

# Stock Return Commonality within Business Groups: Fundamentals or Sentiment?

**Min-Su Kim, Woojin Kim, Dong Wook Lee\***

April, 2013

## **Abstract**

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 1998 Asian crisis. Fundamental factors, such as related-party transactions, cross-holdings of equity stakes, or earnings correlation do not explain the increased stock return commonality within business groups. Rather, trading in the same-business group stocks is highly correlated more so during the post-crisis period. Such pattern is robust to using daily, weekly, and biweekly returns. Overall, our results are consistent with the notion that greater emphasis on corporate governance post the crisis, particularly on business group-related issues, leads investors to categorize stocks in a given business group and treat them as one entity.

**Keywords:** Return commonality; Business group; Corporate Governance; Category/Habitat trading, Korea

**JEL classification:** G10; G11; G12

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## 1. Introduction

It is well established in the literature that stock returns comove in many dimensions. For example, returns of stocks in the same industry exhibit strong commonality. There are groups of stocks, other than those within the same industry, which also exhibit return commonality, for example small stocks or value stocks. For these stocks, it is not so obvious that fundamental values would necessarily comove. In fact, two broad competing theories explain such commonality in returns. Traditional perspective holds that comovement in returns is generated by comovement in fundamental values. Since firms within an industry are exposed to common industry level shocks, industry return commonality may be explained by comovement in fundamental values. A more recent perspective suggests that non-fundamental factors or frictions, such as investor sentiment, may drive return comovement. For example, Barberis, Shleifer, and Wurgler (2005) argue that investors are prone to ‘category’ or ‘habitat’ trading, where investors lump certain individual stocks together and trade them as a group.<sup>1</sup> 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. 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.<sup>2</sup> 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 found that member firms in a business group often transfer resources across each other, similar to

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<sup>1</sup> Barberis, Shleifer, and Wurgler (2005) make a subtle technical distinction between ‘category’ and ‘habitat’, but both basically imply a group of stocks that are bought and sold more as a group rather than as individual stocks.

<sup>2</sup> La Porta, Lopez-de-Silanes, and Shleifer (1999), Morck, Wolfenzon, and Yeung (2005) among many others.

those of an internal capital market, sometimes to help out or ‘prop up’ other member firms, and sometimes to expropriate or ‘tunnel’ from them.

Given the dynamics of inter-corporate resource transfers, it is natural to expect that public firms within a business group exhibit at least some level of return commonality (fundamental perspective). In addition, 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 (non-fundamental perspective). For example, when Samsung Life Insurance, the largest insurance company in Korea, went public in 2010, many retail investors jumped in to subscribe just because the company is a member of Samsung Group.<sup>3</sup>

As such, it is rather surprising that the literature is still largely silent on how and why stock returns among member firms within a business group might comove. Thus, our first contribution is to extend the previous research that examines spillover effect within business groups to commonality in stock returns. That is, we link the return comovement literature in asset pricing with the business group literature in corporate finance and directly examine whether public member firms within a business group indeed exhibit return commonality.

Our next contribution is to evaluate whether traditional fundamental based perspective or more recent non-fundamental based perspective better explains the observed commonality of returns within business groups. Recent research on return comovement emphasizes the importance of distinguishing the two different explanations. (e.g. Barberis, Shleifer, and Wurgler, 2005). Since business groups clearly share common factors through propping or tunneling, our null hypothesis of fundamental based return commonality is more than just a straw man.

To this end, we focus on business groups in Korea. First, Korea has plenty of active business groups. In fact, it is actually more difficult to find a true stand-alone firm in Korea, since vast majority of public firms belong to a business group. Even privatized firms that are widely held typically belong

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<sup>3</sup> 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>).

to a business group. Thus, a business group can easily be identified as a ‘category’ or a ‘habitat’ from investor’s perspective.<sup>4</sup> Second, the boundaries of large business groups are tightly defined for regulatory purposes so that the identity of member firms is clearly identified. For example, the Korea Fair Trade Commission designates large business groups every year with the list of firms that are members within each group. Third, these large business groups often consists of more than one publicly traded firm, which enables us to calculate and measure commonality of stock returns.

Our first finding is that stocks that belong to the same business groups exhibit strong return correlation. In fact, the within-group correlation is stronger than within-industry correlation regardless of the number of digits we use to define an industry.

Having established the existence of the within-group correlation, we next examine the time series patterns of such correlation structure. From the standard corporate governance perspective, we would expect firm-specific components to become more pronounced as governance improves over time, especially following 1997 Asian crisis. To the contrary, we find that within-group correlation, especially when measured against a benchmark within-industry correlation, has actually increased over time.

Moreover, such increases in correlation are not explained by increases in fundamental correlation. For example, correlation of return on assets (ROA) among member firms actually decreases following the 1997 crisis. Similarly, while related party transactions do explain stock return correlation prior to the crisis, they no longer do so in the post-crisis period. These results are robust to using weekly or biweekly returns, which is inconsistent with the market friction explanation.<sup>5</sup>

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<sup>4</sup> 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 invested in Samsung stocks, was launched in November, 2004.

<sup>5</sup> Market friction explanation argues that speed of price discovery may be different among stocks and those stocks with similar speed may exhibit correlation unrelated to fundamentals. Market frictions and any correlation pattern based on them would disappear in longer interval returns during which information is eventually reflected.

Finally, we examine how correlated trading among investors may drive the stock return commonality within business groups. Specifically, we implement a principal component analysis based on daily turnovers of stocks in the same business group. We find that the 1<sup>st</sup> component is able to explain more than 50% of the correlation, which is much higher than correlated trading among firms in the same industry. This implies that there could be substantial amount of synchronized trading that affect stock returns of firms in a given business group.

