Connected Stocks via Business Groups:

Evidence from an emerging market

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December, 2021

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Motivation

Research Question

- **Stock return co-movement is caused by direct or indirect common ownership?**
  - common ownership:
    - We connect stocks through the common ownership by blockholders (ownership $> 1\%$) for direct common ownership
    - We connect stocks through the ultimate owner for indirect common ownership
  - We focus on excess return co-movement for a pair of the stocks
  - We use common ownership (direct or indirect) to forecast cross-sectional variation in the realized correlation of four-factor + industry residuals
  - We demonstrate that correlated trading can be a channel of co-movement

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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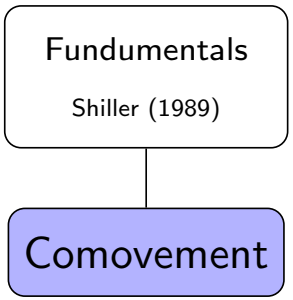
Main effect

Comovement

Main effect



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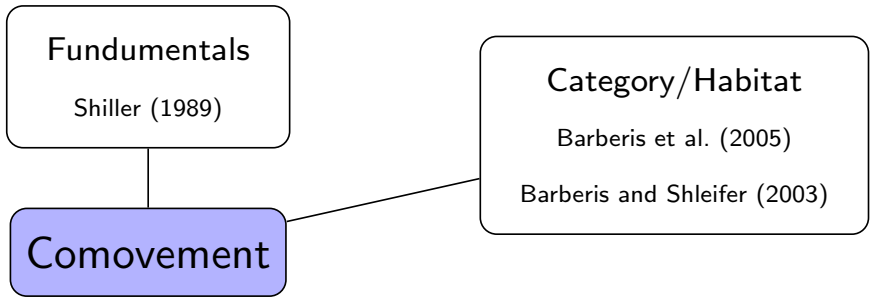
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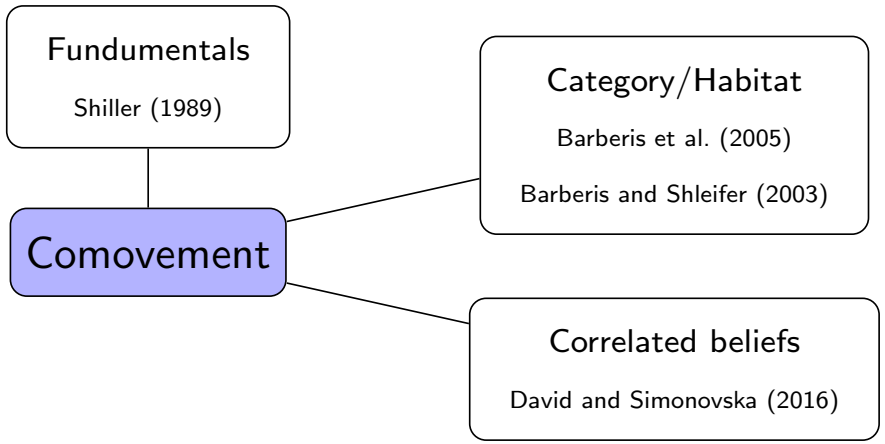
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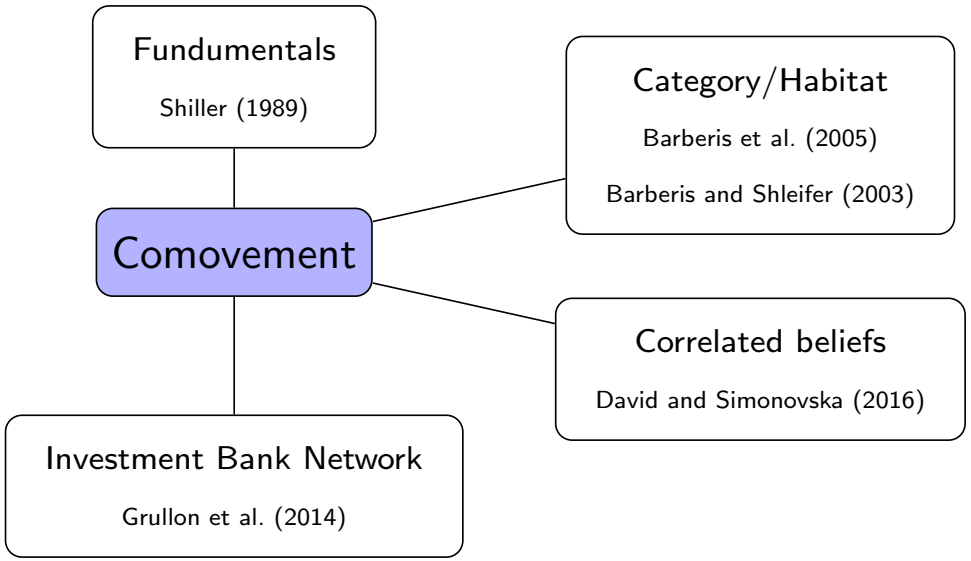
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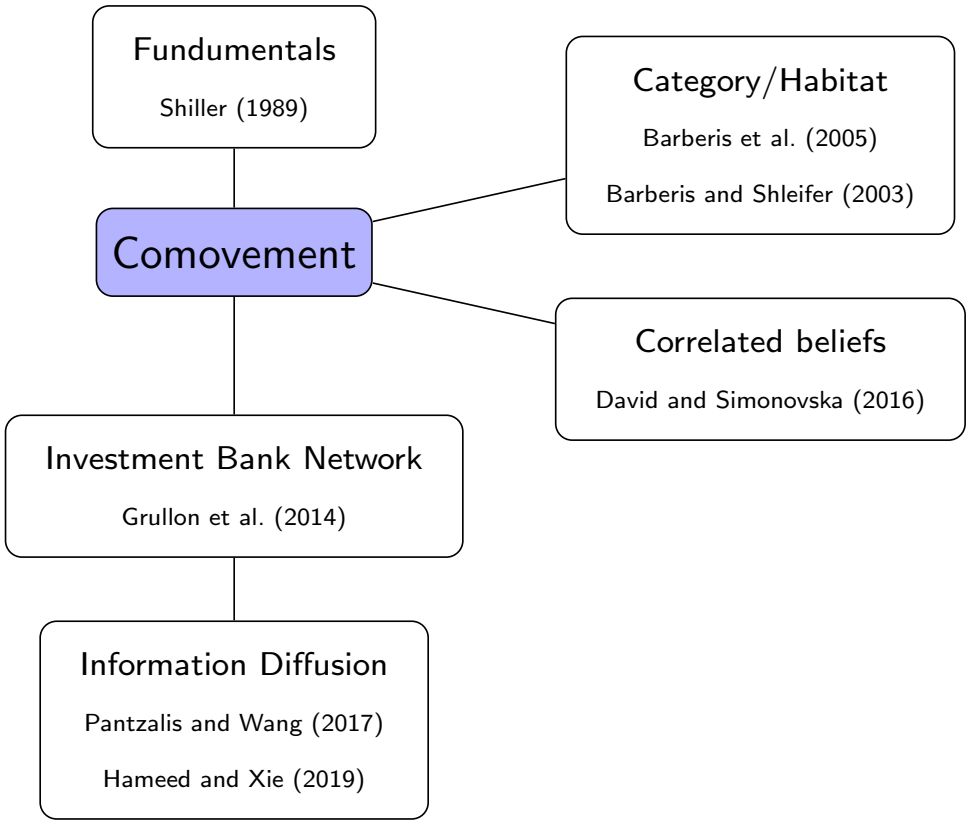
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Main effect

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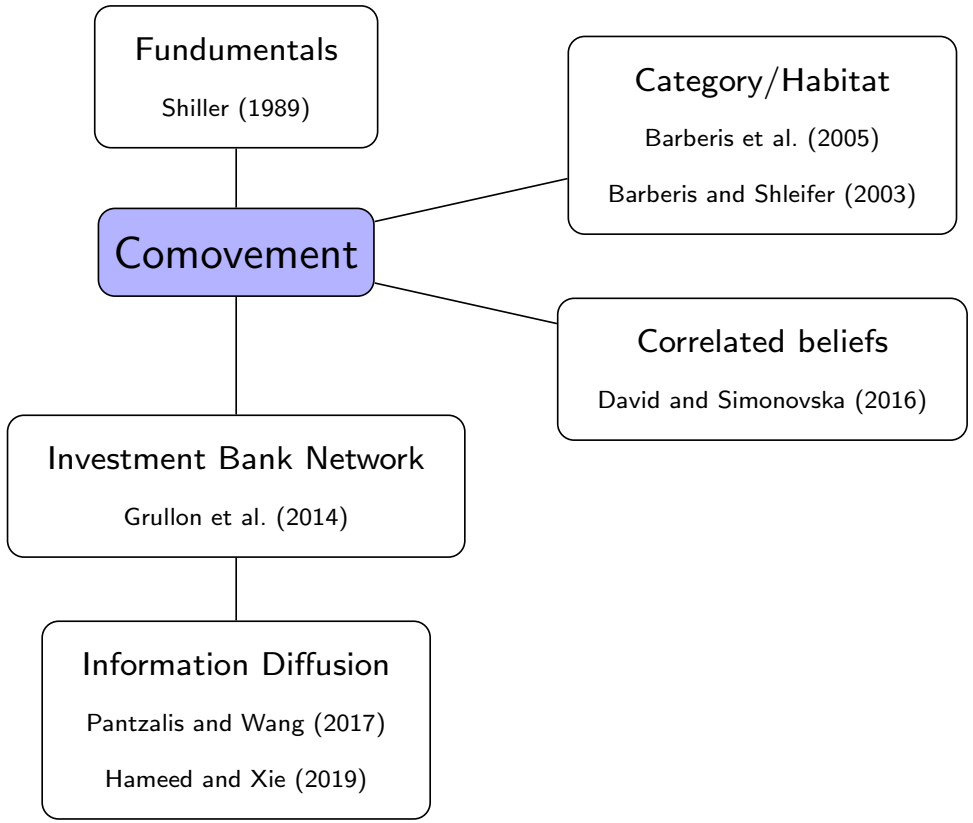

