# Connected Stocks via Business Groups:

## Evidence from an Emerging Market

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December, 2021

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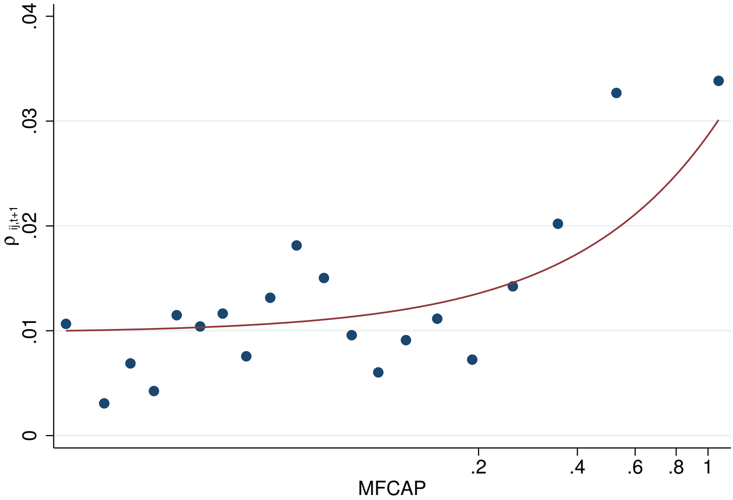
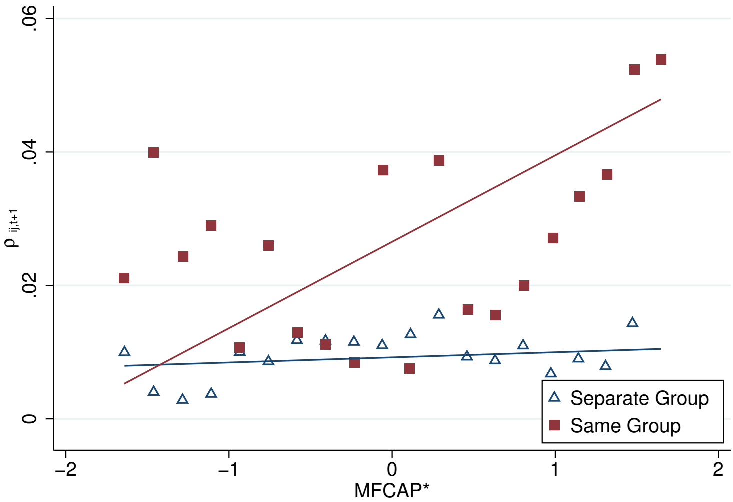
# Co-movement and common ownership



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

# Co-movement and common ownership




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

# Motivation

- **Does direct or indirect common ownership cause stock return co-movement?**
  - 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
    - Hedging
    - 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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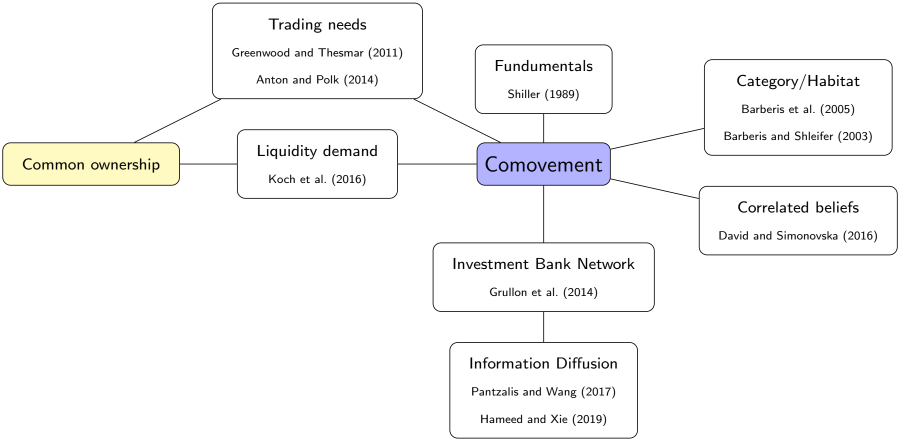
# Main effect