Overall, our results suggest that return commonality among business group member firms are more likely to be driven by non-fundamental factors such as ‘category’ or ‘habitat’ trading rather than fundamental factors. That is, investors categorize stocks in the same business group and, by doing so, cause same-group stocks to respond to firm-specific news as if it were common to them. This could potentially be due to increased awareness of tunneling or propping across member firms within a business group in the midst of regulatory reforms to improve corporate governance following the 1997 crisis.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature 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 and empirical predictions**

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. Of course, 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 the economic fundamentals. However, a link may arise among those index constituent stocks, if investors engage in “categorization” and treat the stocks in

the index similarly. Such categorization typically is in fact quite plausible especially when investors are faced with resource constraints in processing all the available information. Then, stocks sharing such non-fundamental commonality would comove more than they would otherwise do (e.g., Mullainathan 2002; Peng and Xiong 2006).

Consequently, the literature has grown along the following two lines. First, researchers have examined whether the fundamental correlation is reflected in stock price in a timely manner and, second, whether the non-fundamental correlation affects the stock-return correlation. The former approach includes Hong, Tourus, and Valkanov (2007), Hou (2007), Cohen and Frazzini (2008), and Menzly and Ozbas (2010), to name just a few. Studies in the other group include Vijh (1994), Barberis, Shleifer, and Wurgler (2005), and Anton and Polk (2013). The results indicate that the fundamental correlation is oftentimes reflected in stock price with a lag and thus creates a profitable trading opportunity. There is also evidence that stocks co-move even for non-fundamental reasons. In words, both groups of studies point to a non-negligible role of market frictions and/or investor sentiment.

Findings of prior studies help us to hypothesize the business group-related correlation in stock returns.<sup>6</sup> First, 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 which are all effectively controlled by a common controlling shareholder who coordinates group-level policies across member firms. Consequently, we would expect to see a strong stock return commonality among the same-group stocks. In fact, those fundamental within-group linkages are typical of a poor governance system and prior studies have shown that the stock price synchronicity, or equivalently the lack of firm-specific stock price movement, can be triggered by poor investor protection and the lack of corporate transparency (Morck et al. 2000; Jin and Myers 2006). According

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<sup>6</sup> Chiu and Joh (2003) show that the stocks in the same business group comove. However, they do not examine the time-series changes in the comovement nor do they compare against a benchmark. Also, they only focus on the largest 30 business groups, whereas we examine as many as 159 business groups. Thus, our results may offer broader implications.

to this perspective, one would expect the return commonality among same business group stocks to fall as governance improves.<sup>7</sup>

Second, a business group constitutes an appealing category along which investors can economize their limited resources for information processing. Such business-group categorization appears particularly suitable in emerging markets in which various laws and regulations are imposed at the business group level and thus similarly affect companies in the same group.<sup>8</sup> Certainly, the group-level regulations can add to the fundamental correlation among the same-group stocks, and that is probably the very motivation for investors to think through the business-group category. However, as the group-level governance is emphasized and implemented, the categorization along the business groups might be “over-done.” In other words, there is scope for extra correlation among the same business-group stocks based on non-fundamentals above and beyond those implied by fundamentals. Based on this view, greater emphasis on governance, and the business group-related issues in particular, might cause the group-stocks to be *more* highly correlated.

In this context, Korea has uniquely experienced an exogenous and economically significant shock to the degree to which governance improves at the group level and investors recognize it. Specifically, following the 1997 Asian crisis, Korea has gone through a large number of regulatory changes and has also experienced the surge of activist investors.<sup>9</sup> More importantly, most of those governance efforts were focused on large business groups. Consequently, investors have become enormously enlightened in their understanding of corporate governance, especially with respect to the business groups in particular. Such a dramatic change in investors’ perception of the implications of

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<sup>7</sup> Li, Morck, Yang, and Yeung (2004) find that, after the crisis, the firm-specific stock price movements have increased in the crisis countries including Korea. However, they do not examine the stock co-movement within business groups. We confirm the decline in the overall stock comovement subsequent to the crisis.

<sup>8</sup> 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 of voting rights of financial member firms’ holdings in other member firms. The current cutoff is KRW 5 trillion (KRW 2 trillion until 2008), roughly equivalent to US\$5 billion.

<sup>9</sup> Kim, Kim, and Kwon (2009), and Lee and Park (2009) provide empirical evidence in support of investor activism in Korea during the post-crisis period.

business groups is of course facilitated by the improved governance such as the greater transparency in the business group-related information.

However, the emphasis on business group-related corporate governance during the post-crisis period was such that a given business group consisting of multiple publicly traded companies has frequently been treated as a single entity. For example, the regulatory authorities in Korea mandated 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 intra-group transactions.<sup>10</sup> During that period, Korean stock market has experienced another important structural change. The Korean equivalent of Nasdaq, aka Kosdaq, was established in 1996 and thus investors received an avalanche of new stocks. Based on above, our fundamental research question is whether the stocks in a given Korean business group become more or less correlated over time, especially following the financial crisis, above and beyond those implied by the fundamentals.

### **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. We obtain their daily stock return data from Korea Capital Market Institute and their daily trading volume data from Fn-Guide.

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 Committee (KFTC), the

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<sup>10</sup> 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.

Korea Listed Companies Association (KLCA), the company web sites, and newspapers. Specifically, we first obtain information about 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 information for smaller business groups.