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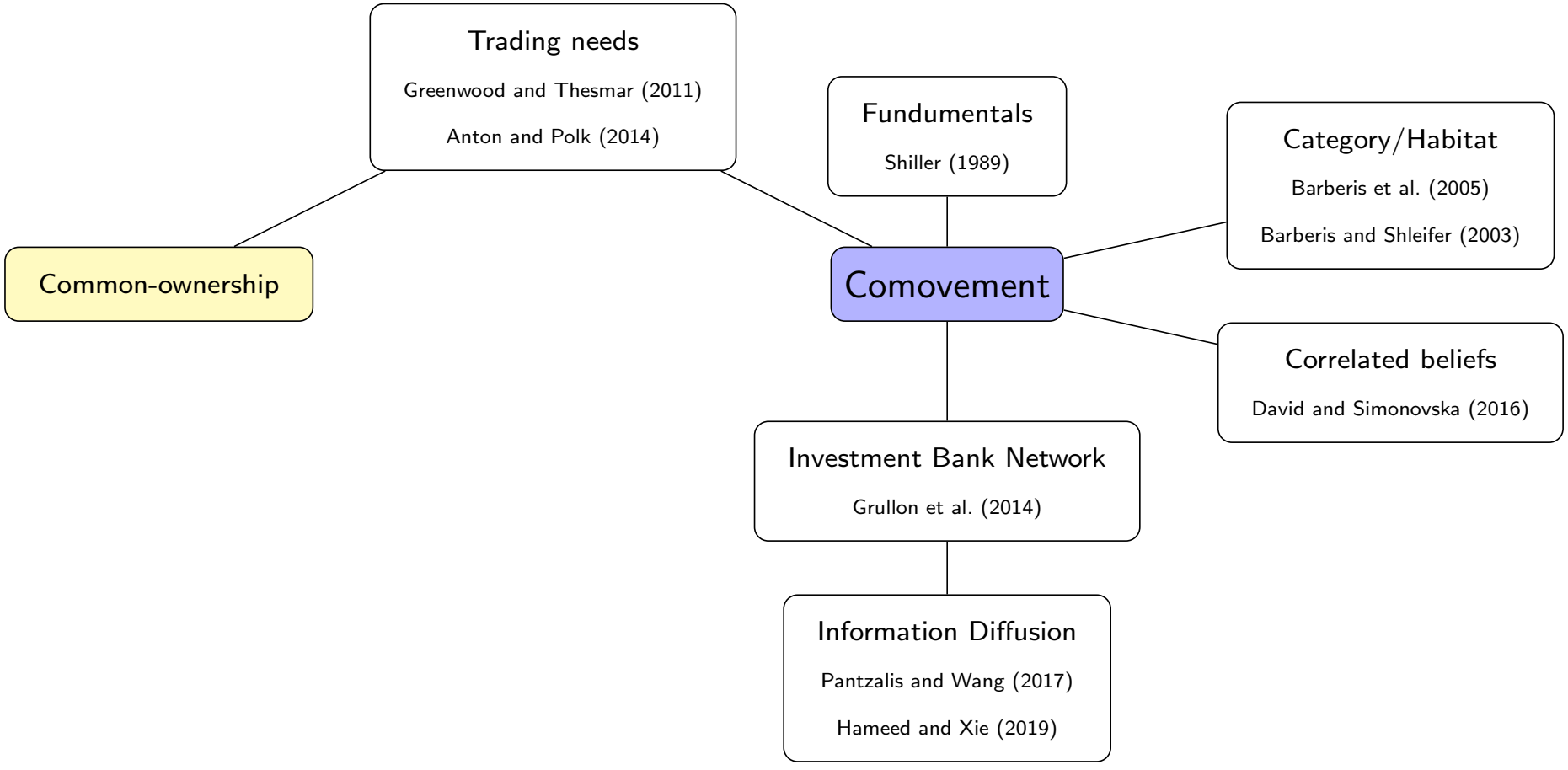
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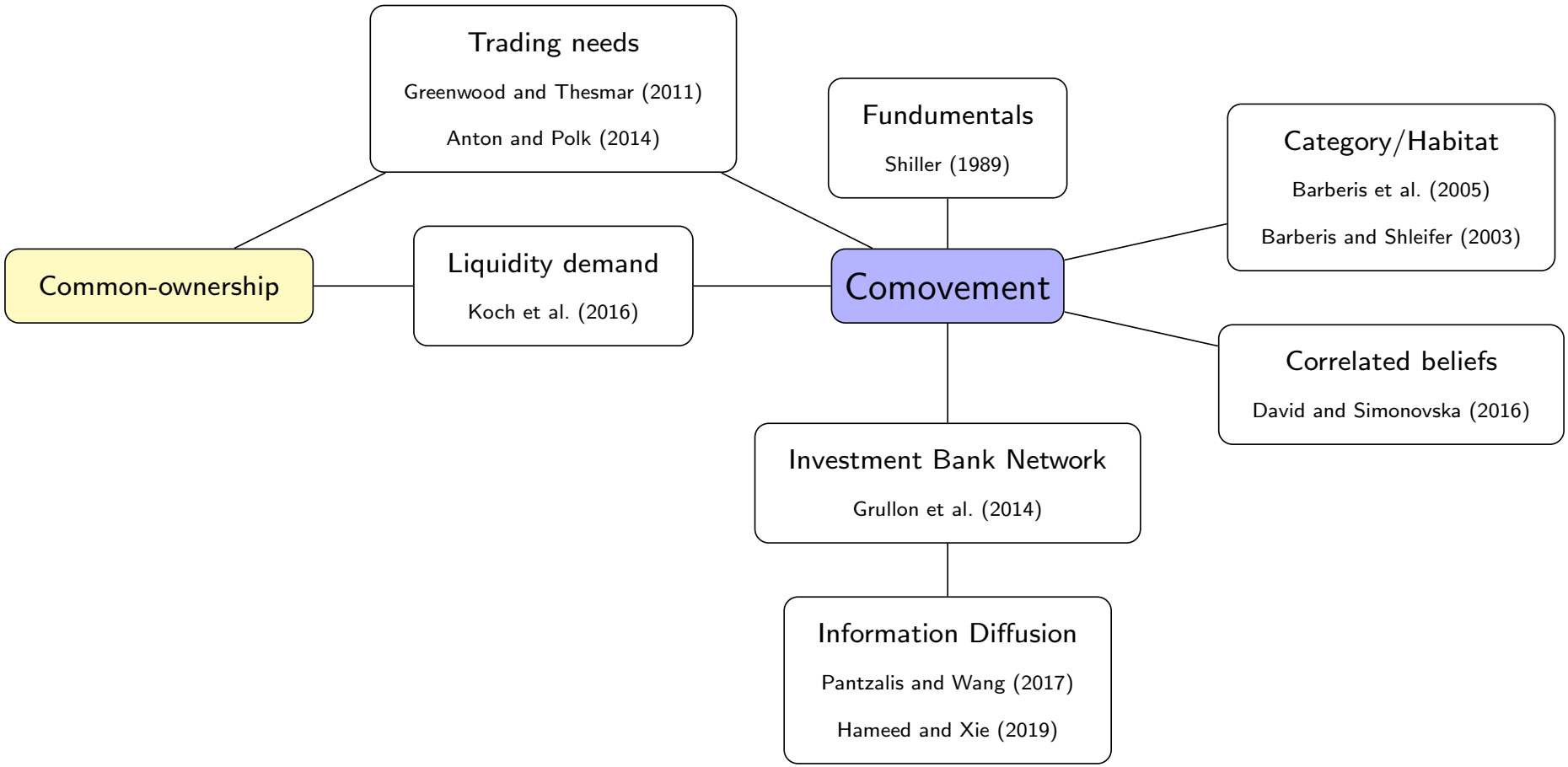
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Liquidity demand
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Comovement
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Investment Bank Network
Grullon et al. (2014)
Information Diffusion
Pantzalis and Wang (2017)
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Our work

- We use daily records of block-holder ownership for firms
- We are not restricted to mutual funds ownership
- Furthermore, 85% of market belongs to the business groups
  - Would business groups be able to raise the co-movement of stock returns?
    - Cho and Mooney (2015):
      The strong co-movement between group returns and firm returns is explained by correlated fundamentals.
    - Kim et al. (2015):
      The increase in correlation appears to be driven more by non-fundamental factors such as correlated trading, rather than fundamental factors such as related-party transactions
  - Common ownership or business group (indirect common ownership) ?
  - Through which channel?

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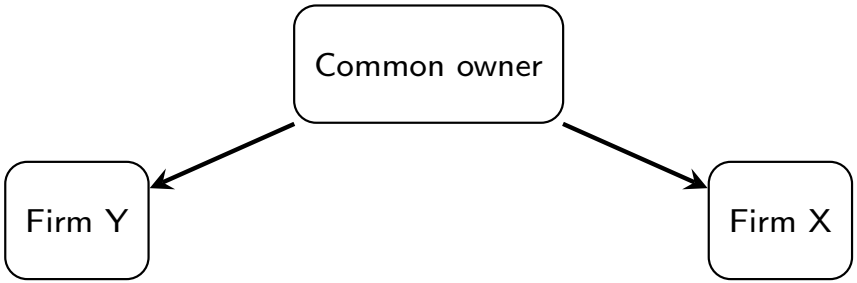
Pair composition

- Firms with at least one common owner



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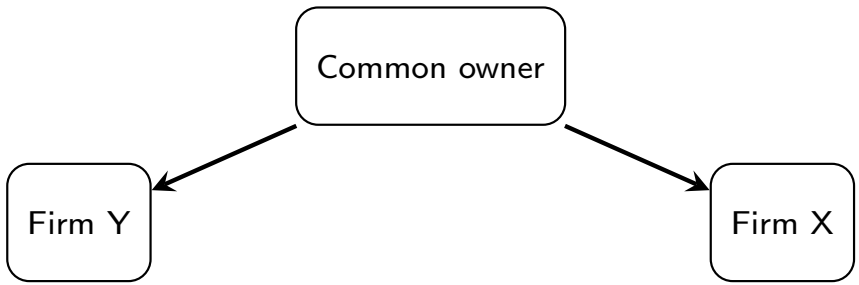


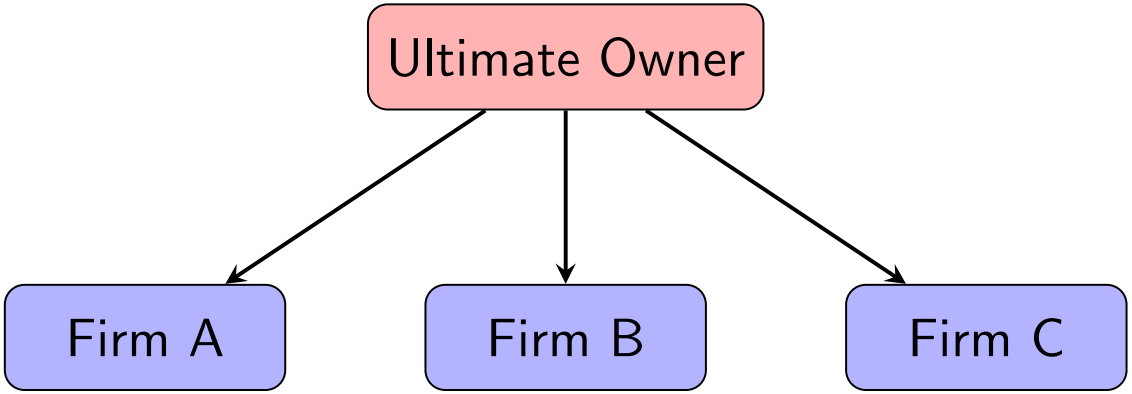
- In a business group, how can one pair be defined?
  - What is the business group?

Pair Composition and Business Group

Business Group

Pair Composition and Business Group

Business Group



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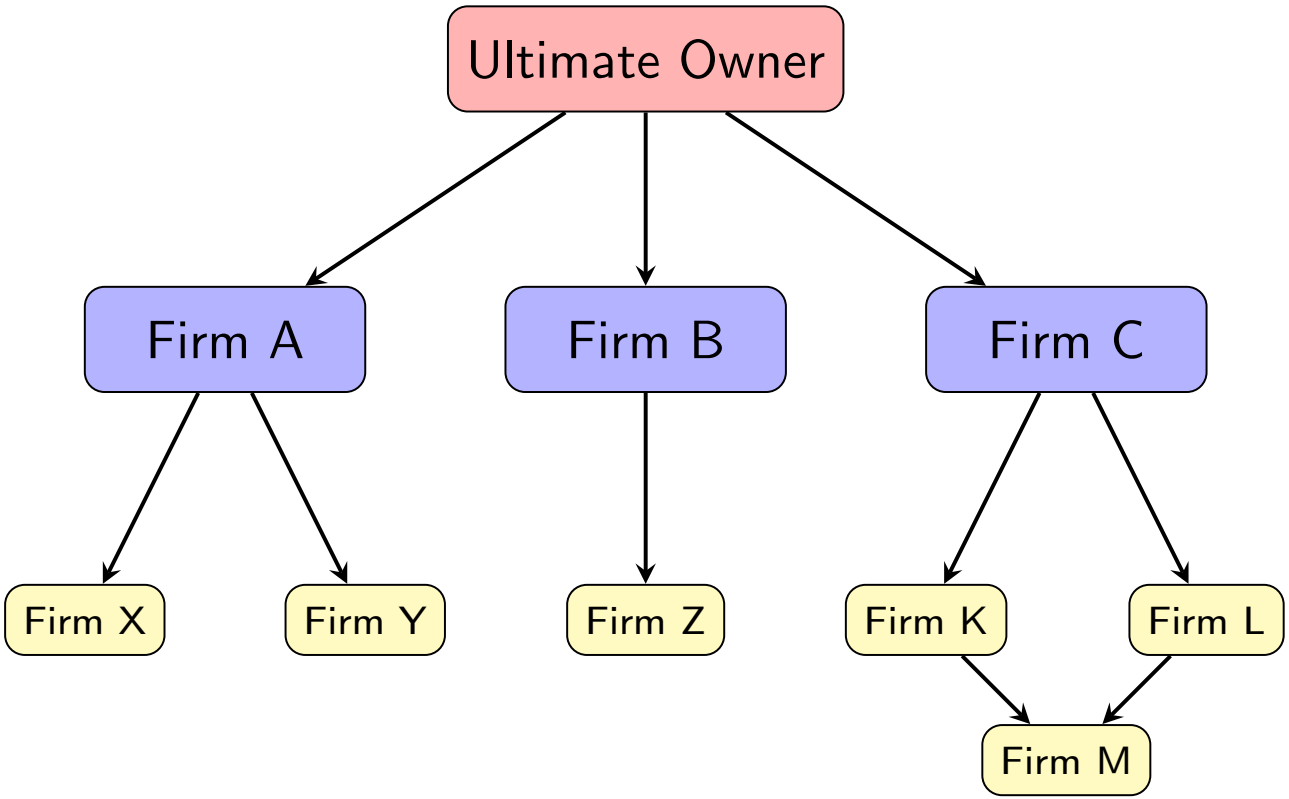
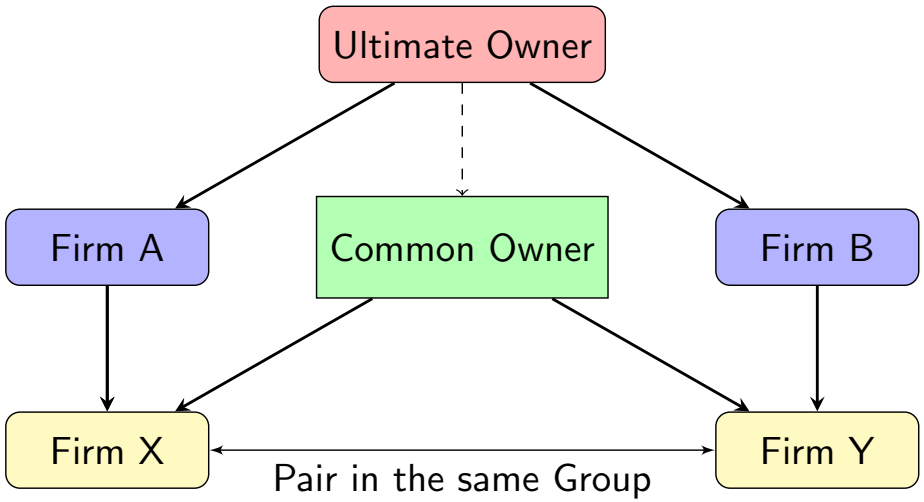
Business Group