Trading needs
Greenwood and Thesmar (2011)
Anton and Polk (2014)
Fundumentals
Shiller (1989)
Category/Habitat
Barberis et al. (2005)
Barberis and Shleifer (2003)
Common ownership
Liquidity demand
Koch et al. (2016)
Comovement
Correlated beliefs
David and Simonovska (2016)
Investment Bank Network
Grullon et al. (2014)
Information Diffusion
Pantzalis and Wang (2017)
Hameed and Xie (2019)

# Our work

- We use daily records of block-holder ownership for firms
- We are not restricted to mutual funds ownership
- 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) ?
  - Channel?

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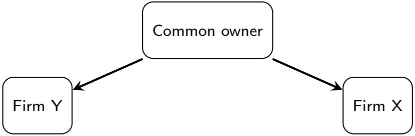
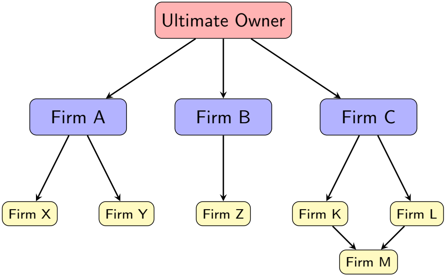
# Pair composition

- Firms with at least one common owner



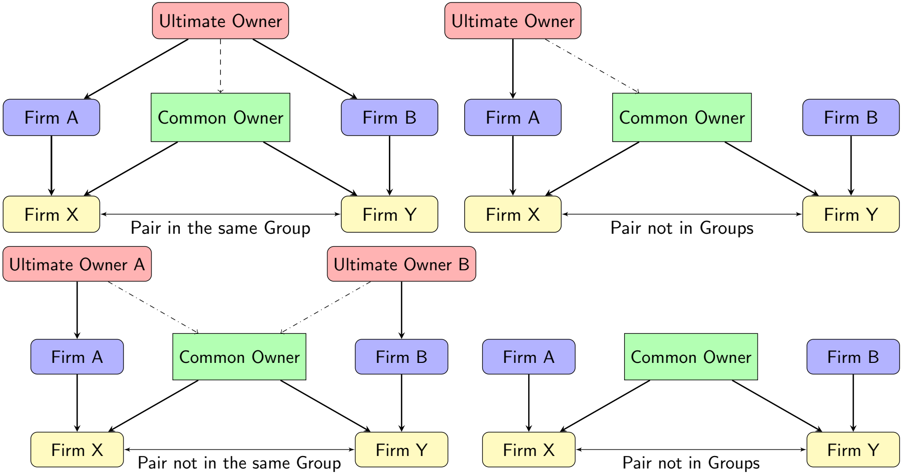

- In a business group, how can one pair be defined?

- Business group



# Pair Composition and Business Group

## Pair in the Business Group



# Data Summary

- Data: 2014/03/25 (1393/01/06) - 2020/03/18 (1398/12/28)
  - 72 Months
  - 618 firm including 562 firms 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
  - 17522 unique pairs which is 9% of possible pairs ( $\frac{618*617}{2} = 190653$ )

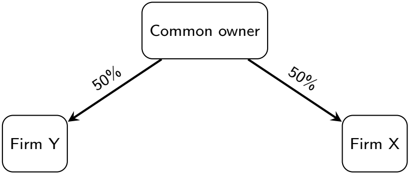
| | mean | min | Median | max |
|---|---|---|---|---|
| Number of unique paris | 5000 | 3370 | 5097 | 6366 |

| 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)

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

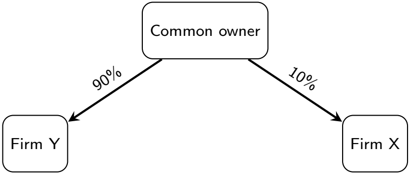



$$\text{FCAP} = \frac{50\%+50\%}{100\%+100\%} = 0.5$$

$$\text{MFCAP} = \frac{\sqrt{50\%}+\sqrt{50\%}}{\sqrt{100\%}+\sqrt{100\%}} = 0.71$$

