Pacific-Basin Finance Journal 35 (2015) 198–224

Contents lists available at ScienceDirect

Pacific-Basin Finance Journal

journal homepage: www.elsevier.com/locate/pacfin

Stock return commonality within business groups: Fundamentals or sentiment?☆

Min-Su Kim [a], Woojin Kim [b,*], Dong Wook Lee [a]

[a] Korea University Business School, Republic of Korea
[b] Seoul National University Business School, Republic of Korea

ARTICLE INFO

Article history:
Received 27 May 2014
Accepted 8 January 2015
Available online 15 January 2015

JEL classification:
G10
G11
G12

Keywords:
Return commonality
Business group
Corporate governance
Category/habitat trading
Korea

ABSTRACT

We examine stock return comovement within business groups in Korea. Based on all publicly traded stocks from 1980 to 2009, we document that stocks of companies belonging to the same business group co-move with each other more than do stocks in the same industry. The within-group correlation in excess of the within-industry correlation has become more pronounced over time, especially following the 1997–98 Asian crisis. The increase in correlation appears to be driven more by non-fundamental factors such as correlated trading, rather than fundamental factors such as related-party transactions. Our study adds to the literature by showing that non-fundamental stock return correlation – i.e., categorization or habitat-driven stock comovement – exists even at the business-group level.

1. Introduction

It is well established in the literature that stocks comove in many dimensions. For example, returns on stocks in the same industry exhibit a strong commonality as those stocks share economic fundamentals or they are exposed to common industry-level shocks (e.g., Ahn et al., 2009; Hou, 2007). There are also groups of stocks, other than those within the same industry, that exhibit strong return commonalities, such as small stocks or value stocks (e.g., Fama and French, 1993). For those stocks, it is not so obvious that their

☆ We are grateful to Randall Morck and Reena Aggarwal for comments. Dong Wook Lee recognizes financial support from the Asian Institute of Corporate Governance at Korea University and also acknowledges that the paper has been financial supported by a Korea University grant ("KUBS Faculty Research Grant"). Woojin Kim appreciates support from the Institute of Management Research at Seoul National University. Financial support from the Institute of Finance and Banking of Seoul National University is also gratefully acknowledged.

* Corresponding author at: 1 Gwanak-ro, Gwanak-gu, Seoul, 151-916, Republic of Korea. Tel./fax: +822 880 5831.
E-mail addresses: equili@korea.ac.kr (M.-S. Kim), woojinkim@snu.ac.kr (W. Kim), donglee@korea.ac.kr (D.W. Lee)

http://dx.doi.org/10.1016/j.pacfin.2015.01.001
0927-538X/

fundamental values would necessarily comove. In fact, two broad competing theories explain such commonality in stock returns. Traditional perspective holds that comovement in stock return is generated by comovement in fundamental values. A more recent perspective suggests that non-fundamental factors, such as investor sentiment and market frictions, may drive return comovement. For example, Barberis et al. (2005) argue that investors are prone to 'category' or 'habitat' trading, where they lump certain individual stocks together and trade them as a group or simply trade only those stocks.[1] Such behavior could generate return comovement at each category or habitat level through correlated trading.

In this paper, we examine stock return commonality among member firms within the same business group. In particular, we focus on the extent to which return commonality among the same-group stocks is driven by non-fundamental factors. A large body of literature in international corporate finance documents that firms outside U.S. or U.K. typically have dominant shareholders and belong to a business group which account for a large fraction of a given economy.[2] A business group consists of multiple (public) firms that are typically linked through inter-corporate equity ownership. Thus, a business group is distinct from conglomerates in U.S. where only one firm is publicly traded and most subsidiaries are 100% owned by the parent or the holding company. A business group is also a broader concept than the so-called "chaebol", which commonly refers to a *family-controlled* business group. Researchers have also found that member firms in a business group often transfer resources across each other, sometimes to help out or 'prop up' other member firms and sometimes to expropriate or 'tunnel' from them. Given the dynamics of inter-corporate equity ownership and resource transfers, it is natural to expect public firms within a business group to exhibit at least some level of stock return commonality for fundamental reasons.

However, a business group also constitutes a handy category along which stocks can be lumped together. In other words, investors can easily classify stocks within a business group as a 'category' or 'habitat', since most member firms bear the group's name as a part of their corporate identity which is easily recognizable. For example, when Samsung Life Insurance, the largest insurance company in Korea, went public in 2010, many retail investors jumped in to subscribe without scrutinizing the validity of the offer price, just because the company is a member of the reputable Samsung Group.[3] For these reasons, it is possible that same-group stocks comove by more than their fundamentals would justify.

As such, it is rather surprising that the literature is still largely silent on whether and how stock returns among member firms within a business group might comove. We thus aim at contributing to the literature by directly examining whether and how public member firms within a business group exhibit stock return commonality. Our next contribution is to evaluate which view better explains the observed commonality of stock returns within business groups; the traditional, fundamental-based perspective or the more recent, non-fundamental-based perspective. Since business groups clearly share common fundamental factors, we do expect a significant return commonality among the same-group stocks, even in the absence of non-fundamental factors. Thus, simply documenting a commonality in stock returns within business groups would be insufficient to claim that non-fundamental-based comovement exists. Instead, we explicitly test whether or not the observed correlation is attributable to non-fundamental reasons.

Our analyses are based on a sample of publicly traded firms in Korea, which has plenty of active business groups. In fact, it is actually more difficult to find a truly free-standing firm in Korea, since vast majority of firms belong to some business group. Even widely held privatized firms – formerly owned by the government – typically belong to a business group. Thus, a business group can easily be identified as a 'category' or a 'habitat' from investor's perspective.[4] The boundaries of large business groups are tightly defined for regulatory purposes so that member firms are clearly identified. For example, the Korea Fair Trade Commission (KFTC) designates large business groups every year with a list of firms that are formal members of each

[1] Barberis et al. (2005) make a subtle technical distinction between 'category' and 'habitat', but both trading patterns imply the existence of a group of stocks that are exposed to the same *un*informed demand shocks.

[2] La Porta et al. (1999), and Morck et al. (2005) among many others.

[3] Refer to a report by Ha and Jung (in Korean) at DongA.com, May 5, 2010, (http://news.donga.com/3/all/20100505/28095625/1). The size of the subscription was KRW 20 trillion, roughly USD 20 billion, which is the largest in Korean stock market history to date. Unfortunately, market price never recovered the original offer price ever since February 18, 2011.

[4] In fact, Korean mutual fund industry recently introduced 'Samsung' fund or 'Hyundai Motors' fund that only invests in stocks within the same business group. The first group fund, which only invests in Samsung stocks, was launched in November 2004.

group. These large business groups typically consist of more than one publicly traded firm, which enables us to calculate and measure commonality in stock returns.

The 1997 Asian financial crisis exogenously enhanced the regulatory interests in the country's business groups, as their poor governance and intra-group ties among member firms are blamed to be an important cause of the crisis. On the one hand, regulatory effort to enhance the autonomy of each member firm could mitigate the fundamental links between them. On the other, more regulatory pressure to become less diversified and more concentrated or focused at the group level may lead to an increase in fundamental correlation.[5] At the same time, the crisis helped raise the public awareness of implications of business groups. Such enhanced public awareness could have strengthened categorization of the same-group stocks and thus increased their comovement. In short, while the direction of changes in fundamental links during the post-crisis period is rather unclear, the likelihood of non-fundamental categorization seems to have increased.

For the period from 1980 to 2009, we first find that stocks belonging to the same business group exhibit strong return correlation and that within-group correlation is on average stronger than within-industry correlation, regardless of how narrowly we define an industry. Having established the existence of the stronger-than-industry within-group correlation on average, we examine the time series patterns of the correlation structure. We find that the difference between the group and the industry correlations flips signs from negative (i.e., group correlation being smaller than industry correlation) to positive (i.e., group correlation being larger than industry correlation) around the 1997–98 Asian financial crisis.

We formally test for the statistical significance of the increase in group-stock correlation by explicitly controlling for possible changes in the market- and industry-wide correlations, and find strong empirical support. We also ensure the robustness of our results by examining the events in which a stock is newly added to, or deleted from, a business group. The addition (deletion) events are associated with an increase (decrease) in correlation with the incumbent stocks in the group. More importantly, these addition/deletion effects are much more pronounced during the post-crisis period.

To correctly identify the driver(s) of the post-crisis increase in group-stock correlation, we examine fundamental correlations and their changes. We find that correlations in both return-on-assets (ROA) and cash flows among firms within the same business group have actually *declined* following the crisis. We also find that related-party transactions (RPT) within business groups *decreased* (albeit slightly) after the crisis. Such reduced fundamental correlation is consistent with the notion that corporate governance and independence of each member firm has improved following the crisis. However, this pattern also implies that changes in fundamental correlations cannot explain the increases in stock return correlation. One might claim that the improved governance after the crisis has made fundamental links more transparent and readily observable, thereby contributing to the increase in stock return correlation. We evaluate this possibility using RPT, which may have become more informative, but find that the effect of RPT on stock return correlation has not materially changed after the crisis.

Given that the fundamental correlation cannot explain the observed stock return correlation pattern, we next consider non-fundamental-based explanations. One possibility is that increased attention on business groups following the crisis facilitated diffusion of information among the same-group companies. In other words, whatever news or information that is common to the same-group stocks is incorporated into their prices at a faster – and thus more similar – speed after the crisis. To gauge the validity of this market friction-based hypothesis, we change the data frequency of our analysis from daily to weekly or biweekly, since the speed of information diffusion is made irrelevant at low-frequency data. We still find that stock return correlation within business group has increased over time, especially after the financial crisis, against the same-industry correlation as a benchmark. In fact, the daily, weekly, and biweekly results are virtually identical. As an augmenting piece of evidence, we also find that the cross-autocorrelation of stock returns within business group did not change following the crisis. These results suggest that information diffusion within business groups has become neither faster nor slower after the crisis.

The other non-fundamental-based explanation is the category/habitat hypothesis. It holds that, due to the enhanced public awareness of business groups, investors show greater tendency to categorize same-group stocks after the crisis and/or investors also focus their attention exclusively on those same-group stocks. To

[5] We would like to thank an anonymous reviewer for pointing this out.

evaluate this hypothesis, we consider the quality of information environment of business groups, on the grounds that categorization is more likely when there is less firm-specific information available. We use the formal designation by the KFTC as a proxy for a better information environment, since the designation subjects the business groups to more stringent regulations including greater disclosure requirements. We find that the increase in group correlation following the crisis is significant only in the relatively smaller, non-KFTC business groups. In the larger, KFTC-designated business groups, the increase in group-correlation over time is statistically insignificant.

The ultimate empirical implication of the category/habitat hypothesis is correlated trading among stocks within the category/habitat and its effects on stock return correlation. More specifically, category trading implies that same-group stocks are purchased or sold at the same time and that such correlated trading leads to a higher correlation in their stock returns. Furthermore, if an investor inhabits a business group and categorizes its member stocks as one entity, then he may even engage in convergence trading between those stocks. Convergence trading, which is considered a form of habitat trading, amounts to reversing different price movements of same-group stocks by selling (short) some of those stocks and purchasing others. Thus, more convergence trading among the same group stocks in the opposite direction could mitigate their return correlation. We find that, during the post-crisis period, the trading-return relationship strengthens in the non-KFTC groups, whereas it weakens in the KFTC groups. This is consistent with non-KFTC groups being subject to category trading while KFTC groups being affected by convergence trading.

To further verify this interpretation, we consider number of stocks within a business group as another potential factor affecting category/habitat trading. The idea is that category trading is more likely when there are only a few stocks, whereas habitat trading involves relatively a larger number of member stocks in a business group. Specifically, we create two-way sorted sub-samples based on number of stocks and KFTC designation; KFTC-designated groups with only 2 publicly traded member stocks, KFTC-designated groups with more than 2 publicly traded member stocks, non-KFTC groups with 2 publicly traded member stocks, and non-KFTC groups with more than 2 publicly traded member stocks. We find that, after the crisis, the magnitude of trading – return relationship increases significantly only in non-KFTC groups with 2 publicly traded member stocks. In contrast, a significant reduction in trading – return relationship is observed only among KFTC groups with at least 3 publicly traded member stocks. For the remaining two sub-samples, trading-return relationship does not change post crisis.

It is important to note that stock return correlations in general have *fallen* after the 1998 Asian financial crisis (e.g., Li et al., 2004). Given this backdrop, the increase in stock return correlation within business groups that we report is striking. It is also surprising that such an increase in correlation is found amid stricter regulations, improved governance and independence of member firms, and more transparent accounting information. As detailed above, our results are consistent with the notion that investors categorize stocks in the same business group as one entity and also focus exclusively on them. Such categorization and habitation may lead same-group stocks to comove more than their fundamentals would justify. Our study thus adds to the literature by showing that non-fundamental stock return correlations exist even in business groups.

The remainder of the paper is organized as follows. Section 2 reviews the relevant studies and explains how our hypotheses fit into this stream of literature. Section 3 describes our data sources and sample construction process. Section 4 provides our main empirical analyses and Section 5 concludes.

