

# Connected Stocks: Evidence from Tehran Stock Exchange

S.M. Aghajanzadeh

M. Heidari

M. Mohseni

Tehran Institute for Advanced Studies

November, 2021

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

- **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

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

# Common-ownership measurements

## Model based measures

- $HJL^A(A, B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A} + \alpha_{i,B}}$

Harford et al. (2011)

- $MHHI = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij} \nu_{ik}}{\sum_i \mu_{ij} \nu_{ij}}$

Azar et al. (2018)

- $Top5_j = \frac{1}{n-1} \sum_i^5 \sum_{j \neq k} \nu_{ik}$

Antón et al. (2020)

- $\kappa_{ij} = \cos(\nu_i, \nu_j) \cdot \sqrt{\frac{IHHI_j}{IHHI_i}}$

Backus et al. (2020)

- $GGL^A(A, B) = \sum_{i=1}^I \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$

Gilje et al. (2020) , Lewellen and Lewellen (2021)

- $MHHI_{\text{Delta}} = \sum_{j=1}^J \sum_{k \neq j}^K \frac{\sum_{i=1}^N w_j * w_k * \mu_{i,j} * \mu_{i,k}}{\sum_{i=1}^N \mu_{i,j} * \mu_{i,k}}$

Lewellen and Lowry (2021)

# Common-ownership measurements

## Model based measures

- $HJL^A(A, B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A} + \alpha_{i,B}}$   
Harford et al. (2011)
- $MHHI = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij} \nu_{ik}}{\sum_i \mu_{ij} \nu_{ij}}$   
Azar et al. (2018)
- $Top5_j = \frac{1}{n-1} \sum_i^5 \sum_{j \neq k} \nu_{ik}$   
Antón et al. (2020)
- $\kappa_{ij} = \cos(\nu_i, \nu_j) \cdot \sqrt{\frac{IHHI_j}{IHHI_i}}$   
Backus et al. (2020)
- $GGL^A(A, B) = \sum_{i=1}^I \alpha_{i,Ag}(\beta_{i,A}) \alpha_{i,B}$   
Gilje et al. (2020) , Lewellen and Lewellen (2021)
- $MHHI_{Delta} = \sum_{j=1}^J \sum_{k \neq j}^K \frac{\sum_{i=1}^N w_j * w_k * \mu_{i,j} * \mu_{i,k}}{\sum_{i=1}^N \mu_{i,j} * \mu_{i,k}}$   
Lewellen and Lowry (2021)

## Ad-hoc measures

- $Overlap_{AP}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{\nu}_A}{\bar{\nu}_A + \bar{\nu}_B} + \alpha_{i,B} \frac{\bar{\nu}_B}{\bar{\nu}_A + \bar{\nu}_B}$   
Anton and Polk (2014)
- $Overlap_{Count}(A, B) = \sum_{i \in I^{A,B}} 1$   
He and Huang (2017), He et al. (2019)
- $Overlap_{Min}(A, B) = \sum_{i \in I^{A,B}} \min\{\alpha_{i,A}, \alpha_{i,B}\}$   
Newham et al. (2018)
- $Overlap_{HL}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$   
Hansen and Lott Jr (1996) , Freeman (2019)

# Common-ownership measurements

## Model based measures

- $HJL^A(A, B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A} + \alpha_{i,B}}$   
Harford et al. (2011)
- $MHHI = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij} \nu_{ik}}{\sum_i \mu_{ij} \nu_{ij}}$   
Azar et al. (2018)
- $Top5_j = \frac{1}{n-1} \sum_i^5 \sum_{j \neq k} \nu_{ik}$   
Antón et al. (2020)
- $\kappa_{ij} = \cos(\nu_i, \nu_j) \cdot \sqrt{\frac{IHHI_j}{IHHI_i}}$   
Backus et al. (2020)
- $GGL^A(A, B) = \sum_{i=1}^I \alpha_{i,Ag}(\beta_{i,A}) \alpha_{i,B}$   
Gilje et al. (2020) , Lewellen and Lewellen (2021)
- $MHHI_{Delta} = \sum_{j=1}^J \sum_{k \neq j}^K \frac{\sum_{i=1}^N w_j * w_k * \mu_{i,j} * \mu_{i,k}}{\sum_{i=1}^N \mu_{i,j} * \mu_{i,k}}$   
Lewellen and Lowry (2021)

## Ad-hoc measures

- $Overlap_{AP}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{\nu}_A}{\bar{\nu}_A + \bar{\nu}_B} + \alpha_{i,B} \frac{\bar{\nu}_B}{\bar{\nu}_A + \bar{\nu}_B}$   
Anton and Polk (2014)
- $Overlap_{Count}(A, B) = \sum_{i \in I^{A,B}} 1$   
He and Huang (2017), He et al. (2019)
- $Overlap_{Min}(A, B) = \sum_{i \in I^{A,B}} \min\{\alpha_{i,A}, \alpha_{i,B}\}$   
Newham et al. (2018)
- $Overlap_{HL}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$   
Hansen and Lott Jr (1996) , Freeman (2019)

