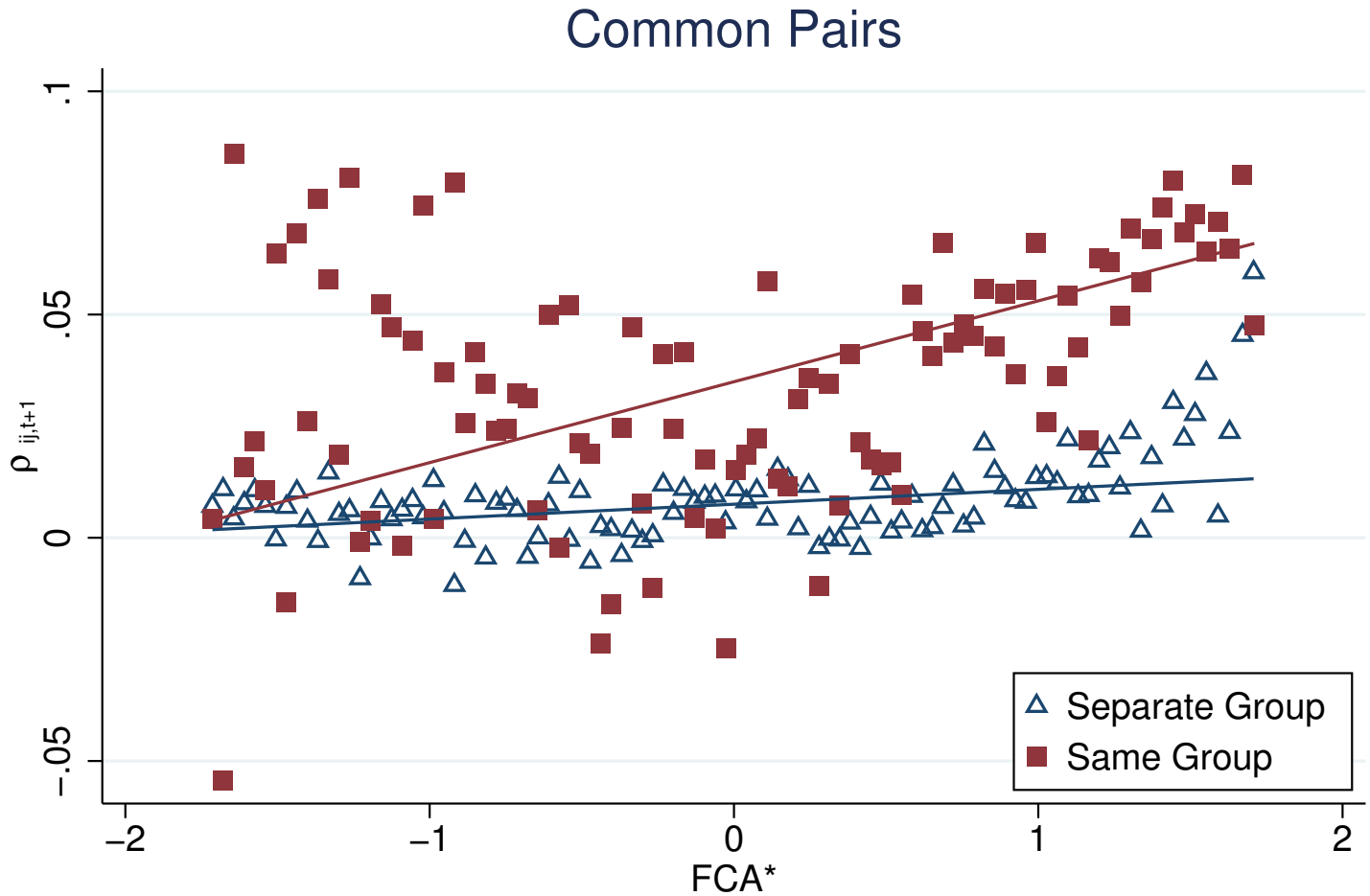
*t* statistics in parentheses

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

Monthly

# Future Correlation via *FCA**

## 4 Factor + Industry (by Business Group)




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

# Fama MacBeth Estimation

## Fortnightly variables for subset of Same Business Group

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| FCA* | 0.0183*** | -0.0127* | 0.0100*** | -0.00219 | 0.00842*** | -0.00535 |
| | (7.04) | (-2.13) | (5.21) | (-0.39) | (5.37) | (-0.98) |
| (FCA* > *Median*[FCA*]) × FCA* | | 0.0460*** | | 0.0186* | | 0.0210* |
| | | (4.63) | | (2.08) | | (2.53) |
| ActiveHolder | | | 0.0162*** | 0.0149** | 0.0188*** | 0.0174*** |
| | | | (3.41) | (3.07) | (4.00) | (3.61) |
| SameIndustry | | | 0.0336*** | 0.0333*** | 0.0330*** | 0.0327*** |
| | | | (7.85) | (7.78) | (7.95) | (7.83) |
| Samesize | | | 0.0340** | 0.0318** | | |
| | | | (3.17) | (3.03) | | |
| SameBookToMarket | | | 0.0609*** | 0.0605*** | | |
| | | | (5.97) | (5.90) | | |
| Constant | 0.0344*** | 0.0149** | 0.0399*** | 0.0314*** | 0.104*** | 0.0941*** |
