Connected Stocks: Evidence from Tehran Stock Exchange

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Abstract

We connect stocks by their common blockholders. We introduce a measure that captures the extent to which distribution of joint holders. A vital feature of the measure is allowing the joint ownership distributions to affect the measure. After that, We show that the degree of shared ownership that crosses a threshold forecasts return correlation, controlling for exposure to systematic return factors and other pair characteristics. We study this effect in business groups and find that being in the same business group significantly affects comovement. Further investigations explain that comovement increases when a bank is a business group's ultimate owner.

Keywords: Asset management; Institutional investors; Return comovement; common Ownership; Indexing

JEL Classifications: G10; G11; G23

1 Introduction

2 Data and Methodology

2.1 Data and Sample

We gathered Industries index and stock returns, trading volume, and other relevant market and accounting data from the Codal website [1] and the Tehran Securities Exchange Technology Management Co (TSETMC)[2] database. Also,

[1] www.codal.ir

[2] www.tsetmc.com

We take a daily ownership table from the TSETMC database that reports all end-of-the-days block-holders of listed firms with their changes in that day. Block-holder is a shareholder who owns at least 1% of the total shares outstanding.

We exclude ETFs and mutual funds from our listed firms because they have different return and ownership patterns compared to other firms in our study. We do not have pre-specified Iranian business groups despite other countries like South Korea, Japan, and India that their groups are announced formally. For defining business groups, we use data provided by Aliabadi et al. 2021. They use Almeida et al. 2011 algorithm with a 40% threshold for defining groups. We restrict our empirical analysis to 2015/03-2020/03(1394/01-1398/12 Persian calendar) due to the availability of daily ownership data and the bubble period in the Tehran exchange market. The Tehran Stock Exchange's main index (TEPIX) quadruple and then fall continuously after our selected period.

Table 1 reports summary statistics of ownership data and business groups. As shown in the table, 494 firms on average have five block-holders that own 73 percent of them. There are 43 business groups on average, with seven members which own 314 (63%) firms.

Table 1: This table reports summary statistics of ownership features for all the listed firms. At this table by group, we mean business groups.

Year	2015	2016	2017	2018	2019	2020	mean
No. of Firms	353	381	514	545	573	597	494
No. of Blockholders	721	886	1258	1367	1397	1369	1166
No. of Groups	41	42	46	45	40	46	43
No. of Firms not in Groups	112	124	191	204	228	253	185
No. of Firms in Groups	241	264	333	349	345	353	314
Avg. Number of Members	6	6	7	8	9	8	7
Med. of Number of Members	4	4	6	6	6	6	5
Av. Of each Blockholder's ownership	21	21.6	20.4	22.9	25.5	25.1	22.75
Med. of each Blockholder's ownership	7.66	6.87	6.8	7.25	9.33	9.63	7.92
Av. Number of Blockholders	5	5	5	5	5	4	5
Med. Number of Owners	4	4	4	4	4	3	4
Av. Block. Ownership	71.9	71.8	68.5	77.9	78.7	69.3	73.02
Med. Block. Ownership	80.6	80.4	77.5	83.4	82	75.1	79.83

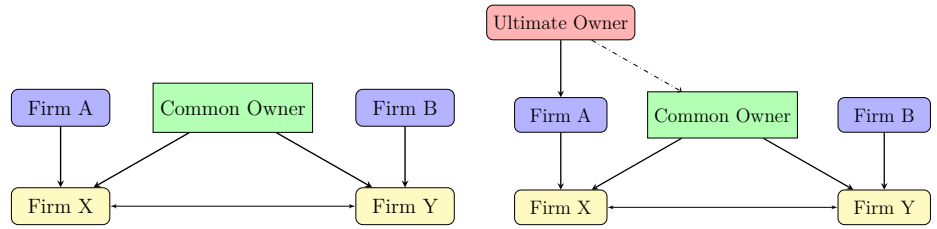
2.1.1 Pair composition

If two firms have at least one common block-holder, We consider them as a pair. By this definition, there are 9336 unique pairs in entire periods, which is 18% of possible pairs (597*596/2 = 177906). As we expected, stocks in

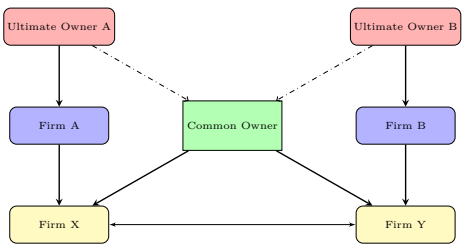
pairs have concentrated ownership relative to the total sample, and pairs have one common owner.

In our empirical analysis, we study pairs that belong to a business group. For assigning one pair to a group, both firms should belong to one ultimate owner. Another possibility is each firm belongs to a different ultimate owner or one of them, or both of them do not belong to any groups, which all of them illustrated in figure 1. By classifying pairs, on average, 15% of them in each year belong to one business group, and 74% of them are not in the same business groups. We report summary statistics of ownership features for all pairs in table 2.

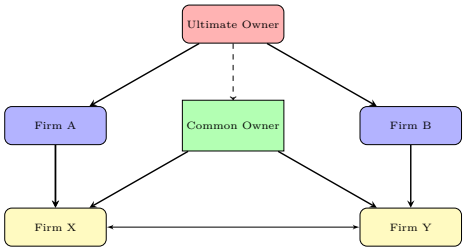
Figure 1: Three categories for pairs base on being in business groups