### Selected measure

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

Measures' detail



# Main effect

Comovement effect

Papers

# Main effect

Common-ownership

Comovement effect

Papers

# Main effect



Papers

# Main effect



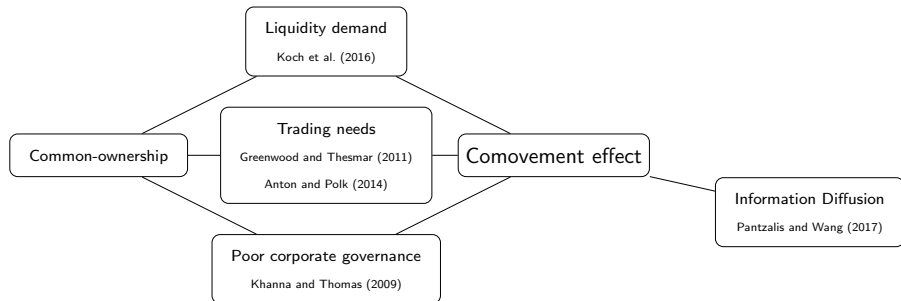
Papers

# Main effect



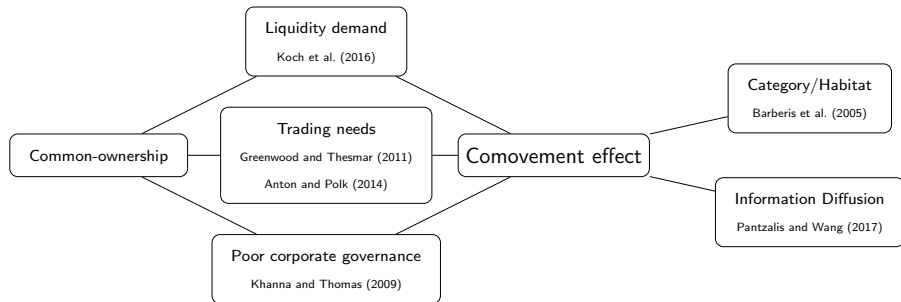
Papers

# Main effect



Papers

# Main effect



Papers

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion



Anton and Polk (2014)

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

# Measuring Common-ownership

Anton and Polk (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

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

# Measuring Common-ownership

Anton and Polk (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

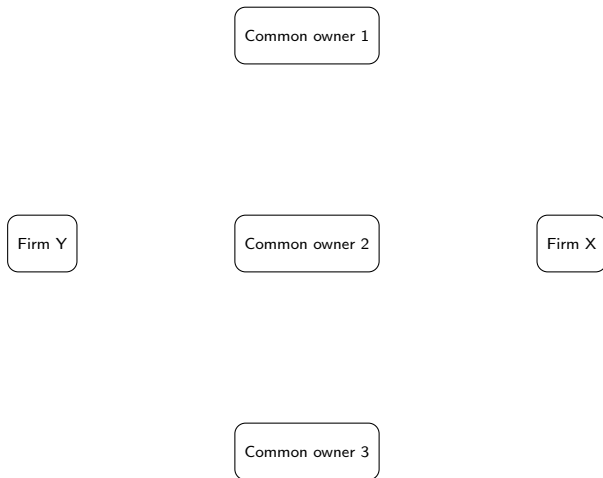
Example of three common owner

Firm Y

Firm X

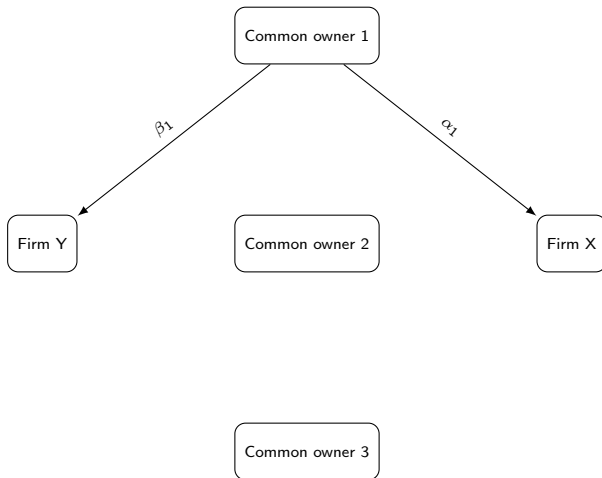
# Measuring Common Ownership

Example of three common owner



# Measuring Common Ownership

Example of three common owner



# 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    | 20      | 10       | 20      | 10     | 5       | 1        |
| $\beta_1$  | 1/3    | 10      | 10       | 20      | 10     | 5       | 1        |
| $\alpha_2$ | 1/3    | 10      | 80       | 20      | 10     | 5       | 1        |
| $\beta_2$  | 1/3    | 20      | 80       | 20      | 10     | 5       | 1        |
| $\alpha_3$ | 1/3    | 70      | 10       | 20      | 10     | 5       | 1        |
| $\beta_3$  | 1/3    | 70      | 10       | 20      | 10     | 5       | 1        |
| SQRT       | 3      | 2.56    | 2.33     | 1.8     | 0.9    | 0.45    | 0.09     |
| SUM        | 1      | 1       | 1        | 0.6     | 0.3    | 0.15    | 0.03     |
| Quadratic  | 3      | 1.85    | 1.52     | 8.33    | 33.33  | 133.33  | 3333.33  |