Pair Composition and Business Group

Pair in the Business Group



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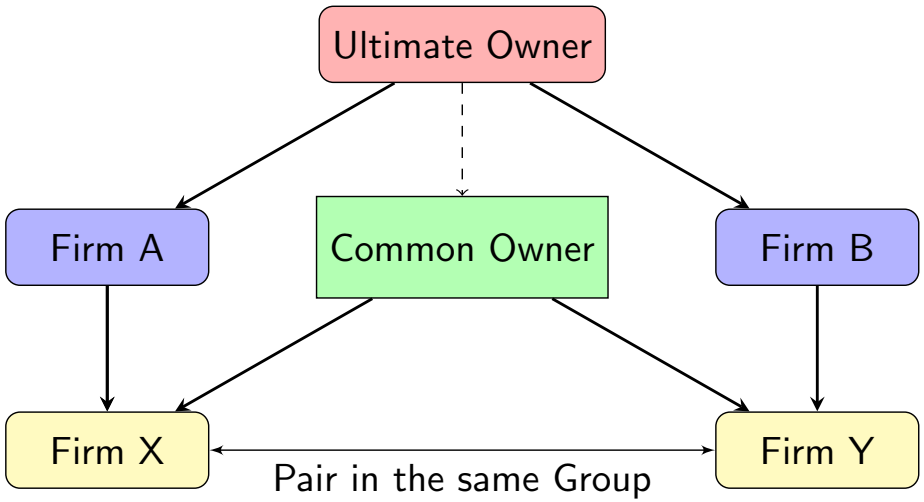

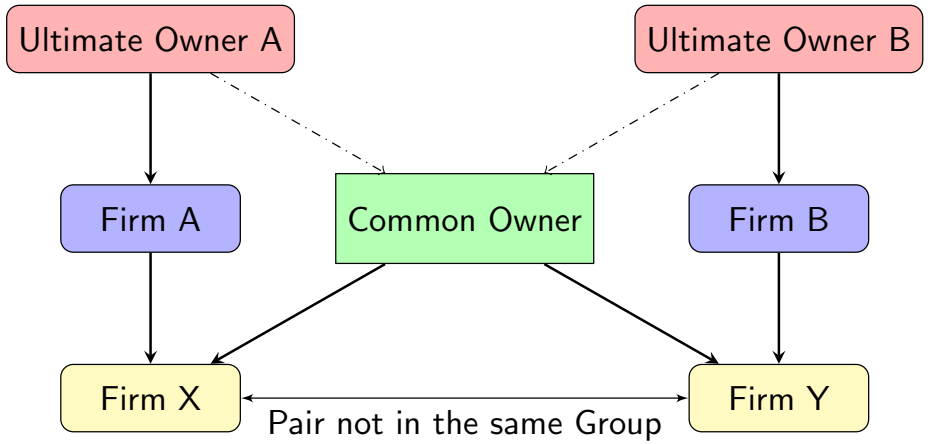

Data Summary

- We use blockholders' data from 2014/03/25 (1393/01/06) to 2020/03/18 (1398/12/28)
  - Includes of 72 Months
  - Consists of 618 firm inculding 562 firm with common owners

Year	2014	2015	2016	2017	2018	2019
No. of Firms	365	376	446	552	587	618
No. of Blockholders	1606	1676	2099	2978	3374	3416
No. of Groups	38	41	43	44	40	43
No. of Firms in Groups	249	268	300	336	346	375
Ave. Number of group Members	7	7	7	8	9	9
Ave. ownership of each Blockholders	18	19	18	17	18	19
Med. ownership of each Blockholders	5	4	4	4	4	5
Ave. Number of Owners	7	6	6	7	7	7
Ave. Block. Ownership	77	77	75	76	75	72

Pair Composition

- Pairs consist of two firms with at least one common owner
  - 93442 unique pairs which is 25% of possible pairs ($\frac{612*611}{2} = 373932$)

	mean	min	Median	max
Number of unique paris	5000	3370	5097	6366

Year	2014	2015	2016	2017	2018	2019
No. of Pairs	7471	7233	7515	8985	9479	9565
No. of Pairs not in Groups	2579	2268	2228	3379	3247	3417
No. of Pairs not in the same Group	4045	4149	4361	4548	4870	4756
No. of Pairs in the same Group	716	695	803	926	1192	1204
Ave. Number of Common owner	1	1	1	1	1	1

Measuring Common-ownership

Anton and Polk (2014)

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

SQRT

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

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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

MFCAP vs. FCAP Summary

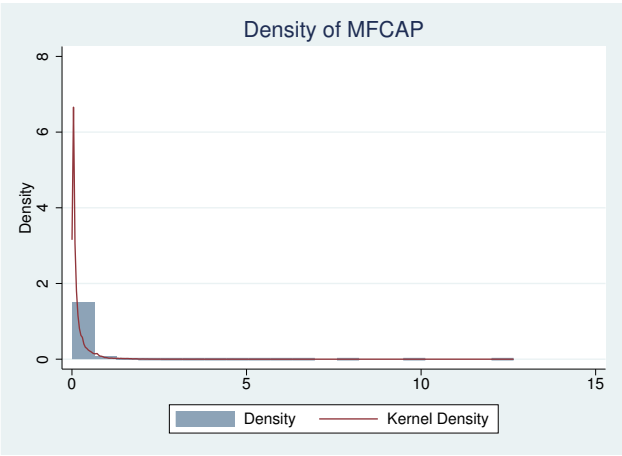
	MonthlyFCA					MonthlyFCAPf				
	mean	std	min	median	max	mean	std	min	median	max
All	0.158	0.272	0.003	0.06	12.65	0.127	0.168	0.003	0.055	1.0
Same Group	0.491	0.447	0.005	0.412	6.174	0.379	0.256	0.004	0.372	1.0
Not Same Group	0.104	0.175	0.004	0.044	3.84	0.087	0.117	0.004	0.041	0.998
Same Industry	0.358	0.44	0.005	0.189	5.656	0.255	0.242	0.004	0.162	0.999
Not Same Industry	0.128	0.222	0.003	0.053	12.65	0.108	0.144	0.003	0.049	1.0

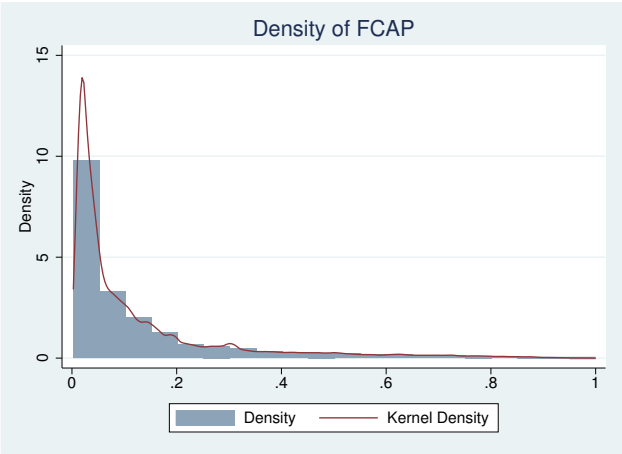
Results

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

MFCAP vs. FCAP Distributions

Monthly





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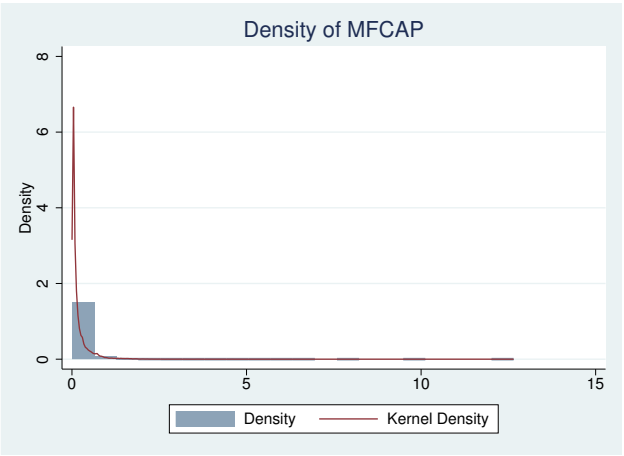