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.

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. To obtain pairwise RPT data which is available from 1986, we resort to TS2000 provided by KLCA and augment it with data from Fn-Guide. Finally, we obtain ownership data manually from the annual reports and holdings filings available through Data Analysis, Retrieval, and Transfer (DART) system which is an electronic disclosure platform similar to EDGAR in US.

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. The sample stocks are distributed across 62 four-digit SIC (129 six-digit SIC) industries. In a given year, the sample stocks are as many as 886 on average, and 239 of them belong to a business group.

## **4. Analysis**

### **4.1. Correlation coefficient**

The standard approach in identifying a stock’s return correlation with a group of stocks is to calculate beta of the stock relative to some index that consists of stocks in the group. The difficulty in

applying this approach to our data structure is that the number of stocks in a business group is on average only 3 or 4. Hence, our basic empirical strategy is to 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 industry. 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 sample period<sup>11</sup> 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. 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.

Panels B and C of Table 1 report the summary statistics of these average correlations. Panel B reports results based on raw returns while panel C reports those based on market model adjusted returns. The results from Panel B indicate that companies exhibit a higher stock return correlation with other member firms in the same business group than they do with their industry peers. 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”, i.e., the average group correlation minus the average industry

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<sup>11</sup> The actual interval used to calculate each pair-wise correlation varies since it is constrained by the minimum number of valid trading days of the two stocks.

correlation, is on average positive and is also skewed positively. Panel C also provides largely similar results.

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 sample firms, it thus means that we have on average 17 publicly traded companies in a 6-digit industry.

The time-series of the average correlations helps resolve this issue. As shown in Table 2 and Figure 1, average correlations, when calculated year-by-year, vary a great deal over time. At the same time, the group and industry correlations move in hands over time. In stark contrast, we find that 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 over time (not tabulated). Thus, the difference in the number of stocks between business group and industry cannot fully explain their differing correlation coefficients.

Another noteworthy pattern in the time-series is that the difference in correlation between business group and industry has increased over time. Given that there have been continued efforts to improve corporate governance in those business groups, one would actually expect the opposite pattern. Chiu and Joh (2003) and Li, Morck, Yang, and Yeung (2004) 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 habitat trading.

#### 4.2. Principal component analysis

As an alternative approach in further scrutinizing the comovement of stocks within a business group, we conduct principal component analysis. Specifically, we extract the 1<sup>st</sup> principal component from the daily returns of stocks that belong to a given business group, and examine the explanatory power of the 1<sup>st</sup> component for those stocks. That is, we examine the fraction of the daily return correlation matrix of the same-group stocks that is explained by the 1<sup>st</sup> principal component. The interpretation is that the greater proportion the first component explains, the greater commonality among those stocks. As before, we conduct a similar analysis using stocks in the same industry.

Table 3 and Figure 2 show that the 1<sup>st</sup> principal component for the business group explains more of the constituent stock returns than the industry component. For example, the business-group first component always explains more than 50% of the correlation among the group-constituent stock returns (raw returns), except for three years of 1983, 1984, and 1985. In contrast, the industry first component does so only in one year (1989).

Another pattern observable in Figure 2 is that, while the industry component becomes less important over time, the business-group component maintains its explanatory power throughout our study period. In fact, this time-series pattern is consistent with the finding in the previous section that the pair-wise stock return correlation among the same-group stocks has increased over time as compared with the same-industry stocks. This pattern is particularly instructive, since there has been an overall reduction in the commonalities in stock returns after the 1997 financial crisis. For example, the cross-sectional dispersion in daily stock returns in our sample has more than doubled (from the order of 2% to greater than 4%) subsequent to the financial crisis.

#### 4.3. Addition to and deletion from business group

We next 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. Using these addition and deletion events, we examine whether a change in group membership is associated with a change in return correlation in a way that is consistent with the earlier univariate results. To this end, we employ four different specifications. Specifically, we compare the 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 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 the panel A). Panel B then reports the results for the deletion events. Although there are fewer events, the return correlation changes more dramatically. Especially when the year  $t-1$  return correlation is compared with that of the next year (i.e., year  $t$ )'s, 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  $t$  correlation from the correlation of year  $t-1$ , so that the decrease in correlation after deletion is measured as a positive change, making the results comparable to the addition events. This allows us to combine the two types of events in a unified analysis whose results are reported in Panel C. With the larger number of events, all four specifications document a reliable change in return correlation following a change in membership of a business group. In panel D, we separately examine the addition/deletion events during the post-crisis period. As mentioned above, there are 69 such events in that period. The results are stronger than the full sample period and it is consistent with the findings in the previous sections.

The results so far suggest that there is genuine correlation in stock returns among member firms within the same business group. Furthermore, the stock return correlation has noticeably

increased following the 1997 Asian financial crisis. In the next subsection, we explore whether such correlation is more likely to be driven by fundamentals or non-fundamentals.

#### 4.4. Fundamental correlation

There are fundamental links among the same-group stocks and those links can potentially explain the stock return correlation we have observed above. To explore the potential effect of fundamental links, we first estimate the correlation in return on assets (ROA), and examine whether this fundamental correlation explains the increase in stock return correlation within business groups in the post-crisis period. Since the ROA measure is available only at annual frequencies, the analysis is deemed to be crude at best. Still, it is useful in understanding the extent to which the fundamental correlation plays a role in the increased correlation during the post-crisis period.