# Measuring Common Ownership

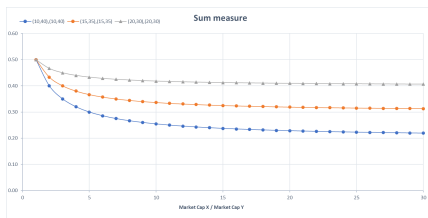
## Comparison

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

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

# Measuring Common Ownership

## Comparison



Comparison of two methods for calculating common ownership

## Conclusion

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

# Pair Composition and Business Group

Business Group

Ultimate Owner

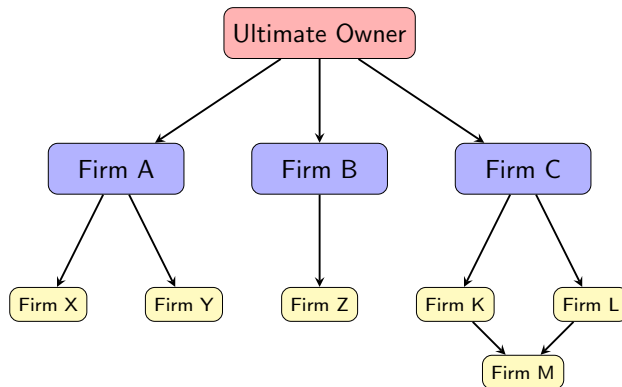
# Pair Composition and Business Group

## Business Group



# Pair Composition and Business Group

## Business Group



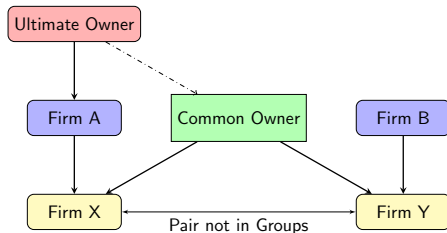
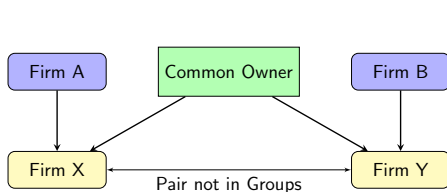
# Pair Composition and Business Group

## Pair in the Business Group



# Pair Composition and Business Group

Pair not in any of Business Groups



# Data Summary

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

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



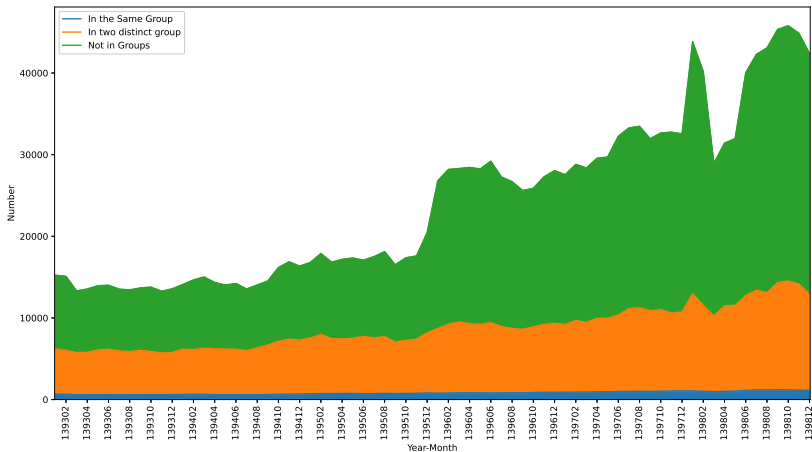
# Pair Composition

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

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

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

# Number of Pairs



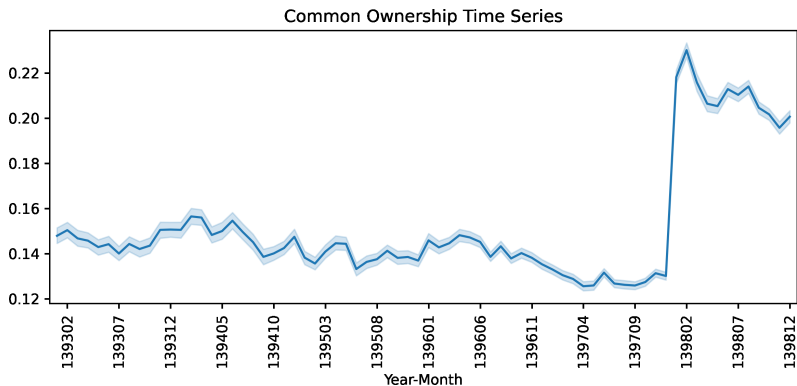
# FCA vs. FCAP Summary

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

## Results

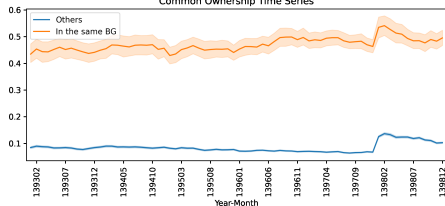
- By the proposed measurement, common ownership increases
- Common ownership is greater in pairs that are in the same business group and industry