(a) Pair not in the business group



(b) Pair not in the same business group



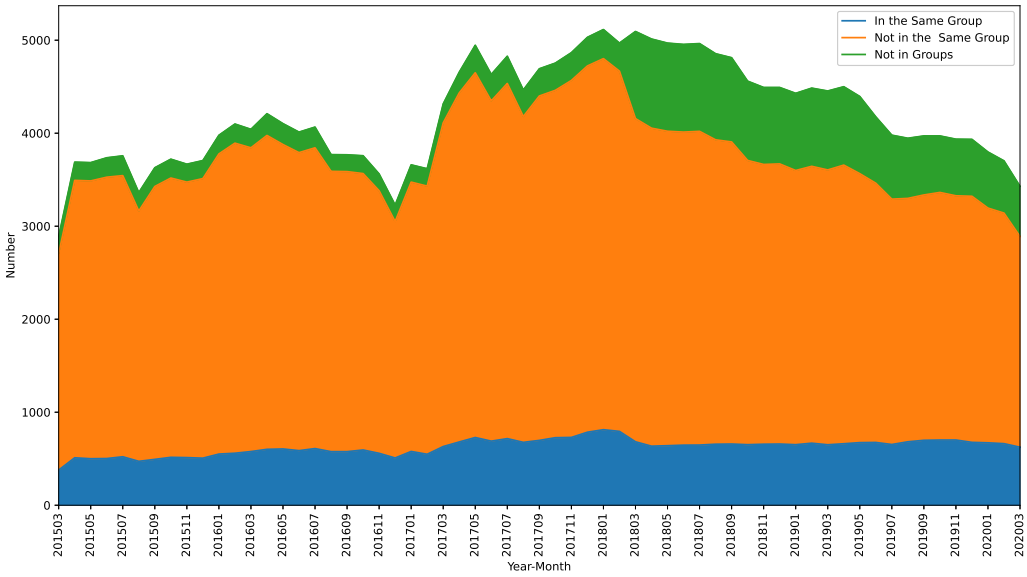
(c) Pair in the same business group

Figure 2 shows the time series of unique pairs' number in each month. The pattern shows that the portion of pairs that are in one business group is roughly stable. The number of pairs in each period is between 2889 to 5115 pairs which, on average, there are 4201 pairs.

Table 2: This table reports summary statistics of ownership features for total pairs. At this table by group, we mean business groups.

Year	2015	2016	2017	2018	2019	2020	Mean
No. of Pairs	4412	5591	6363	7439	6438	4078	5720
No. of Groups	40	41	43	43	39	39	41
No. of Pairs not in Groups	228	272	329	1116	1068	625	606
No. of Pairs in the same Group	628	749	959	1042	961	715	842
No. of Pairs not in the same Group	3541	4527	5032	5201	4313	2729	4224
Avg. Number of Common owner	1.24	1.22	1.21	1.19	1.20	1.18	1.21
Med. Number of Common owner	1	1	1	1	1	1	1
Avg. Number of Pairs in one Group	24	24	26	27	26	20	25
Med. Number of Pairs in one Group	10	11	9	10	11	8	10
Av. Percent of each Blockholder	18.74	19.25	19.41	19.38	19.28	18.82	19.15
Medi. Percent of each Blockholder	10	10.08	10.31	10.17	10.48	10.79	10.31
Av. Number of Owners	6.06	5.93	5.8	5.91	5.94	6.06	5.95
Med. Number of Owners	6.08	5.96	5.82	5.92	5.92	6.02	5.95
Av. Block. Ownership	81.37	82.21	82.64	83.29	83.48	82.94	82.66
Med. Block. Ownership	80.03	80.6	80.74	81.48	81.63	81.28	80.96

Figure 2: The number of unique pairs in each month



2.1.2 Stock Return Correlations

We calculate the monthly correlation of each pair from stocks' daily abnormal returns. Benchmark for calculating abnormal return is the following equation which is a four-factor model plus industry return due to the importance of industries in the Tehran stock exchange (TSE) :

$$R_{i,t} = \alpha_i + \beta_{mkt,i} R_{M,t} + \beta_{Ind,i} R_{Ind,t} + \\ + \beta_{HML,i} HML_t + \beta_{SMB,i} SMB_t + \beta_{UMD,i} UMD_t + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$, $R_{M,t}$ and $R_{Ind,t}$ are excess daily return of respectivly firm, market and firm's industry from bank deposit's daily rate(Risk free). Other variabales difinition is base on Carhart four-factor model[Carhart 1997].

At the end of each month, we estimate our benchmark model base on the past three-month period (from two months before the end of the preceding month) and measure daily residuals. After that, we calculate the monthly correlation of daily residuals during that month for the pair.

We use other benchmarks for calculating a monthly correlation and report its summary in table 3. As we expected, models that include industry returns remove pairs' correlation. According to the results, it seems that our selected benchmark (4 Factor + Industry) almost captures all the pairs' comovement because it is nearly a zero mean variable. We use these correlations for our analysis.

Table 3: This table reports distribution of calculated correlation base on different models.

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

2.1.3 Controls

We are interested in the effects of common ownership on pair's correlation. Their intrinsic similarity dominates our prediction of a higher correlation for these stocks, and these similarities motivate block-holders to hold these stocks simultaneously. These related stocks will comove regardless of who owns them.

The first group of controls is pair controls. These controls include a dummy variable for whether two stocks are in the same industry, **SameIndustry**; a dummy variable for whether two stocks are in the business group,

Table 4: This table reports the number of pairs in the same industry and business group.

Type of Pairs	Yes	No
SameIndustry	1092	8244
	(12%)	(88%)
SameGroup	1065	8271
	(11%)	(89%)

SameGroup. As shown in table 4, 12% and 11% of pairs are in the same industry and business group.

Another group of controls is firm-specific controls. One of these is size control based on the normalized rank-transform of the percentile market capitalization of the two stocks, **Size1** and **Size2** (where we label the larger stock in the pair as the first stock). The other one is a book to market ratio based on the normalized rank-transform of the percentile book to market of the two stocks, **BookToMarket1** and **BookToMarket2**. We also control these characteristics on a pair level. Our measures of similarity, **SameSize**, and **SameBookToMarket**, are the negative of the absolute difference in percentile ranking for a particular characteristic across a pair. we define these variables base on Anton et al. 2014 methodology.

We calculate our controls daily and then report the average of these variables for the entire period at the end of each month. Table 5 shows the summary statistics of specified controls in this section.