2. Literature review

Stocks in a market are related to one another via various links. Some links are fundamental-based, and thus the stocks sharing those links – e.g., stocks in the same industry – tend to (and ought to) co-move. However, there are other inter-stock linkages that are not well justified by economic fundamentals. For example, membership in a broad-based stock market index, such as the Standard and Poor's 500 Index, has little to do with common economic fundamentals. Still, a link may arise among those index constituent stocks if investors engage in "categorization" and treat the stocks in the index similarly. Such categorization is in fact quite plausible especially when investors are faced with resource constraints in processing all available information. Stocks sharing such a non-fundamental link would then comove more than their fundamentals would justify (e.g., Vijh, 1994; Mullainathan, 2002; Barberis et al., 2005; Peng and Xiong, 2006; Anton and Polk, 2013).

A business group can constitute an appealing category along which investors can economize their limited resources for information processing. Being in the same business group clearly creates inter-firm links that are

supported by economic fundamentals. For instance, there are a lot of intra-group transactions with other member firms as they are all effectively controlled by a common controlling shareholder who coordinates group-level policies across member firms. Certainly, such a fundamental link is probably the very motivation for investors to think through the business group category. However, as investors are more aware of the existence of the common boundary – i.e., the membership in a business group – categorization along the business groups might be "over-done." In other words, there is scope for *extra* correlation among the same business-group stocks.

In the context of a business group, there is another scenario for non-fundamental correlation based on speed of information diffusion. (e.g., Hong et al., 2007; Hou, 2007; Cohen and Frazzini, 2008; Menzly and Ozbas, 2010). That is, the increase in return correlation among same-group stocks might be due to *mitigated* market frictions (or equivalently, improved information environments), which would allow market-wide information to get into their prices at more similar rates. As a consequence, same-group stocks may be more highly correlated with each other compared to other stocks during the post crisis period.

Surprisingly, the literature is silent on this issue. More precisely, while prior studies have shown that non-fundamental categorization exists among the same-index stocks (Vijh, 1994; Barberis et al., 2005), same-style mutual funds (Cooper et al., 2005), same-industry stocks (Kruger et al., 2012), and same-country stocks (Froot and Dabora, 1999), no study examines same-business group stocks in the context of trading and/or information category.[6] Given the pervasiveness and persistence of business groups outside U.S., however, an investigation into business groups as a category is well motivated.

Korean stock market makes an instructive setting for our analysis since it has uniquely experienced an exogenous and economically significant shock to both the fundamental and non-fundamental links among same-group stocks. Specifically, following the 1997 Asian crisis, Korea has gone through a large number of both formal and informal regulatory changes in an effort to improve its governance practices and independence of member firms while pressuring business groups to be more focused than diversified.[7] The former efforts, which were more formal, could have weakened the fundamental links leading to a decrease in the same-group stock comovement (e.g., Morck et al., 2000; Jin and Myers, 2006), while the latter initiative, which was less formal, many have strengthened them. During this period, Korea has also experienced a surge of activist investors.[8]

At the same time, such a nation-wide campaign for better governance enhanced the public awareness of those business groups. For example, the emphasis on business group-related corporate governance after the crisis inadvertently forces a given business group consisting of multiple publicly traded companies to be treated as a single entity. The regulatory authorities in Korea even required large business groups to prepare a 'combined' financial statement where a single financial statement would represent all income generated by a business group after effectively netting out all intra-group transactions.[9] Thus, the scope of categorization – for trading and/or information diffusion – might have increased, thereby strengthening the same-group stock comovement.[10] This setting allows us to test whether fundamental or non-fundamental factors better explain the observed correlations among the same-group stocks following the 1997–98 Asian financial crisis.

[6] Chiu and Joh (2003) show that the stocks in the same business group comove, based on a smaller sample. However, they do not examine the implications of fundamental vs. non-fundamental perspectives.

[7] For example, Korea Fair Trade Commission (KFTC) designates large business groups based on group-level total gross domestic assets every year and impose various regulations on all member firms, including a ban on cross-shareholdings and loan guarantees among member firms, and restriction on voting rights of financial member firms' holdings in other member firms. Up until 2001, regulations were imposed on the top-30 largest business groups based on gross total assets. From 2002 to 2008, the cutoff was KRW 2 trillion. The current cutoff is KRW 5 trillion, roughly equivalent to US$ 5 billion.

[8] Kim et al. (2009), and Lee and Park (2009) provide empirical evidence in support of investor activism in Korea during the post-crisis period.

[9] Such regulatory initiative gained popularity because conventional 'consolidated' financial statements (which require more than 80% ownership of a subsidiary) failed to capture all business activities of a business group (which are typically linked through less than 50% ownership chains). For example, there could be 'multiple' consolidated financial statements for a given business group, where the points of consolidation occur at multiple focal firms.

[10] Li et al. (2004) find that, after the crisis, firm-specific stock price movements have increased in countries that experienced the crisis, including Korea. We confirm their finding, as we find that the return dispersion – an inverse measure of stock comovement within a market – increases sharply following the crisis (results not tabulated but available upon request). In our analysis, we examine stock comovement within business groups controlling for market- and industry-wide comovement, while Li et al. (2004) do not.

3. Sample and data

Our sample includes all stocks that have been listed on Korea Stock Exchange or KOSDAQ for the period from January 1980 to December 2009. (Stock price information in electronic format is only available from 1980, and KOSDAQ data are available only since 2000.) We make sure to keep all delisted stocks in the sample while it is still listed on one of the two exchanges. Similarly, all business group member firms, even if they disappear during the sample period for one reason or another, are also included in our sample. We obtain their daily stock return data from Korea Capital Market Institute and their daily trading volume data from Fn-Guide. Since our dataset includes information on not just current business groups but also all business groups that have previously existed since 1980, it is unlikely that our results would be affected by any survivorship bias either at the group level or the firm level.

To identify the affiliation of each of our sample firms with a business group, we take a sequential approach utilizing information provided by the Korea Fair Trade Commission (KFTC), the Korea Listed Companies Association (KLCA), the company web sites, and newspapers. Specifically, we first obtain information on annual designation of "large business groups" from the KFTC, which contains the most authoritative and comprehensive membership information on business groups. Unfortunately, it covers only 'large' business groups and is only available since 2000. We then augment it with the business group affiliation information in the database maintained by the KLCA (TS2000) which provides a broader coverage of business groups, including those smaller groups not regulated by the KFTC.

To obtain pre-2000 group affiliation, we extensively search the company web sites and newspapers for each of the companies in the KFTC/KLCA merged dataset and locate any information about its changes in group affiliation since 1980 up to 2000. We also search for each of the business groups in the KFTC/KLCA merged dataset, to correctly identify their member firms over time. Based on this membership information, we define a business group as a group of at least two publicly traded member firms.

Industry classification is obtained from the KLCA. The information about related-party transactions within business groups is from KIS-Value, database maintained by NICE Information Service, a local data vendor. To obtain pair-wise RPT data which is available from 1986, we resort to TS2000 provided by the KLCA and augment it with data from Fn-Guide.

Table 1, Panel A, reports the resulting sample and its composition. Our sample consists of 2,240 companies, 626 of which belong to one of 159 business groups between 1980 and 2009. The sample stocks are distributed across 62 four-digit SIC (129 six-digit SIC) industries. In a given year, there are 886 stocks on average, and 239 of them belong to a business group. Thus, approximately a quarter of the sample firms belong to a business group.[11] Panel B reports the distribution of the number of publicly traded firms that a typical business group consists of. Roughly half of our business groups consist of only two publicly traded firms while the remaining half consists of more than two publicly traded firms. Some large business groups, 16.6% of all our sample business groups to be exact, consist of at least 5 publicly traded firms.

4. Analysis

4.1. Correlation among the same-group stocks

In this section, we document a significant return correlation among stocks in the same business group, particularly during the period after the 1997–98 Asian financial crisis. We do this in stages. First, we report the distribution of return correlation among the same-group stocks over the full sample period. Second, we show the time-series pattern of the correlation. Third, we conduct a formal statistical test for the post-crisis change in the group-stock correlation. Fourth, we utilize the addition/deletion events and examine whether their effects on the group-stock correlation has increased following the crisis.

4.1.1. Same-group correlation: full sample period analysis

We first calculate pair-wise correlation coefficients among member firms within a business group and compare them with some benchmark such as corresponding numbers among firms within an

[11] The remaining 72% (1,614) reflect those firms without any other *publicly-traded* affiliated firm. But this does not necessarily imply that these firms are genuine stand-alones, since vast majority of them may well be affiliated with many other *private* firms.

Table 1
Data description and summary statistics.
This table shows the number of stocks used in our analysis and the distribution of return correlations during our whole sample period (over 1980–2009). Panel A presents the number of stocks used in our analysis and number of business groups and industry classifications (sic3, sic4, and sic6). Panel B presents the fraction of groups which include 2, 3, 4, and 5+ firms for the full sample period and also for sub-periods (before and after Asian crisis). Panels C, D, and E show the distribution of firm-level average pair-wise daily return correlations among stocks in the same business group and stocks in the same industry. For a given firm in a business group, we calculate its daily stock return correlation coefficient with each of the other firms belonging to the same business group throughout the whole sample period, and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms. Panel C is based on raw returns and panel D is based on market-model-adjusted returns. Panel E is based on Fama-French 3 factors plus a sentiment factor-adjusted return. Daily sentiment index is obtained by summing up all dollar amount trading volume and all dollar amount shares outstanding for all publicly traded stocks in Korea for each day in our sample period and then scaling the former by the latter. 'Difference' in Panels C, D and E denotes the average group correlation minus the average industry correlation.

Panel A. Sample stocks

	Total	Per-year average
Number of sample stocks	2,240	886
(Stocks with group membership)	(626)	(239)
(Number of business groups)	(159)	(71)
Number of industries (sic3)	21	15
Number of industries (sic4)	62	41
Number of industries (sic6)	129	77

Panel B. Number of firms in a group

Number of firms	2	3	4	5 and more
Full sample period	0.5387	0.1928	0.1025	0.1660
Before crisis (1980–1997)	0.5593	0.1674	0.0976	0.1757
After crisis (1998–2009)	0.5078	0.2309	0.1099	0.1514

	Mean	std.dev	Min	Q1	Median	Q3	Max	t-stat.
Panel C. Distribution of average pair-wise correlations: raw returns								
Group stocks	0.30	0.13	0.00	0.21	0.29	0.36	0.83	62.78
Industry (sic3)	0.20	0.08	−0.14	0.16	0.19	0.24	0.49	68.43
Industry (sic4)	0.23	0.11	−0.17	0.17	0.21	0.26	0.71	57.05
Industry (sic6)	0.24	0.11	−0.13	0.17	0.22	0.27	0.71	57.70
Difference (group − sic3)	0.10	0.13	−0.33	0.03	0.09	0.14	0.76	20.23
Difference (group − sic4)	0.08	0.14	−0.43	0.00	0.07	0.14	0.75	14.32
Difference (group − sic6)	0.07	0.14	−0.43	−0.01	0.06	0.13	0.75	12.88
Panel D. Distribution of average pair-wise correlations: market model-adjusted returns								
Group stocks	0.16	0.13	−0.13	0.08	0.13	0.20	0.83	33.25
Industry (sic3)	0.08	0.05	−0.13	0.05	0.07	0.10	0.37	41.90
Industry (sic4)	0.11	0.08	−0.17	0.06	0.09	0.13	0.53	35.23
Industry (sic6)	0.12	0.09	−0.12	0.07	0.10	0.14	0.53	36.91
Difference (group − sic3)	0.08	0.13	−0.28	0.00	0.05	0.12	0.79	15.23
Difference (group − sic4)	0.05	0.15	−0.44	−0.02	0.04	0.11	0.79	9.36
Difference (group − sic6)	0.04	0.15	−0.44	−0.03	0.03	0.11	0.78	8.00
Panel E. Distribution of average pair-wise correlations: 3 factors plus sentiment-adjusted returns								
Group stocks	0.11	0.13	−0.25	0.04	0.08	0.14	0.83	24.70
Industry (sic3)	0.03	0.04	−0.07	0.01	0.02	0.03	0.31	19.60
Industry (sic4)	0.06	0.08	−0.07	0.02	0.03	0.06	0.47	19.63
Industry (sic6)	0.07	0.08	−0.07	0.02	0.04	0.08	0.47	21.75
Difference (group − sic3)	0.08	0.13	−0.28	0.01	0.05	0.12	0.82	15.90
Difference (group − sic4)	0.06	0.15	−0.40	−0.01	0.04	0.11	0.81	10.45
Difference (group − sic6)	0.05	0.15	−0.40	−0.02	0.04	0.11	0.81	9.37

industry. Our basic unit of observation in this calculation is *a stock* rather than *a pair* of two stocks. More specifically, for a given firm in a business group, we calculate its daily stock return correlation coefficient with each of the other firms belonging to the same business group throughout the whole

sample period,[12] and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms instead of same-business group firms. Thus, a company with a business-group membership has two average correlation coefficients, one against other firms in the same business group and the other against other firms in the same industry.[13] Since few business groups have two or more firms in a single industry, there is virtually no overlap between the same-business group and the same-industry counterparties. To ensure the robustness of our results, we alternatively use market-adjusted daily stock returns (i.e., the residuals from the year-by-year market model) to calculate the two average correlation coefficients. In addition, we also calculate correlations based on residual returns from a four factor model which incorporates Fama-French three factors and a market-level investor sentiment factor. To construct daily sentiment factor, we first sum up all dollar amount trading volume and all dollar amount shares outstanding for all publicly traded stocks in Korea for each day in our sample period, as in Baker and Stein (2004), and then scale the former by the latter.