# FCA's time series

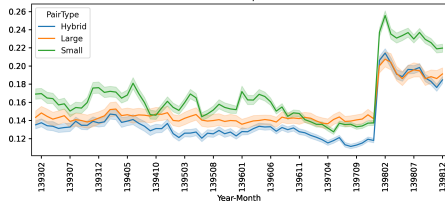


# FCA's time series

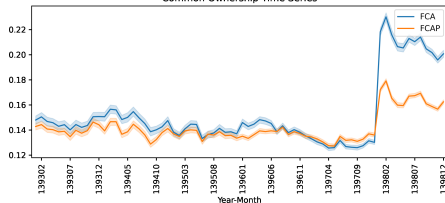
Common Ownership Time Series



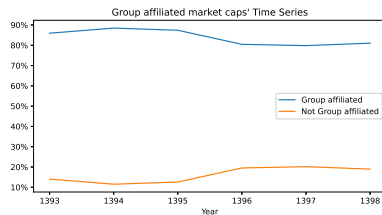
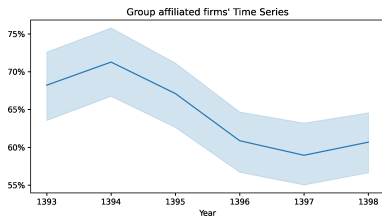
Common Ownership Time Series



Common Ownership Time Series



# Group affiliated firm's time series



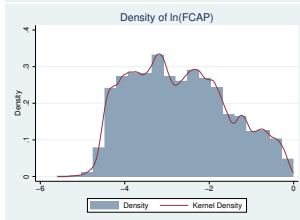
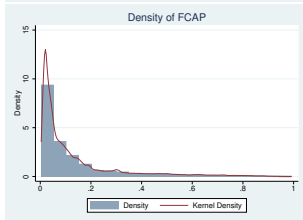
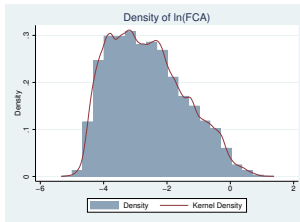
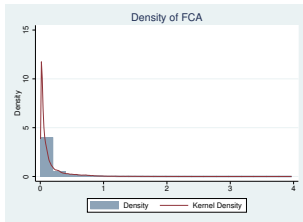
# FCA vs. FCAP Distributions

## Monthly



# FCA vs. FCAP Distributions

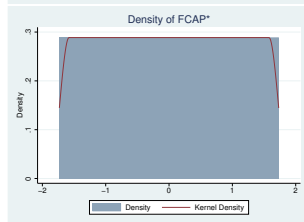
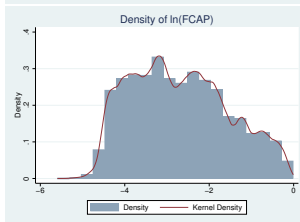
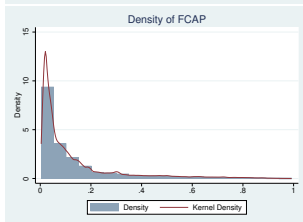
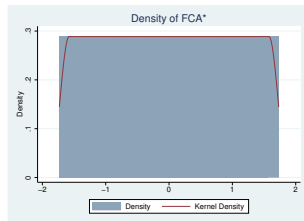
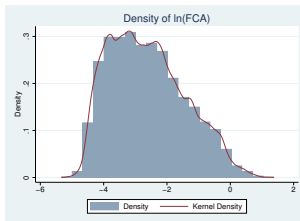
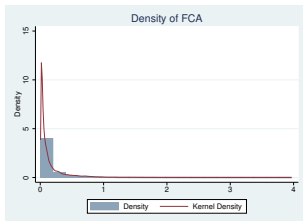
Monthly