Table 5, Panel A, shows that the return on assets is more highly correlated among the same-group firms *prior to* the financial 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.<sup>12</sup> Thus, it is difficult to attribute the increase in stock return correlation subsequent to the financial crisis to the stronger commonality in the economic fundamentals among the same-group firms. Panel B 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. However, the difference in ROA correlation between the pre- and post-crisis period is not significant.

#### 4.5. Role of related party transactions and inter-corporate equity holdings

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<sup>12</sup> This result is broadly consistent with the general consensus among regulators and practitioners that autonomy of member firms has increased in the post-crisis period.

To further scrutinize the role of fundamental factors in explaining stock return correlation among business group member firms, we now examine the specific channels through which resources of one member firm may be transferred over to another member firm. An immediate candidate for such fundamental channel is the transactions within the business group, as the companies in the same business group are known to prop up or tunnel each other via related-party transactions (RPTs). Another legitimate driver is the inter-corporate equity holdings in other member firms in the same business group. We obtain this information manually from the annual reports (analogous to Form 10-K) and holdings disclosures of each of the group-affiliated firms filed at DART system. We then gauge the role of the related-party transaction and the inter corporate equity holdings using the following regression:

$$(excess) \quad corr = \alpha + \sum_i \beta_i X_i + \sum_j \gamma_j (after1998) * X_j + affiliate\_holding$$

(where, X's include the following variables: RPTtoSales is related party transaction scaled by sales. Ln(mktcap) is the logarithm of market capitalization at the end of the year (unit: billion Korean Won). Daily\_tnover is the yearly average of daily turnover. Stddev(ret) is the standard deviation of return. N\_firms is the number of same-group stock.)

Table 6 reports the results of this regression. In panel A, the dependent variable is the difference between average correlation among the same group firms and average correlation among the same industry firms (4 digit SIC) for each firm-year, which reflects excess correlation among same group firms against an industry benchmark. In panel B, the dependent variable is the raw average correlation among the same group firms calculated for each firm-year.

The first column of panel A shows that RPT does not help explain the “extra” correlation among same-group stocks. This suggests that fundamental economic links such as the intra-group transactions may be responsible for the group-level correlation. We also observe that stocks of large

firms and volatile stocks are more highly correlated with other group stocks, consistent with the findings of Hameed et al. (2012). Note that we control for the number of same-group stocks over which each pair-wise correlation is averaged. In unreported results, we include the observations with missing RPTs by giving them a value of 0, and the results remain the same qualitatively, except that the stock return volatility is no longer significant.

When we add the interactive term between the RPT and a dummy for the post-crisis period (1998~) in column (2), the RPT itself becomes positive and significant, meaning that the related-party transaction indeed creates the extra correlation among the same-group stocks prior to the crisis. However, its interactive term with the post-crisis dummy is significant and negative, making its effect on the correlation virtually non-existent during the post-crisis period. Again, including the missing RPT observations with a zero value does not change our results (results not reported).

The previous two specifications do not include the post-crisis dummy itself, since the regression already has year fixed effects. As an alternative specification, we drop year dummies and include the post-crisis dummy. The resulting regression coefficient for this dummy is positive and significant, and thus consistent with the earlier univariate results (i.e., an increase in the excess correlation among the same-group stocks over time, especially after the 1997 Asian financial crisis). To ensure that the differing role of the RPT around the financial crisis is not a sideshow of other firm characteristics, we have each of the control variables interact with the post-crisis dummy in columns (4) through (7). In the presence of the additional interactive terms, the coefficients for `after1998*RPTtoSales` remain significant and negative while the RPT itself has a significant and positive coefficient.

Another important fundamental or rather mechanical linkage among the same-group stocks is the cross-holdings of equity stakes through which performance of one firm is transmitted to another through dividends or capital gains. To examine this link, we calculate the proportional ownership of a member firm in a business group held by other affiliated firms in the same group and include this affiliate holdings in the regression. Unfortunately, this information is available only since 1996. Thus,

instead of utilizing the post-crisis dummy, we estimate the regression twice: once for the period from 1996 in column (8), and then for the post-crisis period alone in column (9). In both estimations, neither the RPT nor the affiliated holdings are related to the extra correlation among the same-group stocks.

As a robustness check, we replace the dependent variable with the raw average within-group correlation in panel B. The results indicate that none of the above inferences are changed by this alternative specification. As another robustness check (which is not tabulated), we treat missing related party transaction value as zero and include those observations in the regression. The results remain qualitatively the same as the original specification in which the missing values are excluded from the regression.

To avoid any information loss in using the aggregate related party transactions at the group level, we also examine the pair-wise return correlation by associating it with pair-wise related-party transactions. 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 modify the above regression specification by dropping the number of firms within a group ( $n\_firms$ ) and instead including a dummy variable indicating that the two firms are in the same industry as defined by the 3-digit SIC codes. The latter variable is useful in additionally controlling for the fundamental correlation. In constructing other control variables, we use the average values across pair firms.<sup>13</sup>

The results reported in Table 7 show that it is still the case that the related party transactions add to the stock return correlation among the same-group stocks only prior to the financial crisis. As in the analysis for Table 6, the post-crisis contribution of the related party transactions to the stock return correlation is virtually non-existent. In an unreported result, we alternatively treat missing pair-wise

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<sup>13</sup> We also tried using the absolute difference between the two firms as control variables and found that the results are similar.

related party transaction value as zero 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 and the inter-corporate equity holdings. 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, it is hard to rationalize why such coordination would have strengthened over time, especially after the 1997 Asian financial crisis when other fundamental links—namely, related-party transactions and the inter-corporate equity holdings—are not related to stock return correlation. One would actually expect exactly the opposite pattern, since corporate governance has improved during the post-crisis period and thus must have weakened such coordination.

