Notes

The message is unclear . . . 3
Are you replicating a study? "An Emerging Market"! . . . 3
It is 2022, 2003 is not recent anymore . . . 3
Is not better to talk about co-movement literature in the main body and the common ownership literature in footnote? . . . 4
We should talk more about their differences and refer to a paper . . . 4
Talk more about paper . . . 4
Talk more about our unique data . . . 4
I realized that at previous paragraph we talk about our main contribution, are we clearly explain our contribution? . . . 4
Talk about our institutional setting and then explain about BG. We jump to the next paragraph. . . . 4
I think that we should pin-point our contributions here and sell it . . . 4
What is the difference between motivation and contribution?! . . . 4
Why is this important? . . . 5
There are other weak papers that answered this question. It is not better to talk about them at least in the footnote? . . . 5
High level is right? . . . 5
Is it really invisible? . . . 5
Should not we talk about the channel? . . . 5
Should not we talk about the identification challenges? . . . 5
We do not have their identification method . . . 5
Is this correct? We talked about this before. We believe that we cannot compare these two coefs. . . . 5
Can we say this? It's not consistent with our second sentence in paragraph 5
High level of common ownership . . . 5
Is it right? We just propose a channel and check it. There was some investigation but we did not include them in the paper . . . 6
Tell about sections . . . 6
I think that we should talk more about the creation of BG. There is a great concern that they are endogenous. . . . 6
Check this table. Is is percise? . . . 10
Is it important? Our modification is true? We have a grater measures at a firm with 3 common owners than a pair with 2 common owner. Which one is more connected?! . . . 10
Business groups might consist of firms which are similar in fundamentals. So, our result comes from this fundumental connection and it is endogenous! . . . 11

We can use the calculated correlation in the regression as a latend variable to control for omitted variable biase. It can capture our fundumental correlation from definition of BGs in the similar frims. 12
Base on Anton and Polk (2014) method 15
Can we say this? 15
Anton and Polk (2014) restrict their investigation to large firms 16
We can add BG fixed effect to this table to tell that our main results are consistence with this fixed effect. I add this column. 16
Talk about the effect of BG fixed effect of our results 16
We should talk more about the effect of BG fixed effect on our results . . 17
Until now 20
What is Turnover? 22
Is there any implications? 29

Connected Stocks via Business Groups: Evidence from an Emerging Market

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August, 2022

The message is unclear

Are you replicating a study? "An Emerging Market"!

Preliminary and Incomplete

Abstract

Using a unique stock ownership dataset with daily frequency from Iran, we study the impact of direct and indirect common ownership on stock return comovements. While being part of the same business group is a main driver of common ownership among firms listed on Tehran Stock Exchange, it can also be regarded as indirect common ownership if two firms with no direct common owner are controlled by the same ultimate owner in a business group. We find that common ownership and business group affiliation are both positively associated with higher stock return comovement, but the impact of being part of the same business group seems to dominate that of direct common ownership. Further analyses show simultaneous trades in the same direction in business groups explains higher return comovements among stocks affiliated with the same business groups.

1 Introduction

It is well established that stock prices comove with each other. Earlier studies explain stock return comovements through commonality in fundamentals. For example, Shiller (1989) provides evidence that comovement of dividends could account for stock price comovement. More recently, it has been recognized that return comovement could rise between fundamentally unrelated stocks (see for example, Barberis and Shleifer (2003) and Barberis et al. (2005) for theoretical models predicting comovement between fundamentally unrelated companies.) The rise in popularity of index and passive investing around the world in the last two

It is 2022, 2003 is not recent anymore

decades has led to an increase in a phenomnon known as common ownership, which has attracted the attention of academics as well as policy makers. For example, Azar et al. (2018) show that an increase in mutual ownership in airline companies leads to less competitive ticket pricing. While the anticompetitive effect of common ownership has sparred somewhat of a controversial debate, Anton and Polk (2014) provide less disputable evidence showing that having common shareholders drive stock return comovement[1]. They use mutual funds' ownership and suggest that comovement increases by increasing common ownership. Also, they show that the comovement increases when there is a significant net flow, either in or out-flow in the months for mutual funds. Subsequently, according to Koch et al. (2016) companies show comovement considering their owners' correlation in their liquidity needs. The authors also add that companies with higher mutual fund ownership have a more liquidity correlation than others. This paper contends that firms without a common owner would comove with each other.

Is not better to talk about co-movement literature in the main body and the common ownership literature in footnote?

While most of the prior investigations on factors affecting common-ownership have focused on the fund, the role of the block-holders as one of the most important factors in firms' governance has remained a black box[2]. The fact that funds are intermediates and behave differently due to their needs, making it difficult to generalize these results to other types of ownership. Edmans et al. (2014) provide a theoretical model to investigate the implications of common ownership of block holders for corporate governance and asset pricing. Regardless, the block holders' daily ownership data, including mutual fund ownership, is publicly accessible in Iran. So research through this data can show whether common ownership other than mutual fund ownership can lead to comovement or not. Following Anton and Polk (2014), we are the first study that uses block-holder ownership to investigate the relationship between common ownership and comovement.

We should talk more about their differences and refer to a paper

Talk more about paper

Talk more about our unique data

I realized that at previous paragraph we talk about our main contribution, are we clearly explain our contributions?

Talk about our institutional setting and then explain about BG. We jump to the next paragraph.

I think that we should pin-point our contributions here and sell it

What is the difference between motivation and contribution?!

[1] The followings are some of the other explanations for return comovement: index inclusion (Barberis et al. (2005)), investors' attention to the companies (Wu and Shamsuddin (2014)), Investment banks' underwriting (Grullon et al. (2014)), correlated beliefs (David and Simonovska (2016)), shareholders' coordination (Pantzalis and Wang (2017)), and preference for companies' dividends (Hameed and Xie (2019)) are among contributing factors to comovement that have been identified by researchers.

[2] A long literature surveyed by Holderness (2003), Edmans (2014), and Edmans and Holderness (2017) considers the potential role of blockholders in firm governance

Despite the presence of the business group in both emerging economies, e.g., Brazil, Chile, China, India, Indonesia, South Korea, and developed countries, e.g., Italy, Sweden, (Khanna and Yafeh (2007)), there is no evidence on whether being at the same business group can lead to the comovement. Business groups consist of legally independent firms operating across diverse industries different from commonly held firms. Although researchers have identified comovement among stock returns, to the best of our knowledge, we are the first comprehensive study about the different roles of the business groups and common ownership on comovement.

Why is this important?

There are other weak papers that answered this question. It is not better to talk about them at least in the footnote?

We hypothesize that stocks with a high level of common ownership and the same ultimate owner exhibit strong comovement. In fact, when we talk about the presence of two stocks in the same business group, we talk about a high level of invisible common ownership between two stocks that we cannot measure by common ownership measurements.

High level is right?

Is it really invisible?

Should not we talk about the channel?

Should not we talk about the identification challenges?

We do not have their identification method

We test this hypothesis using Anton and Polk (2014) methodology and realize that common ownership is crucial for predicting the comovement. Business groups play a more critical role in predicting the correlation of companies' returns than common ownership, with a coefficient about seven times as large as the common ownership coefficient.

Is this correct? We talked about this before. We believe that we cannot compare these two coefs.

Furthermore, We show that common ownership can predict comovement only inside the business groups.

Can we say this? It's not consistent with our second sentence in paragraph

High level of common ownership

We extend our analysis to validate the prominence of business groups. First, we find that the average of common ownership is five times larger for the firms in the business group. So, we restrict the study to the high level of common ownership to distinguish the effect of common ownership and business groups. In this subsample, like the mentioned ones, business groups significantly impact firms' comovement. Second, if business groups affect comovement, there is no need to restrict our investigation to firms with common owners, and also this would affect all the firms in the market. To address these concerns and distinguish the impact of common ownership and business group, we extend our investigation to all the firms in the market and show that the business group can increase firms' comovement for all the firms in the market.

Is it right? We just propose a channel and check it. There was some investigation but we did not include them in the paper

Finally, we investigate different sources of business groups' comovement. We show that correlated trade in business groups is the channel of comovement. We provide evidence that the volume and direction of trades in business groups are related, and firms in the business groups with higher relation in trade have a higher level of comovement.

Tell about sections

2 Data and Methodology

2.1 Data and Sample

Our data have several unique features which distinguish our paper from the existing literature. Stock ownership data for Iranian public firms is available with daily frequency reported at the end of each trading day. This data includes all blockholders, defined as having at least one percent of the outstanding shares in a firm for all investor types- institutional as well as individuals- and is automatically reported by a central authority named Tehran Securities Exchange Technology Management Corporation (TSETMC), which is a subsidiary of Tehran Stock Exchange. This eliminates potential issues in self-reported data (such as those existing in US institutional holding data, known as 13F filings). In order to put together our dataset, we compile daily stock ownership tables (available in separate tables for each firm), which are publicly available starting from 2010.

We use data on business groups, defined as a group of listed firms with interconnected ownership structures controlled by an ultimate owner. Business groups are a common organizational structure in corporate ownership in Iran as well as many other parts of the world. Two-thirds of Iranian public firms are part of complex interlinked ownership networks, each governed by an ultimate owner, which sits at the top of a multi-layer pyramid ownership structure (Aliabadi et al. (2021)). Unlike countries like South Korea, Japan, and India that formally announce business groups, we do not have officially-defined business groups in Iran. We use data provided by Aliabadi et al. (2021) which builds a comprehensive dataset of all Iranian business groups. Using either of the two different methodologies, one introduced by Almeida et al. (2011) with a 40% threshold for control rights, and the other by Aminadav et al. (2011) which is based on Shapley-Shubik index (Shapley and Shubik (1954)) generates the same business group definitions in Iranian public sector(Aliabadi et al. (2021)).[3] Our business group data covers the period 2015-2020.