# FCA vs. FCAP Distributions

## Monthly



# Correlation Calculation

## 4 Factor + Industry

### 1 First 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)

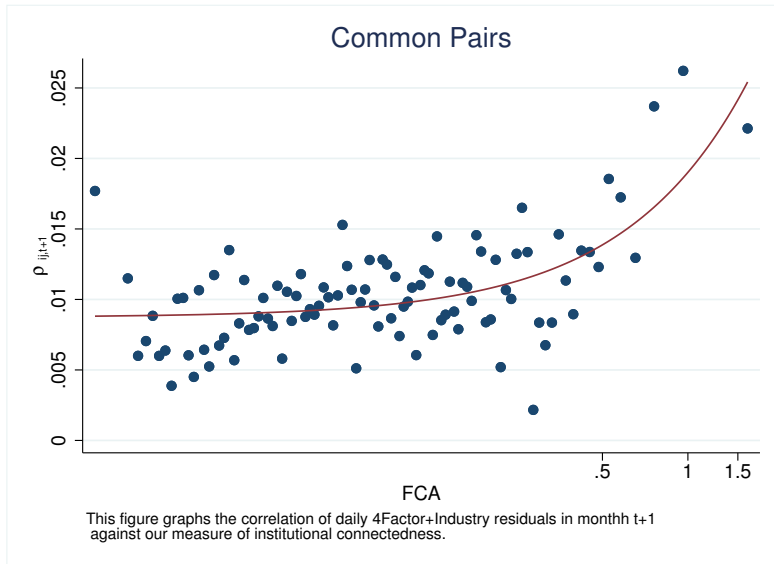
# Correlation Calculation Results

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

## Conclusion

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

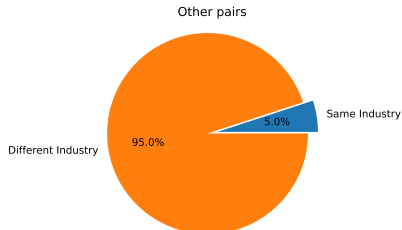
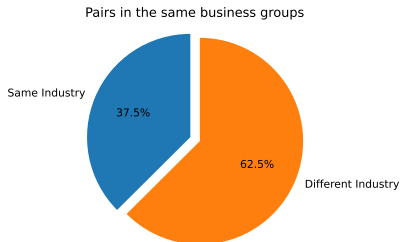
# Future Correlation via *FCA*



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

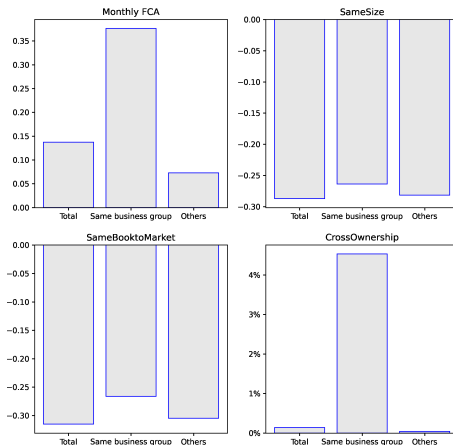
# Industry & Business group

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



# Business group

## Pairs' characteristic



# Summary of Controls

## Variables' distribution

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



# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

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

# Fama-MacBeth (1973)

- Two Step Regression
  - First Step

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

- Second Step

$$\begin{bmatrix} \bar{Y}_1 \\ \vdots \\ \bar{Y}_T \end{bmatrix}_{T \times 1} = \begin{bmatrix} 1 & \delta_1^0 & \delta_1^1 & \cdots & \delta_1^k \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 1 & \delta_T^0 & \delta_T^1 & \cdots & \delta_T^k \end{bmatrix}_{T \times (k+2)} \times \begin{bmatrix} \lambda \\ \lambda_0 \\ \lambda_1 \\ \vdots \\ \lambda_k \end{bmatrix}_{(k+2) \times 1}$$

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

# Calculating standard errors

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

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

where T is the number of periods in the time series

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

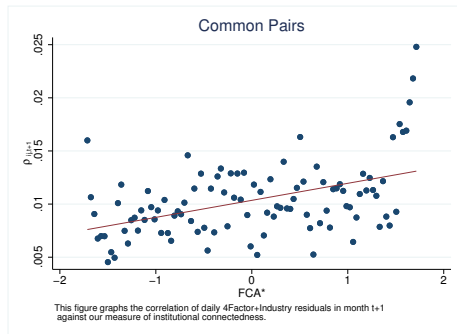
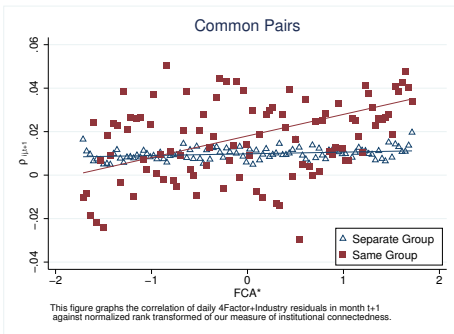
## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