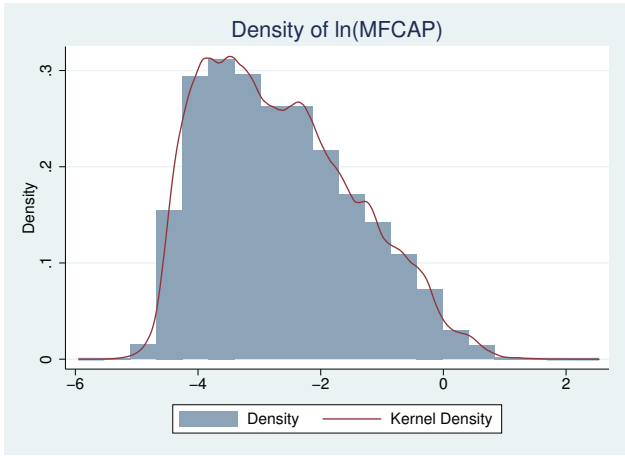

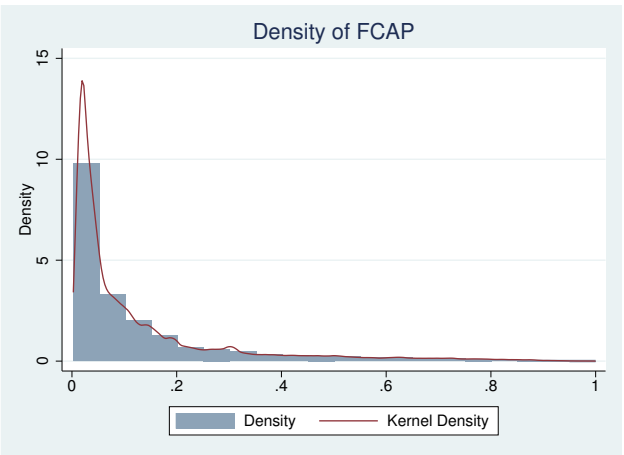

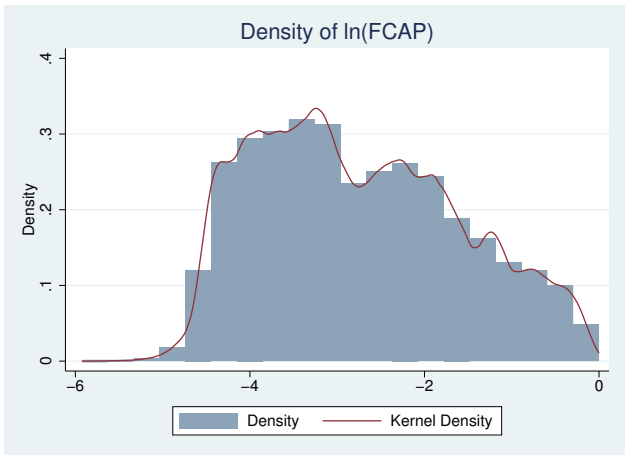

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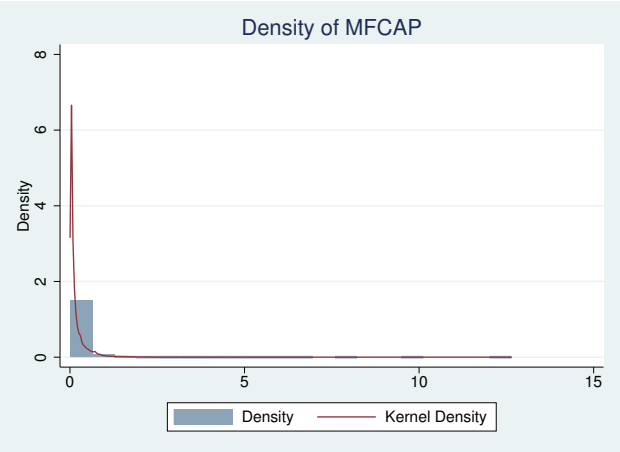
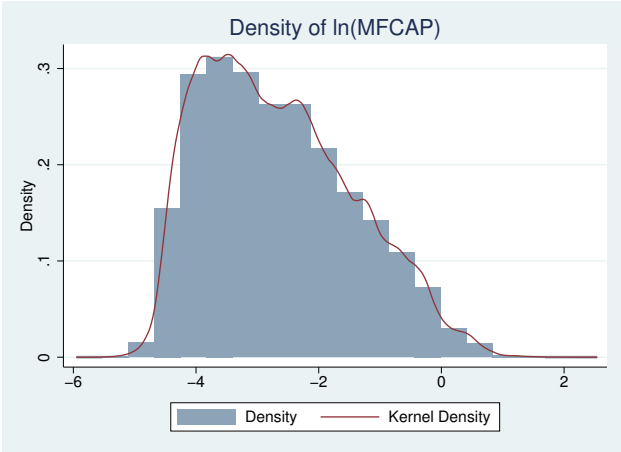
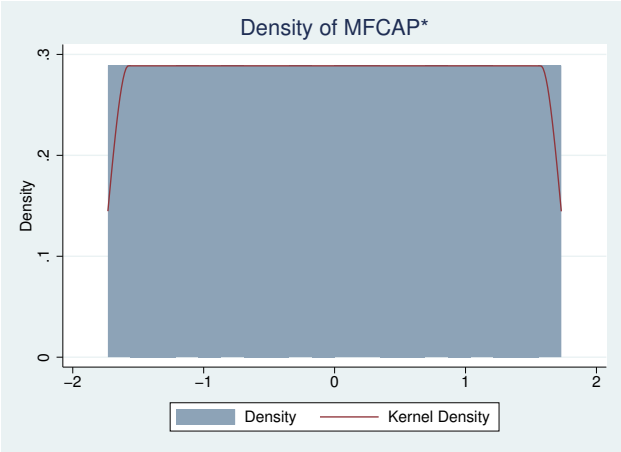
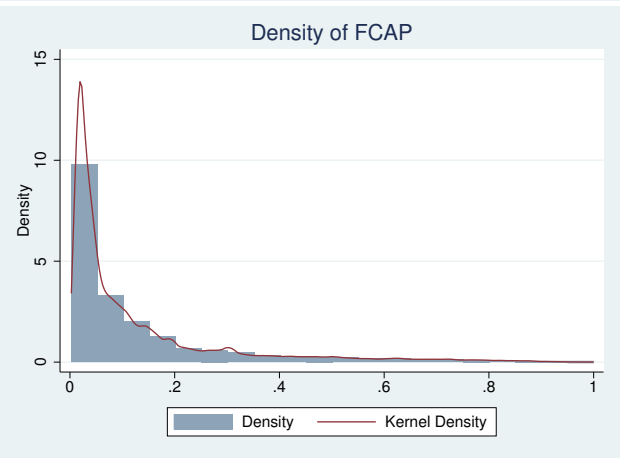
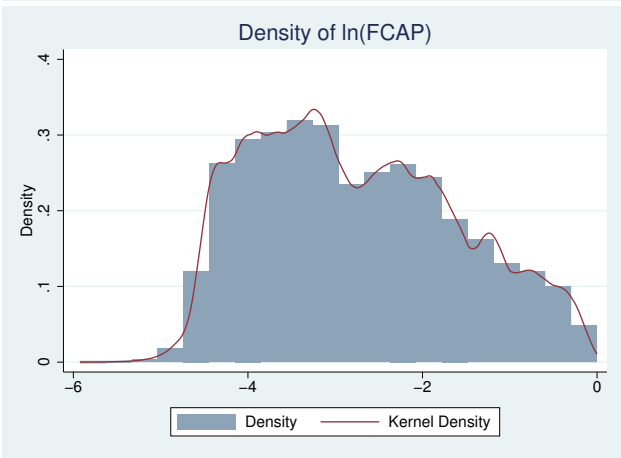
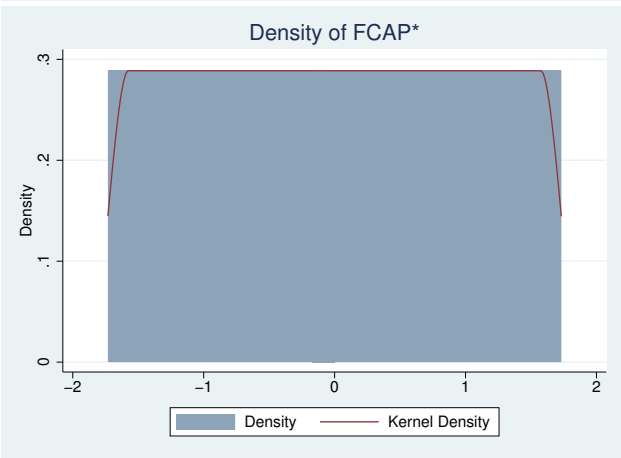












Correlation Calculation

4 Factor + Industry

1. Frist Step:

   Estimate this model on periods of three month (From two months earlier):

   - 4 Factor + Industry :

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

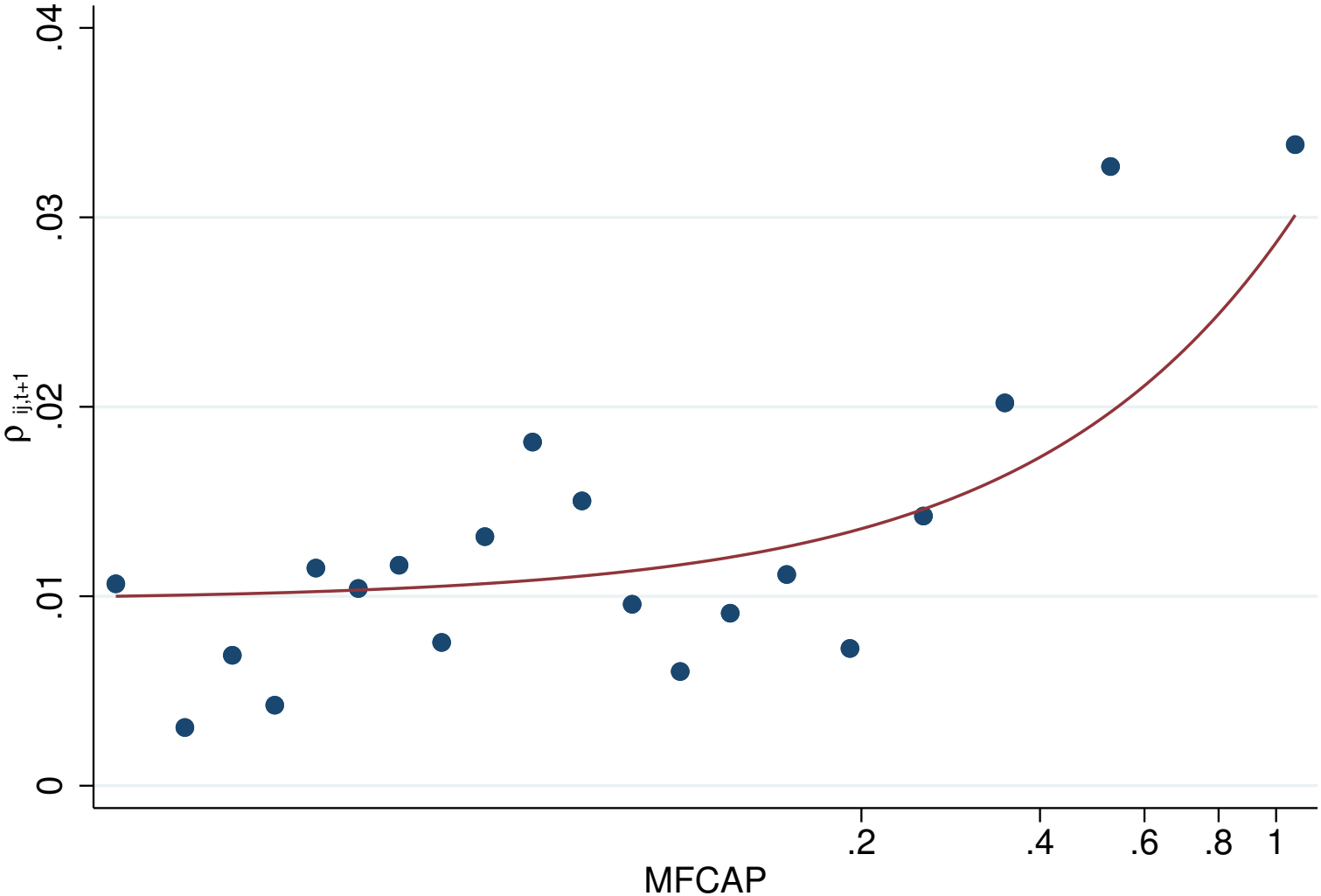
2. Second Step:
   Calculate monthly correlation of each stock pair's daily abnormal returns (residuals)

	mean	std	min	median	max
CAPM + Industry	0.016	0.129	-0.950	0.013	0.830
4 Factor	0.032	0.137	-0.875	0.024	0.869
4 Factor + Industry	0.012	0.125	-0.875	0.010	0.779
Benchmark	0.008	0.146	-0.927	0.006	0.848

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 *MFCAP*



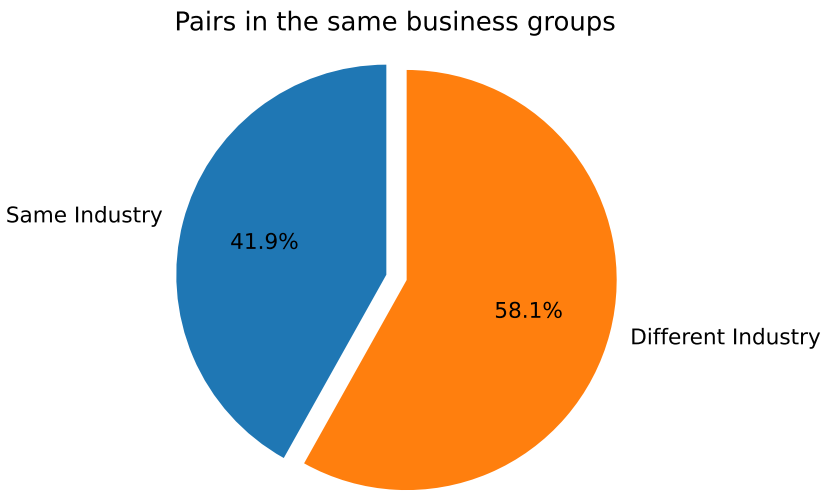
This figure shows the stock return co–movement and common ownership.