Table 5: This table shows the summary statistics of specified controls in empirical studies.

	count	mean	std	min	25%	50%	75%	max
SameIndustry	256296	0.16	0.36	0	0	0	0	1.00
SameGroup	228640	0.17	0.37	0	0	0	0	1.00
Size1	256296	0.75	0.21	0.01	0.62	0.81	0.93	1.00
Size2	256296	0.48	0.25	0.00	0.29	0.46	0.67	1.00
SameSize	256296	-0.27	0.21	-0.99	-0.41	-0.23	-0.10	0.00
BookToMarket1	256296	0.52	0.26	0.00	0.32	0.53	0.74	1.00
BookToMarket2	256296	0.50	0.24	0.00	0.31	0.49	0.69	1.00
SameBookToMarket	256296	-0.29	0.21	-1.00	-0.42	-0.25	-0.12	0.00

3 Measuring common ownership

In table 6 we summarize common ownership measurements which are used in literature. There are two groups of measurement for common ownership. First of all, model-based measures that capture common ownership base on a proper model. These measures have a better economic interpretation, but

most of them are bi-directional or industry-level measures.(e.g, Harford et al. 2011; Azar et al. 2018; Gilje et al. 2020)

In addition to model-based measures, some ad hoc common ownership measures are used in the empirical literature. There is significant doubt on how these measures capture common ownership's impact on the management, and many of these of them have unappealing properties.(e.g, Anton et al. 2014; Azar 2011; Freeman 2019; Hansen et al. 1996; He and Huang 2017; He, Huang, and Zhao 2019; Lewellen et al. 2021; Newham et al. 2018)

Table 6: This table summarizes common ownership measurements in the literature.

Group	Paper	measurment	Flaws
Model Based	Harford et al. 2011	$\sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A}+\alpha_{i,B}}$	Bi-directional
	Azar et al. 2018	$\sum_j \sum_k s_j s_k \frac{\sum_i \mu_{ij}\nu_{ik}}{\sum_i \mu_{ij}\nu_{ij}}$	Industry level
	Gilje et al. 2020	$\sum_{i=1}^{I} \alpha_{i,A} g(\beta_{i,A}) \alpha_{i,B}$	Bi-directional
Ad hoc	He and Huang 2017; He, Huang, and Zhao 2019	$\sum_{i \in I^{A,B}} 1$	invariant to the level of common ownership
	Newham et al. 2018	$\sum_{i \in I^{A,B}} min\{\alpha_{i,A}, \alpha_{i,B}\}$	?
	Anton et al. 2014	$\sum_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{\nu}_A}{\bar{\nu}_A+\bar{\nu}_B} + \alpha_{i,B} \frac{\bar{\nu}_B}{\bar{\nu}_A+\bar{\nu}_B}$	Invariant to the decomposition of ownership
	Freeman 2019; Hansen et al. 1996	$\sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$	? ?

In our primary analysis, we estimate the impact of common ownership on pair's correlation. For this purpose, we need a pair-level measure with an excellent economic interpretation that is not bi-directional. As a result, we propose a modification for Anton et al. 2014's measure that captures the extent of common ownership distribution and apply this measure in this study.

3.1 Modified measurement

We reformulate mentioned Anton's measure in table 6. This factor measure common ownership as the total value of stock held by the F common funds of the two stocks, scaled by the total market capitalization of the two stocks

$$\text{Overlap}_{Sum}(i,j) = \frac{\sum_{f=1}^{F}(S_{i,t}^{f} P_{i,t} + S_{j,t}^{f} P_{j,t})}{S_{i,t} Pi, t + S_{j,t} Pj, t} \tag{2}$$

where $S_{i,t}^{f}$ is the number of shares held by fund f at time t trading at price Pi, t with total shares outstanding of $S_{i,t}$, and similarly for stock j. As shown in equation 2, this measure neglects different distribution of common owners

and represents the percent of joint-held market capitalization from the total market capitalization of the two stocks.

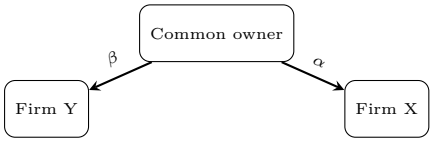
We reweight this formula to capture the difference between ownership distribution. our proposed measures are shown in equation 3 and 4 where all variables as the same Anton's measure. Both modified measures represent the number of equal percents held block-holder. In other words, If for a pair of stocks with n mutual owners, all owners have even shares of each firm's market cap, then the proposed indexes will be equal to n.[3]

$$\text{Overlap}_{Sqrt}(i,j) = [\frac{\sum_{f=1}^{F}(\sqrt{S_{i,t}^{f}P_{i,t}} + \sqrt{S_{j,t}^{f}P_{j,t}})}{\sqrt{S_{i,t}Pi,t} + \sqrt{S_{j,t}Pj,t}}]^2 \tag{3}$$

$$\text{Overlap}_{Quadratic}(i,j) = [\frac{\sum_{f=1}^{F}[(S_{i,t}^{f}P_{i,t})^2 + (S_{j,t}^{f}P_{j,t})^2]}{(S_{i,t}Pi,t)^2 + (S_{j,t}Pj,t)^2}]^{-1} \tag{4}$$

There are some numeric examples for better comparison. Two firms (X and Y) have one common owner who has α and β from each market capitalization, respectively. (illustrated in figure 3) for better illustration, assume that the sum of the holder's ownership equal to 100 percent ($\alpha + \beta = 100$), and two firms' market cap is equal.

Figure 3: Numeric example 1



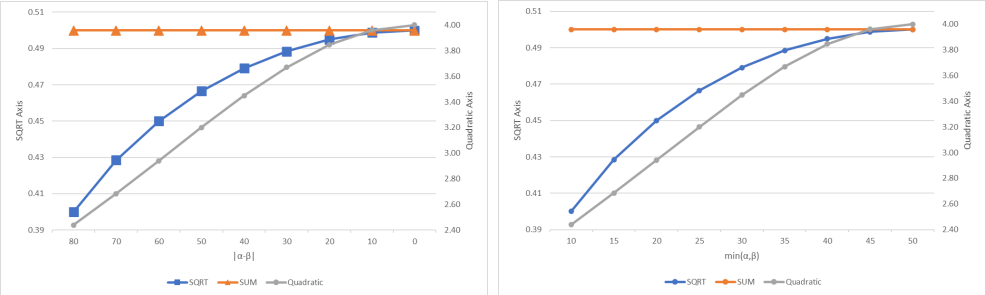
We calculate common ownership measures base on equations 2 (Sum), 3 (SQRT), and 4 (Quadratic) for different ownership distributions. Figure 4 reports calculations results. As we expected, Anton's measure is constant at a fixed level of aggregate common ownership, but SQRT and Quadratic vary from concentrated to dispersed ownership. Concentrated ownership (50-50) has a greater common ownership measure than dispersed (10-90).