# Future Correlation via *FCA*

## Normalized Rank-Transformed



- Use Fama-MacBeth to estimate this model

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

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

# Model Estimation

## Normalized Rank-Transformed

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

t statistics in parentheses

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



# All non-common owner pairs

regression

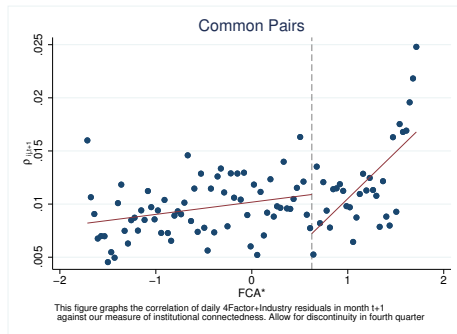
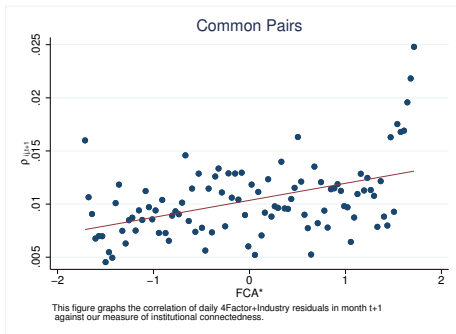
|                             | Future Monthly Correlation of 4F+Industry Residuals |                      |                      |                    |                    |                      |
|-----------------------------|---|----------------------|----------------------|--------------------|--------------------|----------------------|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

t statistics in parentheses

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

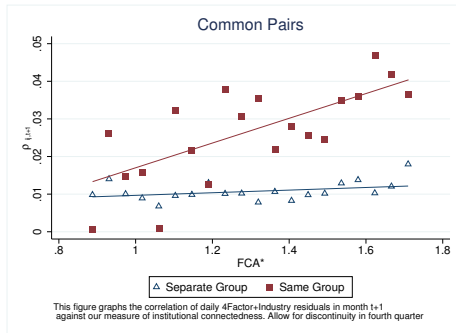
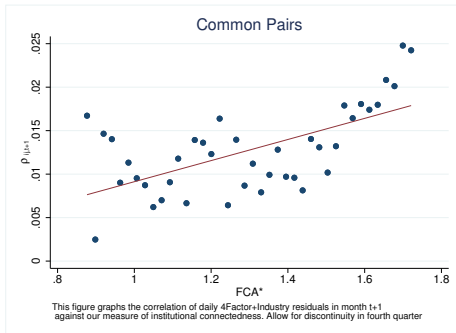
# Future Correlation via *FCA*

## Discontinuity

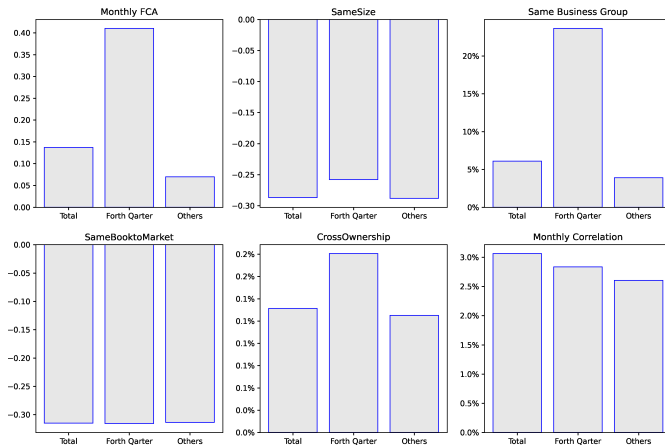


# 4 Factor + Industry Future Correlation via $FCA^*$

## Discontinuity & Business Groups



# Forth quarter summary



# Fama-MacBeth Estimation

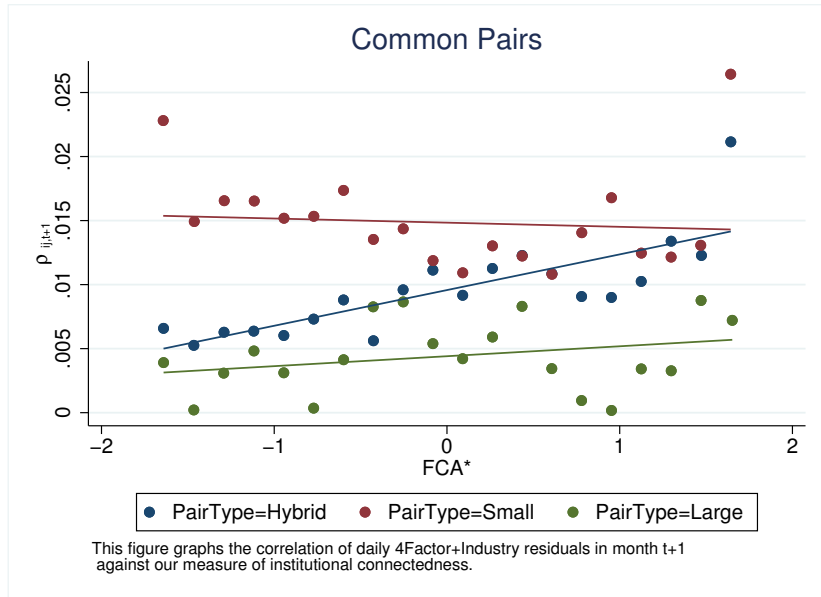
## Discontinuity (sub-sample)