As shown in Panel C of Table 1, the group-stock return correlation is higher than the industry-stock return correlation, on average. That is, companies exhibit a higher stock return correlation with other member firms in the same business group than they do with their industry peers. It is remarkable that, across the entire distribution, the group correlation is noticeably higher than the industry correlation. It is also noteworthy that using a finer industry classification does not change this pattern. While the industry correlation increases from 0.20 to 0.24 when we switch from 3-digit SIC to 6-digit SIC codes, it is still below the average group correlation of 0.30. Similar pattern is observed for medians. As a consequence, the difference between the average group correlation and the average industry correlation is positive on average and it is also skewed positively. Panels D and E which are based on residual returns from market model and four-factor model respectively also provide largely similar results as the raw return results in Panel C. As we increase the number of factors, the level of correlation decreases among both same-industry stocks and same-group stocks, but the fact that same-group stock correlation is statistically significantly larger than same-industry stocks still holds.

In unreported results, we change the weighting schemes in calculating sample averages of firm-level average correlations. Specifically, we calculate the group-level, and industry-level averages first, and then use this group-level and industry-level correlations, rather than firm-level correlations, as the basic unit of observation. We find that the results are virtually unaffected despite the changes in weighting schemes. This implies that the observed correlation structure is not necessarily being driven by smaller business groups with only few stocks.[14]

A potential issue with this comparison is the number of stocks in a business group or an industry. As mentioned in the previous section, as many as 626 sample firms are affiliated with one of 159 business groups; thus, a business group has approximately 4 publicly traded firms, on average. In contrast, the number of industries in our sample is 21 based on 3-digit, 62 based on 4-digit, and 129 based on 6-digit SIC codes. Given that we have 2,240 unique sample firms, it thus means that we have on average 17 publicly traded companies in a 6-digit industry, which is still larger than the average number of stocks per business group. We address this issue in the next sub-section.

4.1.2. Same-group correlation: time-series pattern

The time-series of the average correlations helps resolve the concern that differences in numbers of constituent stocks between business groups and industries may drive relatively larger correlation in the former than the latter. As shown in Table 2 and Fig. 1, both group- and industry-correlations, calculated year-by-year, generally move together over time. In stark contrast, the number of stocks in a business group has remained remarkably stable over time, whereas the number of stocks in a 6-digit industry has risen deterministically

[12] The actual interval used to calculate each pair-wise correlation varies since it is constrained by the maximum number of valid common trading days of the two stocks.

[13] As such, we utilize the *population* of all firms in the same business group and similarly the *population* of all firms in the same industry in calculating within-business group and within-industry correlations. For example, if there are three firms A, B, C in the business group, our procedure yields three firm-level (not pair-level) average correlations, each of which is defined as $[\rho(A,B) + \rho(A,C)] / 2$, $[\rho(B,A) + \rho(B,C)] / 2$, $[\rho(C,A) + \rho(C,B)] / 2$.

[14] We also exclude financials and utilities and find that while industry correlation decreases slightly, group correlation mildly increases, which results in a larger difference between the two.

Table 2
Time series of return correlation.
This table presents the mean of firm-level average pair-wise daily return correlations among stocks in the same business group and stocks in the same industry for each year in our sample period. For a given firm in a business group, we calculate its daily stock return correlation coefficient with each of the other firms belonging to the same business group, and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms. The first 8 columns show yearly means and *t*-stats of average pair-wise correlations among the same-group stocks and the same-industry stocks (SIC3, SIC4, SIC6). The last 6 columns report the difference and *t*-stats between average group correlation and average industry correlation. Panel A is based on raw returns and panel B is based on market-model-adjusted returns.

Year	(1) Group		(2) SIC3		(3) SIC4		(4) SIC6		Difference ((1) − (2))		Difference ((1) − (3))		Difference ((1) − (4))	
	Mean	t-Value	Mean	t-Value	Mean	t-Value	Mean	t-Value	Mean	t-Value	Mean	t-Value	Mean	t-Value
Panel A. Raw return														
1980	0.1593	11.40	0.1512	9.37	0.2039	9.74	0.1947	8.83	0.0059	0.38	−0.0446	−2.47	−0.0395	−1.98
1981	0.1682	9.59	0.1859	10.01	0.2294	10.96	0.2202	9.62	−0.0182	−1.06	−0.0612	−3.28	−0.0503	−2.42
1982	0.1921	11.43	0.2048	9.14	0.2596	10.10	0.2466	9.26	−0.0128	−0.71	−0.0675	−3.50	−0.0617	−2.90
1983	0.1354	8.79	0.1491	9.04	0.1878	9.25	0.1873	8.28	−0.0129	−0.88	−0.0524	−3.14	−0.0523	−2.68
1984	0.1143	11.01	0.1200	9.56	0.1569	10.55	0.1746	9.93	−0.0073	−0.57	−0.0426	−3.11	−0.0596	−3.77
1985	0.0962	8.51	0.0966	8.45	0.1278	9.50	0.1412	8.79	0.0011	0.09	−0.0316	−2.20	−0.0437	−2.65
1986	0.2098	17.75	0.2069	16.17	0.2599	18.21	0.2729	16.14	0.0021	0.14	−0.0501	−3.22	−0.0633	−3.68
1987	0.2514	20.41	0.2610	18.42	0.2992	17.88	0.3139	18.23	−0.0095	−0.64	−0.0477	−2.79	−0.0622	−3.57
1988	0.2448	21.58	0.2712	20.58	0.3247	21.97	0.3315	21.25	−0.0253	−1.79	−0.0799	−5.55	−0.0852	−5.50
1989	0.3330	29.74	0.3371	31.01	0.3913	30.04	0.4014	28.81	−0.0040	−0.37	−0.0582	−4.95	−0.0685	−5.50
1990	0.4726	38.41	0.4685	40.07	0.4978	36.82	0.5001	35.14	0.0051	0.58	−0.0252	−2.56	−0.0285	−2.67
1991	0.3363	27.00	0.3255	25.93	0.3597	24.92	0.3653	23.47	0.0110	1.02	−0.0234	−2.03	−0.0301	−2.38
1992	0.3533	29.49	0.2962	33.07	0.3376	27.10	0.3487	25.77	0.0553	4.38	0.0156	1.05	0.0039	0.25
1993	0.3616	33.83	0.3183	41.66	0.3609	33.90	0.3661	31.05	0.0412	3.83	0.0007	0.05	−0.0053	−0.39
1994	0.2194	23.12	0.1468	24.62	0.1801	19.56	0.1900	19.33	0.0707	6.45	0.0393	2.95	0.0293	2.14
1995	0.2872	29.42	0.2551	30.85	0.2835	26.62	0.2942	26.99	0.0304	3.09	0.0037	0.31	−0.0072	−0.61
1996	0.2613	31.46	0.2171	36.19	0.2507	28.30	0.2568	28.25	0.0429	4.78	0.0106	0.95	0.0043	0.37
1997	0.4400	51.82	0.3723	56.48	0.3912	47.63	0.3927	46.99	0.0665	8.21	0.0488	5.28	0.0471	5.04
1998	0.3909	36.99	0.2998	47.90	0.3165	41.80	0.3184	40.91	0.0900	9.02	0.0744	7.00	0.0725	6.55
1999	0.3584	37.98	0.2647	40.21	0.2930	33.90	0.3004	34.41	0.0930	9.26	0.0653	5.68	0.0583	4.92
2000	0.3251	36.22	0.2506	42.17	0.2824	34.35	0.2892	34.41	0.0744	8.89	0.0427	4.38	0.0365	3.74
2001	0.3233	43.18	0.2681	45.54	0.2961	38.43	0.3068	38.16	0.0542	8.40	0.0273	3.62	0.0172	2.28
2002	0.2939	40.76	0.2152	44.35	0.2390	34.74	0.2467	34.45	0.0784	12.22	0.0548	7.29	0.0483	6.32
2003	0.2498	34.83	0.1842	38.74	0.2038	32.13	0.2102	32.42	0.0645	10.80	0.0460	7.12	0.0401	6.08
2004	0.1767	22.64	0.1100	27.16	0.1334	23.80	0.1420	22.68	0.0658	9.57	0.0433	5.73	0.0345	4.40
2005	0.1862	28.28	0.1113	29.75	0.1415	24.89	0.1512	25.26	0.0747	11.57	0.0447	6.33	0.0354	4.98
2006	0.2527	39.82	0.1863	44.56	0.2043	37.62	0.2129	37.46	0.0663	11.21	0.0484	7.55	0.0399	6.20
2007	0.2551	38.17	0.1610	42.42	0.1899	34.59	0.1997	34.10	0.0940	14.63	0.0652	9.33	0.0551	7.80
2008	0.4178	55.86	0.3167	65.00	0.3382	57.46	0.3433	55.25	0.1007	17.45	0.0796	13.00	0.0748	11.89
2009	0.2725	36.73	0.1523	36.41	0.1734	32.78	0.1822	31.78	0.1199	17.08	0.0991	13.62	0.0908	12.17
Whole	0.3038	62.78	0.2045	68.43	0.2287	57.05	0.2380	57.70	0.0981	20.23	0.0750	14.32	0.0676	12.88

Panel B. Adjusted return

1980	0.0553	4.97	0.0749	6.31	0.1196	8.19	0.1158	6.78	−0.0212	−1.33	−0.0643	−3.79	−0.0587	−3.08
1981	0.0866	6.31	0.1136	8.79	0.1520	10.15	0.1448	8.75	−0.0280	−1.65	−0.0654	−3.59	−0.0533	−2.74
1982	0.1026	8.33	0.1334	8.71	0.1841	10.20	0.1732	9.08	−0.0314	−1.97	−0.0816	−4.71	−0.0758	−3.97
1983	0.1006	7.34	0.1152	8.84	0.1482	9.03	0.1513	7.94	−0.0124	−0.93	−0.0475	−3.17	−0.0489	−2.71
1984	0.0579	7.05	0.0783	8.22	0.1124	9.89	0.1341	9.34	−0.0220	−1.87	−0.0545	−4.25	−0.0753	−5.00
1985	0.0596	6.48	0.0668	6.48	0.0937	8.29	0.1095	7.90	−0.0061	−0.50	−0.0341	−2.57	−0.0487	−3.14
1986	0.0586	5.60	0.1034	7.76	0.1520	10.43	0.1755	10.64	−0.0463	−2.77	−0.0934	−5.04	−0.1177	−5.88
1987	0.0893	6.84	0.1373	11.47	0.1882	12.88	0.2015	12.76	−0.0494	−2.79	−0.0988	−4.69	−0.1162	−5.45
1988	0.0621	6.89	0.1383	13.07	0.2072	17.56	0.2184	17.27	−0.0763	−4.84	−0.1451	−8.65	−0.1559	−8.95
1989	0.0934	9.62	0.1474	18.75	0.2281	22.12	0.2417	21.54	−0.0536	−4.47	−0.1348	−9.59	−0.1486	−10.23
1990	0.1014	13.41	0.1434	21.65	0.2055	18.97	0.2117	18.98	−0.0409	−3.56	−0.1042	−6.85	−0.1104	−7.13
1991	0.1013	13.34	0.1404	19.32	0.1983	18.28	0.2069	17.02	−0.0384	−3.44	−0.0970	−6.74	−0.1056	−6.88
1992	0.1680	15.06	0.1314	22.15	0.1945	19.30	0.2095	19.32	0.0348	2.63	−0.0265	−1.55	−0.0412	−2.34
1993	0.1359	12.41	0.1182	20.84	0.1802	19.42	0.1908	18.69	0.0162	1.30	−0.0443	−2.79	−0.0548	−3.34
1994	0.1520	15.86	0.0964	15.82	0.1313	14.72	0.1401	14.63	0.0542	4.97	0.0207	1.51	0.0120	0.85
1995	0.1335	14.32	0.1238	17.31	0.1610	16.07	0.1711	16.50	0.0081	0.76	−0.0275	−2.02	−0.0373	−2.72
1996	0.1145	12.86	0.0874	17.01	0.1273	16.56	0.1338	16.93	0.0258	2.61	−0.0128	−1.01	−0.0190	−1.47
1997	0.1758	17.02	0.1356	19.72	0.1648	20.18	0.1675	20.07	0.0367	3.46	0.0111	0.89	0.0091	0.73
1998	0.2104	17.75	0.1350	20.29	0.1543	20.42	0.1569	19.55	0.0724	6.26	0.0561	4.50	0.0546	4.20
1999	0.2243	20.22	0.1589	24.61	0.1888	22.89	0.1966	23.20	0.0640	5.50	0.0355	2.66	0.0287	2.07
2000	0.2052	23.16	0.1497	27.54	0.1855	23.63	0.1934	24.05	0.0549	6.07	0.0197	1.85	0.0123	1.15
2001	0.1705	25.34	0.1330	27.19	0.1650	25.01	0.1761	24.67	0.0365	5.48	0.0055	0.68	−0.0051	−0.63
2002	0.1365	22.53	0.0853	25.08	0.1117	20.33	0.1193	20.69	0.0506	7.88	0.0248	3.24	0.0174	2.24
2003	0.1107	19.69	0.0660	21.77	0.0865	19.60	0.0932	20.05	0.0442	7.75	0.0242	3.91	0.0177	2.83
2004	0.0871	13.10	0.0460	14.13	0.0677	14.36	0.0759	13.83	0.0406	6.22	0.0194	2.71	0.0111	1.49
2005	0.1133	17.14	0.0535	17.62	0.0844	16.94	0.0942	17.64	0.0595	8.90	0.0289	3.90	0.0195	2.63
2006	0.1271	19.71	0.0760	24.30	0.0956	21.75	0.1034	22.03	0.0511	8.30	0.0315	4.70	0.0239	3.57
2007	0.1294	19.47	0.0573	24.25	0.0845	20.08	0.0932	20.20	0.0719	10.68	0.0449	6.07	0.0362	4.86
2008	0.1752	23.40	0.0881	34.76	0.1105	30.78	0.1179	30.48	0.0868	12.49	0.0647	8.93	0.0584	7.88
2009	0.1613	21.45	0.0536	25.97	0.0749	23.04	0.0834	22.22	0.1074	14.36	0.0864	11.10	0.0785	9.84
Whole	0.1601	33.25	0.0813	41.90	0.1076	35.23	0.1175	36.91	0.0774	15.23	0.0525	9.36	0.0448	8.00