#### 4.6. Category/Habitat vs. Market frictions

Thus far, we have used daily stock returns and found a higher correlation among the same-group than among the same-industry stocks during the post-crisis period. We also examined various fundamental correlations among the same-group stocks and found that the fundamental correlation does not explain the increased stock return commonality of the same-group stocks. If the increased return correlation among the same-group stocks is to be attributable to non-fundamental factors, then there are two candidates. According to Barberis, Shleifer, and Wurgler (2005), they are categorization/habitation and market friction. That is, same-group stocks might have shown excess comovement over time as investors have increasingly categorized those stocks into one group and thus ignored the difference among them (“category trading”) or investors have traded only those same-

category stocks (“habitat trading”). Alternatively, it could be that a group of stocks have been responding to common news at the increasingly similar rates (“market frictions”).<sup>14</sup>

To gauge the relative importance of the two explanations, we repeat our analysis using weekly or biweekly returns. The idea is that if the observed increase in return correlation is due to a more synchronized reaction to common information, then this increase should be weaker or non-existent in a longer-horizon return during which the relevant information is fully reflected into stock price. Figure 3 shows that this is not the case. The increased stock return commonality is also found in both weekly and biweekly returns, and the pattern is very similar to the daily return case. In an unreported result, we also repeated the analysis in Table 6 with weekly or biweekly returns. The results were virtually identical.

As another attempt to gauge the relative importance of those explanations, we examine the cross-autocorrelation among same-business group stocks. Unlike the category/habitat-driven correlation, the friction-driven correlation would be detected by a reduction in the cross-autocorrelation surrounding the crisis. To this end, we construct a portfolio of same-group stocks and examine its 1<sup>st</sup>-order autocorrelation, as the autocorrelation of a portfolio is basically the average of the cross-autocorrelation among the constituent stocks. We also conduct a similar analysis using the same-industry stocks.

Figure 4 shows that the autocorrelation of the industry portfolio is always greater than that of the group portfolio and the difference appears to be declining over time.<sup>15</sup> It thus means that industry-wide news is diffused within the industry at a slower rate than group-wide news travels in the group. Also, the result means that this difference becomes less important. Thus, a market-friction explanation would hold that the “excess” comovement among group stocks relative to industry stocks becomes

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<sup>14</sup> Or, it could be that newly entering investors particularly engage in categorization of same-business group stocks, or that there are more group-wide information or news over time.

<sup>15</sup> Both autocorrelations are positive and thus suggest that there is diffusion of information with a lag within a business group and an industry.

weaker over time. However, we have found exactly the opposite pattern, namely, that the correlation among same-groups stocks relative to the same-industry stocks increased over time.

#### 4.7. Trading volume analysis

The results in the previous section are more consistent with the category/habitat explanation than with the market friction story. One other possibility, distinct from market friction, is that there may have been an increase in group-wide news. Such an increase—if any—could be due to the greater fundamental correlation among member firms, but our earlier results are inconsistent with this explanation. Instead, the results so far provide support for the view that there has been an increase in investors' greater awareness of governance issues and they pay special attention when a company belongs to the same business group that another company belongs to. Such awareness and recognition might affect investors to perceive those same-group companies as one entity and make those investors trade at the business group level. Alternatively, the heightened interest in a given business group might cause investors to trade within that group.

One empirical implication stemming from this category/habitat explanation is that stocks in the same business group are traded simultaneously. To examine this implication, we examine the commonality in trading among the same-group stocks. Specifically, we conduct a principal component analysis for daily trading volume (i.e., share turnover) of the same-group stocks. We continue to use the same-industry stocks as a benchmark.

Figure 5 shows that there is a strong commonality in the trading behavior of the same-group stocks. As a general rule, more than 50% of their trading volume is explained by the 1st principal component. This fraction is in fact higher than the return case. The benchmark is again the stocks in the same industry. The industry turnover commonality is hovering at a lower level of 40% and it declines over time, particularly after the 1998 Asian financial crisis. It thus makes the post-crisis group-wide turnover commonality more pronounced.

## 5. Conclusions

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 inter-corporate ownership, or non-fundamental correlation based on some ‘category’ or ‘habitat’ trading.

To test which explanation is more consistent with the observe 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 Asian crisis triggered a massive reform on corporate governance regulations in Korea, changes in correlation structure over time could shed some light on the link between governance and correlation. We find that although overall stock market correlation has decreased subsequent to the crisis, correlation among the same group firms has been steadily increasing over time. Such increase in group-level correlation is not explained by fundamental factors, such as correlation in ROA, related party transactions, or inter-corporate ownership.

Finally, we explore how correlated trading among investors may drive the within-group return correlation by implementing a principal component analysis using daily turnovers of stocks that belong to a same business group. We find that 1<sup>st</sup> principal component of turnovers explain more than

50% of trading, which is consistent with the ‘category’ of ‘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 too much 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 a 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<sup>16</sup>, 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.

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<sup>16</sup> Tunneling and propping cannot be easily defined in this case since propping a member firm means tunneling from other member firms.

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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 and C shows the return distribution of correlation coefficients of raw and market-model-adjusted returns, respectively. Difference in Panel B and C (for each industry classification) represents the average group correlation minus the average industry correlation.