Now assume that there are three common owners for two firms. First holders ownership from firm X and Y are respectively α_1 and β_1. It is similar

3

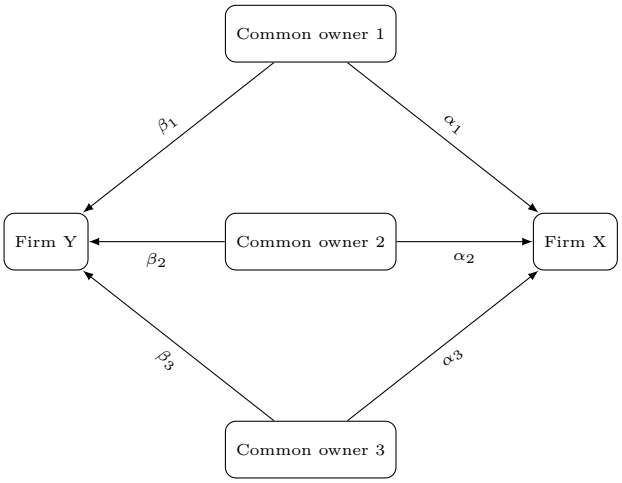
- Each holder owns $1/n$ of each firm ,Firm's market cap is α_1 and α_2, So for each holder of firms we have $S_{i,t}^{f}P_{i,t} = \alpha_i/n$
$[\frac{\sum_{f=1}^{n}\sqrt{\alpha_1/n}+\sum_{f=1}^{n}\sqrt{\alpha_2/n}}{\sqrt{\alpha_1}+\sqrt{\alpha_2}}]^2 = [\frac{\sqrt{n}(\sqrt{\alpha_1}+\sqrt{\alpha_2})}{\sqrt{\alpha_1}+\sqrt{\alpha_2}}]^2 = n$
$[\frac{\sum_{f=1}^{n}(\alpha_1/n)^2+\sum_{f=1}^{n}(\alpha_2/n)^2}{\alpha_1^2+\alpha_2{}^2}]^{-1} = [\frac{\alpha_1^2+\alpha_2^2}{n(\alpha_1^2+\alpha_2^2)}]^{-1} = n$

Figure 4: Comparison of three measure for common ownership



for other holders. (illustrated in figure 5). As before firm's market cap are equal. We calculate measures for concentrated or disparate ownership and ownerships that are less than the total firm's market cap. Table 7 reports calculation results. For ownerships that consist of total market cap, results are consistent with the first example. Although, when aggregate ownership decreases, the Quadratic measure denotes unrealistic numbers.

Figure 5: Numeric example 2



A fundamental assumption in previous examples is equality of firms' market cap. In the last example, we relax this assumption.

Table 7: text

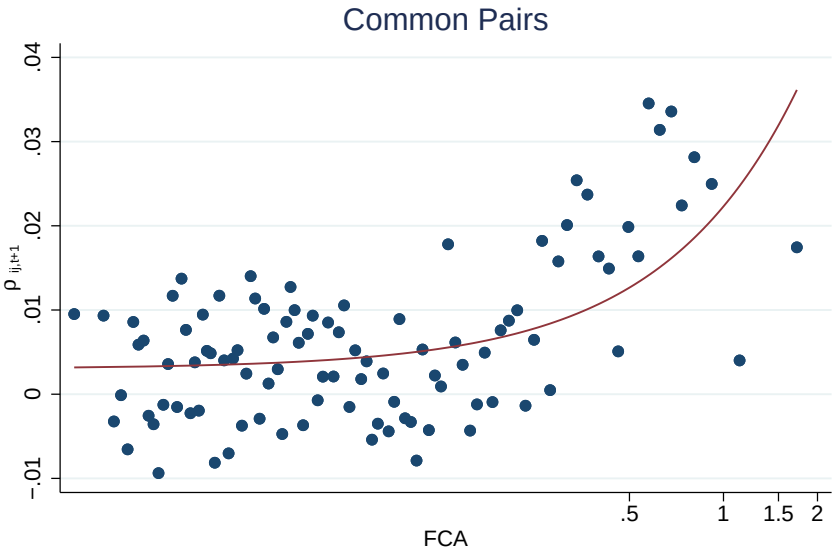
Ownership	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII
α_1	1/3	20	10	20	10	5	1
β_1	1/3	10	10	20	10	5	1
α_2	1/3	10	80	20	10	5	1
β_2	1/3	200	80	20	10	5	1
α_3	1/3	70	10	20	10	5	1
β_3	1/3	70	10	20	10	5	1
SQRT	3	2.56	2.33	1.8	0.9	0.45	0.09
SUM	1	1	1	0.6	0.3	0.15	0.03
Quadratic	3	1.85	1.52	8.33	33.33	133.33	3333.33

Table 8:

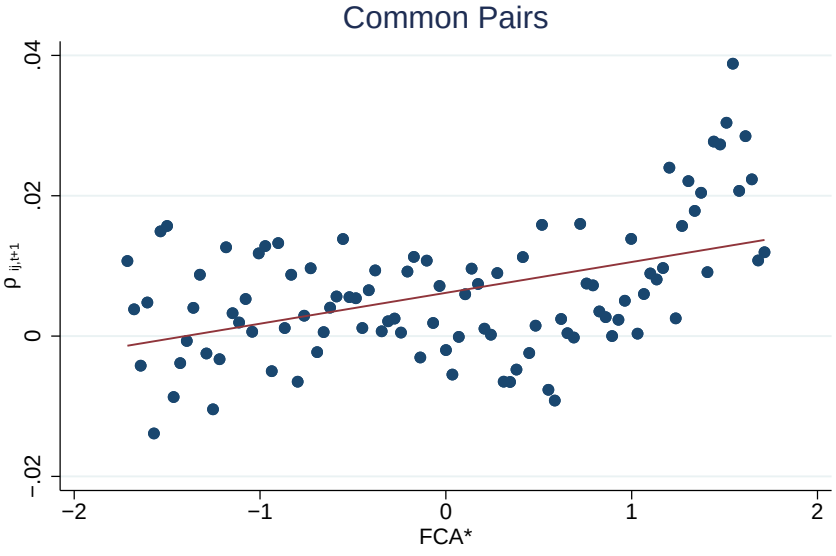
	$(\alpha_1,\beta_1),(\alpha_2,\beta_2)$					
	(10,40),(40,10)		(40,40),(10,10)		(10,40),(40,10)	
$\frac{\text{MarketCap}_x}{\text{MarketCap}_y}$	SQRT	SUM	SQRT	SUM	SQRT	SUM
1	0.9	0.5	0.9	0.5	0.9	0.5
2	0.9	0.5	0.9	0.5	0.8	0.4
3	0.9	0.5	0.9	0.5	0.75	0.35
4	0.9	0.5	0.9	0.5	0.71	0.32
5	0.9	0.5	0.9	0.5	0.69	0.30
6	0.9	0.5	0.9	0.5	0.67	0.29
7	0.9	0.5	0.9	0.5	0.65	0.28
8	0.9	0.5	0.9	0.5	0.64	0.27
9	0.9	0.5	0.9	0.5	0.63	0.26
10	0.9	0.5	0.9	0.5	0.62	0.25

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

4 Forecasting Comovement



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



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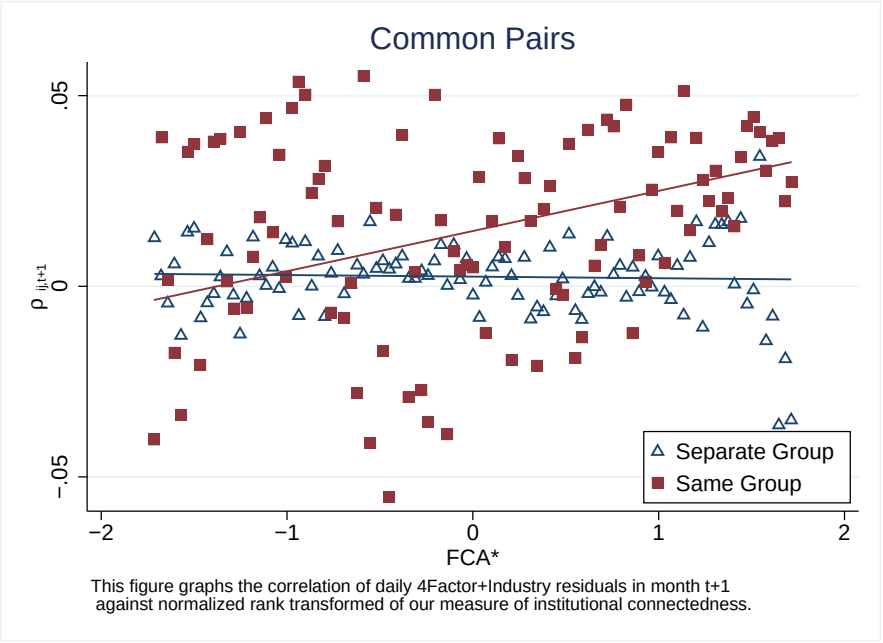
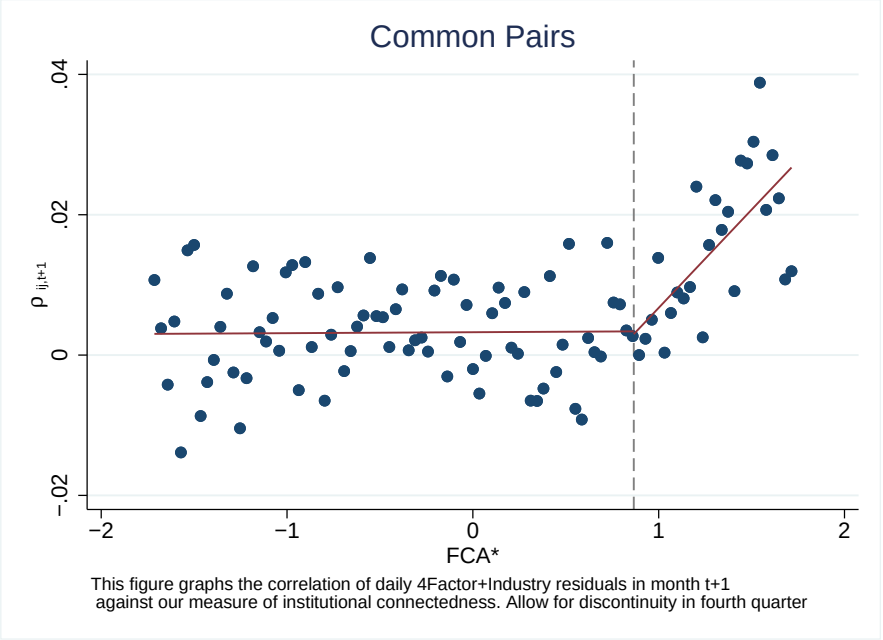


This figure graphs the correlation of daily 4Factor+Industry residuals in month t+1 against normalized rank transformed of our measure of institutional connectedness.

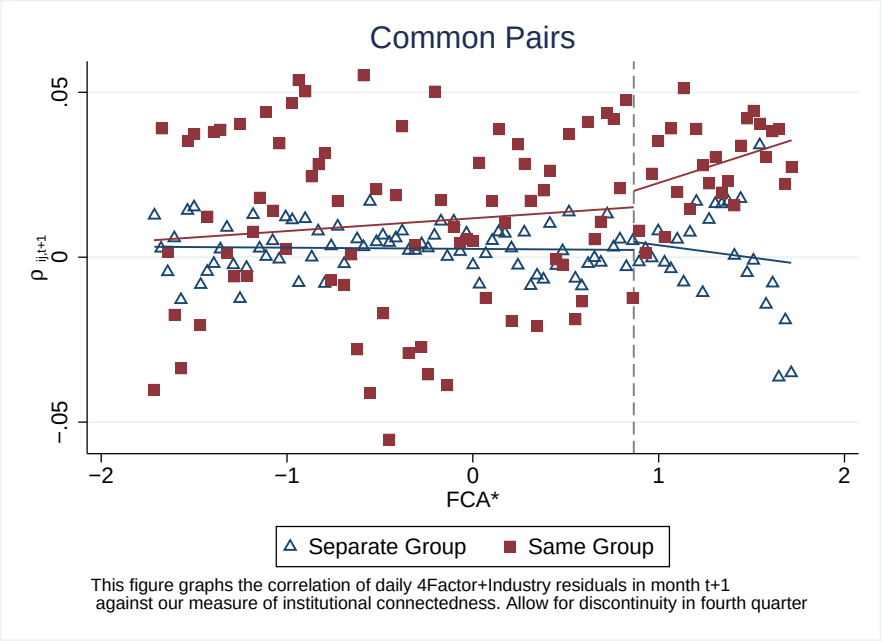
4.1 Modeling Cross-Sectional Variation in Comovement