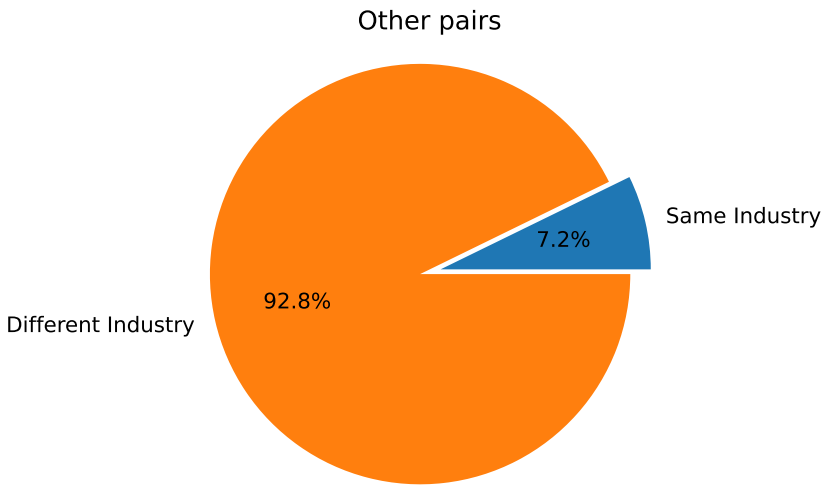
Controls

- **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	1673 (10.2%)	14688 (89.8%)
SameGroup	1390 (14.0%)	8534 (86.0%)
SameGroup & SameIndustry	597 (3.5%)	16361 (96.5%)





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Fama-MacBeth Estimation

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

Fama-MacBeth (1973)

- Two Step Regression
  - First Step

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

  - Second Step

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

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

Calculating standard errors

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

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

where T is the number of periods in the time series

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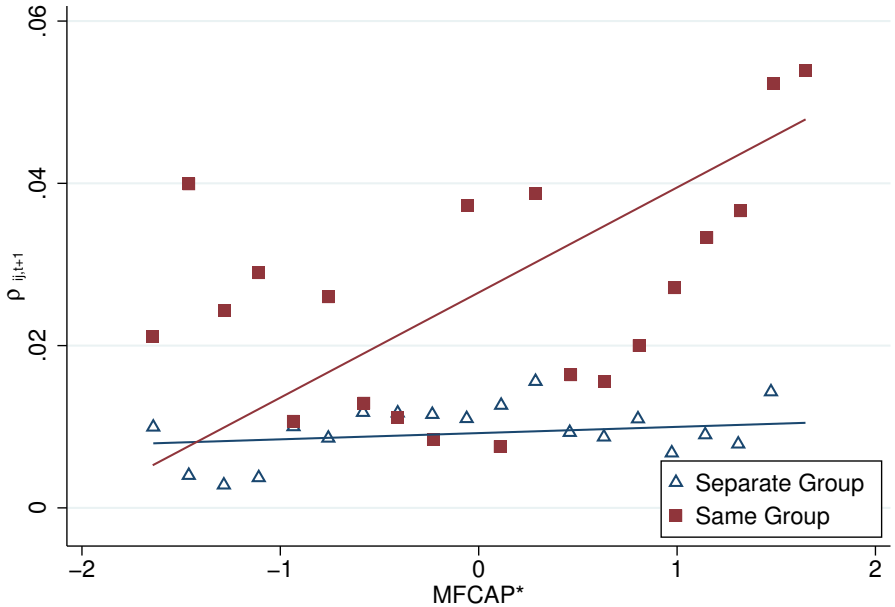
Future Correlation via *MFCAP*

Normalized Rank-Transformed



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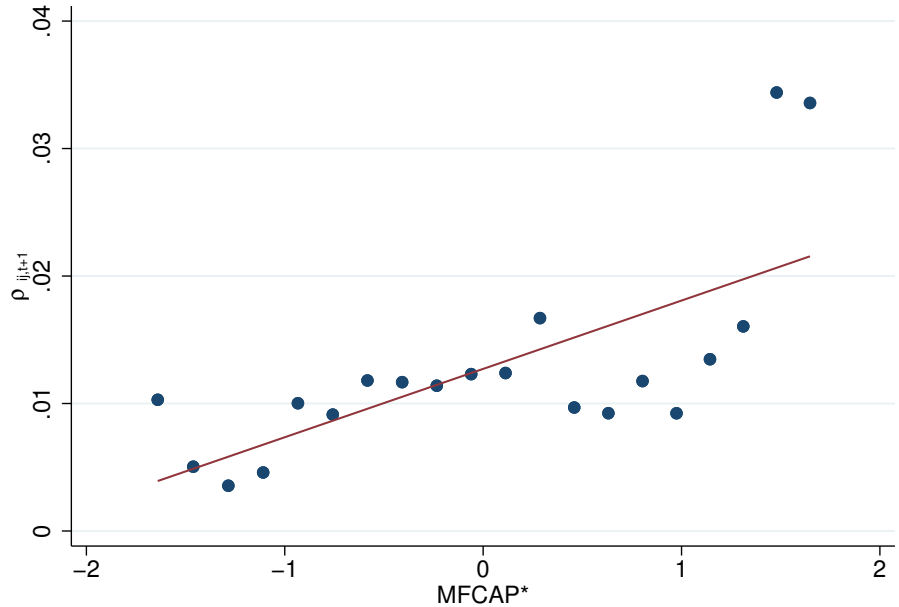


This figure shows the stock return co−movement and common ownership.

Estimation model

- Use Fama-MacBeth to estimate this model

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

- 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 Pairs's co-movement					
	(1)	(2)	(3)	(4)	(5)	(6)
MFCAP*	0.00501***	0.00324***			0.000682	0.000348
	(7.27)	(4.80)			(1.01)	(0.46)
Same Group			0.0346***	0.0312***	0.0304***	0.0275***
			(8.96)	(5.39)	(5.13)	(4.44)
Controls	No	Yes	No	Yes	Yes	Yes
PairType Control	No	No	No	No	No	Yes
Observations	297874	297874	297874	297874	297874	297874

t statistics in parentheses

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

Model Estimation

Normalized Rank-Transformed

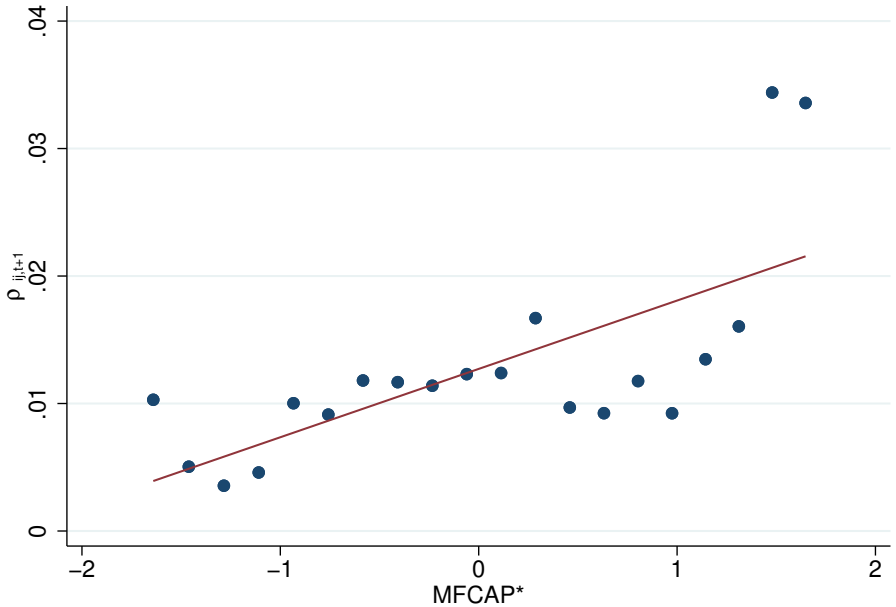
	Dependent Variable: Future Pairs's co-movement			
	(1)	(2)	(3)	(4)
MFCAP*	0.0123***	-0.000448	-0.000463	0.00111
	(4.10)	(-0.70)	(-0.75)	(1.06)
Same Group			0.0318	0.0338
			(1.40)	(1.24)
$(\text{MFCAP}^*) \times$ SameGroup			0.000209	-0.00476
			(0.02)	(-0.27)
Sub-sample	SameGroup	Others	All	All
Business Group FE	No	No	No	Yes
Observations	36061	261813	297874	297874

t statistics in parentheses

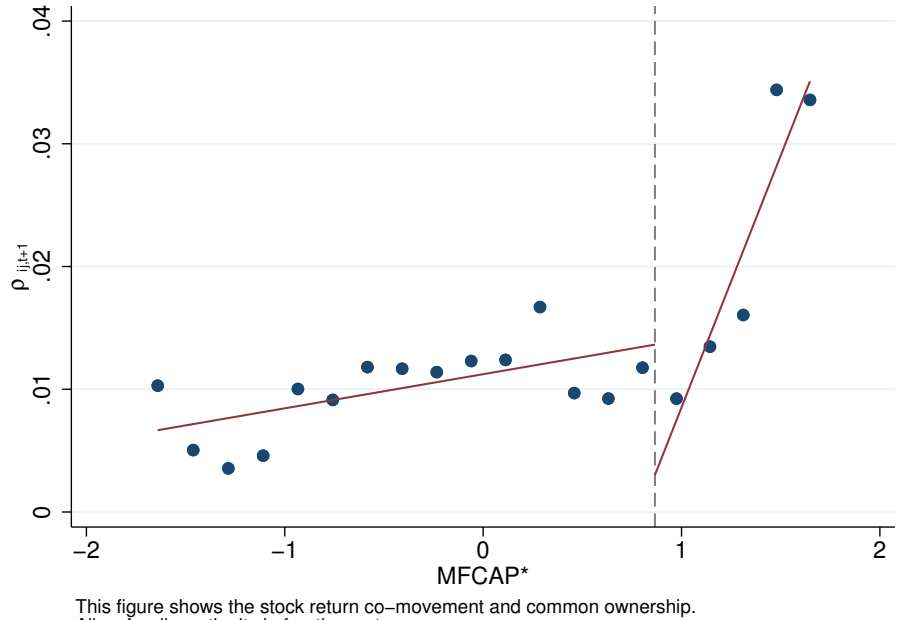
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Future Correlation via *MFCAP*

Discontinuity



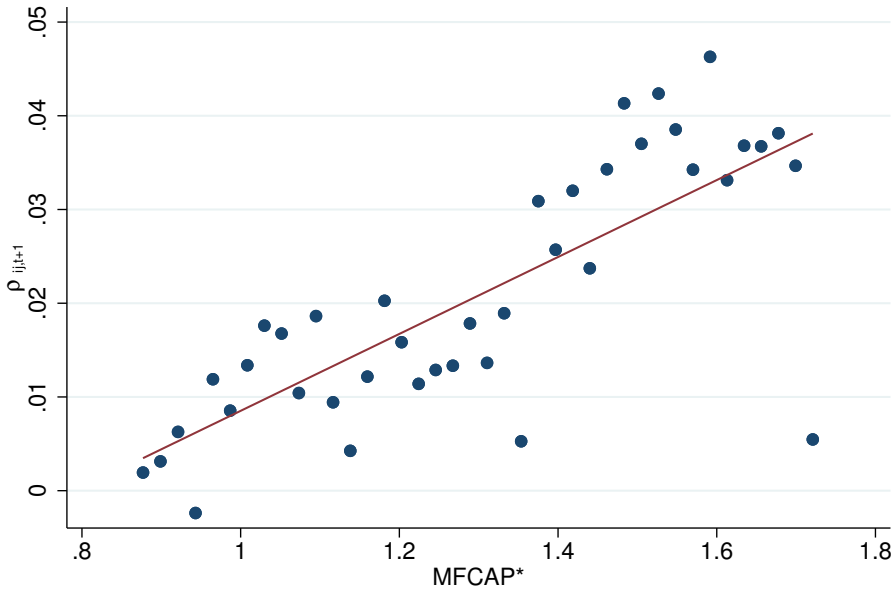
This figure shows the stock return co−movement and common ownership.