I think that we should talk more about the creation of BG. There is a great concern that they are endogenous.

We also gather stock returns, trading volume, firm-level trading data, and ac-

[3]For further discussion see appendix A

counting information from Codal (equivalent to SEC's EDGAR) [4] and TSETMC's website[5]. We exclude ETFs. The final sample used in our empirical analysis spans from 2015 to 2020 (1393/01-1398/12 Persian calendar).

Panel A table 1 reports summary statistics for ownership and business groups data. An average firm in our sample has six blockholders holding 75 percent of shares in aggregate. More than two-thirds of our sample firms are part of a business group. There are around 40 business groups, each consisting of, on average, seven firms.

2.2 Pair composition

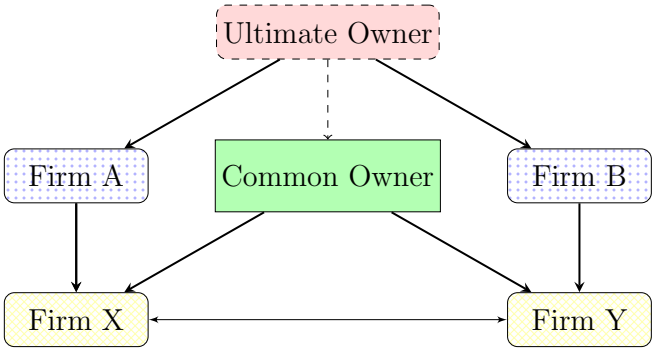
If any two firms have at least one common blockholder in a month, we consider them a commonly held firm pair. By this definition, there are 19973 unique pairs in our entire sample period, which is 12.7% of all possible pairs ($\frac{560*559}{2} = 156520$). Firm pairs in our sample have on average 1.2 common owners.

An important feature of common ownership in the Iranian public sector is that business groups are the main driver of common ownership, in contrast to US data in which the rise in common ownership is generally attributed to passively managed funds such as index funds. The asset management industry, especially in the form of mutual funds or ETFs, is generally a young but growing industry in Iran and does not have a large presence in firms' ownership structures. We, therefore, also identify pairs based on whether the two firms belong to the same business groups.

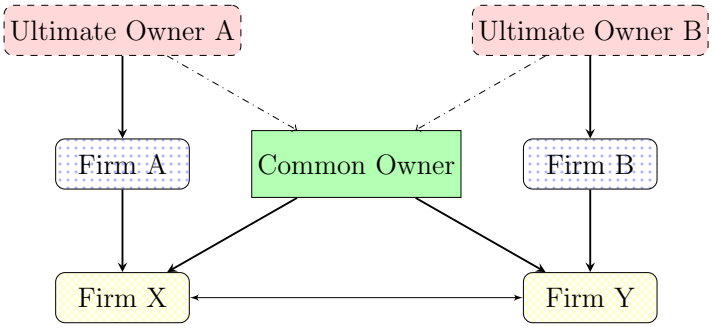
If both firms in a pair belong to the same ultimate owner, we identify them as being in the same business group. The two firms in a pair could also belong to different business groups or not be part of any business groups. Figure 1 illustrates all possibilities based on whether firm pairs belong to the same, different, or any business groups. In about one-third of our pairs, neither of the two firms belong to any business group, while in about 11 percent of our pairs, firms are part of the same business group. Panel B of table 1 reports summary statistics for firm pairs.

[4] www.codal.ir
[5] www.tsetmc.com

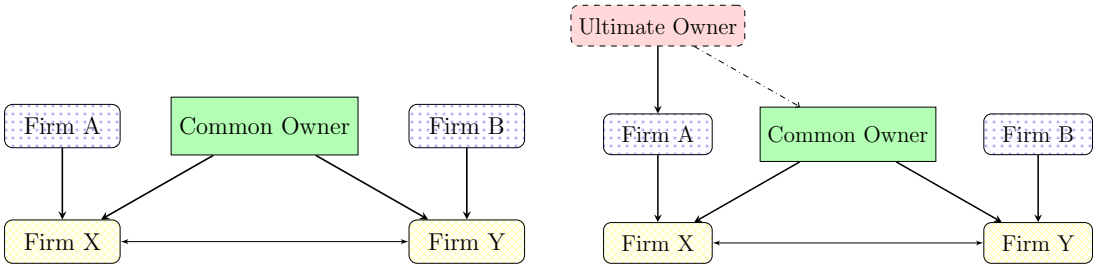
Figure 1: Firm pairs and business groups



(A) Pair in the same business group



(B) Pair in two distinct business group



(C) Pair not in the business group

Table 1: Summary Statistics
This table reports summary statistics of ownership features for all TSE stocks from 2015 to 2020. Panel A lists the total number of firms and Business groups and other features as of the year end for each of the years in our sample. Panel B reports summary statistics for firm pairs. The number of unique stock pairs is $n(n-1)/2$, where n is the number of stocks. In total, we have 19973 unique firm pairs in our sample.

(A) Ownership Characteristics for listed firms

Year	2015	2016	2017	2018	2019	2020	Average
No. of Firms	337	356	392	479	499	560	437
No. of Blockholders	1563	1656	1893	2510	2701	2991	2219
No. of Groups	37	40	42	43	39	42	40
No. of Firms in Groups	233	254	278	311	323	357	292
Ave. Number of group Members	6	6	7	7	8	8	7
Ave. ownership of each Blockholders (%)	17	18	18	17	18	19	17
Med. ownership of each Blockholders (%)	5	4	4	4	4	5	4
Ave. Number of Owners	7	7	7	7	7	6	6
Med. Number of Owners	5	5	5	6	5	5	5
Ave. Block. Ownership (%)	77	77	76	76	75	72	75

(B) Number of Pairs, in, and outside the Business Groups

Year	2015	2016	2017	2018	2019	2020	Average
No. of Pairs	9051	8980	9288	11147	11199	12171	10306
No. of Pairs not in Groups	3293	2979	3058	4427	4168	4571	3749
No. of Pairs not in the same Group	4727	4993	5129	5400	5464	5770	5247
No. of Pairs in the same Group	850	857	949	1126	1316	1556	1109
Ave. Number of Common owner	1.18	1.18	1.17	1.17	1.17	1.15	1.17

2.3 Measurement of common-ownership

There are a number of different measures for common ownrship used in the literature. Table 2 summarizes all the major common ownership measures, which can be categorized into two groups; model-based (e.g, Harford et al. (2011); Azar et al. (2018); Gilje et al. (2020)) as well as ad hoc measures (e.g, Anton and Polk (2014); Azar (2011); Freeman (2019); Hansen and Lott Jr (1996); He and Huang (2017); Lewellen and Lowry (2021); Newham et al. (2018)).

Table 2: 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 et al. (2019)	$\sum_{i \in I^{A,B}} 1$	Invariant to the level of common ownership
	Newham et al. (2018)	$\sum_{i \in I^{A,B}} min\{\alpha_{i,A}, \alpha_{i,B}\}$	Ignore level of ownership
	Anton and Polk (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 and Lott Jr (1996)	$\sum_{i \in I^{A,B}} \alpha_{i,A} \times \sum_{i \in I^{A,B}} \alpha_{i,B}$	Ignore importance of the firms

Check this table. Is is percise?

Since we want to estimate the impact of common ownership on stock return comovement in our primary analysis, we need a pair-level measure of common ownership. Anton and Polk (2014) study the impact of common ownership on US stock return comovements using a measure that captures the total value held by the common owners of the two stocks, scaled by the total market capitalization, hereafter *FCAP*. This measure is straightforward to construct, is not bi-directional, and provides a meaningful economic interpretation, which are all features we would like our measure of common ownership to have. One shortcoming of this measure, however, is that it does not capture the distributional impact of ownership by each of the common owners (e.g., *FCAP* yields the same values if common owners each hold 5 percent of a firm's stocks; versus if one holds 1 percent and the other 9 percent of the firm's stocks).

Is it important? Our modification is true? We have a grater measures at a firm with 3 common owners than a pair with 2 common owner. Which one is more connected?!

As a result, we propose a modification to *FCAP* that allows us to capture the extent of ownership by each of the common owners, , *MFCAP*, although we replicate our entire analysis with the measure introduced in Anton and Polk (2014),

FCAP. Our proposed measure is

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

where $S_{i,t}^{f}$ is the number of shares held by owner f in firm i at time t trading at a price Pi,t with total shares outstanding of $S_{i,t}$. Taking the square root of the dollar value of each common owenrs's holding allows us to capture the ownership differences among common owners (See appendix B for further discussion).

To construct a monthly measure of common ownership for each firm pair, we calculate the *MFCAP* and *FCAP* every trading day and take the average of the daily values over a month. Panel A table 3 compares the distribution of common ownership measures for both methods. As expected, the modified measure generates a wider distribution of values between the two common ownership measures. The average common ownership measure is five times larger for firms in the same business group. This is consistent with our prior understanding of the ownership structure in the Iranian public sector, in which business groups are one of the main drivers of common ownership. In addition, the average common ownership measure is three times larger for firms that are in the same industry. It is worth noting that firms that belong to the same business group tend to be in the same industry.