$$\begin{aligned}\rho_{ij,t+1} = \beta_0 &+ \beta_1 * tr(\text{FCA}_{ij,t}) + \beta_2 * \text{SameGroup}_{ij} \\ &+ \beta_3 * tr(\text{FCA}_{ij,t}) * \ \text{SameGroup}_{ij} \\ &+ \sum_{k=1}^{n} \alpha_k * \text{Control}_{ij,t} + \varepsilon_{ij,t+1}\end{aligned} \tag{5}$$

4.2 Discontinuity



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



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

4.3 Results

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
FCA*	0.00469***	0.00386***	0.00108	-0.000208	-0.0000636	-0.000294
	(4.64)	(4.90)	(1.21)	(-0.23)	(-0.07)	(-0.34)
ρ_t		0.129***	0.129***	0.129***	0.129***	0.129***
		(5.11)	(5.08)	(5.08)	(5.08)	(5.07)
SameGroup			0.0179***	0.0101***	0.0114***	0.0121***
			(8.00)	(3.96)	(4.28)	(4.56)
(FCA*) × SameGroup				0.00952***	0.00969***	0.00950***
				(4.36)	(4.40)	(4.31)
SameIndustry					-0.00403*	-0.00515**
					(-2.19)	(-2.72)
SameSize						0.0115***
						(4.19)
SameBookToMarket						0.00784*
						(2.06)
Constant	0.00623***	0.00531***	0.00249***	0.00227**	0.00264***	0.00804***
	(7.92)	(7.65)	(3.61)	(3.23)	(3.96)	(6.47)
Observations	247465	246715	246715	246715	246715	246715
R^2	0.001	0.035	0.036	0.036	0.036	0.037

t statistics in parentheses

This table reports Fama and MacBeth (1973) estimates of monthly cross-sectional
regressions forecasting the correlation of daily 4Factor+Industry residuals in month t + 1 for each pairs.
The independent variables are updated monthly and include our measure of institutional connectedness,
FCA and a series of controls at time t.
We measure the negative of the absolute value of the difference in size ranking across the two stocks in the pair Samesize$_ij,t$.
We also capture the similarity in business group by dummy of sgroup.
Independent variables which we denote with * are rank-transformed and normalized to have unit standard deviation.
We calculate Newey and West (1987) standard errors (Four lags) of the Fama and MacBeth (1973) estimates
that take into account autocorrelation in the cross-sectional slopes

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

	Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals				
	(1)	(2)	(3)	(4)	(5)
FCA*	-0.000294	-0.000294	-0.000294	-0.000294	-0.000294
	(-0.34)	(-0.34)	(-0.34)	(-0.34)	(-0.34)
(FCA*) × SameGroup	0.00950***	0.00950***	0.00950***		
	(4.31)	(4.31)	(4.31)		
SameGroup	0.0121***	0.00689**		0.00689**	
	(4.56)	(2.83)		(2.83)	
Bearish Market × SameGroup		0.00526***	0.00526***	0.00526***	0.00526***
		(3.71)	(3.71)	(3.71)	(3.71)
Bullish Market × SameGroup			0.00689**		0.00689**
			(2.83)		(2.83)
(FCA*) × Bullish Market × SameGroup				0.00464**	0.00464**
				(2.98)	(2.98)
(FCA*) × Bearish Market × SameGroup				0.00486**	0.00486**
				(2.86)	(2.86)
Observations	246715	246715	246715	246715	246715
R^2	0.037	0.037	0.037	0.037	0.037

t statistics in parentheses

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

	Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals				
	(1)	(2)	(3)	(4)	(5)
FCA*	0.00469***	0.000122	-0.000201	-0.000548	-0.000578
	(4.64)	(0.10)	(-0.18)	(-0.50)	(-0.53)
(FCA* > $Q3$[FCA*]) × FCA*		0.0104***	0.00922***	0.00424*	0.00411*
		(5.13)	(4.70)	(2.10)	(2.03)
ρ_t			0.129***	0.129***	0.129***
			(5.10)	(5.08)	(5.08)
SameGroup				0.0163***	0.0184***
				(7.21)	(7.49)
SameIndustry					-0.00531**
					(-2.85)
SameSize					0.0113***
					(4.15)
SameBookToMarket					0.00778*
					(2.04)
Constant	0.00623***	0.00286**	0.00232**	0.00137	0.00712***
	(7.92)	(3.00)	(2.71)	(1.60)	(4.89)
Observations	247465	247465	246715	246715	246715
R^2	0.001	0.001	0.035	0.036	0.037

t statistics in parentheses

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

	Future Monthly Correlation of 4F+Industry Residuals						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FCA*	-0.000578	-0.000294	-0.000162	-0.000816	-0.000284	-0.000254	-0.000465
	(-0.53)	(-0.34)	(-0.19)	(-0.76)	(-0.33)	(-0.23)	(-0.45)
(FCA* > $Q3$[FCA*]) × FCA*	0.00411*			0.00153		0.000235	0.000510
	(2.03)			(0.67)		(0.10)	(0.21)
(FCA*) × SameGroup		0.00950***		0.00899***	0.00271		0.00290
		(4.31)		(3.60)	(0.61)		(0.68)
(FCA* > $Q3$[FCA*]) × (FCA*) × SameGroup			0.0126***		0.00992	0.0125***	0.00940
			(4.66)		(1.88)	(3.89)	(1.78)
Observations	246715	246715	246715	246715	246715	246715	246715
R^2	0.037	0.037	0.037	0.037	0.037	0.037	0.038