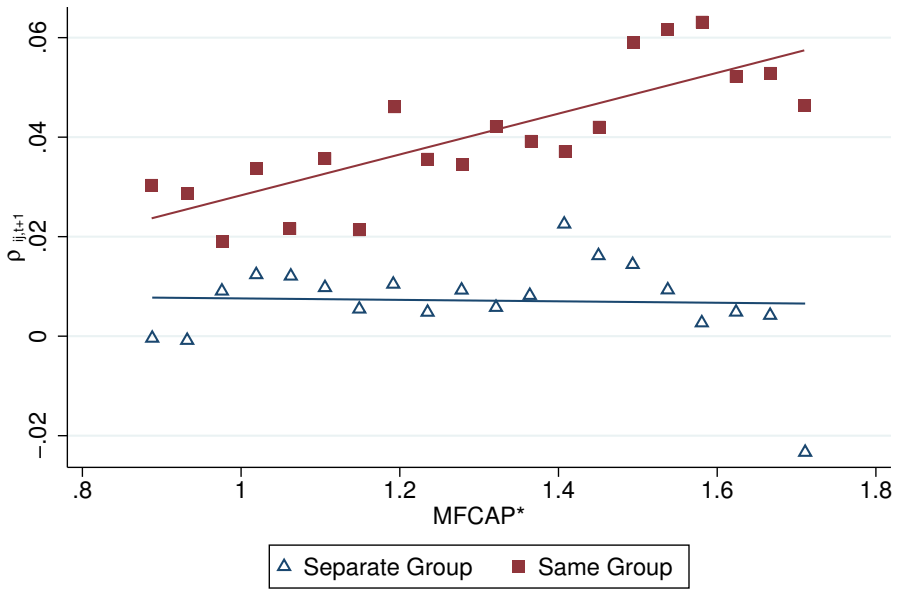
This figure shows the stock return co−movement and common ownership.
Allow for discontinuity in fourth quarter

4 Factor + Industry Future Correlation via *MFCAP**

Discontinuity & Business Groups



This figure shows the stock return co–movement and common ownership.
Allow for discontinuity in fourth quarter



This figure shows the stock return co–movement and common ownership.
Allow for discontinuity in fourth quarter

Fama-MacBeth Estimation

Discontinuity (sub-sample)

	Dependent Variable: Future Pairs's co-movement			
	(1)	(2)	(3)	(4)
Same Group	0.0341***		-0.0410	-0.0407*
	(8.32)		(-1.94)	(-2.09)
MFCAP*		0.0338***	-0.0423	-0.0338
		(4.75)	(-1.29)	(-1.47)
(MFCAP*) × SameGroup			0.0518***	0.0526***
			(3.62)	(3.87)
Controls	Yes	Yes	Yes	Yes
Business Group FE	No	No	No	Yes
Observations	76527	76527	76527	76527

t statistics in parentheses

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

All non-common owner pairs

regression

	Dependent Variable: Future Pairs' co-movement						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SameGroup	0.0156***		0.0158***			0.0138***	0.0131***
	(9.84)		(10.22)			(8.27)	(7.68)
MFCAP*		-0.0000723	-0.000277	0.00169	-0.000322*	-0.000390**	-0.000427*
		(-0.44)	(-1.80)	(1.42)	(-2.19)	(-2.70)	(-2.29)
(MFCAP*) × SameGroup						0.00313**	0.00364**
						(2.80)	(3.34)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sub-Sample	Total	Total	Total	SameGroups	Others	Total	Total
Business Group FE	No	No	No	No	No	No	Yes
Observations	6018646	6018646	6018646	114526	5904120	6018646	6018646

t statistics in parentheses

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

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TrunOver

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

TrunOver

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

- Koch et al. (2016)

TrunOver

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

- Koch et al. (2016)

	Dependent Variable: ΔTurnOver_i			
	(1)	(2)	(3)	(4)
$\Delta\text{TurnOver}_{\text{Market}}$	0.457^{***}	0.351^{***}	0.182^{***}	0.235^{***}
	(4.04)	(10.69)	(3.42)	(4.72)
$\Delta\text{TurnOver}_{\text{Industry-i}}$	0.220^{***}	0.159^{***}	0.0528	0.117^{*}
	(4.28)	(4.10)	(1.03)	(2.37)
$\Delta\text{TurnOver}_{\text{Group,-i}}$			0.286^{***}	0.213^{***}
			(6.21)	(5.15)
Portfo. Weight	-	-	MC	MC
Control	No	Yes	No	Yes
Observations	746640	742341	305563	301329
R^2	0.298	0.579	0.460	0.749

t statistics in parentheses

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

	Dependent Variable: Future Monthly Correlation of Delta turnover						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Same Group	0.0385***	0.0225***			0.0217***	0.0259*	0.00626
	(10.19)	(4.95)			(4.71)	(2.30)	(0.60)
MFCAP*			0.00623***	0.00128	-0.000254	-0.000331	-0.00691
			(4.20)	(1.04)	(-0.22)	(-0.29)	(-1.10)
(MFCAP*) × SameGroup						-0.00244	0.0101
						(-0.37)	(1.58)
Controls	No	Yes	No	Yes	Yes	Yes	Yes
Business Group FE	No	No	No	No	No	No	Yes
Observations	288164	278286	288164	278286	278286	278286	278286

t statistics in parentheses

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

	Dependent Variable: Future Pairs's co-movement				
	(1)	(2)	(3)	(4)	(5)
$\rho(\Delta\text{TurnOver})\_t+1$	0.0498^{***}	0.0494^{***}	0.0481^{***}	0.0822^{***}	0.0410^{***}
	(7.96)	(6.71)	(7.24)	(10.23)	(7.03)
ρ_t	0.0455^{***}	0.0415^{***}	0.0399^{***}	0.118^{***}	0.0280^{***}
	(10.05)	(6.41)	(5.60)	(17.54)	(3.62)
Control	No	Yes	Yes	Yes	Yes
Sub-sample	Total	Total	Total	SameGroup	Others
Business Group FE	No	No	No	No	No
Observations	288146	288146	288146	35026	253120

t statistics in parentheses

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

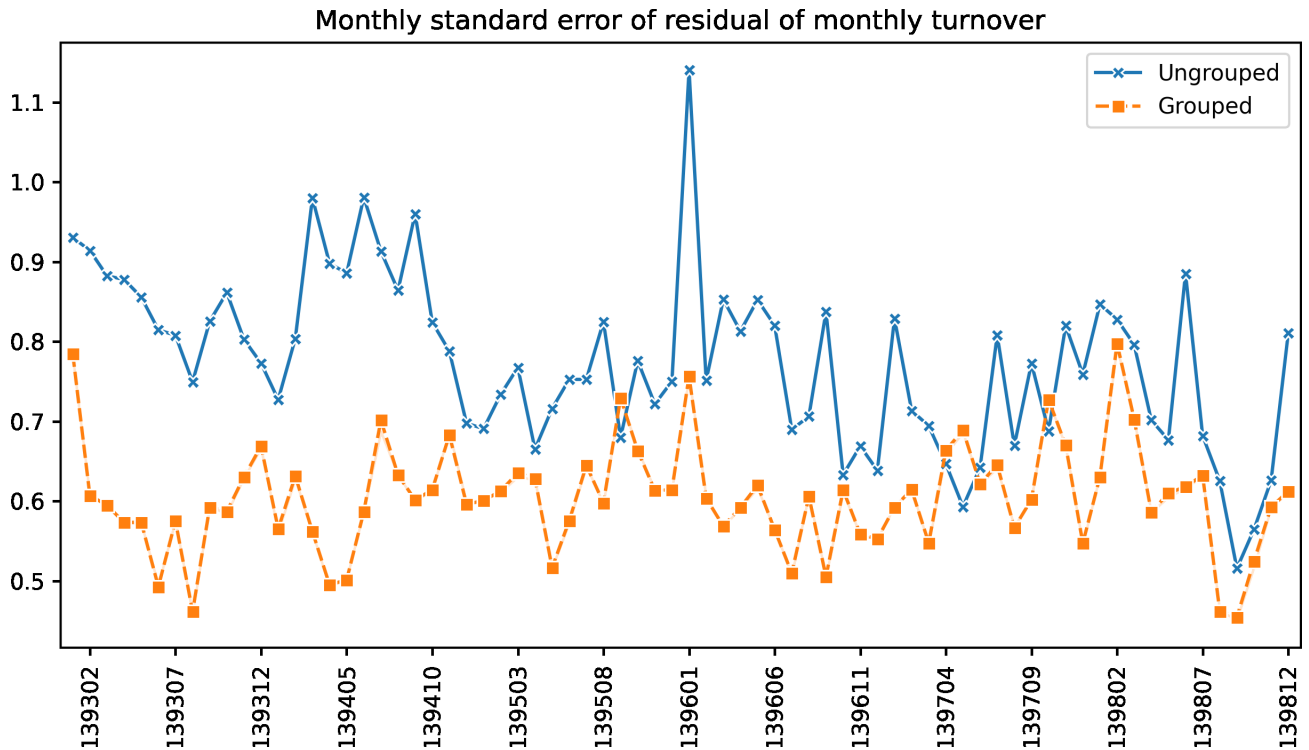
Residual of Monthly Turnover

- $\text{Turnover}_{i,t} = \alpha_0 + \alpha_1 \times \text{Turnover}_{i,avg} + \alpha_2 \times \text{Turnover}_{m,t} + \boxed{\varepsilon_{i,t}}$
  - $\text{Turnover}_{i,t}$: Monthly Turnover (Average of daily turnovers in each month)
  - $\text{Turnover}_{i,avg}$: Annual average of monthly turnover
  - $\text{Turnover}_{m,t}$: Market's turnover

Grouped	Firm$\times$ Month	mean	std	min	25%	50%	75%	max
Ungrouped	8050	-0.001	0.822	-4.789	-0.509	-0.016	0.504	4.407
Grouped	18199	0.001	0.777	-4.832	-0.481	-0.033	0.469	4.955

Residual of Monthly Turnover

Grouped	Group $\times$ Month	mean	std	min	25%	50%	75%	max
Ungrouped	72	0.776	0.108	0.516	0.694	0.774	0.840	1.140
Grouped	2393	0.604	0.300	0.001	0.413	0.580	0.763	2.797



Low residual standard error

	Dependent Variable: Future Pairs's co-movement			
	(1)	(2)	(3)	(4)
Same Group	0.0277***	0.0280***	0.0204***	-0.0301
	(4.88)	(5.32)	(3.50)	(-0.71)
LowResidualStd		-0.00160	-0.00369	-0.0313
		(-0.70)	(-1.56)	(-0.98)
LowResidualStd × SameGroup			0.0182***	0.0190***
			(3.60)	(4.06)
Group Size Effect	No	Yes	Yes	No
Business Group FE	No	No	No	Yes
Observations	297874	297874	297874	297874

t statistics in parentheses

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

Ins Imbalance

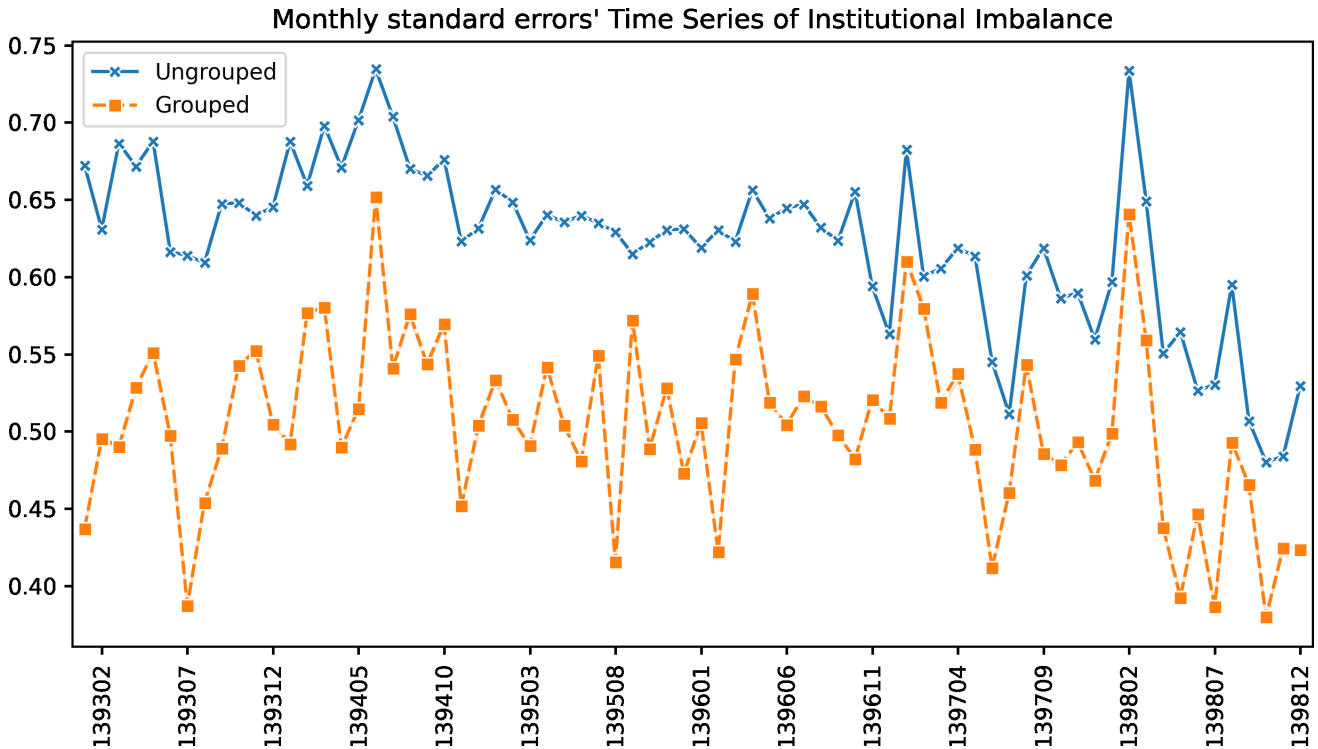
- Seasholes and Wu (2007)

$$Imbalance_{ins} = \frac{Buy_{ins} - Sell_{ins}}{Buy_{ins} + Sell_{ins}}$$

Grouped	Group $\times$ Month	mean	std	min	25%	50%	75%	max
Ungrouped	20197	0.010	0.630	-1.0	-0.474	0.016	0.479	1.0
Grouped	12021	-0.041	0.581	-1.0	-0.462	-0.009	0.341	1.0