Business groups might consist of firms which are similar in fundamentals. So, our result comes from this fundumental connection and it is endogenous!

Hence, as part of our analyses, we also study the impact of business groups on stock return comovement, which is to the best of our knowledge a novel contribution of our paper to the literature.

2.4 Stock Return comovement

Since we are interested in studying the impact of common ownership and business groups on stock return comovement and that firms in the same business groups in Iran tend to be from the same industry, we would ideally want to subtract the impact of industry return in calculating abnormal returns. In addition, we know from prior literature that stocks from the same industry tend to comove together (King (1966),Meyers (1973)). Therefore, we use the Fama-French four-factor model plus industry return to calculate abnormal returns, as shown in equation 2. To measure monthly stock return comovement for each firm pair at the end of each month, we first estimate our benchmark model using the past three months. Using the estimated coefficients (betas), we then measure daily residuals and calculate the

correlation of daily residuals from equation 2 during each month.

$$R_{i,t} = \alpha_i + \beta_{mkt,i} R_{M,t} + \beta_{Ind,i} R_{Ind,t} + \\ + \beta_{HML,i} HML_t + \beta_{SMB,i} SMB_t + \beta_{UMD,i} UMD_t + \varepsilon_{i,t} \tag{2}$$

where $R_{i,t}$, $R_{M,t}$ and $R_{Ind,t}$ are firm, market and firm's industry excess daily, respectivly. Our proxy for risk free rate is bank deposit's daily rate. Other variabales difinition is based on Carhart four-factor model [Carhart (1997)]. Using other benchmark models (e.g. CAPM and Fama French four factor model) in calculating monthly correlations generate similar results and are reported in panel B table 3.

2.5 Controls

Stocks' intrinsic similarities may well drive return comovement. We follow the literature (e.g., Anton and Polk (2014)) to control for potential drivers of stock return comovements, which can be firm-specific as well as pair characteristics. We separately control for both firms' size and book to market in a pair. Following Anton and Polk (2014), we use the normalized rank-transform of the percentile market capitalization of the two stocks, **Size1** and **Size2**, where we label the larger stock in a pair as the first stock. Similarly, we control for the normalized rank-transform of the percentile book to market of the two stocks, **BM1** and **BM2**. We also control for whether firms in a pair are similar in size and book to market: **SameSize**, and **SameBM** are the negative of the absolute difference in percentile ranking of size and book to market of the two stocks in a pais, respectively.

In addition, we control for whether the two stocks are in the same industry and business group, **SameIndustry**, **SameGroup**, respectively. We also control for cross-ownership between two stocks and define **CrossOwnership** as the maximum percent of cross-ownership between the two firms.

We construct our control variables daily and take the monthly averages as the value of each variable at the end of each month. Panel C of table 3 reports the summary statistics of our control variables.

We can use the calculated correlation in the regression as a latend variable to control for omitted variable biase. It can capture our fundumental correlation from definition of BGs in the similar frims.

Table 3: Summary Statistics of Pairs' Features
This table reports summary statistics for all the founded pairs from 2014 to 2019. Panel A reports snapshots from the calculation of common ownership for our measurement of common ownership (MFCAP) and Anton and Polk (2014) measure (FCAP). Panel B shows the distribution of calculated correlation of residuals for different models. Panel C depicts Control variables' distribution.

(A) Common Ownership with for two measures

	MFCAP					FCAP				
	mean	std	min	median	max	mean	std	min	median	max
All	0.15	0.24	0.00	0.06	4.62	0.12	0.16	0.0	0.05	0.97
Same Group	0.47	0.41	0.00	0.41	4.04	0.38	0.25	0.0	0.37	0.97
Different Group	0.10	0.16	0.00	0.04	2.90	0.08	0.11	0.0	0.04	0.97
Same Industry	0.34	0.41	0.01	0.18	4.04	0.25	0.24	0.0	0.16	0.96
Different Industry	0.12	0.19	0.00	0.05	4.62	0.10	0.14	0.0	0.05	0.97

(B) Distribution of Correlation base on Different models

	mean	std	min	median	max
CAPM + Industry	0.019	0.127	-0.925	0.015	0.902
4 Factor	0.032	0.136	-0.877	0.023	0.837
4 Factor + Industry	0.015	0.125	-0.903	0.012	0.755

(C) Distribution of specified Controls

	mean	std	min	median	max
Size1	0.72	0.22	0.01	0.77	1.00
Size2	0.45	0.24	0.00	0.43	0.99
SameSize	-0.28	0.20	-0.97	-0.23	-0.00
BM1	0.51	0.25	0.00	0.52	1.00
BM2	0.50	0.23	0.01	0.50	1.00
SameBM	-0.30	0.19	-0.96	-0.26	-0.00
CrossOwnership	0.56	5.14	0.00	0.00	95.56

Table 4: Summary Statistics of Sub-samples
This table reports the mean of control variables for the three subsamples, for the pairs in the same business group, same industry, and high level of common ownership, which is in the fourth quarter of each period.

	Mean					
	Comovement	SameGroup	SameInd.	SameBM	SameSize	CrossOwner.
SameGroup						
No (88%)	1.02%	0.00	0.09	-0.30	-0.28	0.18%
Yes (11%)	4.24%	1.00	0.45	-0.25	-0.26	4.53%
SameIndustry						
No (86%)	1.00%	0.07	0.00	-0.30	-0.29	0.33%
Yes (13%)	4.05%	0.40	1.00	-0.23	-0.21	2.96%
Pairs						
Others (74%)	1.08%	0.04	0.08	-0.29	-0.29	0.50%
ForthQuarter (25%)	2.35%	0.35	0.29	-0.28	-0.24	1.21%
Total (100%)	1.40%	0.11	0.13	-0.29	-0.28	0.68%

3 Empirical Evidences

3.1 Forecasting Comovement

Figure 2 plots stock return comovement for different levels of common ownership, measured by MFCAP. Higher levels of common ownership between two firms seem to be associated with stronger correlation in their stock returns. In order to study the impact of common ownership on stock return comovement, we empirically estimate the effect of lagged measures of common ownership on stock return comovement.

We estimate a series of cross-sectional regression models in which the dependent variable is within-month realized correlation of abnormal returns of stock pairs ($\rho_{i,j,t+1}$). As explained in section 2.4, abnormal returns are the daily residuals from a model consisting of Fama-French four factors plus industry returns. The main independent variable of interest is our measure of common ownership, $MFCAP^{*}_{ij,t}$. We are also interested in the effect of being part of the same business group, $Same\ Group_{ij}$, on stock return comovement.

$$\begin{aligned} \rho_{ij,t+1} = \beta_0 &+ \beta_1 * \text{MFCAP}^{*}_{ij,t} + \beta_2 * \text{SameGroup}_{ij} \\ &+ \beta_3 * \text{MFCAP}^{*}_{ij,t} \times \text{SameGroup}_{ij} \\ &+ \sum_{k=1}^{n} \alpha_k * \text{Control}_{ij,t} + \varepsilon_{ij,t+1} \end{aligned} \tag{3}$$

To mitigate the autocorrelation problem, we estimate the cross-sectional regressions each month and report the time-series average coefficients as in Fama and MacBeth (1973). Standard errors are calculated using Newey and West (1987) to

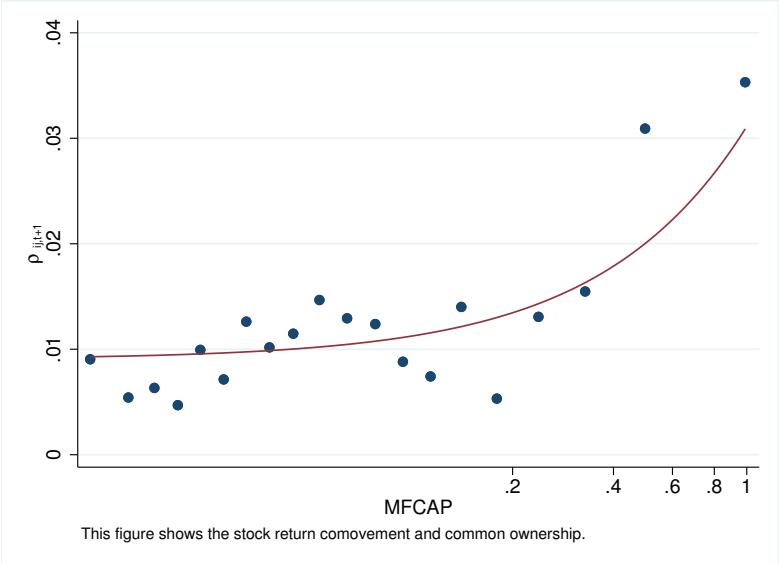


Figure 2: Comovement for different level of common ownership

Base on Anton and Polk (2014) method

correct for potential autocorrelation in the time series of cross-sectional estimates for up to four lags.

The results of our Fama McBeth regressions are presented in Panel A of Table 5. Column 1 reports the results of univariate regressions showing stock return comovement is significantly larger in stock pairs that have higher levels of common ownership ($MFCAP^*_{i,j}$). In Column 2 we control for *Same Industry*, *Same Size*, *Same Book to Market*, and *Cross-Ownership*, defined as described in Section 2.5. The variables *Same Size* and *Same Book to Market* are normalized to have a standard deviation of one and are transformed so that higher values indicate greater similarity between the two stocks in a pair. We find that our measure of common ownership, $MFCAP^*_{i,j}$, is still significantly associated with higher stock return comovement.