| | (9.76) | (3.01) | (8.38) | (5.53) | (5.71) | (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

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

Monthly

# Fama MacBeth Estimation

## Fortnightly variables for subset of Different Business Group

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| FCA* | 0.00422** | -0.00178 | 0.00194* | -0.00210 | 0.00172 | -0.00290* |
| | (3.11) | (-1.37) | (1.98) | (-1.75) | (1.93) | (-2.26) |
| (FCA* > *Median*[FCA*]) × FCA* | | 0.0146*** | | 0.00996*** | | 0.0115*** |
| | | (4.22) | | (3.48) | | (3.82) |
| ActiveHolder | | | 0.000676 | 0.000186 | -0.000437 | -0.00102 |
| | | | (0.48) | (0.13) | (-0.30) | (-0.70) |
| SameIndustry | | | 0.0238*** | 0.0231*** | 0.0211*** | 0.0202*** |
| | | | (4.34) | (4.23) | (4.23) | (4.05) |
| Samesize | | | 0.0217*** | 0.0217*** | | |
| | | | (3.94) | (3.94) | | |
| SameBookToMarket | | | 0.00482 | 0.00477 | | |
| | | | (1.49) | (1.48) | | |
| Constant | 0.00831*** | 0.00285 | 0.0124*** | 0.00886*** | 0.0240 | 0.0202 |
| | (4.07) | (1.67) | (5.03) | (4.03) | (1.53) | (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 |