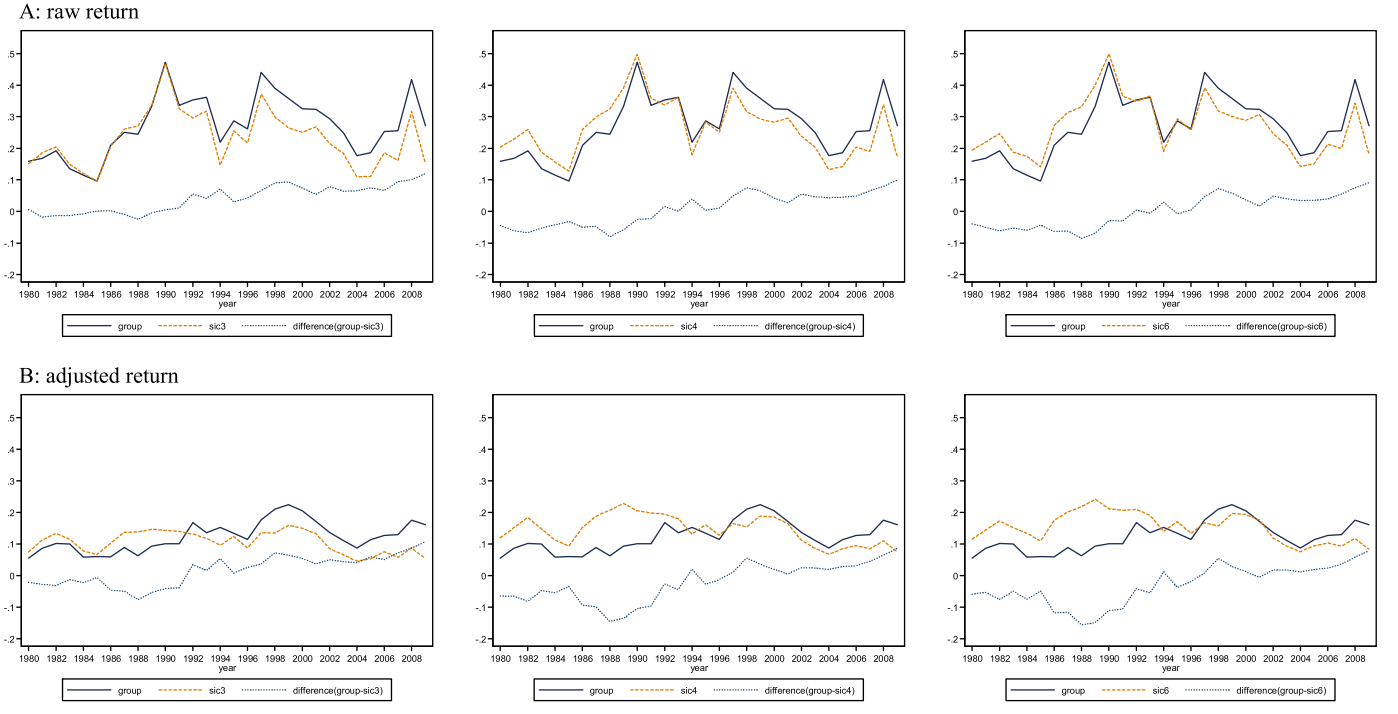

Fig. 1. Time-series pattern of stock return correlations. This figure presents the mean of firm-level average pair-wise daily return correlations among stocks in the same business group and stocks in the same industry for each year in our sample period. For a given firm in a business group, we calculate its daily stock return correlation coefficient with each of the other firms belonging to the same business group, and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms. Panel A is based on raw return correlation while panel B is based on market-model residuals.

Table 3
Factor regressions of business group stock returns.
This table shows cross-sectional averages of time-series regressions of individual stock returns on group, industry, and/or market value weighted returns. We remove stock *i*'s return from the group-level return, the industry return, and market return when we run the firm-level regressions. After 1998 is a dummy variable that equals one for year 1998 and onward. *t*-statistics are reported in brackets. ***,**, and * indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively, based on cross-sectional standard errors of time-series regression coefficients.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Group return	0.4515***	0.4539***						0.1848***
	[48.42]	[47.19]						[19.17]
Industry return			0.6858***	0.7069***			0.4513***	0.3969***
			[69.15]	[67.16]			[30.53]	[27.99]
Market return					0.8423***	0.8470***	0.4353***	0.3090***
					[75.69]	[69.07]	[27.38]	[18.08]
After 1998		0.0003***		0.0002*		0.0001	0.0001	0.0002
		[3.69]		[1.75]		[0.62]	[0.81]	[1.07]
Group return		0.0077						0.0309***
* after1998		[1.42]						[3.47]
Industry return				−0.0361***			−0.0628***	−0.0737***
* after1998				[−3.93]			[−4.44]	[−5.07]
Market return						−0.0020	0.0493***	0.0304**
* after1998						[−0.23]	[3.88]	[2.30]
Intercept	0.0004***	0.0002*	−0.00003	−0.0001	−0.0002	−0.0002*	−0.0003**	−0.0002*
	[3.62]	[1.85]	[−0.28]	[−0.77]	[−1.58]	[−1.91]	[−2.12]	[−1.76]
n(firms)	590	590	589	589	590	590	589	589
Adj. R-sq.	0.1571	0.1595	0.1973	0.1992	0.1814	0.1828	0.2315	0.2673

over time (not reported). Thus, the difference in the number of constituent stocks cannot fully explain their differing correlation coefficients.

We now turn to the main take-away from the time-series patterns, namely, that the *difference* between the group and the industry correlations has increased over time. More precisely, the difference turns positive following the 1997–98 Asian financial crisis. Prior to it, the difference is negative, meaning that the comovement within industry is stronger than the within-group comovement. For example, with the most narrowly defined industry classification (SIC 6), the *t*-statistic for the difference between group- and industry-correlation is positive (and significant) only since 1997 with raw returns and since 1998 with the adjusted returns.[15]

4.1.3. Formal test of correlation change following financial crisis

To better understand the statistical significance of the same-group stock correlation and its changes around the crisis, we employ an alternative approach. Specifically, we regress a business-group stock on a portfolio of other stocks in the same group and examine the resulting beta. We control for the market-wide and industry-wide correlations by including the market and industry portfolios in the regression. We also examine changes in the group-portfolio beta around the crisis by including a dummy variable for the post-crisis period and its interactive term with each of the three portfolios (i.e., group, market, and industry). The coefficient and *t*-statistic of the interactive term between the group portfolio and the post-crisis dummy allow us to test whether there has been any meaningful change in the same-group correlation following the crisis, after controlling for the market-wide and industry-wide correlations before and after the crisis. Below is the regression specification:

$$r_{it} = \alpha + \sum\nolimits_j \beta_{ij} IndexRet_{jt} + \gamma_i \, After1998 + \sum\nolimits_j \delta_{ij} \, IndexRet_{jt} \times After1998 + e_{it} \quad (1)$$

[15] Chiu and Joh (2003) also report that correlation among the same business group firms has increased over time. However, they do not compare it with any benchmark, such as within-industry correlation. Moreover, they do not explicitly explore the potential reason behind such group-level correlation while we provide a direct test between the fundamental perspective and category/habitat trading.

Table 4
Analysis of additions to and deletions from business group membership.
This table presents changes in firm-level average pair-wise correlations when a stock newly enters or leaves a business group. Panel A (B) reports changes in correlations when a firm newly enters (departs from) a business group at year T. In panel A, Δ (Δ2) group_corr denotes differences in correlations between year T (T + 1) and (T − 1). In panel B, Δ (Δ2) group_corr is the differences in correlations between year T − 1 and T (T + 1). Δ and Δ2 group_adjcorr denote changes in correlations based on market model residuals. In Panels C, D and E, we combine IN and OUT events. Panels D and E report the changes in firm-level average pair-wise correlations during the two sub-sample periods, before and after the financial crisis, respectively.

Variable	Obs.	Mean	std.dev	t-Value
Panel A: IN (after − before)				
Δ group_corr	64	0.028	0.137	1.61
Δ2 group_corr	61	0.038	0.147	2.03
Δ group_adjcorr	64	0.005	0.091	0.48
Δ2 group_adjcorr	61	0.011	0.102	0.85
Panel B: OUT (before − after)				
Δ group_corr	28	0.084	0.111	4.00
Δ2 group_corr	27	0.044	0.150	1.53
Δ group_adjcorr	28	0.061	0.103	3.14
Δ2 group_adjcorr	27	0.039	0.115	1.78
Panel C: full sample				
Δ group_corr	92	0.045	0.132	3.26
Δ2 group_corr	88	0.040	0.147	2.55
Δ group_adjcorr	92	0.022	0.098	2.19
Δ2 group_adjcorr	88	0.020	0.106	1.75
Panel D: full sample: before financial crisis				
Δ group_corr	23	0.002	0.136	0.08
Δ2 group_corr	23	0.038	0.167	1.09
Δ group_adjcorr	23	−0.014	0.116	−0.57
Δ2 group_adjcorr	23	0.001	0.134	0.02
Panel E: full sample: after financial crisis				
Δ group_corr	69	0.059	0.128	3.82
Δ2 group_corr	65	0.041	0.141	2.34
Δ group_adjcorr	69	0.034	0.088	3.23
Δ2 group_adjcorr	65	0.027	0.095	2.26

where $IndexRet_{jt}$ is a value-weighted index return at day t. We consider three types of index returns ($j = 1, 2, 3$) simultaneously; group-level return (Group return), the value-weighted industry return (Industry return), and the value-weighted market return (Market return).[16] We first run time-series regressions for each business group stock i in our sample, and then report the cross-sectional averages. Thus, t-statistics are based on cross-sectional standard errors of the estimated coefficients.

Table 3 reports the results. Models (1) through (7) are the build-ups toward the complete model (8).[17] In column (1), where we only include the group portfolio, the beta coefficient amounts up to 0.45 and it is highly significant. Column (2) allows for a change in group beta post-crisis and it shows that the change is positive but insignificant. A similar analysis is conducted for the industry and market portfolios in columns (3) through (6). We find that while the market beta hardly changes after the crisis, the industry beta declines significantly during the post-crisis period. The latter finding is particularly well reconciled with greater idiosyncratic volatility after the financial crisis (e.g., Li et al., 2004). Column (7) presents a specification which includes all variables except for the group index return and its interaction with the post-crisis dummy. Thus, sequential

[16] We remove stock i's return from the group-level return, the industry return, and market return when we run the firm-level time-series regressions.
[17] One firm that is dropped in columns (3), (4), (7) and (8) of Table 3 is KT&G, whose main line of business is monopolized production of tobacco. Since this firm does not have any industry peers, we could not create an industry benchmark return.

inclusions of industry return and then group return are appropriately reflected in columns (7) and (8). There seems to be a non-trivial increase in adjusted R^2's, as we first add the industry return and then the group return.