As discussed earlier, anecdotal evidence seems to suggest common ownership in the Iranian public sector is mainly driven by business groups. The average common ownership measure, $MFCAP^*_{i,j}$, for pairs in the same business group is five times larger than the rest. Hence in Column 3, we separately estimate univariate regressions of an indicator variable for whether firms in a pair are part of the same business groups on stock return comovement. We find firms that belong to the same business groups have significantly higher stock return comovement.

Can we say this?

The magnitude of this effect is economically large. The estimated coefficient for *SameGroup* in Column 3 is 0.036, which is more than three times larger than the coefficient for the constant term, and is statistically significant, suggesting that return comovement in our sample is almost four times larger for firm pairs that

are in the same business groups, compared to the those that are not. This result is robust to the addition of control variables as reported in Column 4. In Column 5, once we include both our measure of common ownership, $MFCAP^{*}_{i,j}$, and *Same Group* indicator in our regression model, the coefficient estimate for *Same Group* remains statistically significant and very similar in magniture compared to that in Column 4. However, the coefficent estimate on common ownership measure, *MFCAP*, is no longer significant. This suggests that common ownership affects stock return comovement among our sample firms mostly through business group affiliations. It is also worth noting that firms in the same industry have siginificantly higher stock return comovement, as is the case for firms closer in size and book-to-market. This is in spite of the fact that we already account for industry return, size and book-to-market in measuring daily residuals from equation 2. In the last column, we control for additional pair level fixed effects based on the size of the firms in a pair. Pairs are categorized into large or small if both firms are large or small. If one firm in a pair is large and the other is small, we categorize the pair as hybrid. Our results are robust to the addition of pair type fixed effects.

Anton and Polk (2014) restrict their investigation to large firms

We can add BG fixed effect to this table to tell that our main results are consistence with this fixed effect. I add this column.

Talk about the effect of BG fixed effect of our results

In panel B of Table 5, we examine the interaction effect of common ownership and business groups on return comovement. In Column 1, we restrict our sample only to pairs that are in the same business groups. The coefficient estimate on common ownership measure, $MFCAP^{*}$, remains positive and highly significant. This suggest that variations in common ownership among firms in the same business group significantly impact their respective stock return comovement. In Column 2, however, we restrict our sample to firm pairs that are either not part of the same business group or do not belong to any business groups. The coefficient estimate on $MFCAP^{*}$ here is both economically small and statistically insignificant, suggesting that measure of common ownership does not seem to be associated with return comovement among firm pairs that are not affiliated with the same business groups. As described before, this is likely due to the fact that common ownership in Iran's public firms is mostly driven by business groups, hence *Same Group* indicator largely acts as a proxy for common ownership. Using the full sample in Column 3, we estimate our regression model by including both $MFCAP^{*}$ and *Same Group* as well as their interaction term. We find that being part of the same business group significantly increases stock return comovement between two stocks. Moreover, for firms affiliated with the same business group, higher common ownership is associated with higher return comovement. The coefficient estimate on $MFCAP^{*}$ is statistically insignificant, which is consistent with our findings in

Column 2. Including business group fixed effects in Column 4 allows us to focus on expoliting within-business group variations in return comovements. The positive estimated coeffcient on the interaction term suggests, within each business group, firm pairs with higher common ownership observe higher return comovements.

We should talk more about the effect of BG fixed effect on our results

Table 5: Connected Comovement

This table reports Fama and MacBeth (1973) estimates of monthly cross-sectional regressions forecasting the correlation of daily Fama et al. (1993)–Carhart (1997) plus industry residuals in month t + 1 for the sample of stocks defined in Table 1. The independent variables are updated monthly include our measure of institutional connectedness, the number of equal percents held block-holder, $MFCA^{*}_{ij,t}$, and a series of controls at time t. We measure the negative of the absolute value of the difference in size and book-to-market ratio (BE/ME) percentile ranking across the two stocks in the pair (SameSize, and SameBM, respectively). All independent variables, excluding dummy variables, are then rank-transformed and normalized to have a 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. We report the associated t-statistics in parentheses. We report estimates of regressions using variables to investigate the effect of common ownership and business group in Panel A. Panel B shows the estimation result for investigating the effect of common ownership in the business groups.

(A) The main analysis

	Dependent Variable: Future Pairs's Comovement						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MFCAP*	0.00600***	0.00328***			0.00104	0.000929	0.00144**
	(8.10)	(4.87)			(1.68)	(1.53)	(2.86)
SameGroup			0.0358***	0.0254***	0.0242***	0.0219***	0.0190***
			(9.99)	(8.45)	(8.21)	(7.02)	(5.68)
SameIndustry		0.0267***		0.0216***	0.0212***	0.0215***	0.0222***
		(7.39)		(6.81)	(6.72)	(6.80)	(6.83)
SameSize		0.0123**		0.0143***	0.0138***	0.0254***	0.0251***
		(3.24)		(3.85)	(3.71)	(5.56)	(5.19)
SameBM		0.0224***		0.0213***	0.0214***	0.0199***	0.0207***
		(6.41)		(6.09)	(6.16)	(5.77)	(5.61)
CrossOwnership		0.0600***		0.0300*	0.0316*	0.0377**	0.0370**
		(5.50)		(2.36)	(2.48)	(2.93)	(2.83)
Constant	0.0142***	0.0204***	0.0103***	0.0187***	0.0188***	0.0280***	0.0339***
	(12.80)	(8.91)	(9.42)	(7.99)	(8.04)	(9.43)	(8.50)
Size Control	No	No	No	No	No	Yes	Yes
Business Group FE	No	No	No	No	No	No	Yes
Observations	389591	389591	389591	389591	389591	389591	389591

(B) Common Ownership and Business Group

	Dependent Variable: Future Pairs's Comovement			
	(1)	(2)	(3)	(4)
MFCAP*	0.00915***	-0.000114	-0.000161	0.000309
	(6.64)	(-0.18)	(-0.26)	(0.63)
SameGroup			0.0100**	0.00749
			(2.97)	(1.99)
MFCAP* × SameGroup			0.0123***	0.0118***
			(10.04)	(9.69)
Sub-sample	SameGroup	Others	All	All
Business Group FE	No	No	No	Yes
Observations	47076	342515	389591	389591

t statistics in parentheses

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

3.2 High level of common ownership

In line with the previous estimations, figure 3 provides that a higher level of common ownership affects more on the firms' comovement. As shown in panel A table 3, pairs in the same business group have a higher level of common ownership than others. So, the previous results could be driven by a high level of common ownership. For detailed analysis, we define a dummy variable for the higher level of common ownership, which we define as the pairs with $\text{MFCAP}_{ij,t}$ in the fourth quarter in each period. Figure 4 shows the relation between future comovement and current measurement of common ownership for that pairs. As shown in the right panel, in line with the last explanation, common ownership only affects the pairs in the same group, and common ownership without the same group will not affect pairs' comovement, although for a high level of common ownership.

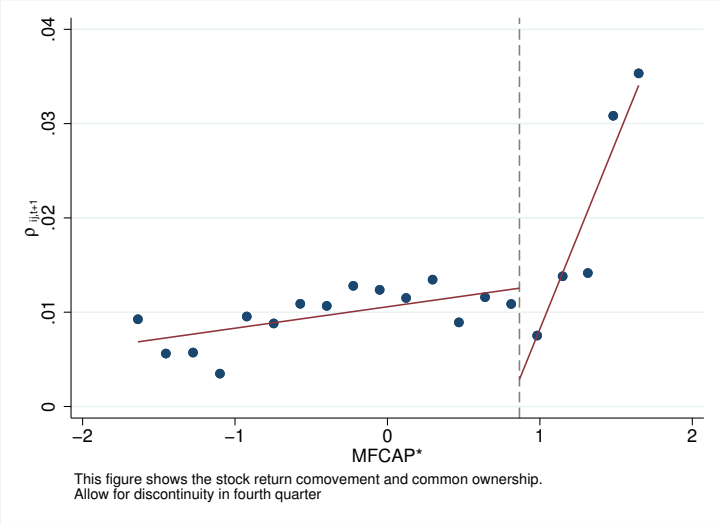


Figure 3: Comovement for different level of common ownership

We estimate the equation 3 with the same methodology in section 3.1 for the sub-sample of a high level of common ownership. Panel A of table 6 reports estimations results. As expected, firms in the same business group have a high statistical and economically significant effect on forecasting future comovements. Columns three to seven confirm our prior explanations for the importance of business groups compared to common ownership in pairs with a higher level of common ownership. Pairs in the fourth quarter may have different characteristics that affect our results. In table 4, we summarized our control variables which shows that pairs' attributes do not look significantly different than other pairs except the presence of the pairs in the same group, which we want to examine this feature.