SQRT

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




$$\text{FCAP} = \frac{90\%+10\%}{100\%+100\%} = 0.5$$

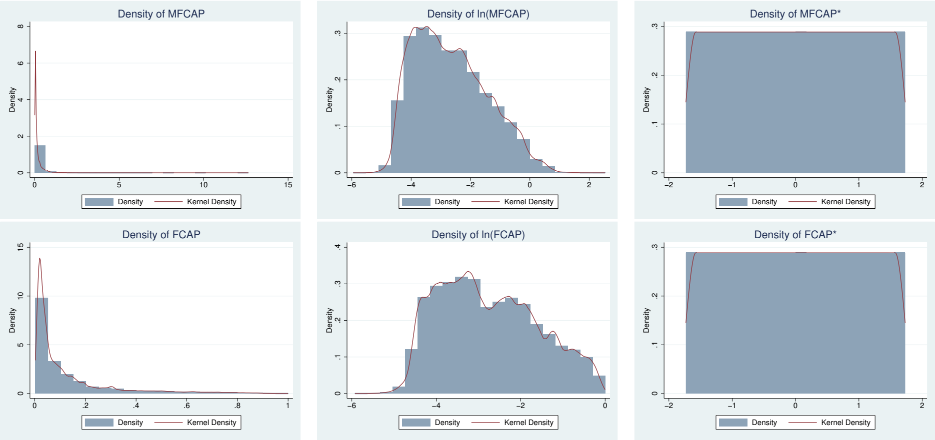
$$\text{MFCAP} = \frac{\sqrt{90\%}+\sqrt{10\%}}{\sqrt{100\%}+\sqrt{100\%}} = 0.63$$

More example

# Measuring Common-ownership

| | 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 |

# MFCAP vs. FCAP Distributions
## Monthly



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 |

# 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

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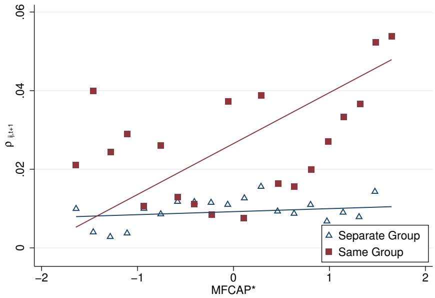
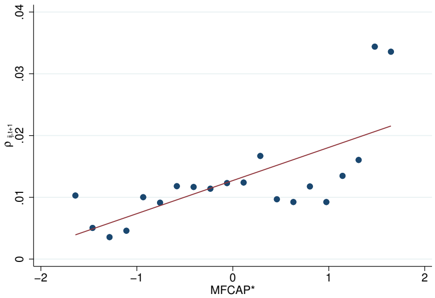
# Co-movement and Common Ownership




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




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 $(4(70/100)^{\frac{2}{9}} = 3.69 \sim 4)$

Methodology

# 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

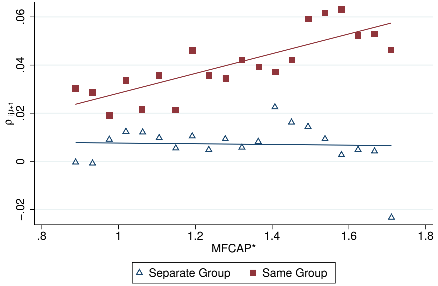
| | Dependent Variable: Future Pairs's co-movement | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| MFCAP* | 0.0123*** | -0.000448 | -0.000463 | 0.00111 |
| | (4.10) | (-0.70) | (-0.75) | (1.06) |
| Same Group | | | 0.0318 | 0.0338 |
| | | | (1.40) | (1.24) |
| (MFCAP*) × SameGroup | | | 0.000209 | -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