Ins Imbalance std

Grouped	Group $\times$ Month	mean	std	min	25%	50%	75%	max
Ungrouped	72	0.624	0.054	0.48	0.601	0.631	0.655	0.735
Grouped	2057	0.502	0.251	0.00	0.337	0.503	0.647	1.414



Low Ins Imbalance Group

	Dependent Variable: Future Pairs's co-movement			
	(1)	(2)	(3)	(4)
Same Group	0.0277***	0.0293***	0.0243	0.0342
	(4.88)	(4.55)	(1.60)	(1.32)
Low Imbalance std		-0.00126	-0.00556***	-0.0163
		(-0.78)	(-3.56)	(-1.23)
Low Imbalance std × SameGroup			0.0194	-0.000313
			(1.30)	(-0.01)
Group Size Effect	No	Yes	Yes	No
Business Group FE	No	No	No	Yes
Observations	297874	297874	297874	297874

t statistics in parentheses

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

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Conclusion

- Direct common ownership can affect firms' co-movement
- Firms in the business groups co-move more than other pairs
- Direct common ownership only matters for firms in the business groups
- Firms in the same business group trade together

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Measuring Common Ownership

Proof

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

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

Back

Measuring Common-ownership

Anton and Polk (2014)

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

Measuring Common-ownership

Anton and Polk (2014)

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

SQRT

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

Quadratic

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

Measuring Common-ownership

Anton and Polk (2014)

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

SQRT

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

Quadratic

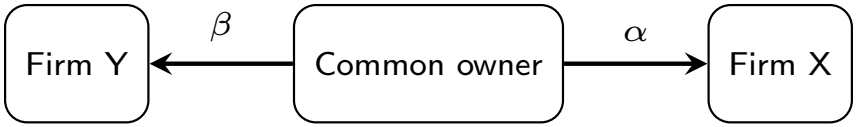
$$\left[\frac{\sum_{f=1}^{F}[(S_{i,t}^{f} P_{i,t})^2 + (S_{j,t}^{f} P_{j,t})^2]}{(S_{i,t} Pi,t)^2 + (S_{j,t} Pj,t)^2}\right]^{-1}$$

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

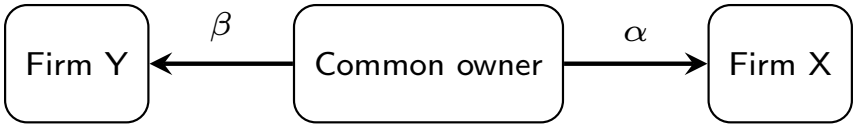
Measuring Common Ownership

Example



Measuring Common Ownership

Example

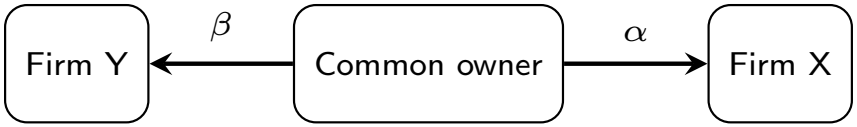


For better observation, assume that

- $\alpha + \beta = 100$
- both firm have equal market cap

Measuring Common Ownership

Example



For better observation, assume that

- $\alpha + \beta = 100$
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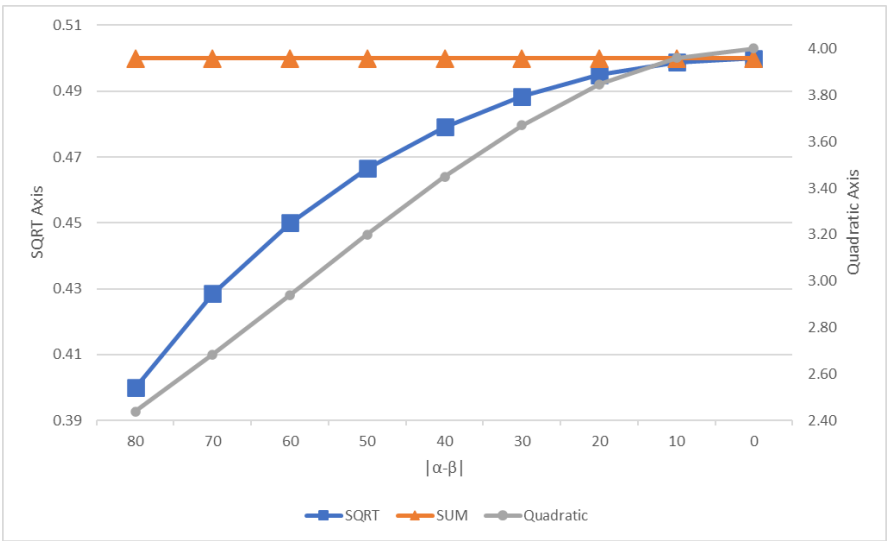
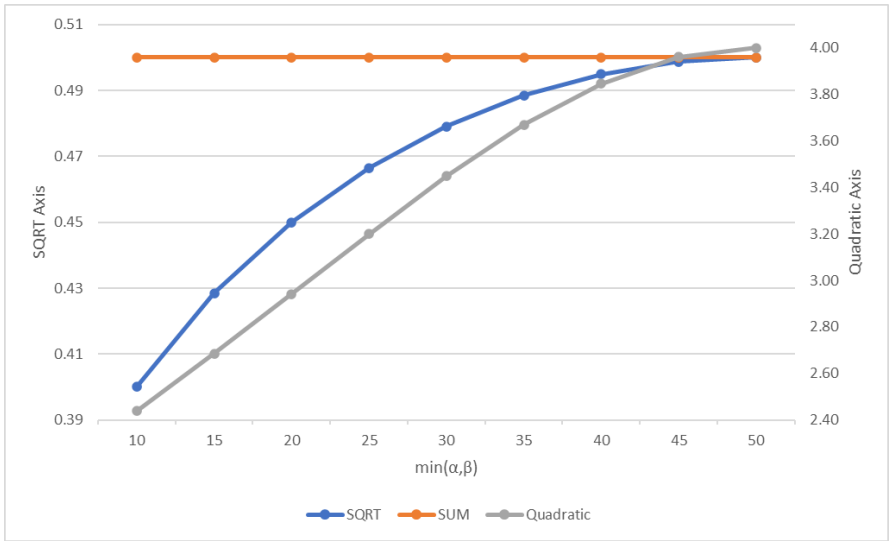