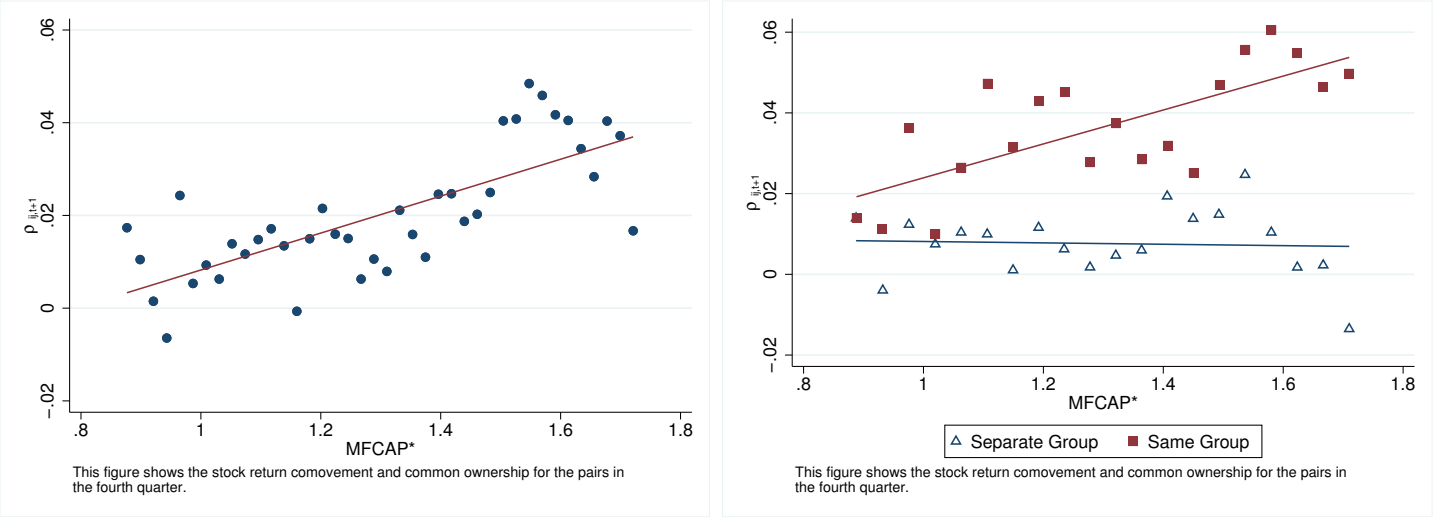


Figure 4: Comovement for different level of common ownership for pairs in the fourth quarter

3.3 All Pairs

Until now

We restrict our investigations to firms with at least one common owner in the former analyses. By this analysis, we cannot separate the effect of the business group and common ownership; both of them can affect comovement. Furthermore, this restriction limits our result to commonly held firms, but if belonging to the same business group can increase stocks' comovement, it would affect all the firms in the same business groups. So, we extend our investigations by constructing all the pairs in the market to separate the effect of direct common ownership and business group and solve the mentioned problems.

For this purpose, we include stocks in one pair if they have at least two months in common. By this definition, we do not restrict our investigation to commonly held stocks and set $\text{MFCA}_{ij,t}$ to zero for a pair without any common owner. Controls are defined as before, and we use equation 3 by the same methodology as used in section 3.1.

Panel B table 6 reports results of estimations. These results suggest that pairs in the same group comove more than stocks not in the same group. In addition, pairs with common ownership common do not comove greater than others. In column three, we use variables of common ownership and the same business group together. Results supported our previous explanation of table 5. The *Same Group* is critical for forecasting future comovement, and common ownership matters for the pairs in the same business group.

Table 6: Connected Comovement

Panel A represents the estimates of monthly cross-sectional regressions forecasting the comovement for the high level of common ownership. This means that our estimation is limited to the subsample of stocks defined in Table 1 with common ownership, which is in the fourth quarter of each period. Panel B shows the results for the estimation of that feature for all the pairs in the market, which means that the pairs with stocks that have at least two months in common and set $\text{MFCA}_{ij,t}$ to zero for a pair without any common owner. Other methods and definitions of variables are as the table 5.

(A) High level of Common Ownership

	Dependent Variable: Future Pairs's Comovement						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SameGroup	0.0254***		0.0249***			0.00477	0.00252
	(8.45)		(8.21)			(1.32)	(0.66)
(MFCAP > 75th Percentile)		0.00660***	0.000777	0.0230***	-0.00258*	-0.00157	-0.000513
		(5.48)	(0.73)	(7.09)	(-2.00)	(-1.29)	(-0.46)
(MFCAP > 75th Percentile) × SameGroup						0.0248***	0.0237***
						(7.24)	(7.34)
Sub-sample	All	All	All	SameGroup	Others	All	All
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Business Group FE	No	No	No	No	No	No	Yes
Observations	389591	389591	389591	47076	342515	389591	389591

t statistics in parentheses

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

(B) All the Pairs

	Dependent Variable: Future Pairs' co-movement						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SameGroup	0.0184***		0.0185***			0.0154***	0.0138***
	(8.46)		(9.00)			(6.00)	(5.26)
MFCAP*		0.000404	-0.0000630	0.00191	-0.000289	-0.000832**	-0.000314
		(1.56)	(-0.26)	(1.97)	(-1.19)	(-3.36)	(-1.27)
MFCAP* × SameGroup						0.00281**	0.00261**
						(3.43)	(3.12)
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	4566594	4566594	4566594	94035	4472559	4566594	4566594

t statistics in parentheses

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

4 Evidence for correlated trading

In the previous sections, we have provided evidence consistent with the hypothesis that the presence of firms in the business groups can raise firms' comovement. Although we don't have definitive insight into the specific channel that business groups can promote commonality, our analysis provides a useful overview. We claim that this relationship exists because the business group is an important proxy for the likelihood that trading in these stocks will be correlated. To better understand how the business group can generate comovement in firms' returns, we now refine our basic analysis to consider other proxy measures for business group trading. We employ two proxies for business group trading that are designed to capture different trading motivations: turnover and institutional imbalance. While the first could be due to buying or selling of business groups, the latter reflects buying.

4.1 Turnover

First, we should show that stocks in groups have a similar daily trading behavior. Accordingly, We use the turnover measure as a daily trading measures. For each firm, we run time-series regressions of the firm's daily change in turnover, $\Delta\text{Turnover}_{i,t}$, on changes in market turnover, $\Delta\text{Turnover}_{Market,t}$, changes in the industry and business group portfolio's turnover, $\Delta\text{Turnover}_{Ind,t}$ and $\Delta\text{Turnover}_{Group,t}$ and ,as well as control variables. We compute the daily change of turnover by this definition $\Delta\text{Turnover}_{i,t} = \ln(\frac{\text{Turnover}_{i,t}}{\text{Turnover}_{i,t-1}})$. We estimate the following regression for each stock across trading days in a given year separately, and cross-sectional averages of the estimated coefficients are reported, with t-statistics in parentheses :

What is Turnover?

$$\begin{aligned}\Delta\text{Turnover}_{i,t} = \alpha + \beta_{Market,t}\Delta\text{Turnover}_{Market,t} + \beta_{Ind,t}\Delta\text{Turnover}_{Ind,t} \\ + \beta_{Group,t}\Delta\text{Turnover}_{Group,t} + \delta\text{Controls} + \varepsilon_{i,t}\end{aligned}$$

We control for lead and lag changes in the two portfolios and the firm's measures and size. We estimate that model with Fama and MacBeth (1973) method and adjust its standard errors with Newey and West (1987) for seven periods. As shown in Table 7, firms' change in turnover comes from market reaction and group's change (This result is robust to the different methods of weighting for portfolios). This observation shows that firms in one group trade together each day.

Furthermore, we use our previous methodology to investigate these results. We calculate correlation of ΔTurnover for founded pairs and examine its relation with our variables. Panel A table 8 reports the estimation result, which confirms that pairs in the business groups lead to correlated trade. In addition, we study the

effect of correlation of liquidity change on comovement for founded pairs in panel B table 8. These results suggest that business groups yield to future comovement through correlated trading in that month.

Table 7: ΔTurnover of firm and Business group
This table reports Fama and MacBeth (1973) estimates of daily change in turnover ($\Delta\text{Turnover}_{i,t} = \ln(\frac{\text{Turnover}_{i,t}}{\text{Turnover}_{i,t-1}})$) for all the firms in the market. The independent variables are change in turnover for Market, Insudtry, and Business group for that day. We exclude firm's change from associated groups to prevent spurious correlations. We calculate Newey and West (1987) standard errors (seveb lags) of the Fama and MacBeth (1973) estimates that take into account autocorrelation in the cross-sectional slopes. We report the associated t-statistics in parentheses.

	Dependent Variable: $\Delta\text{Turnover}_i$			
	(1)	(2)	(3)	(4)
$\Delta\text{Turnover}_{\text{Market}}$	0.416***	0.326***	0.252***	0.228***
	(12.25)	(5.35)	(6.41)	(4.24)
$\Delta\text{Turnover}_{\text{Industry-i}}$	0.142***	0.213***	0.0335	0.167**
	(3.79)	(6.29)	(1.34)	(2.87)
$\Delta\text{Turnover}_{\text{Group-i}}$			0.330***	0.218***
			(12.74)	(3.80)
Control	No	Yes	No	Yes
Observations	854662	851772	333789	331263
R^2	0.285	0.543	0.433	0.712

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Simultaneous trade and Comovement
This table reports Fama and MacBeth (1973) estimates of the pairwise correlation in liquidity for the sample of stocks defined in Table 1. Other methods and definitions of variables are as same as in the table 5. We report the associated t-statistics in parentheses. Controls not shown here are reported in the Internet Appendix. We report estimates of regressions using variables to investigate the effect of common ownership and business group in Panel A. Panel B shows the estimation result for investigating the effect of commonality in liquidity and comovement.