In column (8) where we include all three portfolios as well as the interaction terms with the post-crisis dummy, we find that the business group beta continues to be positive and significant. More importantly, this group beta increases after the crisis, as the interactive term is positive and significant. The market beta also increased following the crisis. But, the increase in the group beta is larger in relative terms than the market beta increase. More specifically, while the market beta increases about 10% after 1998 (0.3090 + 0.0304), the group beta rises almost twice as much as the market beta increase, from 0.1848 to 0.2157 (=0.1848 + 0.0309). It is also worth noting that the drop in the industry beta is more pronounced in this specification. We can thus infer that the finding in prior studies – namely, an increase in idiosyncratic volatility after the crisis by Li et al. (2004) – is attributable mostly to weaker industry-wide commonality. Controlling for this trend, however, the group-wide commonality in fact increases.

4.1.4. Correlation around addition/deletion

Another way of examining the stock return correlation with other firms in the same business group is to use the stock itself as a benchmark. Specifically, we examine whether becoming a new member of a business group or leaving a business group has any effect on the stock's correlation with other group members. Some existing public companies are newly added to a business group due to acquisitions and some companies lose their group membership through group-level divestitures. We are able to identify as many as 92 addition/deletion events, 69 of which occur during the post-crisis period. We then compare the average return correlation one year before the event (i.e., year $t-1$) with either the event year (i.e., year t), or the year after ($t+1$). We also alternate between raw returns and market-adjusted returns.

Panel A of Table 4 shows that when an existing public company newly obtains membership in a business group, its average stock return correlation with the existing member companies increases. The increase is particularly noticeable and statistically significant when the comparison is made between year $t-1$ and year $t+1$ (the second line in Panel A). Panel B then reports the results for the deletion events. Although there are fewer events, the return correlation changes are more pronounced. Especially when year $t-1$ return correlation is compared with that of the next year (i.e., year t), the change is statistically significant both with raw returns and market-adjusted returns.

Note that, for the deletion event, the correlation difference is computed by deducting the year t (or year $t+1$) average correlation from the average correlation of year $t-1$, so that the decrease in average correlation after deletion is measured as *positive*. This allows us to combine the two types of events in a unified analysis whose results are reported in Panel C. With the resulting larger number of events, all four specifications show a reliable change in average return correlation following a change in membership of a business group.

Finally, in Panels D and E, we separately examine the addition/deletion events that occurred before and after the financial crisis, respectively. The test statistics (unreported) indicate that one-year in-and-out effect is actually statistically significantly stronger during the post-crisis period, which is consistent with the findings in the previous sub-sections.

There could be some potential selection issue in our in-and-out analysis, since entering (or leaving) a business group is not likely to be random. Specifically, those stocks that have closer links with a group may be more likely to become a group member while those stocks that have looser links may be more likely to leave.[18] We conjecture that closer pre-membership fundamental link would be more pronounced for firms in the same industry holding other things equal. Based on this logic, we identify in-and-out firms with the same SIC code as the largest firm in the business group, and compare them with other in-and-out firms whose main line of business is different from that of the business group. In unreported results, we find that change in correlation subsequent to entry into or departure from a business group is largely similar between same-industry firms and different-industry firms. These results suggest that stronger correlation as a member

[18] We would like to thank an anonymous reviewer for pointing this out.

Table 5
Change in correlation of return on assets, cash flow, and related-party transactions.
This table presents the distribution of firm-level average pair-wise correlations in annual fundamental variables and their changes following the 1997-98 Asian financial crisis among firms in the same business group. Panel A reports correlations in ROA while panels B and C reports those in raw cash flows and cash flows scaled by sales, respectively. CorrROA97 (98) denotes the average correlation of ROA among firms in the same business group until 1997 (year 1998 and onward). Change98 is the change in correlation following the crisis. ExcessROA97 (98) denotes the difference between average correlation among the same group firms and average correlation among the same industry (4 digit SIC) firms. Other variables are defined similarly. Panels D and E report averages of firm-level related-party transactions (RPT) scaled by sales and pair-level RPT scaled by average sales of the pair for group firms.

Variable	Mean	Std.dev	t-Value	N
Panel A. ROA				
Panel A-1				
CorrROA97	0.2308	0.4333	7.51	199
CorrROA98	0.1496	0.2421	8.72	199
Change98	−0.0811	0.5081	−2.25	199
Panel A-2				
ExcessROA97	0.0268	0.4511	0.84	199
ExcessROA98	0.0536	0.2778	2.72	199
Change98	0.0267	0.5034	0.75	199
Panel B. Cash flow				
Panel B-1				
CorrCashflow97	0.2745	0.4728	8.15	197
CorrCashflow98	0.1003	0.3367	4.18	197
Change98	−0.1743	0.5674	−4.31	197
Panel B-2				
ExcessCashflow97	0.0294	0.5340	0.77	197
ExcessCashflow98	−0.0485	0.3846	−1.77	197
Change98	−0.0779	0.6002	−1.82	197
Panel C. Cash flow / sales				
Panel C-1				
CorrCashflow97	0.0843	0.4047	2.92	196
CorrCashflow98	0.0590	0.2951	2.80	196
Change98	−0.0253	0.5294	−0.67	196
Panel C-2				
ExcessCashflow97	−0.0076	0.4682	−0.23	196
ExcessCashflow98	−0.0504	0.3913	−1.80	196
Change98	−0.0429	0.5982	−1.00	196

Sub-period	Mean	Std.dev	N
Panel D. Related-party transactions / sales			
By 1997	0.3061	0.2796	1115
1998 and forward	0.3025	0.7425	1389
Total	0.3041	0.5836	2504
Difference = −0.0036 (t-value = −0.1674)			
Panel E. Pair-wise related-party transaction / sales			
By 1997	0.0375	0.1018	1852
1998 and forward	0.0228	0.0626	4557
Total	0.0270	0.0763	6409
Difference = −0.0147 (t-value = −5.8062)			

is not particularly driven by firms in the same industry. As such, we believe that potential selection issues, at least those related with industry closeness, is less likely to affect our results.

In sum, a stock, after becoming a member in a business group, becomes more highly correlated with other stocks in the same business group. Conversely, a stock's return correlation with other group stocks decreases following a stock's departure from a business group. And this pattern is more pronounced after the crisis. In the following sub-sections, we examine whether such correlations, and its increases after the crisis, are driven more by fundamentals or non-fundamentals.

4.2. Fundamental correlation

Thus far, we have reported an *increase* in group correlation (compared to industry correlation) following the 1997 − 98 Asian financial crisis. This increase in stock-return correlation is not well aligned with the general notion that corporate governance and autonomy of each member firm have improved during the post-crisis period which would weaken the fundamental links among the same-group stocks, if any.[19] In this section, we directly examine the correlation in fundamentals among those same-group stocks in order to empirically verify our notion and to better understand the observed stock-return correlation patterns.

Of possible fundamental links among the same-group stocks, we examine the correlations in return on assets (ROA) and cash flows (CF). Since ROA and CF measures are available only at annual frequencies, the analysis is deemed to be crude at best. Still, they should be useful in understanding the extent to which fundamental correlation plays a role in the increased stock return correlation during the post-crisis period. We also augment this analysis with the related party transactions (RPT). Our measure of RPT defined for each firm-year is somewhat noisy as each transaction may involve different value and have different material impact. Nevertheless, RPTs are directly observable cash flows between group member firms, which provide direct information on the extent of fundamental links without any estimation.

Table 5, Panel A-1, shows that ROA is *more highly correlated* among the same-group firms *prior to* the financial crisis than after the crisis. The average correlation in ROA among the same-group firms is 0.23 in the pre-crisis period (up to 1997), whereas the ROA correlation is at a lower level of 0.15 during the post-crisis period (from 1998), on average. The difference between the two correlation coefficients is statistically significant. This result is thus consistent with the general consensus among regulators and practitioners that the autonomy of group member firms has increased in the post-crisis period and the fundamental links among them accordingly weakened. Thus, it is difficult to attribute the increase in stock return correlation subsequent to the financial crisis to a stronger commonality in economic fundamentals among the same-group firms. Panel A-2 reports the distribution of "excess" ROA correlation, which uses the ROA correlation with the same-industry firms as benchmark. With this measure, the fundamental correlation is higher post the crisis but the difference between the pre- and post-crisis period is not significant.

Panels B and C report the cash flow results, with each panel scaling cash flow differently. Similar to the ROA results, we find that cash flow correlation *falls* during the post-crisis period. While the statistical significance varies across the two panels, a stronger fundamental correlation post crisis does not seem to be the case.

Panels D and E report the RPT results. Unlike ROA and cash flow correlations, RPTs are themselves a measure of fundamental correlation and thus the number of observations used in the analysis is greater. Consistent with the notion of better corporate governance, improved autonomy of each member firm, and weaker fundamental links after the financial crisis, RPT has declined. While the decrease is only modest, it is unlikely that changes in RPT can explain the increase in stock-return correlation following the crisis.

In sum, the findings in this sub-section indicate that fundamental correlation does not increase following the crisis. Rather, it declines, thereby confirming our premise that corporate governance as well as independence of each member firm has improved during the post-crisis period. Note that we are not arguing that fundamental links do not affect or negatively affect stock return correlation after the crisis. Our point is that stock return correlation may have increased post crisis despite decreases in at least *some* observable fundamental links.

4.3. Improved disclosure?

Perhaps one can argue that, following the crisis, better corporate governance and the resulting improvement in accounting transparency have made a given fundamental link more readily observable. It is possible that such an improvement in disclosure contributed to the stock-return correlation among the same-group

[19] For example, any new loan guarantees among member firms of large business groups were completely prohibited as of April 1998, and any existing loan guarantees were to be completely eliminated by March 2000. In a similar spirit, related party transactions made by members of large business groups that exceed a certain size threshold had to be approved by the board of directors and subsequently disclosed as of April 2000. In addition to these formal regulations, the government implicitly guided large business groups to dissolve the 'planning and coordination division' at the group level, which was under direct influence of the controlling families and also was often criticized as a main culprit of the crisis.

Table 6
Pair-level analysis of return correlation and RPTs.
This table presents regression results where the dependent variable is the pair-wise stock return correlation of group firms calculated each year. In this analysis, the unit of observation is a *pair* of stocks in a business group rather than a firm. RPTtoSales is pair-wise related party transactions scaled by the average sales of the two firms. Ln(avgmktcap) denotes logarithm of average market capitalization the two firms. Avg(turnover) and avg(stdret) are averages of daily turnover and standard deviation of return of the two firms, respectively. Avg(ROA) and avg(cashflow/sales) are averages of ROA and cash flow to sales of the two firms. Samesic3 is a dummy variable that equals one if the two pair firms are included in the same three-digit SIC. The first three columns include year fixed effects. After1998 is a dummy variable that equals one for year 1998 and onward. Numbers in brackets report *t*-statistics based on standard errors clustered on both business group and year. ***, **, and * indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively.

Variables	(1)	(2)	(3)	(4)
RPTtoSales	0.1721**		0.1533**	0.2593***
	[2.549]		[2.543]	[3.222]
Ln(avgmktcap)		0.0260***	0.0321***	0.0282***
		[3.627]	[4.132]	[3.841]
Avg(turnover)		0.7492	1.0538	−0.9040
		[1.285]	[1.197]	[−1.363]
Avg(stdret)		−0.0719	2.6448	6.3660***
		[−0.095]	[1.335]	[4.514]
Avg(ROA)	0.0165		0.0229	−0.0024
	[0.334]		[0.355]	[−0.037]
Avg(cashflow/sales)	11.3656**		7.3246**	12.2736**
	[2.442]		[1.980]	[2.010]
samesic3	0.0320**		0.0464***	0.0436***
	[2.371]		[3.454]	[3.241]
after1998				−0.1433***
				[−3.590]
after1998*RPTtoSales				−0.2470**
				[−2.185]
Constant	0.2743***	0.1252**	0.0534	0.0717
	[15.578]	[2.567]	[0.826]	[1.164]
Dummy	year	year	year	no
Observations	5878	12,231	5260	5260
Adj. R-sq.	0.226	0.242	0.311	0.160

stocks. In fact, regulations have changed following the crisis, so that RPTs above a certain size threshold made by members of large business groups designated by the KFTC must be approved by the board of directors and subsequently disclosed.[20] Given the modest decline in RPT and the change in the way that post-crisis RPT is reported, we investigate whether the effect of a given related-party transaction on stock return correlation is stronger during the post-crisis period. To avoid any information loss in using aggregate related party transactions at the group level, we compare pair-wise stock return correlation directly with pair-wise related-party transactions. That is, we do not take the *averages* of return correlations with other firms in this analysis, but rather use the return correlation between any *two* member firms. Similarly, we measure the RPTs between any *two* member firms. Since the unit of observation in this analysis is a pair of two member firms, it is expected to provide a cleaner and more powerful test.