Panel A. Sample stocks

	total	per-year average
number of sample stocks	2240	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. Distribution of Pair-wise Correlations: Raw Returns

	mean	std.dev	min	Q1	median	Q3	max
group stocks	0.30	0.13	0.00	0.21	0.29	0.36	0.83
Industry (sic3)	0.20	0.08	-0.14	0.16	0.19	0.24	0.49
Industry (sic4)	0.23	0.11	-0.17	0.17	0.21	0.26	0.71
Industry (sic6)	0.24	0.11	-0.13	0.17	0.22	0.27	0.71
difference (group - sic3)	0.10	0.13	-0.33	0.03	0.09	0.14	0.76
difference (group - sic4)	0.08	0.14	-0.43	0.00	0.07	0.14	0.75
difference (group - sic6)	0.07	0.14	-0.43	-0.01	0.06	0.13	0.75

Panel C. Distribution of Pair-wise Correlations: Adjusted Returns

	mean	std.dev	min	Q1	median	Q3	max
group stocks	0.16	0.13	-0.13	0.08	0.13	0.20	0.83
Industry (sic3)	0.08	0.05	-0.13	0.05	0.07	0.10	0.37
Industry (sic4)	0.11	0.08	-0.17	0.06	0.09	0.13	0.53
Industry (sic6)	0.12	0.09	-0.12	0.07	0.10	0.14	0.53
difference (group - sic3)	0.08	0.13	-0.28	0.00	0.05	0.12	0.79
difference (group - sic4)	0.05	0.15	-0.44	-0.02	0.04	0.11	0.79
difference (group - sic6)	0.04	0.15	-0.44	-0.03	0.03	0.11	0.78

Table 2. Time Series of Return correlation

The first 3 columns show time series of average correlation of returns in the same business group and industry code. The last 3 columns report the difference between the average group correlation and the average industry correlation for sic3, sic4, and sic6, respectively.

Panel A. Raw return

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
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

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
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

Table 3. Time series of PCA result...

This table shows time series of the proportion of the first component in principal component analysis of daily return. N(group) and N(industry) denote the number of group and industry(sic4 classification) which have full observations (strongly balanced panel) in a given year, respectively.

Year	N(group)	N(industry)	Raw return		Adjusted return	
			Group	Industry	Group	Industry
1980	25	29	0.5054	0.3693	0.4666	0.3080
1981	25	29	0.5239	0.3834	0.4770	0.3453
1982	25	29	0.5266	0.4109	0.4824	0.3759
1983	26	29	0.4997	0.3676	0.4814	0.3459
1984	26	29	0.4828	0.3232	0.4580	0.2993
1985	26	30	0.4601	0.3197	0.4405	0.2982
1986	29	31	0.5296	0.4247	0.4591	0.3630
1987	33	31	0.5694	0.4932	0.4949	0.3997
1988	37	31	0.5501	0.4887	0.4682	0.3893
1989	42	30	0.5979	0.5073	0.4771	0.3753
1990	47	34	0.6756	0.6093	0.4719	0.3756
1991	52	35	0.5959	0.4948	0.4745	0.3672
1992	54	36	0.5963	0.4646	0.5091	0.3688
1993	57	38	0.6116	0.4832	0.4995	0.3651
1994	58	39	0.5219	0.3572	0.4948	0.3388
1995	58	40	0.5632	0.4245	0.4815	0.3398
1996	59	41	0.5480	0.3938	0.4683	0.3095
1997	56	39	0.6533	0.4863	0.5059	0.3184
1998	53	40	0.6542	0.4383	0.5574	0.3213
1999	47	38	0.6153	0.4298	0.5356	0.3582
2000	52	38	0.6112	0.4368	0.5449	0.3598
2001	77	50	0.5988	0.4397	0.5111	0.3367
2002	81	51	0.5849	0.3801	0.4979	0.2784
2003	81	50	0.5506	0.3132	0.4725	0.2222
2004	97	53	0.5154	0.2703	0.4692	0.2207
2005	102	54	0.5168	0.2849	0.4771	0.2453
2006	99	56	0.5601	0.3515	0.4860	0.2671
2007	99	56	0.5511	0.3319	0.4779	0.2524
2008	101	54	0.6489	0.4378	0.5027	0.2575
2009	119	56	0.5665	0.3162	0.5022	0.2360

Table 4. Changes in stock return correlation around the group membership changes

IN (Out) denotes an event that a firms are newly included in (depart from) a business group at year T. In the case of IN,  $\Delta$  ( $\Delta 2$ ) group\_corr is the difference of correlation between T (T+1) and (T-1). In the case of OUT,  $\Delta$  ( $\Delta 2$ ) group\_corr is the difference of correlation between T-1 and T (T+1).  $\Delta$  and  $\Delta 2$  Group\_adjcorr denote the difference of correlation between 1 and 2 year, respectively.

variable	Obs.	mean	std.dev	t-value
<b>Panel A: IN (after - before)</b>				
$\Delta$ group_corr	64	0.028	0.137	1.61
$\Delta 2$ group_corr	61	0.038	0.147	2.03
$\Delta$ group_adjcorr	64	0.005	0.091	0.48
$\Delta 2$ group_adjcorr	61	0.011	0.102	0.85
<b>Panel B: OUT (before - after)</b>				
$\Delta$ group_corr	28	0.084	0.111	4.00
$\Delta 2$ group_corr	27	0.044	0.150	1.53
$\Delta$ group_adjcorr	28	0.061	0.103	3.14
$\Delta 2$ group_adjcorr	27	0.039	0.115	1.78
<b>Panel C: Full sample</b>				
$\Delta$ group_corr	92	0.045	0.132	3.26
$\Delta 2$ group_corr	88	0.040	0.147	2.55
$\Delta$ group_adjcorr	92	0.022	0.098	2.19
$\Delta 2$ group_adjcorr	88	0.020	0.106	1.75
<b>Panel D: Full sample: After financial crisis</b>				
$\Delta$ group_corr	69	0.059	0.128	3.818
$\Delta 2$ group_corr	65	0.041	0.141	2.336
$\Delta$ group_adjcorr	69	0.034	0.088	3.233
$\Delta 2$ group_adjcorr	65	0.027	0.095	2.262

Table 5. Change in the correlation of ROA

CorrROA97 (98) denotes the average of correlation of ROA in the same business group by 1997 (year 1998 and forward). ExcessROA97 (98) denotes the difference between average correlation among the same group and average correlation among the same industry(sic4) firms. Change98 is the difference between these two values in each panel.