t statistics in parentheses

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

	All Firms			Big Firms			Big & Small Firms			Small Firms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FCA*	-0.000294	-0.000578	-0.000254	0.000842	-0.000249	-0.0000466	-0.00101	-0.000939	-0.000665	-0.00250	-0.00141	-0.000810
	(-0.34)	(-0.53)	(-0.23)	(0.90)	(-0.22)	(-0.04)	(-0.84)	(-0.60)	(-0.41)	(-1.14)	(-0.38)	(-0.22)
$(\text{FCA}^* > Q3[\text{FCA}^*]) \times \text{FCA}^*$		0.00411*	0.000235		0.00381	0.00243		0.00168	-0.00199		0.00723	-0.00231
		(2.03)	(0.10)		(1.37)	(0.89)		(0.58)	(-0.44)		(1.21)	(-0.39)
SameGroup	0.0121***	0.0184***	0.00839**	0.00690*	0.00878**	0.00508	0.0155**	0.0176***	0.0116*	0.00546	0.0243***	0.00387
	(4.56)	(7.49)	(2.78)	(2.38)	(3.32)	(1.52)	(3.21)	(3.84)	(2.15)	(0.73)	(3.60)	(0.40)
$(\text{FCA}^*) \times \text{SameGroup}$	0.00950***			0.00379			0.00401			0.0226***		
	(4.31)			(1.76)			(1.06)			(4.17)		
$(\text{FCA}^* > Q3[\text{FCA}^*]) \times (\text{FCA}^*) \times \text{SameGroup}$			0.0125***			0.00460			0.00906			0.0238**
			(3.89)			(1.88)			(1.46)			(2.85)
SameIndustry	-0.00515**	-0.00531**	-0.00539**	-0.0227***	-0.0231***	-0.0231***	0.00369	0.00356	0.00364	0.0115*	0.0109*	0.0112*
	(-2.72)	(-2.85)	(-2.84)	(-8.07)	(-8.29)	(-8.26)	(1.23)	(1.23)	(1.24)	(2.58)	(2.58)	(2.51)
Observations	246715	246715	246715	113173	113173	113173	99325	99325	99325	34217	34217	34217
R^2	0.037	0.037	0.037	0.032	0.032	0.033	0.044	0.044	0.045	0.081	0.081	0.083

t statistics in parentheses

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

5 Forecasting Comovement the Presence of Business Groups

5.1 Overview of Business Groups in Tehran Stock Exchange

5.2 Modeling Cross-Sectional Variation in Comovement in Business Groups

5.2.1 Effective Business GRoup

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

5.2.2 Check banking and Investment Groups

$$\begin{aligned}\rho_{ij,t+1} = \beta_0 &+ \beta_1 * \text{FCA}^*_{ij,t} + \beta_2 * \text{SameGroup}_{ij} \\ &+ \beta_3 * \text{FCA}^*_{ij,t} * \text{ SameGroup}_{ij} \\ &+ \beta_4 * \text{Bank's Group}_{ij,g} + \beta_5 * \text{Bank's Group}_{ij,g} * \text{FCA}^*_{ij,t} \\ &+ \beta_6 * \text{Bank In Group}_{ij,g} + \beta_7 * \text{Bank In Group}_{ij,g} * \text{FCA}^*_{ij,t} \\ &+ \beta_8 * \text{Inv. In Group}_{ij,g} + \beta_9 * \text{Inv. In Group}_{ij,g} * \text{FCA}^*_{ij,t} \\ &+ \sum_{k=1}^{n} \alpha_k * \text{Control}_{ij,t} + \varepsilon_{ij,t+1}\end{aligned}$$

5.3 Results

5.3.1 Effective Business GRoup

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

5.3.2 Check banking and Investment Groups

	De. Variable:Future Monthly Correlation of 4F+Industry Residuals				
	(1)	(2)	(3)	(4)	(5)
FCA*	-0.000481	-0.000500	-0.000418	-0.000484	-0.000393
	(-0.50)	(-0.51)	(-0.44)	(-0.50)	(-0.41)
SameGroup	0.0122***	0.0110***	0.0135***	0.0129**	0.0133**
	(4.57)	(3.72)	(4.22)	(2.71)	(2.77)
(FCA*) × SameGroup	0.00956***	0.00864***	0.00934***	0.00968**	0.00907*
	(4.28)	(3.63)	(3.89)	(2.68)	(2.53)
(FCA*) × Bank's group × SameGroup		0.00701			0.00896*
		(1.98)			(2.27)
(FCA*) × Bank in group × SameGroup			0.00436		0.00198
			(0.65)		(0.30)
(FCA*) × Inv. in group × SameGroup				-0.000916	-0.00243
				(-0.21)	(-0.46)
Observations	246715	246715	246715	246715	246715
R^2	0.037	0.038	0.038	0.038	0.039