(A) Correlation of ΔTurnover and interested variables

	Dependent Variable: Monthly Correlation of Delta turnover						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SameGroup	0.0177***		0.0176***			0.0144***	0.0167***
	(5.56)		(5.24)			(4.39)	(5.26)
MFCAP*		0.00168	0.0000714	0.00110	-0.000141	-0.000201	-0.00108
		(1.99)	(0.09)	(0.57)	(-0.15)	(-0.21)	(-0.92)
MFCAP* × SameGroup						0.00347	0.00395
						(1.42)	(1.63)
Sub-sample	All	All	All	SameGroup	Others	All	All
Business Group FE	No	No	No	No	No	No	Yes
Observations	327447	327447	327447	40605	286842	327447	327447

(B) Correlation of ΔTurnover and Comovement

	Dependent Variable: Future Pairs's Comovement				
	(1)	(2)	(3)	(4)	(5)
$\rho(\Delta\text{Turnover})_{t+1}$	0.0516***	0.0486***	0.0849***	0.0423***	0.0492***
	(10.50)	(10.29)	(14.01)	(9.00)	(10.41)
ρ_t	0.0412***	0.0387***	0.113***	0.0262***	0.0375***
	(11.74)	(11.35)	(16.37)	(7.47)	(11.95)
Control	No	Yes	Yes	Yes	Yes
Sub-sample	Total	Total	SameGroup	Others	Total
Business Group FE	No	No	No	No	Yes
Observations	338895	338895	41955	296940	338895

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Besides, we have to directly show that firms within correlated turnover groups have a higher level of comovement. So, we extract the annual average level of firms and monthly turnover for each month and also a monthly average of industry turnover. We assume that the model's residual (abnormal turnover) belongs to the business groups. We expect firms in the groups to have a lower dispersion in their abnormal turnover than other firms, and firms in the low dispersion groups comove more than others. We calculate firms' abnormal turnover by the mentioned hypothesis. Its summary stats is in panel A table 9. After that, we calculate the standard error of calculated abnormal turnover in each business group. Groups' standard errors description is shown in panel B table 9 and time series in in figure 5. On average, the affiliated firms' standard error is lower than unaffiliated ones. As expected, abnormal turnover in business groups has a lower dispersion than others. For finding the relation between these groups and comovement, we define a dummy variable for groups in the low level of standard error, which is lower than the median of each period. We use this dummy variable to study our connection. Panel A table 11 reports our estimation result and shows that pairs in the business groups of low dispersion have a higher level of comovement than other firms. For analysis, we restrict our investigations to a subsample of *Same Group* and others and estimate our desired variable. Also, we use the interaction of *Same Group* with our dummy variable for the full sample, which confirmed our prior results.

Table 9: Summary statistics

(A) Frims' Monthly Abnormal Turnover

	Firm × Month	mean	std	min	25%	50%	75%	max
Ungrouped	8206	-0.004	0.783	-4.702	-0.471	-0.013	0.466	5.061
Grouped	18022	0.002	0.712	-5.997	-0.416	-0.009	0.424	3.392

(B) Groups' Monthly Abnormal Turnover' standard erros

	Group × Month	mean	std	min	25%	50%	75%	max
Ungrouped	72	0.776	0.113	0.504	0.685	0.781	0.867	1.030
Grouped	2441	0.601	0.313	0.001	0.403	0.567	0.763	3.274

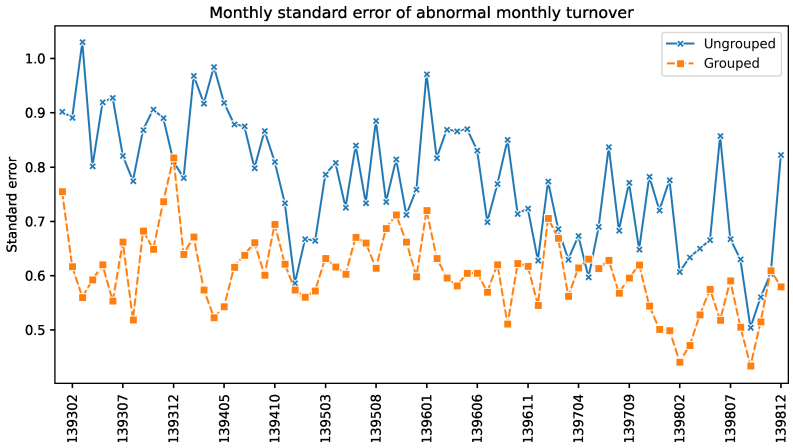


Figure 5: Time series of standard errors in abnormal turnover for groups

4.2 Institutional Imbalance

Although we provide evidence for simultaneous trade in the last section, we should show that stocks in groups that trade together are traded in the same direction. So, for each firm, we calculate daily institutional imbalances, which is the net buying value of institutional investors relative to total traded value on that day ($\text{InsImb} = \frac{\text{Buy}_{\text{value}} - \text{Sell}_{\text{value}}}{\text{Buy}_{\text{value}} + \text{Sell}_{\text{value}}}$ [Seasholes and Wu (2007)]). We expect that institutional imbalances have a lower variation in groups due to the correlated tradings that the ultimate owner ordered to do. So, we calculate monthly institutional imbalances for firms at the first step. As we expected, firms in the business groups have a lower level of standard error in imbalances (Panel B table10). Then, we calculate the monthly standard deviation of the group's imbalances and compare them to unaffiliated ones. The standard error is 12.2% and significantly (with a t-stats of 4.2) lower than ungrouped firms.

According to the main hypothesis, we need to compare pairs in groups with low standard error and other pairs. For this purpose, we define a dummy for groups whose average standard errors are lower than half of the sample;**LowImbalancestd**. So, this dummy is equal to one if at least one pair's firms belong to the low imbalance std business group. We expect pairs in the same business groups with a low standard imbalance error to move more than others. Panel B table 11 reports estimation results and confirms that pairs in that group comove greater than others.

Table 10: Summary statistics

(A) Panel A: Frims' Monthly Imbalances

	Group × Month	mean	std	min	25%	50%	75%	max
Ungrouped	20896	0.004	0.626	-1.0	-0.478	0.013	0.462	1.0
Grouped	12177	-0.043	0.574	-1.0	-0.453	-0.011	0.330	1.0

(B) Panel B: Groups' Monthly Imbalances' standard erros

	Group × Month	mean	std	min	25%	50%	75%	max
Ungrouped	72	0.619	0.054	0.481	0.594	0.627	0.655	0.734
Grouped	2062	0.497	0.247	0.000	0.334	0.495	0.636	1.414

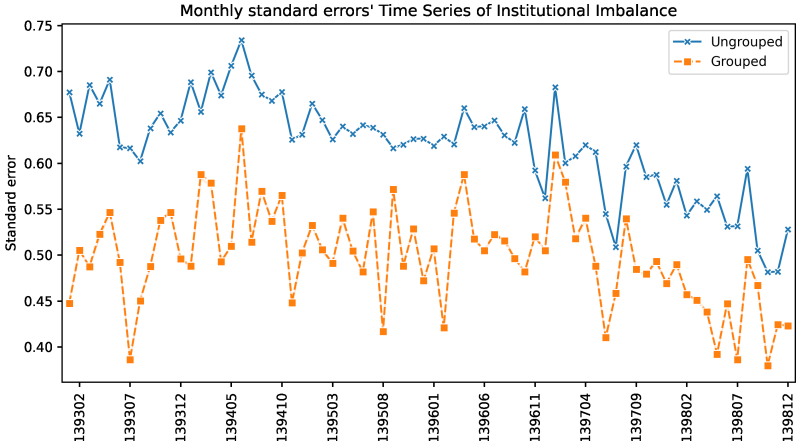


Figure 6: Time series of standard errors in imbalance for groups

Table 11: Turnover and Imbalance and Comovement

This table reports Fama and MacBeth (1973) estimates of monthly cross-sectional regressions forecasting the comovement for the sample of stocks defined in Table 1. Other methods and definitions of variables are as in the table 5. We also define two dummy variables for the firm's presence in the particular group. LowTurnoverStd is a dummy variable for groups in which the standard error of ΔTurnover ($\Delta\text{Turnover}_{i,t} = \ln(\frac{\text{Turnover}_{i,t}}{\text{Turnover}_{i,t-1}})$) is lower than the median of each period and LowImbalanceStd for a group with low dispersion in institutional imbalances ($\text{InsImb} = \frac{\text{Buy}_{\text{value}} - \text{Sell}_{\text{value}}}{\text{Buy}_{\text{value}} + \text{Sell}_{\text{value}}}$). Controls not shown here are reported in the Internet Appendix. We report estimates of regressions using variables to investigate the effect of Turnover and Imbalance in Panel A and Panel B.