Variable	mean	Std.dev	t-value	N
<b>Panel A</b>				
CorrROA97	0.2308	0.4333	7.51	199
CorrROA98	0.1496	0.2421	8.72	199
Change98	-0.0811	0.5081	-2.25	199
<b>Panel B</b>				
ExcessROA97	0.0268	0.4511	0.84	199
ExcessROA98	0.0536	0.2778	2.72	199
Change98	0.0267	0.5034	0.75	199

Table 6. Regression result

This table shows regression results. In panel A, the dependent variable is the difference between average correlation among the same business group firms and average correlation among the same industry (sic4) firms for each firm-year, which reflect excess correlation among same group firms against an industry benchmark. In panel B, the dependent variable is the raw average correlation among the same group firms calculated for each firm-year. RPTtoSales is related party transaction scaled by sales. Ln(mktcap) is the logarithm of market capitalization at the end of the year (unit: billion Korean Won). Daily\_tnover is the yearly average of daily turnover. Stddev(ret) is the standard deviation of return. N\_firms is the number of same-group stock. After1998 is a dummy variable equal to one for year is 1998 and forward. Heteroscedasticity-robust t-statistics are in the bracket. \*\*\*, \*\*, and \* indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively.

Panel A: Excess correlation among same business group firms									
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
RPTtoSales	0.0041 [0.534]	0.0545*** [3.106]	0.0443** [2.436]	0.0493*** [2.847]	0.0555*** [3.191]	0.0573*** [3.298]	0.0574*** [3.189]	-0.0020 [-0.519]	-0.0020 [-0.494]
ln(mktcap)	0.0153*** [7.186]	0.0151*** [7.127]	0.0188*** [9.183]	0.0272*** [7.645]	0.0151*** [7.076]	0.0149*** [6.969]	0.0151*** [7.102]	0.0083*** [3.311]	0.0065** [2.450]
dailiy_tnover	-0.1408 [-0.508]	-0.1356 [-0.485]	-0.2455 [-0.944]	-0.2042 [-0.728]	-0.8518 [-0.697]	-0.2314 [-0.821]	-0.1345 [-0.482]	-0.4779 [-1.340]	-0.5145 [-1.483]
stddev(ret)	1.4769*** [3.308]	1.4605*** [3.279]	2.4216*** [7.917]	1.5388*** [3.472]	1.4998*** [3.362]	-0.4225 [-0.429]	1.4437*** [3.236]	1.9229*** [3.494]	2.2680*** [3.833]
n_firms	-0.0033*** [-5.188]	-0.0035*** [-5.500]	-0.0035*** [-5.507]	-0.0036*** [-5.761]	-0.0035*** [-5.555]	-0.0036*** [-5.678]	-0.0042*** [-4.622]	-0.0024*** [-3.344]	-0.0015* [-1.816]
after1998*RPTtoSales		-0.0550*** [-3.032]	-0.0438** [-2.339]	-0.0494*** [-2.734]	-0.0560*** [-3.111]	-0.0576*** [-3.199]	-0.0581*** [-3.127]		
after1998			0.0190** [2.332]						
after1998*ln(mktcap)				-0.0175*** [-4.443]					
after1998*daily_tnover					0.7207 [0.588]				
after1998*stddev(ret)						2.3271** [2.161]			
after1998*n_firms							0.0016 [1.448]		
affil_holding								-0.0001 [-0.611]	0.0000 [0.017]
Constant	-0.0942 [-1.489]	-0.1243* [-1.891]	-0.0706** [-2.139]	-0.1344** [-2.067]	-0.1241* [-1.876]	-0.0731 [-1.046]	-0.1245* [-1.890]	-0.0598 [-0.991]	-0.1352** [-2.342]
dummy	year,sic4	year,sic4	sic4	year,sic4	year,sic4	year,sic4	year,sic4	year,sic4	year,sic4
Observations	2,410	2,410	2,410	2,410	2,410	2,410	2,410	1,367	1,103
R-squared	0.227	0.232	0.192	0.415	0.414	0.412	0.408	0.392	0.387