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

t statistics in parentheses

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

# Grouped by size



# Model Estimation

Grouped by size

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

t statistics in parentheses

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

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

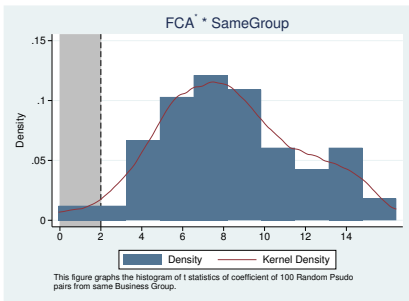
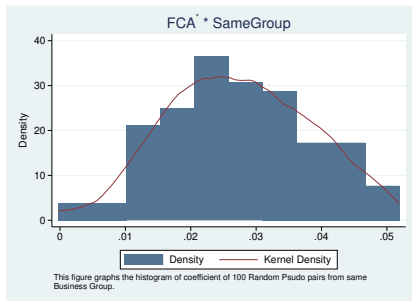
## 7 Business Group Effect

## 8 Conclusion



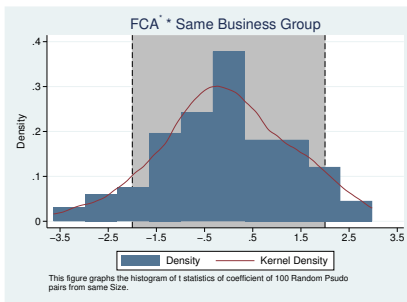
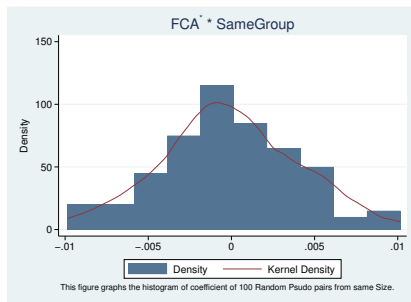
# Random Pairs from Same Business Group

$\beta_3$  in model 1



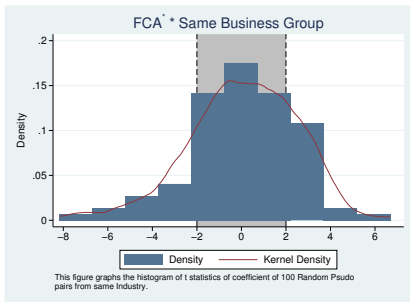
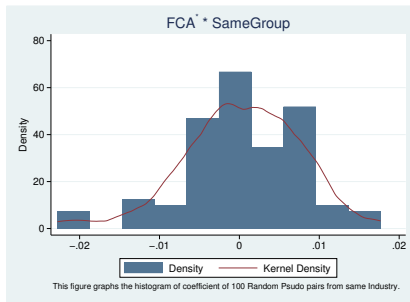
# Random Pairs from Same Size

$\beta_3$  in model 1



# Random Pairs from Same Industry

$\beta_3$  in model 1



# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

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

*t* statistics in parentheses

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

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

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

t statistics in parentheses

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

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

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

t statistics in parentheses

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

# Cross-sectional analyze of Group turnover

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

t statistics in parentheses

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



# Pairwise correlations in turnover

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

t statistics in parentheses

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

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

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

t statistics in parentheses

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

# Cross-sectional analyze of Group Amihud

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

t statistics in parentheses

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

# Pairwise correlations in liquidity

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

*t* statistics in parentheses

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

- Antón et al. (2018):

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

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

- Ivashina and Sun (2011):