Comparison of three methods for calculating common ownership

Measuring Common Ownership

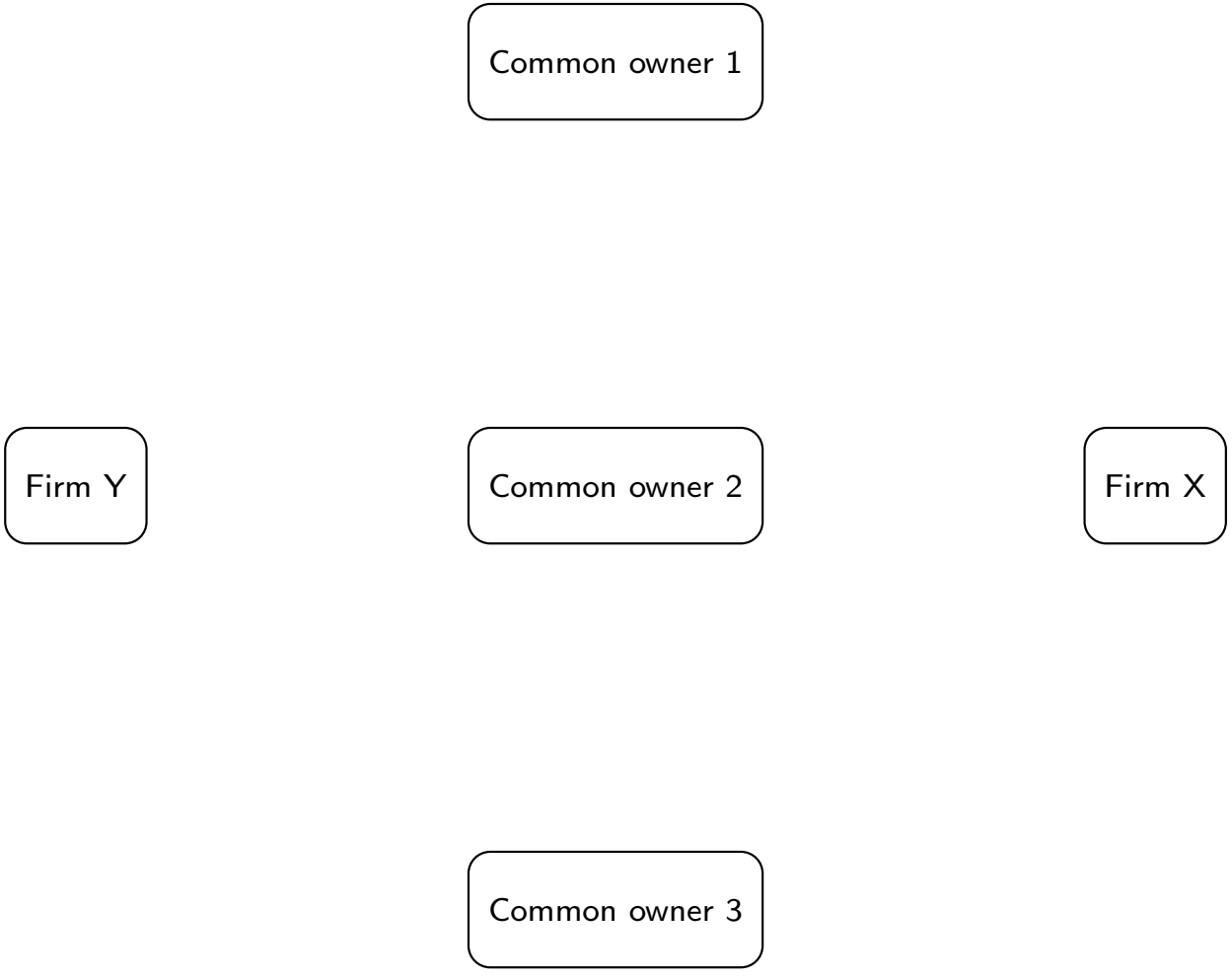
Example of three common owner

Firm Y

Firm X

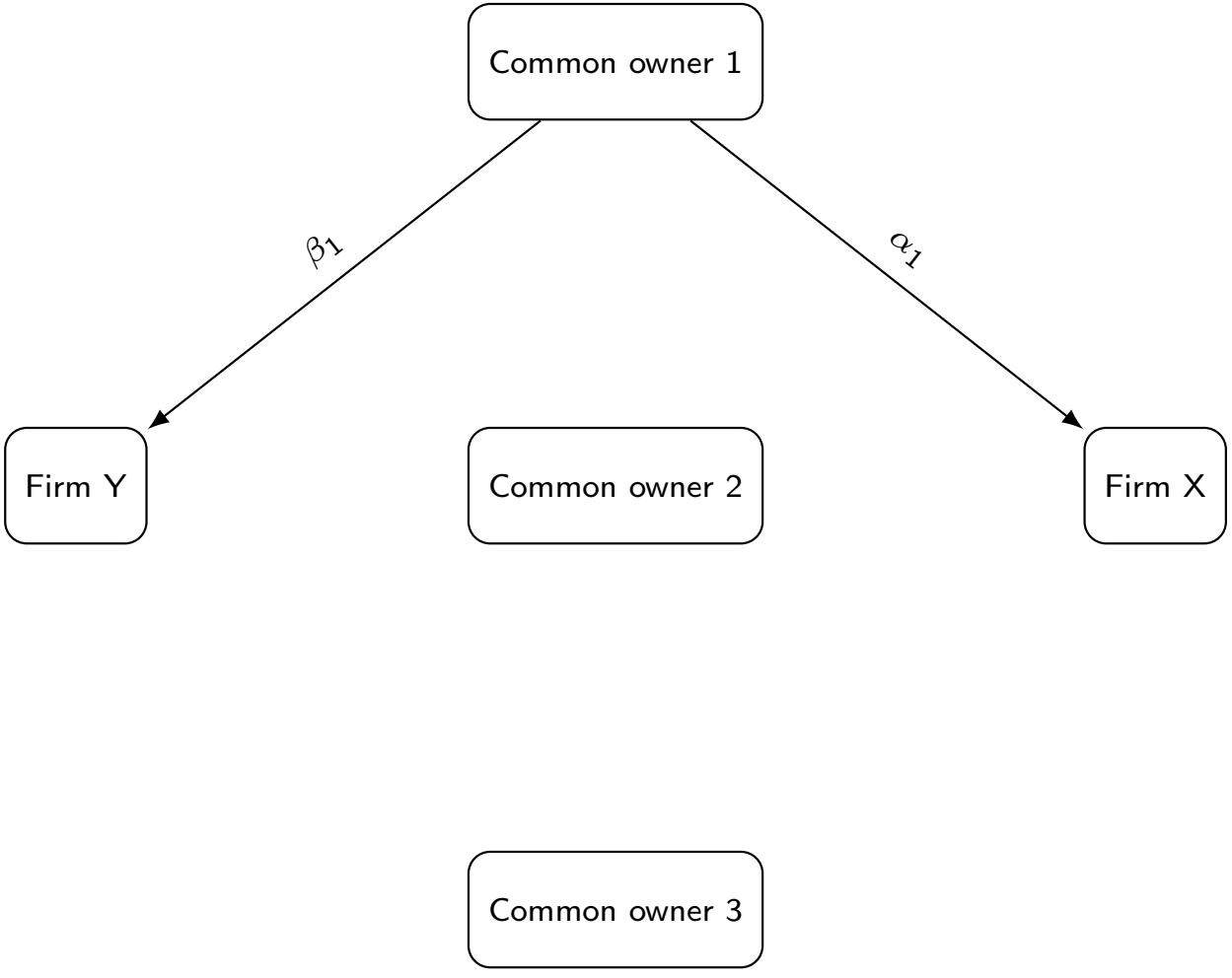
Measuring Common Ownership

Example of three common owner



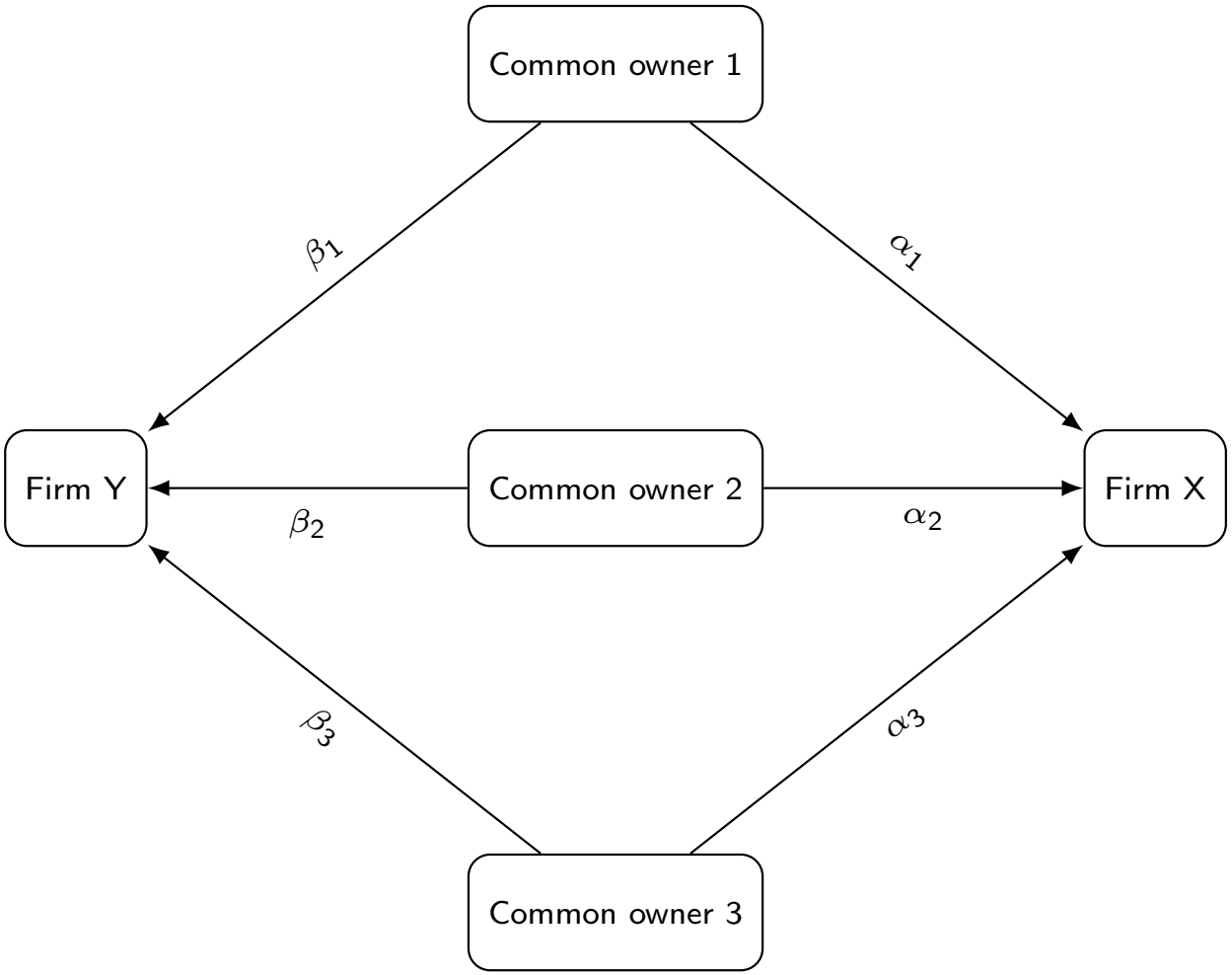
Measuring Common Ownership

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
α_1	1/3	20	10	20	10	5	1
β_1	1/3	10	10	20	10	5	1
α_2	1/3	10	80	20	10	5	1
β_2	1/3	20	80	20	10	5	1
α_3	1/3	70	10	20	10	5	1
β_3	1/3	70	10	20	10	5	1
SQRT	3	2.56	2.33	1.8	0.9	0.45	0.09
SUM	1	1	1	0.6	0.3	0.15	0.03
Quadratic	3	1.85	1.52	8.33	33.33	133.33	3333.33

Measuring Common Ownership

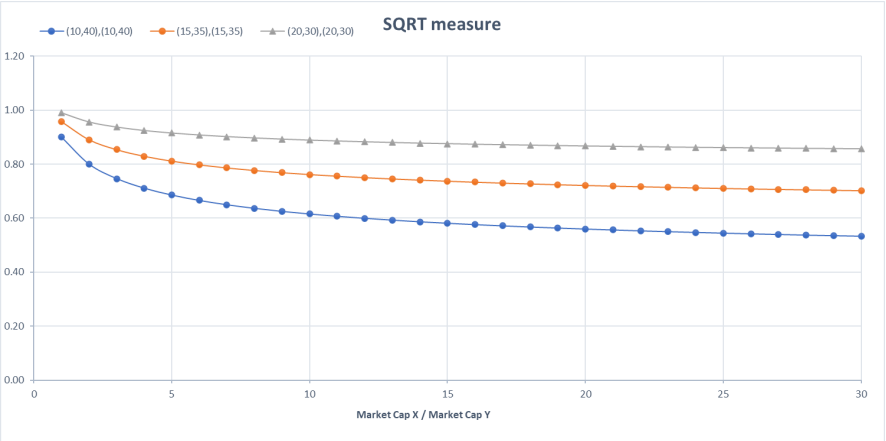
Comparison

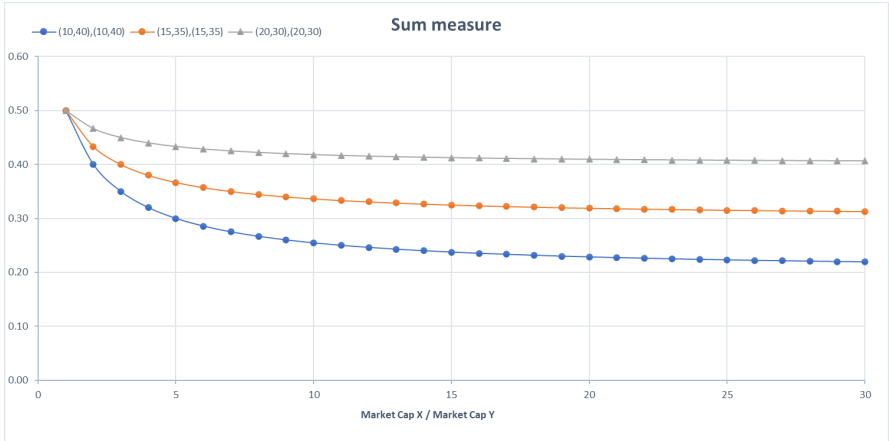
- For better comparison we relax previous assumptions:
  - Two Firms with different market caps.

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

Measuring Common Ownership

Comparison





Comparison of two methods for calculating common ownership

Conclusion

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

Common Ownership measure

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Common Ownership Measure	0.00177***	0.00150**	0.00133**	0.00102	0.000936	0.000663	0.000536	0.000377	-0.0000197	-0.0000113
	(3.93)	(2.90)	(2.76)	(1.87)	(1.90)	(1.17)	(1.06)	(0.65)	(-0.04)	(-0.02)
Same Group			0.0156***	0.0157***	0.00774***	0.00813***	0.00575*	0.00624**	0.00503*	0.00549*
			(7.32)	(7.44)	(3.61)	(3.71)	(2.62)	(2.81)	(2.11)	(2.27)
Common Ownership Measure × SameGroup					0.0103***	0.00935***	0.0110***	0.00992***	0.0119***	0.0107***
					(7.76)	(6.72)	(7.47)	(6.49)	(7.94)	(6.97)
SameIndustry							-0.000364	-0.000312	0.000286	0.000339
							(-0.21)	(-0.19)	(0.17)	(0.21)
SameSize							0.0133***	0.0135***	0.0131***	0.0132***
							(4.48)	(4.56)	(4.61)	(4.68)
SameBookToMarket							0.00772***	0.00772***	0.00893***	0.00893***
							(4.55)	(4.58)	(5.05)	(5.09)
CrossOwnership							0.0280*	0.0260	0.0303*	0.0283*
							(2.07)	(1.93)	(2.27)	(2.14)
Observations	1665996	1665996	1665996	1665996	1665996	1665996	1665996	1665996	1665996	1665996
Group FE	No	No	No	No	No	No	No	No	Yes	Yes
Measurement	Sum	Quadratic	Sum	Quadratic	Sum	Quadratic	Sum	Quadratic	Sum	Quadratic
R^2	0.000171	0.000170	0.000348	0.000349	0.000443	0.000437	0.000898	0.000898	0.00575	0.00575

t statistics in parentheses

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

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Main Effect

- **Common-ownership and comovement effect**
  [Anton and Polk (2014)]
  Stocks sharing many common investors tend to comove more strongly with each other in the future than otherwise similar stocks.

- **Common-ownership and liquidity demand**
  [Koch et al. (2016), Pastor and Stambaugh (2003), Acharya and Pedersen (2005)]
  Commonality in stock liquidity is likely driven by correlated trading among a given stock's investors. Commonality in liquidity is important because it can influence expected returns

- **Trading needs and comovement**
  [Greenwood and Thesmar (2011)]
  If the investors of mutual funds have correlated trading needs, the stocks that are held by mutual funds can comove even without any portfolio overlap of the funds themselves

- **Stock price synchronicity and poor corporate governance**
  [Boubaker et al. (2014), Khanna and Thomas (2009), Morck et al. (2000)]
  Stock price synchronicity has been attributed to poor corporate governance and a lack of firm-level transparency. On the other hand, better law protection encourages informed trading, which facilitates the incorporation of firm-specific information into stock prices, leading to lower synchronicity

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

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

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
- $GGL^A(A,B) = \sum_{i=1}^{I} \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$ Gilje et al. (2020)
  - Bi-directional
  - Less information
  - Not sensitive to the scope
  - Measure increases when the relative ownership of firm A increases

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

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