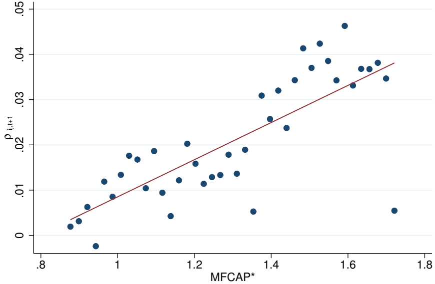
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

# Co-movement and Common Ownership

## High level of common ownership



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

## High level of common ownership (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*) $\times$ 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 pairs

| | 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

Koch et al. (2016)

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

| | Dependent Variable: $\Delta$TurnOver_$i$ | | | |
|---|---|---|---|---|
| | (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

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

# Business group and correlation in Turnover

| | 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*) $\times$ 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

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

# Correlation in Turnover and Co-movement

| | 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) |
| $\rho_t$ | 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

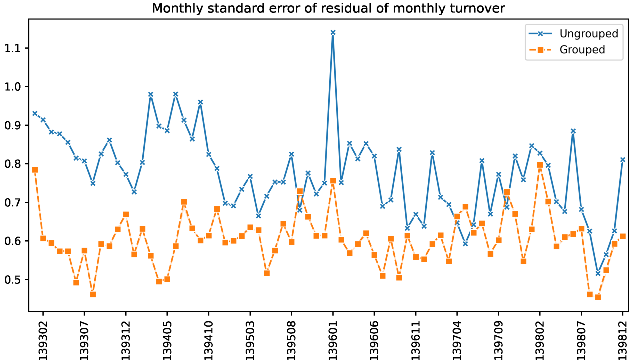
- $\text{Turnover}_{i,t} = \alpha_0 + \alpha_1 \times \text{Turnover}_{i,avg} + \alpha_2 \times \text{Turnover}_{m,t} + \boxed{\varepsilon_{i,t}}$
  - $\text{Turnover}_{i,t}$: Monthly Turnover (Average of daily turnovers in each month)
  - $\text{Turnover}_{i,avg}$: Annual average of monthly turnover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

| Grouped | Firm × 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

## Standard error

| Grouped | Group × 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 $\times$ 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

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

# Institutional Imbalance

- Seasholes and Wu (2007)

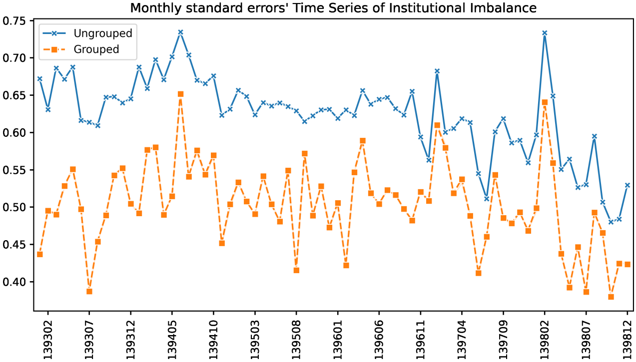
$$Imbalance_{ins} = \frac{Buy_{ins} - Sell_{ins}}{Buy_{ins} + Sell_{ins}}$$

| Grouped | Group × 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

## Standard error

| Grouped | Group × 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 $\times$ 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 affects 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.
- In the Business groups, firms are traded in the same time and also in the same direction.

# References I


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# Measuring Common Ownership
## Proof

- If two stocks in pair have n mutual owner, which total market cap divides them equally, the mentioned indexes equal n.
  - Each holder owns $1/n$ of each firm.
  - Firm's market cap is $\alpha_1$ and $\alpha_2$:
  - So for each holder of firms we have $S^f_{i,t}P_{i,t} = \alpha_i$
  - SQRT

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

  - Quadratic

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

Back

# Measuring Common-ownership

Anton and Polk (2014)

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

SQRT

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

Quadratic

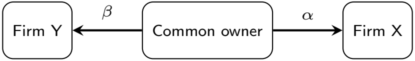
$$\boxed{[\frac{\sum_{f=1}^{F}[(S_{i,t}^{f}P_{i,t})^2 + (S_{j,t}^{f}P_{j,t})^2]}{(S_{i,t}Pi,t)^2 + (S_{j,t}Pj,t)^2}]^{-1}}$$