Due to the data availability, the analysis covers a shorter period from 1986 to 2009. For this analysis, we estimate the following regression;

$$(excess)corr_{i,t} = \alpha + \sum\nolimits_k \beta_k X_{i,t,k} + \gamma_i \, After\ 1998 \times RPTtoSales_{i,t} + e_{i,t}, \quad (2)$$

where each *i* indexes a pair of two firms within the business group and X's include the following variables: RPTtoSales is pair-wise related party transactions scaled by the average sales of the two firms. Ln(avgmktcap) denotes logarithm of average market capitalization the two firms. Avg(turnover) and avg(stdret) are averages of daily turnover and standard deviation of return of the two firms, respectively.

[20] The regulation became effective as of April 2000. The threshold was initially 10% of shareholders' equity or KRW 10 billion (roughly US$ 10 million), which were tightened to 5% or KRW 5 billion since 2012.

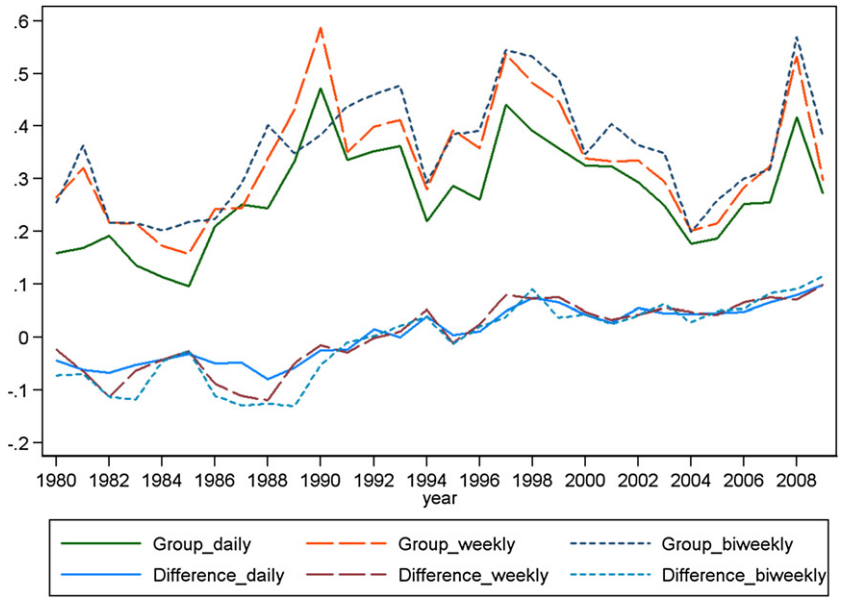

Fig. 2. Time-series pattern of stock return correlation: daily vs. weekly vs. biweekly. This figure presents the mean of firm-level average pair-wise return correlations among stocks in the same business group and stocks in the same industry for each year in our sample period. For a given firm in a business group, we calculate its stock return correlation coefficient with each of the other firms belonging to the same business group, and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms. We report three different correlations based on daily, weekly, and biweekly returns. Difference_daily, _weekly, and _biweekly represent the difference between average correlations among the same business group stocks and average correlation among the same industry (4 digit SIC) stocks.

Hameed et al. (2012) and other earlier studies (Veldkamp, 2006; Piotroski and Roulstone, 2004; Chan and Hameed, 2006; Frankel et al., 2006) suggest that equity market capitalization and share turnover could be related with stock return correlations. Avg(ROA) and avg(cashflow / sales) are averages of ROA and cash flow to sales of the two firms. [21] Samesic3 is a dummy variable that equals one if the two pair firms are included in the same three-digit SIC. After1998 is a dummy variable that equals one for year 1998 and onward. We cluster standard errors on both business group and year, following Petersen (2009).

The results reported in Table 6 show that the related party transactions add to the stock return correlation among the same-group stocks, but only prior to the financial crisis. Specifically, its interactive term with the post-crisis dummy in column (4) is significant and negative, making its effect on the correlation virtually non-existent during the post-crisis period. That is, the earlier positive contribution of the RPT to the stock return comovement is mostly undone in the post-crisis period. In an unreported result, we alternatively treat missing pair-wise related party transaction values as zeros and re-estimate the regressions; the results are qualitatively the same.

Of course, there might well be other fundamental links among the same-group firms besides the related party transactions. For example, the mere existence of a common controlling shareholder *alone* may create a sizable commonality in the stocks of the same-group firms, as the corporate policies are coordinated across those firms. Still, such coordination efforts must be realized through some *channel*, the most likely of which are RPTs. Moreover, it is hard to rationalize why such coordination would have strengthened over time, especially after the 1997–98 Asian financial crisis when the channels themselves – namely, related-party transactions – are not related to stock return correlation. One would actually expect exactly the opposite pattern, since

[21] We also tried using the absolute difference between the two firms as control variables and found that the results are similar.

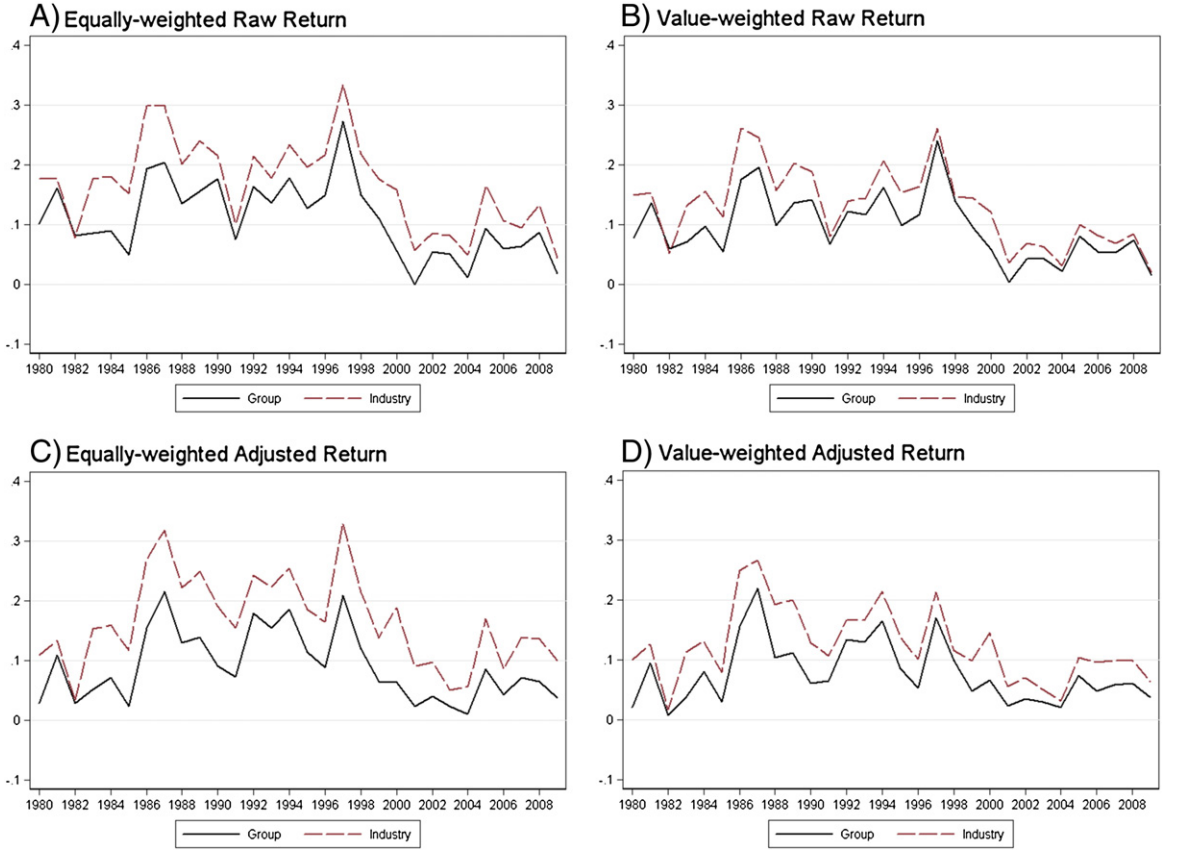

Fig. 3. Time-Series of Portfolio Autocorrelation of Daily Returns. This figure presents average AR(1) coefficients of portfolio returns that consist of stocks belonging to the same business group and the same industry (4 digit SIC). We calculate four different portfolio returns; those based on equal-weighted raw return (panel A), value-weighted raw return (panel B), equal-weighted market-model residuals (panel C), and value-weighted market-model residuals (panel D).

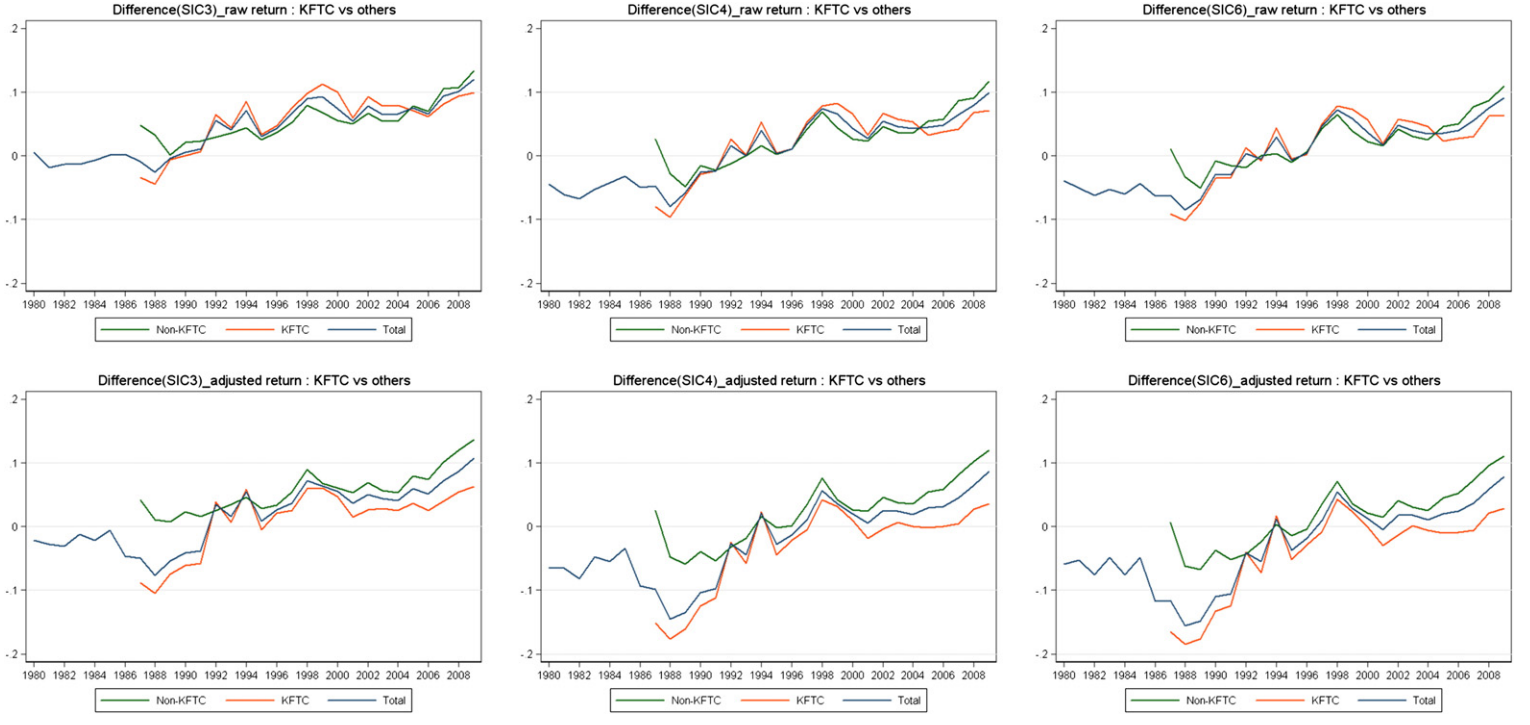

Fig. 4. Difference in Stock Return Correlations: KFTC-Designated Large Business Groups vs. Other Business Groups. This figure presents differences in firm-level average pair-wise stock return correlations between stocks in the same business group and stocks in the same industry. For a given firm in a business group, we calculate its stock return correlation coefficient with each of the other firms belonging to the same business group, and take the average of the obtained pair-wise correlations. For the same given firm, we also calculate another average correlation coefficient using same-industry firms. In each panel, we report the differences separately for KFTC-designated large business groups and other business groups. The top three figures are based on raw returns while the bottom three are based on market-model residuals. We also consider three different industry correlations; those based on 3-digit, 4-digit, and 6-digit SIC codes.

Table 7
Subsample analysis of time-series regressions.
This table shows cross-sectional averages of time-series regressions of individual stock returns on group, industry, and/or market value weighted returns. We remove stock *i*'s return from the group-level return, the industry return, and market return when we run the firm-level regressions. We report the results separately for large business groups formally designated by the Korea Fair Trade Commission (KFTC), and the remaining business groups. The analysis starts in 1987 when KFTC initiated such designation for regulatory purposes. After 1998 is a dummy variable that equals one for year 1998 and onward. *t*-statistics are reported in brackets. ***,**, and * indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively, based on cross-sectional standard errors of time-series regression coefficients.