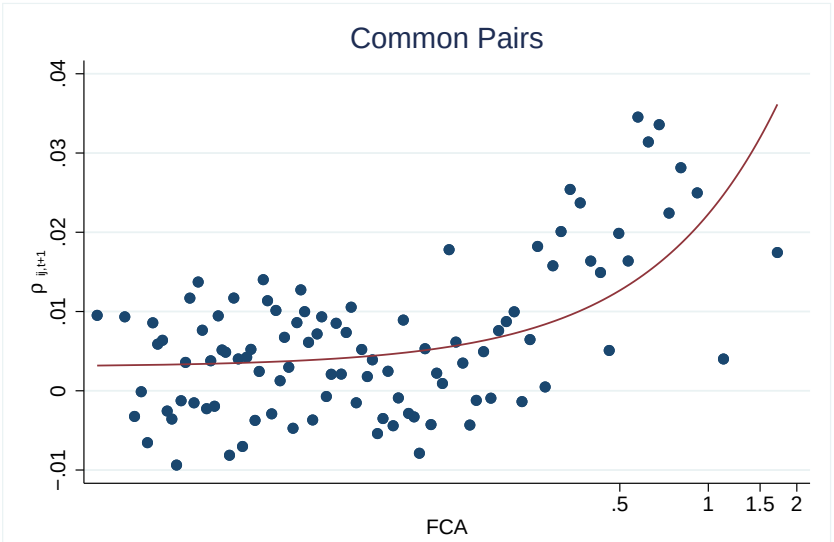
t statistics in parentheses

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

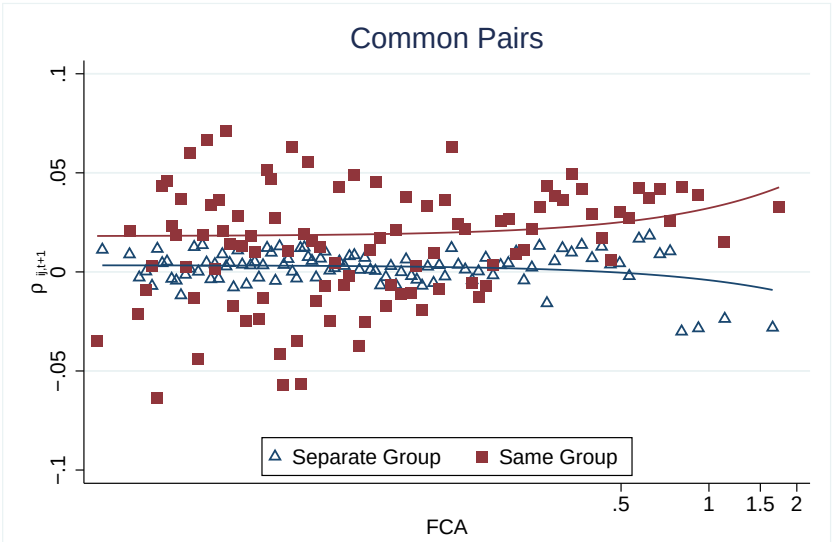
6 Robustness Check

7 Conclusion

Appendix A Logaritmic Transformation



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



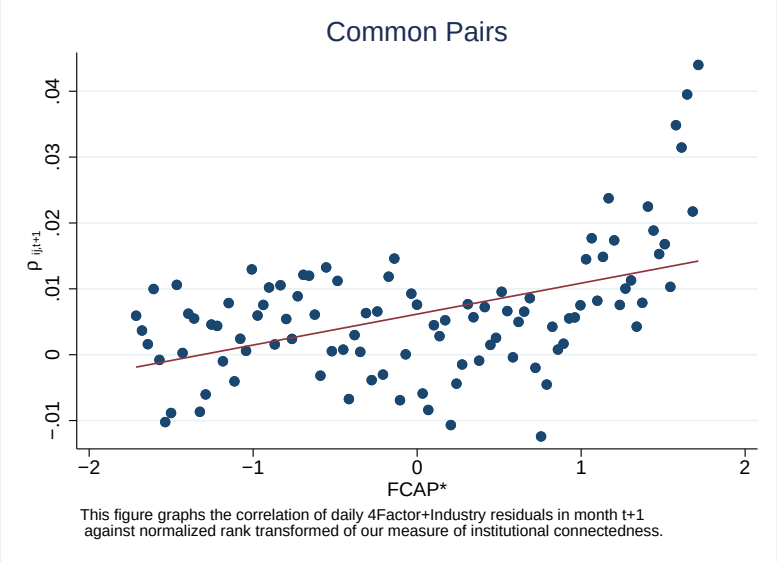
This figure graphs the correlation of daily 4Factor+Industry residuals in monthh t+1 against our measure of institutional connectedness.

	Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(FCA)$	0.00415***	0.00347***	0.00103	-0.000325	-0.000176	-0.000381
	(5.18)	(5.45)	(1.34)	(-0.41)	(-0.23)	(-0.51)
ρ_t		0.129***	0.129***	0.129***	0.129***	0.129***
		(5.10)	(5.08)	(5.08)	(5.08)	(5.07)
SameGroup			0.0175***	0.0285***	0.0301***	0.0305***
			(7.55)	(7.62)	(7.40)	(7.60)
$(\ln(FCA)) \times$ SameGroup				0.00680***	0.00691***	0.00678***
				(4.46)	(4.48)	(4.41)
SameIndustry					-0.00414*	-0.00522**
					(-2.25)	(-2.76)
SameSize						0.0114***
						(4.15)
SameBookToMarket						0.00776*
						(2.05)
Constant	0.0171***	0.0145***	0.00519*	0.00121	0.00203	0.00683**
	(7.05)	(7.54)	(2.21)	(0.49)	(0.88)	(2.97)
Observations	247465	246715	246715	246715	246715	246715
R^2	0.001	0.035	0.036	0.036	0.036	0.037

t statistics in parentheses

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

Appendix B Anton Polk's measure



	Dependent Variable:Future Monthly Correlation of 4F+Industry Residuals					
	(1)	(2)	(3)	(4)	(5)	(6)
FCAP*	0.00505***	0.00415***	0.00141	-0.0000485	0.0000890	-0.000240
	(5.14)	(5.51)	(1.67)	(-0.06)	(0.11)	(-0.29)
ρ_t		0.129***	0.129***	0.129***	0.129***	0.129***
		(5.10)	(5.08)	(5.07)	(5.07)	(5.07)
SameGroup			0.0175***	0.00896***	0.0104***	0.0111***
			(8.02)	(3.56)	(4.06)	(4.33)
(FCAP*) × SameGroup				0.0105***	0.0107***	0.0106***
				(4.37)	(4.38)	(4.33)
SameIndustry					-0.00415*	-0.00524**
					(-2.23)	(-2.73)
SameSize						0.0113***
						(4.09)
SameBookToMarket						0.00798*
						(2.09)
Constant	0.00622***	0.00532***	0.00255***	0.00230**	0.00268***	0.00806***
	(7.93)	(7.65)	(3.70)	(3.26)	(4.01)	(6.49)
Observations	247465	246715	246715	246715	246715	246715
R^2	0.001	0.035	0.036	0.036	0.036	0.037

t statistics in parentheses

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

Appendix C Fortnightly Frequency

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