## 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

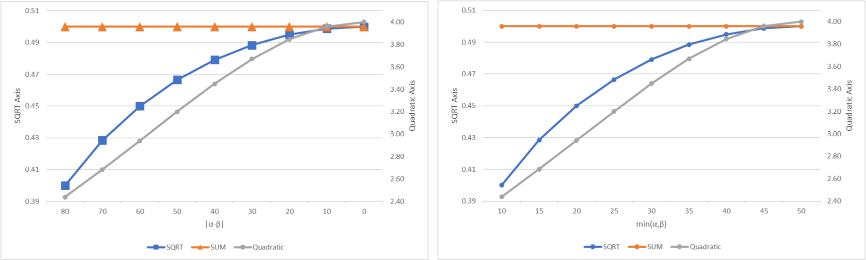
# Measuring Common Ownership

## Example




For better observation, assume that

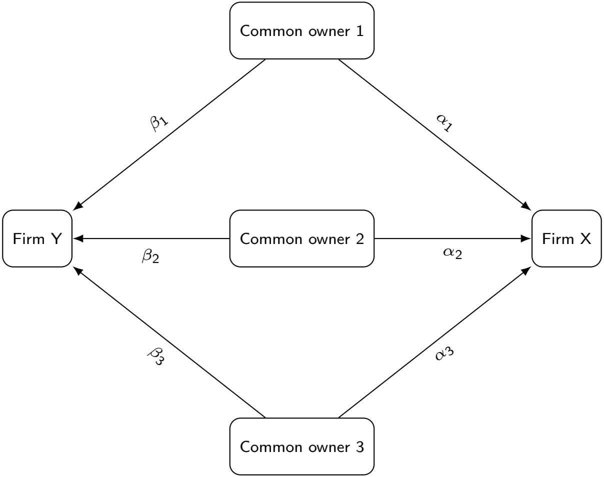
- $\alpha + \beta = 100$
- both firm have equal market cap




Comparison of three methods for calculating common ownership

# Measuring Common Ownership

## Example of three common owner



# Measuring Common Ownership

## Example of three common owner

| Ownership | Type I | Type II | Type III | Type IV | Type V | Type VI | Type VII |
|---|---|---|---|---|---|---|---|
| $\alpha_1$ | $1/3$ | 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 |

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# Measuring Common Ownership

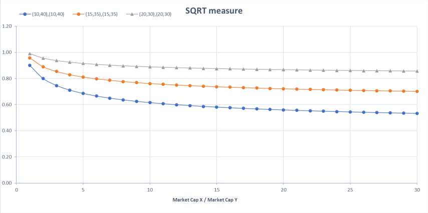
## Comparison

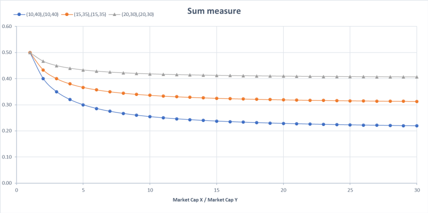
- For better comparison we relax previous assumptions:
  - Two Firms with different market caps.

| | $(\alpha_1,\beta_1),(\alpha_2,\beta_2)$ | | | | | |
|---|---|---|---|---|---|---|
| | (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

Grapgh

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

  Using deterended weekly return for calculation

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

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

being in the same director network has a significant effect

- Stock price synchronicity:

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

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

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

- OLS estimation of

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

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

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

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

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

# Commonownership measurements

## Model-based measures

- $\text{HJL}_I^A(A,B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A}+\alpha_{i,B}}$ Harford et al. (2011)
    - 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
- $\text{MHHI} = \sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij}\nu_{ik}}{\sum_i \mu_{ij}\nu_{ij}}$ Azar et al. (2018)
    - Capture a specific type of externality
    - Measured at the industry level
    - Assumes that investors are fully informed about the externalities
- $\text{GGL}^A(A,B) = \sum_{i=1}^{I} \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$ 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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# 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

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

  - 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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