(A) Low Abnormal Turnover std groups and Comovement

	Dependent Variable: Future Pairs's Comovement					
	(1)	(2)	(3)	(4)	(5)	(6)
SameGroup	0.0229***	0.0241***			0.0141***	0.0114**
	(7.20)	(8.00)			(3.60)	(2.93)
LowTurnoverStd		0.00233**	0.0296***	-0.000636	-0.000473	0.00284
		(2.65)	(5.72)	(-0.60)	(-0.45)	(1.88)
LowTurnoverStd × SameGroup					0.0279***	0.0260***
					(4.78)	(4.77)
Sub-sample	Total	Total	SameGroup	Others	Total	Total
Business Group FE	No	No	No	No	No	Yes
Observations	389591	389591	47076	342515	389591	389591

(B) Low Imbalance std groups and Comovement

	Dependent Variable: Future Pairs's Comovement					
	(1)	(2)	(3)	(4)	(5)	(6)
SameGroup	0.0229***	0.0228***			0.00974**	0.00969*
	(7.20)	(7.14)			(2.70)	(2.53)
LowImbalanceStd		-0.00163	0.0263***	-0.00683***	-0.00577***	-0.00114
		(-1.51)	(4.72)	(-6.17)	(-5.26)	(-0.64)
LowImbalanceStd × SameGroup					0.0330***	0.0290***
					(5.91)	(5.15)
Sub-sample	Total	Total	SameGroup	Others	Total	Total
Business Group FE	No	No	No	No	No	Yes
Observations	389591	389591	47076	342515	389591	389591

t statistics in parentheses

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

5 Conclusion

A unique feature of the Iranian stock ownership data is that it is published with daily frequency by the central authority in charge of trading clearing house. This allows us to revisit an important question on the impact of common ownership on stock return comovements. Two firms are defined as commonly owned if they share a direct common owner. Even short of direct common ownership, however, firms can be part of the same business groups, defined as a group of listed firms with interconnected ownership structures controlled by an ultimate owner. Given the prevalent presence of business groups in Iran's public sector, we focus on both direct and indirect common ownership. Direct common ownership is proxied by a modified version of the measure introduced in Anton and Polk (2014). We use affiliation with the same busness group as a proxy for indirect common ownership. The average common ownership measure is five times larger for firms in the same business group.

We find that business group affiliation is positively associated with higher stock return comovement. Moreover, among firm pairs that belong to the same business groups, those with higher direct common ownership experience higher levels of return comovement. Additional analyses suggest simultaneous trades in the same direction among firms affiliated with the same business groups explains higher return comovements among those stocks, and that direct common ownership likely facilitate simultaneous trading.

Is there any implications?

References

Aliabadi, E., Heidari, M., and Ebrahimnejad, A. (2021). Internal capital markets in business groups: Evidence from an emerging market.

Almeida, H., Park, S. Y., Subrahmanyam, M. G., and Wolfenzon, D. (2011). The structure and formation of business groups: Evidence from korean chaebols. *Journal of Financial Economics*, 99(2):447–475.

Aminadav, G., Bachrach, Y., Kosenko, K., Rosenschein, J. S., and Wilf, Y. (2011). Rebuilding the great pyramids: A method for identifying control relations in complex ownership structures. *Available at SSRN 1903941*.

Anton, M. and Polk, C. (2014). Connected stocks. *The Journal of Finance*, 69(3):1099–1127.

Azar, J. (2011). A new look at oligopoly: Implicit collusion through portfolio diversification.

Azar, J., Schmalz, M. C., and Tecu, I. (2018). Anticompetitive effects of common ownership. *The Journal of Finance*, 73(4):1513–1565.

Barberis, N. and Shleifer, A. (2003). Style investing. *Journal of financial Economics*, 68(2):161–199.

Barberis, N., Shleifer, A., and Wurgler, J. (2005). Comovement. *Journal of financial economics*, 75(2):283–317.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, 52(1):57–82.

David, J. M. and Simonovska, I. (2016). Correlated beliefs, returns, and stock market volatility. *Journal of International Economics*, 99:S58–S77.

Edmans, A. (2014). Blockholders and corporate governance. *Annu. Rev. Financ. Econ.*, 6(1):23–50.

Edmans, A. and Holderness, C. G. (2017). Blockholders: A survey of theory and evidence. *The handbook of the economics of corporate governance*, 1:541–636.

Edmans, A., Levit, D., and Reilly, D. (2014). Governance and comovement under common ownership. Technical report, National Bureau of Economic Research.

Fama, E. F., French, K. R., Booth, D. G., and Sinquefield, R. (1993). Differences in the risks and returns of nyse and nasd stocks. *Financial Analysts Journal*, 49(1):37–41.

Fama, E. F. and MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy*, 81(3):607–636.

Farajpour, M., Fatemi, F., and Ebrahimnejad, A. (2019). Firm interlock and stock price synchronicity: Evidence from the tehran stock exchange. *Financial Research Journal*, 21(1):35–58.

Freeman, K. (2019). The effects of common ownership on customer-supplier relationships. *Kelley School of Business Research Paper*, (16-84).

Gilje, E. P., Gormley, T. A., and Levit, D. (2020). Who's paying attention? measuring common ownership and its impact on managerial incentives. *Journal of Financial Economics*, 137(1):152–178.

Grullon, G., Underwood, S., and Weston, J. P. (2014). Comovement and investment banking networks. *Journal of Financial Economics*, 113(1):73–89.

Hameed, A. and Xie, J. (2019). Preference for dividends and return comovement. *Journal of Financial Economics*, 132(1):103–125.

Hansen, R. G. and Lott Jr, J. R. (1996). Externalities and corporate objectives in a world with diversified shareholder/consumers. *Journal of Financial and Quantitative Analysis*, pages 43–68.

Harford, J., Jenter, D., and Li, K. (2011). Institutional cross-holdings and their effect on acquisition decisions. *Journal of Financial Economics*, 99(1):27–39.

He, J. and Huang, J. (2017). Product market competition in a world of cross-ownership: Evidence from institutional blockholdings. *The Review of Financial Studies*, 30(8):2674–2718.

He, J., Huang, J., and Zhao, S. (2019). Internalizing governance externalities: The role of institutional cross-ownership. *Journal of Financial Economics*, 134(2):400–418.

Holderness, C. G. (2003). A survey of blockholders and corporate control. *Economic policy review*, 9(1).

Khanna, T. and Yafeh, Y. (2007). Business groups in emerging markets: Paragons or parasites? *Journal of Economic literature*, 45(2):331–372.

King, B. F. (1966). Market and industry factors in stock price behavior. *the Journal of Business*, 39(1):139–190.

Koch, A., Ruenzi, S., and Starks, L. (2016). Commonality in Liquidity: A Demand-Side Explanation. *The Review of Financial Studies*, 29(8):1943–1974.

Lewellen, K. and Lowry, M. (2021). Does common ownership really increase firm coordination? *Journal of Financial Economics*.

Meyers, S. L. (1973). A re-examination of market and industry factors in stock price behavior. *The Journal of Finance*, 28(3):695–705.

Newey, W. K. and West, K. D. (1987). Hypothesis testing with efficient method of moments estimation. *International Economic Review*, pages 777–787.

Newham, M., Seldeslachts, J., and Banal-Estanol, A. (2018). Common ownership and market entry: Evidence from pharmaceutical industry.

Pantzalis, C. and Wang, B. (2017). Shareholder coordination, information diffusion and stock returns. *Financial Review*, 52(4):563–595.

Seasholes, M. S. and Wu, G. (2007). Predictable behavior, profits, and attention. *Journal of Empirical Finance*, 14(5):590–610.

Shapley, L. S. and Shubik, M. (1954). A method for evaluating the distribution of power in a committee system. *American political science review*, 48(3):787–792.

Shiller, R. J. (1989). Comovements in stock prices and comovements in dividends. *The Journal of Finance*, 44(3):719–729.

Wu, Q. and Shamsuddin, A. (2014). Investor attention, information diffusion and industry returns. *Pacific-Basin Finance Journal*, 30:30–43.

Appendix A Overview of Business Groups in Tehran Stock Exchange

There is no difference between emerging markets (such as Chile, India, Indonesia, South Korea, Pakistan, and many more) and developed ones (like Italy and Sweden); business groups present everywhere. However, group-affiliated firms are relatively large and economically important in emerging markets. These groups principally consist of legally independent firms grouped by persistent formal (e.g., equity) and informal (e.g., family) links.(Khanna and Yafeh (2007)) There is a complex ownership network in TSE as an emerging market. This complicated ownership creates a vast number of business groups in which an ultimate owner controls them through a multi-layer of ownership. (Farajpour et al. (2019))

The reason for many of these business groups back to the 1979 Iran revolution. After the revolution, due to social sentiment, critical sectors of the economy nationalized, and their ownership transferred to the government or other pseudo-government foundations. Also, some other groups of firms in heavy industries were established and controlled by the Industrial Development and Renovation Organization (IDRO) during the 1960s and 1970s. (IDRO was a state-owned holding company for investing in capital-intensive industries)

The business groups are formed from mentioned ancestors due to two related forces; A multi-phased privatization by the state and the development of the domestic stock market. In the first wave of privatization, more than 300 companies were fully or partially privatized. In the second one, approximately $150 billion ownership of State-Owned Enterprises (SOEs) and assets were transferred. Pension funds, military institutions, cultural and religious foundations, and revolutionary foundations (pseudo-government groups) primary customers in the second wave of privatization. These waves of privatization transferred control of hundreds of SOEs to semi-governmental groups and were the main driver of the formation of business groups in Iran. In addition, the developing stock market from the early 2000s intensifies this effect. The government tried to develop the stock market as a tool for better privatization. (Aliabadi et al. (2021))

In conclusion, the multiple waves of privatization with the development of the stock market changed ownership structure in pre-revolutionary holding companies and post-revolutionary foundations and create large business groups that govern primary industries.

Appendix B Modified Anton's measure

We reformulate mentioned Anton's measure in table 2. This factor measure common ownership as the total value of stock held by the F common-holders of the two stocks, scaled by the total market capitalization of the two stocks

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

where $S_{i,t}^{f}$ is the number of shares held by owner 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 4, this measure neglects different distributions of common owners and represents the percent of joint-held market capitalization from the total market capitalization of the two stocks.