	KFTC—designated large business groups	Other business groups	All business groups
Group return	0.1901***	0.1912***	0.1914***
	[13.44]	[18.19]	[20.29]
Industry return	0.4305***	0.3424***	0.3947***
	[23.05]	[18.94]	[27.94]
Market return	0.2783***	0.3288***	0.3124***
	[13.54]	[15.83]	[21.41]
after1998	−0.00002	0.0003	0.0002
	[−0.43]	[1.15]	[1.01]
Group return * after1998	0.0143	0.0264**	0.0249***
	[1.62]	[2.45]	[2.94]
Industry return * after1998	−0.0645***	−0.0649***	−0.0717***
	[−4.23]	[−3.49]	[−5.02]
Market return * after1998	0.0506***	0.0043	0.0272***
	[3.23]	[0.61]	[2.82]
Intercept	−0.0002	−0.0001	−0.0002*
	[−0.77]	[−0.45]	[−1.69]
n(firms)	338	374	589
Adj. R−sq.	0.3085	0.2332	0.2716

corporate governance and autonomy of member firms have improved during the post-crisis period and, as a result, such coordination must have weakened.

4.4. Faster diffusion of information?

Thus far, we have used daily stock returns and found a higher correlation among the same-group stocks than among the same-industry stocks following the 1997–98 Asian financial crisis. We also examined various fundamental correlations among the same-group stocks and found that the fundamental correlation cannot explain the increased stock return commonality of the same-group stocks during the post-crisis period. If the increased return correlation among the same-group stocks is to be attributable to non-fundamental factors, then there are two candidates, namely, categorization/habitation and market frictions (Barberis et al., 2005). That is, same-group stocks might have shown excess comovement over time as investors have increasingly categorized those stocks into one group (category trading) or investors have traded only those same-category stocks (habitat trading). Alternatively, it could be that the same-group stocks have been responding to common news at increasingly similar rates (reduced market frictions).

Imagine that a given piece of news gets into prices at different speeds across stocks. In that situation, the return correlation among stocks might be modest at daily frequencies but the correlation of returns measured over a longer-horizon, during which the news is eventually incorporated into the price, might well be stronger. What we find so far is an *increase* in daily correlation over time (not higher correlation *level* for daily returns). If more synchronized news incorporation from reduced market friction is driving this, we would expect this *increase* – not the correlation level per se – to be weaker at low data frequency. This is because correlation level would already have been high at low data frequency even before synchronized news incorporation.

To gauge the relative importance of these two explanations, we repeat our analysis using weekly or biweekly returns. The idea is that if the observed increase in stock-return correlation is due to a more synchronized reaction to common information, then this increase should be weaker or even non-existent in a longer-horizon return during which relevant information is fully reflected into stock prices in the first place. Fig. 2

Table 8
Turnover Correlation and Return Correlation

This table presents regression results where the dependent variable is the firm-level average stock return correlation of group firms in excess of industry correlation and the key explanatory variable is the firm-level average trading correlations of group firms. In panel A, we report the results separately for large business groups formally designated by the Korea Fair Trade Commission (KFTC), and the remaining business groups. In panel B, we further classify business groups into those with only two publicly traded stocks, and those with more than two stocks. RPTtoSales is related party transaction scaled by sales. Ln(mktcap) is the logarithm of market capitalization at the end of the year in KRW billion. Daily_tnover is the yearly average of daily turnover. Stddev(ret) is the standard deviation of daily returns. N_firms is the number of same-group stocks. ROA is net income divided by lagged asset. N_SIC2 is the number of distinct industries (SIC2) within a business group. Cashflow/Sales is yearly cash flow divided by sales. After1998 is a dummy variable that equals one for year 1998 and onward. Trading correlations denoted as corr(tnover) are firm-level averages of pair-wise correlations in daily turnover of firms in a business group calculated in a similar way as return correlation. All specifications include industry fixed effects (SIC 4 digits). Numbers in brackets report t-statistics based on standard errors clustered on both business group and year. ***, **, and * indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively.

Panel A: Sub−sample analysis based on KFTC−designation

Variables	All business groups		KFTC−designated large business groups		Other business groups	
	(1)	(2)	(3)	(4)	(5)	(6)
RPTtoSales	0.0035	0.0343	0.0360*	0.0507	0.0042	−0.0136
	[0.647]	[1.469]	[1.797]	[1.589]	[0.878]	[−0.398]
ln(mktcap)	0.0118***	0.0119***	0.0138***	0.0138***	0.0052	0.0051
	[2.664]	[2.649]	[2.789]	[2.779]	[0.921]	[0.895]
Daily_tnover	−0.0096	−0.0016	−0.0388	−0.0299	0.0506	0.0450
	[−0.029]	[−0.005]	[−0.062]	[−0.048]	[0.160]	[0.143]
stddev(ret)	0.7820	0.7588	1.0552	1.0320	0.3815	0.3932
	[1.115]	[1.095]	[1.164]	[1.132]	[0.711]	[0.730]
N_firm	−0.0005	−0.0004	−0.0000	0.0001	−0.0113***	−0.0110***
	[−0.252]	[−0.234]	[−0.006]	[0.064]	[−2.822]	[−2.622]
N_SIC2	−0.0049	−0.0057	−0.0040	−0.0044	−0.0084	−0.0081
	[−0.793]	[−0.932]	[−0.533]	[−0.605]	[−0.796]	[−0.779]
ROA	−0.0630	−0.0713	−0.2071*	−0.2063*	0.0240	0.0279
	[−1.078]	[−1.207]	[−1.765]	[−1.740]	[0.745]	[0.882]
cashflow/sales	−16.0874	−0.9192	161.6718***	153.5751**	−53.1464*	−60.1371*
	[−0.396]	[−0.022]	[2.702]	[2.452]	[−1.761]	[−1.851]
corr(tnover)	0.4621***	0.4576***	0.5846***	0.5806***	0.2724***	0.2714***
	[6.503]	[6.652]	[6.767]	[6.708]	[4.117]	[4.013]
After1998	0.0535***	0.0631***	0.0934***	0.1021***	0.0172	0.0123
	[2.618]	[2.749]	[3.262]	[3.519]	[0.896]	[0.507]
After1998 * corr(tnover)	−0.0587	−0.0532	−0.2737***	−0.2653***	0.1495**	0.1501**
	[−0.792]	[−0.738]	[−3.200]	[−3.050]	[2.014]	[1.988]
After1998 * RPTtoSales		−0.0353		−0.0310		0.0193
		[−1.464]		[−0.850]		[0.539]
Constant	−0.1440***	−0.1502***	−0.2052***	−0.2044***	−0.0193	−0.0159
	[−6.803]	[−6.422]	[−5.315]	[−5.282]	[−0.687]	[−0.494]
Dummy	sic4	sic4	sic4	sic4	sic4	sic4
Observations	2346	2346	1282	1282	1064	1064
R−squared	0.424	0.426	0.483	0.484	0.437	0.438

(*continued on next page*)

Table 8 (*continued*)

Panel B: Sub-sample analysis based on number of stocks within business group and KFTC-designation

	Groups with 2 publicly traded stocks						Groups with more than 2 publicly traded stocks					
	All business groups		KFTC-designated large business groups		Other business groups		All business groups		KFTC-designated large business groups		Other business groups	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RPTtoSales	0.1044**	0.1028*	0.1288	0.1402	0.0652*	0.0127	−0.0039	0.0196	0.0243	0.0304	−0.0038	−0.0241
	[2.554]	[1.678]	[1.129]	[1.229]	[1.840]	[0.250]	[−0.684]	[0.975]	[1.262]	[1.067]	[−0.458]	[−0.679]
Ln(mktcap)	0.0094	0.0094	0.0004	−0.0000	0.0187**	0.0183**	0.0115**	0.0116**	0.0147***	0.0148***	−0.0085	−0.0087
	[1.319]	[1.323]	[0.015]	[−0.001]	[2.288]	[2.157]	[2.088]	[2.091]	[2.965]	[2.986]	[−1.223]	[−1.239]
Daily_tnover	0.1923	0.1926	0.7013	0.4953	0.2150	0.2023	−0.0864	−0.0741	−0.0734	−0.0648	−0.1039	−0.1128
	[0.656]	[0.656]	[0.499]	[0.382]	[0.745]	[0.701]	[−0.190]	[−0.163]	[−0.109]	[−0.096]	[−0.229]	[−0.252]
Stddev(ret)	0.4427	0.4459	2.1466	2.2214	−0.0762	0.0187	0.9592	0.9391	1.0010	0.9905	0.8249	0.8404
	[0.753]	[0.737]	[1.284]	[1.387]	[−0.132]	[0.029]	[1.190]	[1.178]	[1.161]	[1.143]	[1.178]	[1.209]
N_firm							0.0003	0.0003	0.0000	0.0000	−0.0155***	−0.0150**
							[0.158]	[0.149]	[0.005]	[0.025]	[−2.864]	[−2.576]
N_SIC2	−0.0186	−0.0184	0.0156	0.0189	−0.0452**	−0.0425**	−0.0041	−0.0045	−0.0051	−0.0053	0.0082	0.0084
	[−1.033]	[−0.979]	[0.209]	[0.243]	[−2.532]	[−2.273]	[−0.657]	[−0.720]	[−0.673]	[−0.703]	[0.626]	[0.648]
ROA	−0.1181	−0.1182	0.0035	0.0066	−0.0954	−0.0891	−0.0612	−0.0674	−0.2198*	−0.2199*	0.0798	0.0837
	[−1.346]	[−1.345]	[0.007]	[0.013]	[−1.375]	[−1.135]	[−0.822]	[−0.878]	[−1.706]	[−1.720]	[1.540]	[1.639]
Cashflow/sales	48.8345	49.4475	−226.0554	−326.2708	10.3635	7.8102	14.4251	24.0522	196.1497***	193.5470***	−5.2099	−10.5940
	[0.687]	[0.724]	[−0.745]	[−0.885]	[0.188]	[0.148]	[0.308]	[0.478]	[3.529]	[3.339]	[−0.101]	[−0.205]
Corr(tnover)	0.4184***	0.4187***	0.6472***	0.6402***	0.2297***	0.2281***	0.4996***	0.4986***	0.5115***	0.5109***	0.3545***	0.3544***
	[4.318]	[4.327]	[5.857]	[5.435]	[2.973]	[2.903]	[5.095]	[5.126]	[4.415]	[4.405]	[4.257]	[4.258]
After1998	0.0429	0.0422	0.0775	0.1178	0.0095	−0.0082	0.0642***	0.0721***	0.0864***	0.0898***	0.0306	0.0245
	[1.525]	[1.233]	[1.042]	[1.062]	[0.357]	[−0.223]	[2.785]	[2.781]	[2.981]	[2.962]	[1.511]	[1.009]
After1998 * corr(tnover)	−0.0260	−0.0265	−0.2412	−0.2399	0.1588**	0.1569*	−0.1166	−0.1141	−0.2517**	−0.2494**	0.0832	0.0829
	[−0.263]	[−0.267]	[−1.135]	[−1.101]	[1.961]	[1.923]	[−1.134]	[−1.125]	[−2.142]	[−2.131]	[0.593]	[0.594]
After1998 * RPTtoSales		0.0037		−0.1770		0.0837		−0.0262		−0.0114		0.0215
		[0.056]		[−0.651]		[1.374]		[−1.208]		[−0.337]		[0.573]
Constant	−0.0797	−0.0796	−0.1767	−0.1726	0.0281	0.0476	−0.1634***	−0.1691***	−0.2051***	−0.2046***	−0.0282	−0.0242
	[−1.297]	[−1.285]	[−0.979]	[−0.896]	[0.829]	[1.159]	[−4.905]	[−4.798]	[−5.134]	[−5.084]	[−0.562]	[−0.475]
Dummy	sic4	sic4	sic4	sic4	sic4	sic4	sic4	sic4	sic4	sic4	sic4	sic4
Observations	714	714	151	151	563	563	1632	1632	1131	1131	501	501
R-squared	0.444	0.444	0.593	0.594	0.450	0.453	0.447	0.448	0.473	0.473	0.525	0.525

shows that this is not the case. The increased stock return commonality continues to be found in both weekly and biweekly returns, and the pattern is very similar to the daily return case.

As another attempt to gauge the role of information diffusion or market frictions, we examine the cross-autocorrelation among the same-group stocks. If one constructs a portfolio with a certain number of stocks, then autocorrelation of the portfolio is equivalent to average cross-autocorrelation among the constituent stocks (e.g., Ahn et al., 2002). Our argument is that, unlike the category/habitat-driven correlation, reduced market frictions would appear as less pronounced cross-autocorrelation, or equivalently, less pronounced autocorrelation in portfolio returns. To this end, we construct a portfolio of same-group stocks and examine its 1st-order autocorrelation. We also conduct a similar analysis using the same-industry stocks. As we want to verify any change in this effect around the 1997–98 crisis, we estimate portfolio autocorrelation each year to check if it drops after 1998. Fig. 3 shows that the difference in autocorrelation between the group and the industry portfolios has hardly changed over time.[22] The results thus imply that changes in cross-autocorrelation among the same-group stocks cannot explain the increased stock-return correlation among them.