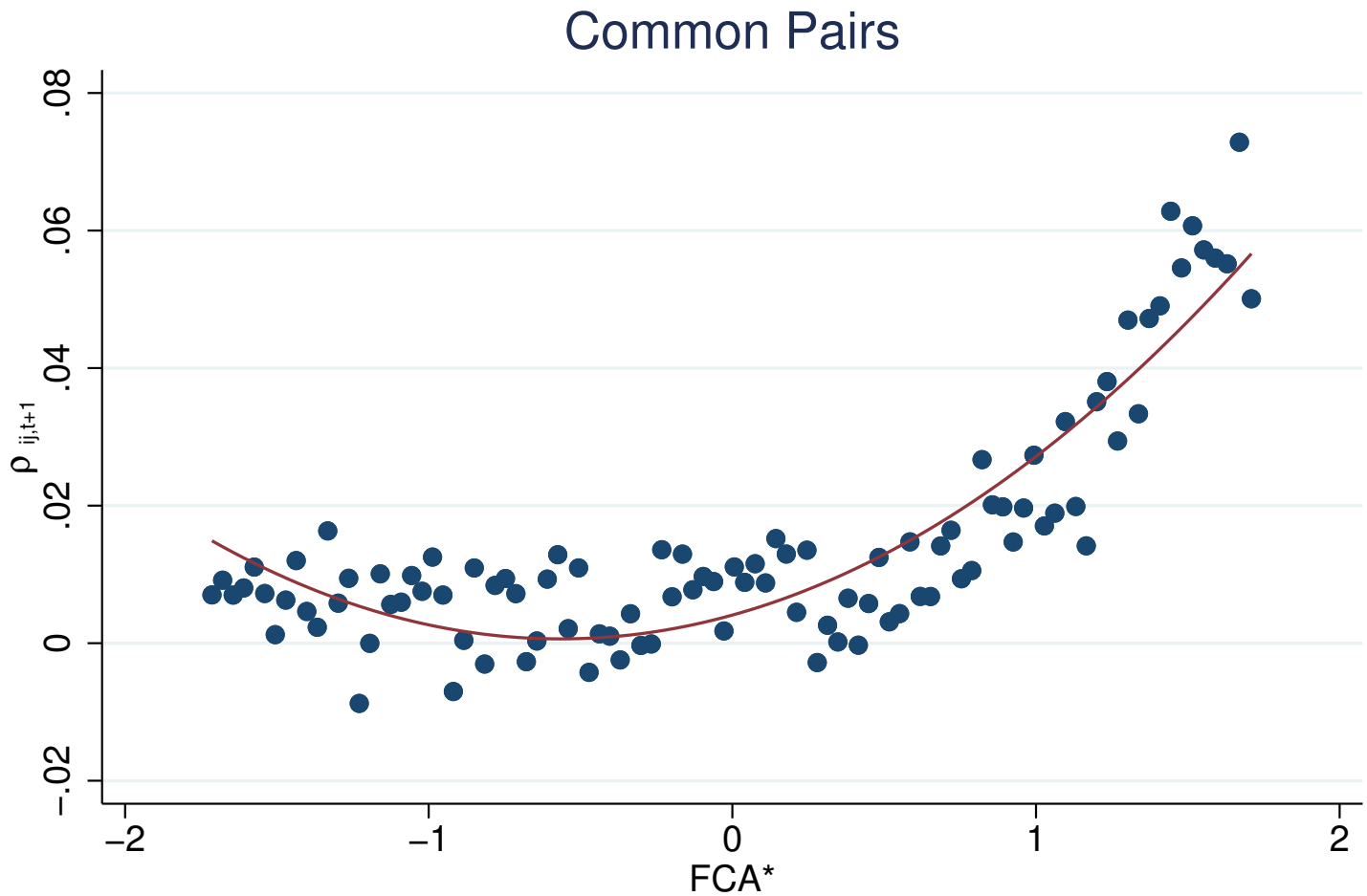
*t* statistics in parentheses

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

Monthly

# 4 Factor + Industry Future Correlation via *FCA**

## Normalized Rank Transformed for each cross section (Fortnightly)




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

Monthly

# Fama MacBeth Estimation

## Fortnightly variables

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| FCA* | 0.0124*** | 0.0126*** | 0.0114*** | 0.0112*** | 0.00613*** | 0.00618*** | 0.00634*** | 0.00717*** |
| | (7.43) | (7.54) | (8.09) | (7.90) | (8.02) | (7.89) | (8.12) | (7.01) |
| FCA*$^2$ | | 0.0109*** | 0.0101*** | 0.00959*** | 0.00697*** | 0.00700*** | 0.00701*** | 0.00710*** |
| | | (10.30) | (10.52) | (10.08) | (9.59) | (9.97) | (9.37) | (8.49) |
| $\rho\_t$ | | | 0.0737*** | 0.0736*** | 0.0711*** | 0.0709*** | 0.0712*** | 0.0724*** |
| | | | (5.49) | (5.48) | (5.37) | (5.36) | (5.38) | (5.41) |
| ActiveHolder | | | | 0.00761*** | 0.00345 | 0.00331 | 0.00267 | 0.00336 |
| | | | | (4.62) | (1.84) | (1.84) | (1.40) | (1.90) |
| SameIndustry | | | | | 0.0310*** | 0.0301*** | 0.0299*** | 0.0334*** |
| | | | | | (7.85) | (7.57) | (7.40) | (7.46) |
| Samesize | | | | | | | 0.0416*** | 0.0214*** |
| | | | | | | | (3.66) | (3.91) |
| SameBookToMarket | | | | | | | 0.0126** | 0.0146*** |
| | | | | | | | (3.19) | (4.29) |
| Constant | 0.0150*** | 0.00429* | 0.00372* | 0.00224 | 0.0330** | 0.0428** | 0.0288*** | 0.0108*** |
| | (6.31) | (2.35) | (2.24) | (1.35) | (2.82) | (2.85) | (3.52) | (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 |
| r2 | 0.00132 | 0.00215 | 0.0133 | 0.0136 | 0.0183 | 0.0191 | 0.0182 | 0.0162 |

$t$ statistics in parentheses

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

Monthly