We re-weight this formula to capture the difference between ownership distributions. Our proposed measures are shown in equations 5 and 6, where all variables are as the same as Anton's measure. Both modified measures represent the number of block-holders with equal-percent ownership. In other words, if for a pair of stocks with n mutual owners, all owners have even shares of each firm's market cap, the proposed indices equals to the number of holders.[6] There are some numeric examples for a better comparison.

$$\text{Overlap}_{Sqrt}(i,j) = [\frac{\sum_{f=1}^{F}(\sqrt{S_{i,t}^{f}P_{i,t}} + \sqrt{S_{j,t}^{f}P_{j,t}})}{\sqrt{S_{i,t}Pi,t} + \sqrt{S_{j,t}Pj,t}}]^2 \tag{5}$$

$$\text{Overlap}_{Quadratic}(i,j) = [\frac{\sum_{f=1}^{F}[(S_{i,t}^{f}P_{i,t})^2 + (S_{j,t}^{f}P_{j,t})^2]}{(S_{i,t}Pi,t)^2 + (S_{j,t}Pj,t)^2}]^{-1} \tag{6}$$

For the first example, two firms (X and Y) have one common owner who has α and β from each market capitalization, respectively (illustrated in figure 7).

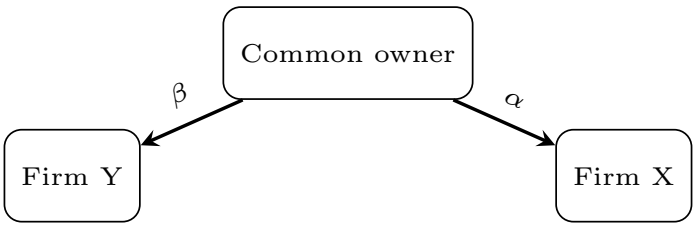
[6] Each holder owns $1/n$ of each firm ,firm's market cap is α_1 and α_2, so for each holder of firms we have $S_{i,t}^{f}P_{i,t} = \alpha_i/n$

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

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

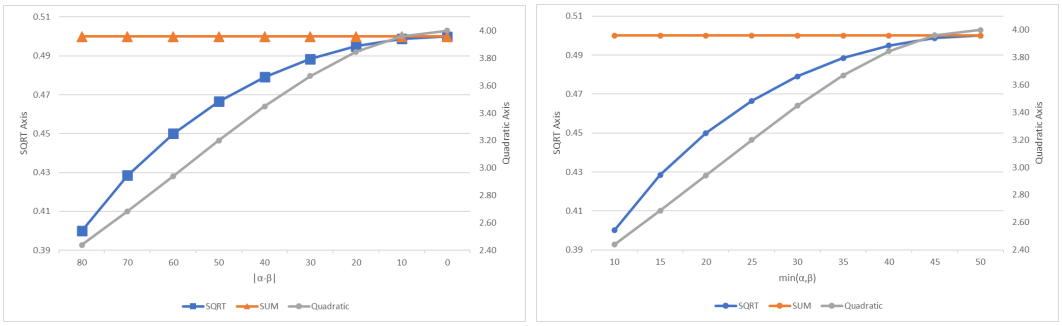
For better illustration, assume that the sum of holders' ownership equals to 100 percent ($\alpha + \beta = 100$), and two firms' market caps have equal amounts. We

Figure 7: Numeric example 1



calculate common ownership measures based on equations 4 (Sum), 5 (SQRT), and 6 (Quadratic) for different ownership distributions. Figure 8 reports calculations results. As we expected, Anton's measure is constant at a fixed level of aggregated 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).

Figure 8: Comparison of three measures for common ownership



For the second example, assume that there are three common owners for the two mentioned firms. First holder's ownership from firm X and Y are respectively α_1 and β_1. It is similar for other holders (illustrated in figure 9). As before, the firm's market cap is equal. We calculate measures for concentrated or disparate ownerships, and ownerships that are less than the sum of the market caps. Table 12 reports calculation results. For ownerships that consist of total market cap, results are consistent with the first example. Although, when total ownership decreases, the Quadratic measure denotes unrealistic numbers. We conclude that our Quadratic measure is not suitable for lower levels of common ownership.

A fundamental assumption in previous examples, is the equality of firms' market cap. In the last example, we relax this assumption. Table 13 reports calculated

Figure 9: Numeric example 2

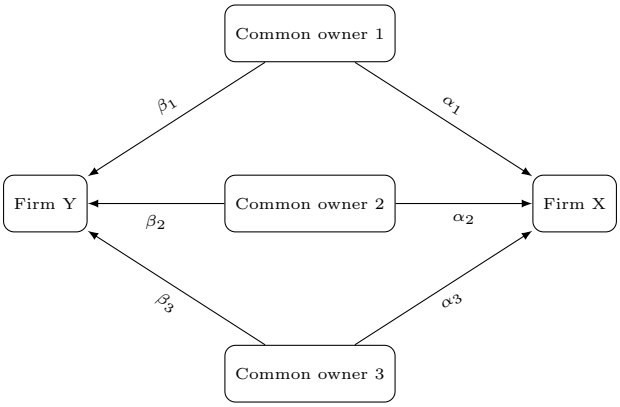
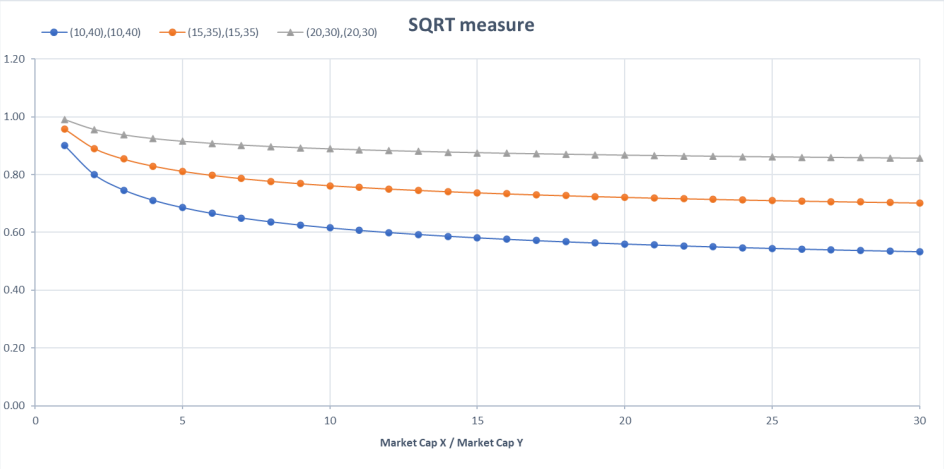


Table 12: text

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	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

measures for fixed total ownership on different relative market cap ratios. We extend our analysis to higher market cap ratios and report our results in figures 10 and 11. In this setting, the SQRT measure has a better variation compared to Anton's measure.

Figure 10: SQRT measure for fixed aggregate ownership on different relative market cap ratios



In conclusion, We use the SQRT measure for our main study. This measure has an acceptable variation within different distributions and relative market caps. Also, it has a fair value at a lower level of total common ownership. As it is presented in the table 14, the obtained results are robust to different measurements of common ownership.

Figure 11: Sum measure for fixed aggregate ownership on different relative market cap ratios

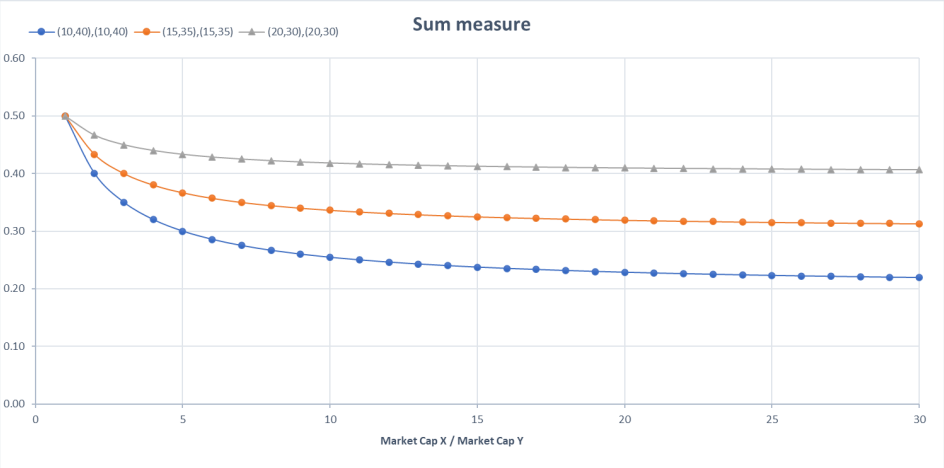


Table 13: text

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

Table 14: Connected Co-movement

	Dependent Variable: Future Monthly Correlation of 4F+Industry Residuals							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Common Ownership Measure	0.00370***	0.00325***	0.00155*	0.00109	0.000333	-0.000105	0.000550	0.000283
	(5.58)	(4.97)	(2.61)	(1.84)	(0.54)	(-0.17)	(1.07)	(0.58)
SameGroup			0.0229***	0.0234***	0.0100**	0.0103**	0.00626	0.00668
			(7.89)	(7.93)	(3.26)	(3.17)	(1.79)	(1.79)
Common Ownership Measure × SameGroup					0.0134***	0.0135***	0.0127***	0.0126***
					(9.47)	(10.65)	(9.23)	(9.71)
Observations	398818	398818	398818	398818	398818	398818	398818	398818
Group FE	No	No	No	No	No	No	Yes	Yes
Measurement	Sum	Sum	Sum	Sum	Sum	SQRT	Sum	SQRT
R^2	0.00433	0.00427	0.00518	0.00515	0.00554	0.00551	0.0182	0.0182

t statistics in parentheses

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