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

# Table of Contents

## 1 Motivation

## 2 Literature

- Common-ownership measurements
- Main Effect

## 3 Empirical Studies

- Measuring Common-ownership
- Correlation Calculation
- Controls

## 4 Methodology

## 5 Results

- Normalized Rank-Transformed
- Discontinuity

## 6 Further Evidence

## 7 Business Group Effect

## 8 Conclusion

# Conclusion

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

# References I

- Antón, M., Ederer, F., Giné, M., and Schmalz, M. C. (2020). Common ownership, competition, and top management incentives. *Ross School of Business Paper*, (1328).
- Antón, M., Mayordomo, S., and Rodríguez-Moreno, M. (2018). Dealing with dealers: Sovereign cds comovements. *Journal of Banking & Finance*, 90:96–112.
- Anton, M. and Polk, C. (2014). Connected stocks. *The Journal of Finance*, 69(3):1099–1127.
- Azar, J., Schmalz, M. C., and Tecu, I. (2018). Anticompetitive effects of common ownership. *The Journal of Finance*, 73(4):1513–1565.
- Backus, M., Conlon, C., and Sinkinson, M. (2020). Theory and measurement of common ownership. In *AEA Papers and Proceedings*, volume 110, pages 557–60.
- Barberis, N., Shleifer, A., and Wurgler, J. (2005). Comovement. *Journal of financial economics*, 75(2):283–317.
- Boubaker, S., Mansali, H., and Rjiba, H. (2014). Large controlling shareholders and stock price synchronicity. *Journal of Banking & Finance*, 40:80–96.
- Freeman, K. (2019). The effects of common ownership on customer-supplier relationships. *Kelley School of Business Research Paper*, (16-84).
- Gilje, E. P., Gormley, T. A., and Levit, D. (2020). Who's paying attention? measuring common ownership and its impact on managerial incentives. *Journal of Financial Economics*, 137(1):152–178.
- Greenwood, R. and Thesmar, D. (2011). Stock price fragility. *Journal of Financial Economics*, 102(3):471–490.
- Hansen, R. G. and Lott Jr, J. R. (1996). Externalities and corporate objectives in a world with diversified shareholder/consumers. *Journal of Financial and Quantitative Analysis*, pages 43–68.
- Harford, J., Jenter, D., and Li, K. (2011). Institutional cross-holdings and their effect on acquisition decisions. *Journal of Financial Economics*, 99(1):27–39.
- He, J. and Huang, J. (2017). Product market competition in a world of cross-ownership: Evidence from institutional blockholdings. *The Review of Financial Studies*, 30(8):2674–2718.
- He, J., Huang, J., and Zhao, S. (2019). Internalizing governance externalities: The role of institutional cross-ownership. *Journal of Financial Economics*, 134(2):400–418.



# References II

- Ivashina, V. and Sun, Z. (2011). Institutional stock trading on loan market information. *Journal of financial Economics*, 100(2):284–303.
- Khanna, T. and Thomas, C. (2009). Synchronicity and firm interlocks in an emerging market. *Journal of Financial Economics*, 92(2):182–204.
- Koch, A., Ruenzi, S., and Starks, L. (2016). Commonality in Liquidity: A Demand-Side Explanation. *The Review of Financial Studies*, 29(8):1943–1974.
- Lewellen, J. W. and Lewellen, K. (2021). Institutional investors and corporate governance: The incentive to be engaged. *Journal of Finance, Forthcoming*.
- Lewellen, K. and Lowry, M. (2021). Does common ownership really increase firm coordination? *Journal of Financial Economics*.
- Newham, M., Seldeslachts, J., and Banal-Estanol, A. (2018). Common ownership and market entry: Evidence from pharmaceutical industry.
- Pantazis, C. and Wang, B. (2017). Shareholder coordination, information diffusion and stock returns. *Financial Review*, 52(4):563–595.

# Table of Contents

## 9 Appendix I

## 10 Appendix II

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

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

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

Back

# Table of Contents

## 9 Appendix I

## 10 Appendix II

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

- Common-ownership and comovement effect

[Anton and Polk (2014)]

Stocks sharing many common investors tend to comove more strongly with each other in the future than otherwise similar stocks.

- Common-ownership and liquidity demand

[Koch et al. (2016), Pastor and Stambaugh (2003), Acharya and Pedersen (2005)]

Commonality in stock liquidity is likely driven by correlated trading among a given stock's investors. Commonality in liquidity is important because it can influence expected returns

- Trading needs and comovement

[Greenwood and Thesmar (2011)]

If the investors of mutual funds have correlated trading needs, the stocks that are held by mutual funds can comove even without any portfolio overlap of the funds themselves

- Stock price synchronicity and poor corporate governance

[Boubaker et al. (2014), Khanna and Thomas (2009), Morck et al. (2000)]

Stock price synchronicity has been attributed to poor corporate governance and a lack of firm-level transparency. On the other hand, better law protection encourages informed trading, which facilitates the incorporation of firm-specific information into stock prices, leading to lower synchronicity

Graph

# 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

JBFB-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-MacBeth



# 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. (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. (2018)
  - Capture a specific type of externality
  - Measured at the industry level
  - Assumes that investors are fully informed about the externalities
- $GGL^A(A, B) = \sum_{i=1}^I \alpha_{i,AG}(\beta_{i,A}) \alpha_{i,B}$  Gilje et al. (2020)
  - Bi-directional
  - Less information
  - Not sensitive to the scope
  - Measure increases when the relative ownership of firm A increases

# Commonownership measurements

## Ad hoc common ownership measures

- $Overlap_{Count}(A, B) = \sum_{i \in I^{A,B}} 1$

He and Huang (2017), He et al. (2019)

- $Overlap_{Min}(A, B) = \sum_{i \in I^{A,B}} \min\{\alpha_{i,A}, \alpha_{i,B}\}$

Newham et al. (2018)

- $Overlap_{AP}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{v}_A}{\bar{v}_A + \bar{v}_B} + \alpha_{i,B} \frac{\bar{v}_B}{\bar{v}_A + \bar{v}_B}$

Anton and Polk (2014)

- $Overlap_{HL}(A, B) = \sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$

Hansen and Lott Jr (1996) , Freeman (2019)

- Unappealing properties

- Unclear is whether any of these measures represents an economically meaningful measure of common ownership's impact on managerial incentives.
- Both  $Overlap_{Count}$  and  $Overlap_{AP}$  are invariant to the decomposition of ownership between the two firms, which leads to some unappealing properties.

Back