4.5. Direct evidence of category/habitat trading

4.5.1. Sub-sample analysis based on information environment

Regulations on business groups have become stricter in general during the post-crisis period. These policy initiatives were broadly adopted to strengthen independence of each member firm within a business group in an effort to prevent any potential spillover from a bad member firm to a healthy one. As a result, firm-specific information has become more readily available to outside investors. Such stricter regulations are, however, focused on relatively large business groups formally designated by the Korea Fair Trade Commission (KFTC). Therefore, it is sensible to conjecture that categorization is more likely in relatively smaller business groups where firm-specific information is still inadequate. The enhanced post-crisis recognition of business groups is more likely to affect those relatively smaller groups than the larger ones, since the smaller business groups are less well known prior to the crisis. Such greater awareness would cause investors to perceive the same-group companies as one entity and make them trade at the business group level, particularly in the case of those smaller business groups.

We first take a univariate approach to comparing large business groups designated by the KFTC with non-large business groups. As shown in Fig. 4, the increase in stock-return correlation within business groups is more pronounced in relatively smaller groups than in larger, KFTC-designated groups.

To confirm this univariate result while controlling for other factors, and to produce statistical test statistics, we re-estimate Eq. (1) separately for the two sub-samples. Table 7 reports the results of this analysis. We also report the results for the full sample in the last column for completeness.[23] We continue to find the differing results between the two sub-samples. That is, the group-stock correlation increases significantly after the crisis only in smaller business groups. In the KFTC-designated groups, the correlation increases but the magnitude is smaller and insignificant.

4.5.2. Trading correlation vis-à-vis stock-return correlation

The ultimate empirical implication of the category/habitat hypothesis is that trading in the same-group stocks is correlated and this trading correlation affects the stock-return correlation among those stocks. More specifically, if a group of investors try to buy or sell the stocks in the same business group simultaneously, then there will be a positive relationship between the return correlations of those stocks and their trading correlations. Or, if investors bet on group-stock comovement and engage in a type of "convergence trading" by buying some stocks in a group and selling other stocks in the same group, then a negative relationship will exist between the return correlations of those stocks and their trading correlations.

[22] Both autocorrelations are positive and thus suggest that there is diffusion of information with a lag within a business group and an industry.

[23] The results in the last column are slightly different from those reported in Table 3, since the sample period is restricted to post 1987 when KFTC first started designating large business groups to impose group-level regulations. The number of observations in the first and second column does not add up to those in the third column primarily because group membership and KFTC designation varies over time.

To examine these predictions, we first obtain average correlations of daily turnover for group stocks in a similar manner as we did for return correlations. Then we add this turnover correlation as an additional explanatory variable for return correlation and interact the turnover correlation with the post-crisis dummy. We report the results separately for both KFTC-designated large business groups and the remaining smaller business groups. The dependent variable is the firm-level average excess return correlation in business groups relative to corresponding industry correlation. The independent variables are as follows: RPTtoSales is related party transaction scaled by sales. Ln(mktcap) is the logarithm of market capitalization at the end of the year (in KRW billion). Daily_tnover is the yearly average of daily turnover. Stddev(ret) is the annualized standard deviation of daily return. N_firms is the number of same-group stocks. We also include the annual ROA and cash flow to sales (not their correlations over many years) as additional control variables for fundamental correlation. All specifications include industry fixed effects (SIC 4 digit). As in Table 6, standard errors are clustered on two dimensions, business group and year.

The results in Table 8, Panel A, are striking. While the coefficient on the interactive term between post crisis dummy and turnover correlation is significant and *negative* for the larger, KFTC-designated groups, it is significantly *positive* for the smaller groups. The negative relationship between stock-return correlation and trading correlation in the KFTC-designated groups is consistent with investors trading between stocks in the same-group—i.e., buying some stocks and selling others (positive trading correlation), driving their deviating prices back to convergence (negative return correlation). The positive relationship between stock-return correlation and trading correlation in the smaller groups then suggests that investors either buy or sell stocks in those groups in the same direction.

There could be a few explanations for less parallel trading and more convergence trading for KFTC stocks. First, there are more stocks that can be traded in KFTC groups. As such, there could be more different price movements to exploit. Second, since KFTC stocks are larger in general, they are more shortable than non-KFTC stocks. Finally, more firm-specific information is available for KFTC stocks.

To further verify our interpretation, we bring in another dimension and construct as many as four subsamples. Specifically, we use the number of publicly traded stocks within a business group, along with the KFTC designation. Our conjecture is that category trading is more likely when there are only a few stocks, whereas habitat trading involves relatively a larger number of member stocks in a business group. Given the characteristics of our sample business groups (Panel B, Table 1), we classify our sample business groups into those with only two publicly-traded stocks and those with more than two stocks. This results in four types of business groups; KFTC-designated groups with 2 publicly traded member stocks, KFTC-designated groups with more than 2 publicly traded member stocks, non-KFTC groups with 2 publicly traded member stocks, and non-KFTC groups with more than 2 publicly traded member stocks. Our prediction is that category trading would be more pronounced in non-KFTC groups with 2 publicly traded member stocks, whereas habitat/convergence trading would be more pronounced in KFTC-designated groups with more than 2 publicly traded member stocks.

The results are reported in Panel B of Table 8. Consistent with our predictions, we find a significant and positive coefficient on the interactive term between post-crisis dummy and trading correlations (i.e., a sign of category trading) in the non-KFTC groups with 2 publicly traded member stocks (columns (5) and (6)). Also consistent with our prediction, we find a significant and negative coefficient on the interactive term only in the KFTC-designated groups with more than 2 publicly traded member stocks (columns (9) and (10)).

5. Conclusion

Business groups are a ubiquitous corporate phenomenon that is commonly observed in non-U.S. economies. Although there has been much research investigating the implications of such complex structures from corporate finance perspective, much less attention has been paid to their implications for investors. This paper fills this gap by systematically analyzing the potential correlation between stocks that are members of the same business group in Korea.

We first document that there is substantial amount of correlation among stocks that belong to the same business group and this correlation is of larger magnitude than those among stocks in the same industry. Such correlation may be due to either fundamental correlation between member firms through related party transactions, or non-fundamental correlation based on some ‘category’ or ‘habitat’ trading.

To test which explanation is more consistent with the observed data, we next examine the time-series patterns of within-group and within-industry correlations. Conventional wisdom from corporate governance literature tells us that when governance improves, firm-specific component becomes more important, leading to less correlation with the overall market. Since 1997–98 Asian crisis triggered a massive reform on corporate governance regulations in Korea, especially in the direction of increasing autonomy of member firms within a business group, changes in correlation structure over time could shed some light on the link between governance and correlation. We find that although return correlation with an industry benchmark has decreased subsequent to the crisis, correlation among the same group firms has been steadily increasing over time. The group-level correlations are sharply identified when we examine additions to and deletions from a formal business group membership. Such change in group-level correlation, however, is not explained well by fundamental factors, such as correlations in ROA or cash flow, or related party transactions.

Finally, we find that increases in return commonality post crisis is more pronounced among member firms of relatively smaller business group that are not formally regulated by the Korea Fair Trade Commission (KFTC). Moreover, the relationship between turnover correlation and return correlation becomes stronger only for non-KFTC designated business groups subsequent to the crisis. Since these groups are unaffected by regulatory changes, these results are difficult to explain by changes in fundamental correlations. Rather, our findings are more consistent with the 'category' or 'habitat' view that investors who invest in group stocks may trade them together in a basket.

Then why do investors consider group stocks, which are publicly traded firms on their own, to be exposed to more correlation among member firms above and beyond those implied by fundamental correlation? Our conjecture is that continued emphasis on group-level corporate governance both by the media and regulatory authorities has effectively made investors to think of them almost as a single company. Another possibility is that investors are fully aware of potential tunneling or propping among member firms, but overestimates its impact. For example, whenever there is good news for a specific member firm, investors expect that it will be spilled over to other member firms, which creates a positive correlation structure. Whenever there is a bad news, on the other hand, investors expect that other firms will help out this firm,[24] which again leads to a positive correlation (of negative returns). Further examination of stock returns of business group members will broaden our understanding of business groups and their implications for investors around the world.

References

Ahn, Dong-Hyun, Boudoukh, Jacob, Richardson, Matthew, Whitelaw, Robert F., 2002. Partial adjustment or stale prices? Implications from stock index and futures return autocorrelations. Rev. Financ. Stud. 15, 655–689.

Ahn, Dong-Hyun, Conrad, Jennifer, Dittmar, Robert F., 2009. Basis assets. Rev. Financ. Stud. 22, 5133–5174.

Anton, Miguel, Polk, Christopher, 2013. Connected stocks. J. Financ. 69, 1099–1127.

Baker, Malcolm, Stein, Jeremy C., 2004. Market liquidity as a sentiment indicator. J. Financ. Mark. 7, 271–299.

Barberis, Nicholas, Shleifer, Andrei, Wurgler, Jeffrey, 2005. Comovement. J. Financ. Econ. 75, 283–317.

Chan, Kalok, Hameed, Allaudeen, 2006. Stock price synchronicity and analyst coverage in emerging markets. J. Financ. Econ. 80, 115–147.

Chiu, Ming Ming, Joh, Sung Wook, 2003. The effects of the economic crisis and corporate reform on business groups: evidence from Korea. Working Paper.

Cohen, Lauren, Frazzini, Andrea, 2008. Economic links and predictable returns. J. Financ. 63, 1977–2011.

Cooper, Michael J., Gulen, Huseyin, Paghavendra Rau, P., 2005. Changing names with style: mutual fund name changes and their effects on fund flows. J. Financ. 60, 2825–2858.

Fama, Eugene F., French, Kenneth R., 1993. Common risk factors in the returns on stocks and bonds. J. Financ. Econ. 33, 3–56.

Frankel, Richard, Kothari, S.P., Weber, Joseph, 2006. Determinants of the informativeness of analyst research. J. Account. Econ. 41, 29–54.

Froot, Kenneth A., Dabora, Emil M., 1999. How are stock prices affected by the location of trade? J. Financ. Econ. 53, 189–216.

Hameed, Allaudeen, Morck, Randall, Shen, Jianfeng, Yeung, Bernard, 2012. Information, analysts, and stock return co-movement. Working Paper.

Hong, Harrison, Torous, Walter, Valkanov, Rossen, 2007. Do industries lead the stock market? J. Financ. Econ. 83, 367–396.

Hou, Kewei, 2007. Industry information diffusion and the lead-lag effect in stock returns. Rev. Financ. Stud. 20, 1113–1138.

Jin, Li, Myers, Stewart C., 2006. R^2 around the world: new theory and new tests. J. Financ. Econ. 79, 257–292.

Kim, Woochan, Kim, Woojin, Kown, Kap-Sok, 2009. Value of outside blockholder activism: evidence from the switchers. J. Corp. Financ. 15, 505–522.

Kruger, Philipp, Landier, Augustin, Thesmar, David, 2012. Categorization bias in the stock market. Working paper.

La Porta, Rafael, Lopez-de-Sillanes, Florencio, Shleifer, Andrei, 1999. Corporate ownership around the world. J. Financ. 54, 471–517.

Lee, Dong Wook, Park, Kyung Suh, 2009. Does institutional activism increase shareholder wealth? Evidence from spillovers on non-target companies. J. Corp. Financ. 15, 488–504.

[24] Tunneling and propping cannot be easily defined in this case since propping a member firm means tunneling from other member firms.

Li, Kan, Morck, Randall, Yang, Fan, Yeung, Bernand, 2004. Firm-specific variation and openness in emerging markets. Rev. Econ. Stat. 86, 658–669.
Menzly, Lior, Ozbas, Oguzhan, 2010. Market segmentation and cross-predictablity of returns. J. Financ. 65, 1555–1580.
Morck, Randall, Yeung, Bernard, Wayne, Yu., 2000. The information content of stock markets: why do emerging markets have synchronous stock price movements? J. Financ. Econ. 58, 215–260.
Morck, Randall, Wolfenzon, Daniel, Yeung, Bernard, 2005. Corporate governance, economic entrenchment, and growth. J. Econ. Lit. 43, 655–720.
Mullainathan, Sendhil, 2002. Thinking through categories. Working Paper.
Peng, Lin, Xiong, Wei, 2006. Investor attention, overconfidence and category learning. J. Financ. Econ. 80, 563–602.
Petersen, Michael, 2009. Estimating standard errors in finance panel data sets: comparing approaches. Rev. Financ. Stud. 22, 435–480.
Piotroski, Joseph D., Roulstone, Darren T., 2004. The influence of analysts, institutional investors, and insiders on the incorporation of market, industry, and firm-specific information into stock prices. Account. Rev. 79, 1119–1151.
Veldkamp, Laura L., 2006. Information markets and the comovement of asset prices. Rev. Econ. Stud. 73, 823–845.
Vijh, Annad M., 1994. S&P 500 trading strategies and stock betas. Rev. Financ. Stud. 7, 215–251.