Panel B. Raw average correlation among the same group firms

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
RPTtoSales	-0.0003 [-0.056]	0.0593*** [3.122]	0.0202 [0.932]	0.0524*** [2.802]	0.0515*** [2.745]	0.0544*** [2.902]	0.0610*** [3.141]	-0.0056* [-1.847]	-0.0051 [-1.591]
ln(mktcap)	0.0250*** [10.247]	0.0248*** [10.199]	0.0282*** [11.447]	0.0407*** [10.165]	0.0253*** [10.415]	0.0253*** [10.401]	0.0248*** [10.170]	0.0124*** [4.195]	0.0119*** [3.795]
dailiy_tnover	0.3342 [1.164]	0.3403 [1.177]	-0.5615** [-2.079]	0.2503 [0.878]	5.9806*** [4.226]	0.5066* [1.691]	0.3409 [1.181]	-0.0852 [-0.235]	-0.0640 [-0.176]
stddev(ret)	2.3949*** [4.612]	2.3755*** [4.588]	5.7301*** [16.012]	2.4783*** [4.837]	2.0661*** [4.015]	5.6450*** [4.879]	2.3657*** [4.560]	2.0957*** [3.403]	2.1080*** [3.228]
n_firms	-0.0032*** [-4.545]	-0.0034*** [-4.865]	-0.0022*** [-2.673]	-0.0037*** [-5.159]	-0.0030*** [-4.298]	-0.0033*** [-4.651]	-0.0039*** [-4.055]	-0.0020** [-2.255]	-0.0011 [-0.996]
after1998*RPTtoSales		-0.0650*** [-3.390]	-0.0272 [-1.247]	-0.0576*** [-3.040]	-0.0574*** [-3.026]	-0.0605*** [-3.192]	-0.0668*** [-3.406]		
after1998			-0.1084*** [-11.400]						
after1998*ln(mktcap)				-0.0229*** [-5.159]					
after1998*dailiy_tnover					-5.6759*** [-4.033]				
after1998*stddev(ret)						-4.0405*** [-3.254]			
after1998*n_firms							0.0009 [0.736]		
affil_holding								-0.0003 [-1.238]	-0.0000 [-0.179]
Constant	0.1711*** [3.006]	0.1355** [2.280]	0.2516*** [9.839]	0.1223** [2.190]	0.1343** [2.424]	0.0466 [0.737]	0.1354** [2.268]	0.3516*** [8.652]	0.4959*** [9.275]
dummy	year,sic4	year,sic4	sic4	year,sic4	year,sic4	year,sic4	year,sic4	year,sic4	year,sic4
Observations	2,410	2,410	2,410	2,410	2,410	2,410	2,410	1,367	1,103
R-squared	0.404	0.408	0.231	0.415	0.414	0.412	0.408	0.392	0.387

Table 7 Pair-wise correlation regression

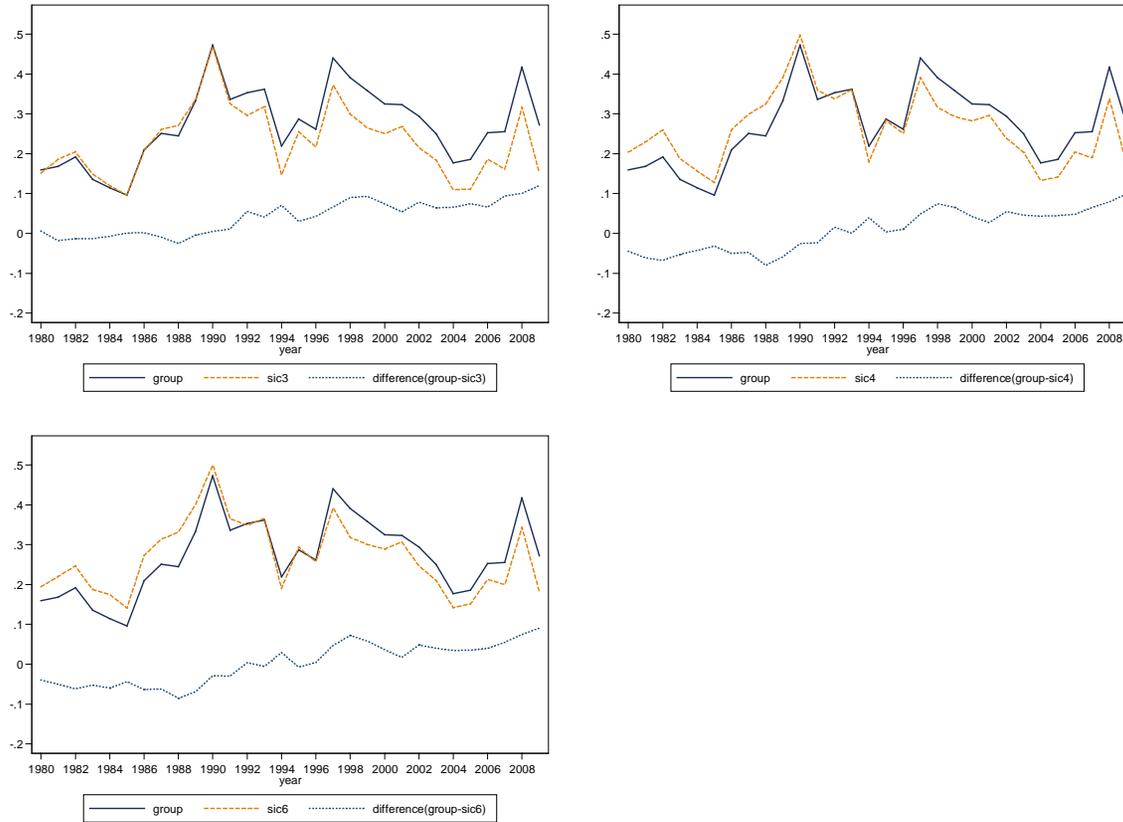
RPTtoSales is pair-wise related party transaction scaled by the average of sales of a pair of firms. Ln(avgmktcap) denotes the logarithm of average of market capitalization. Avg(turnover) and avg(stdret) are average of daily turnover and standard deviation of return, respectively. Samesic3 is a dummy variable that is equal to 1 if a pair of firms are included in the same sic3. Heteroscedasticity-robust t-statistics are in the bracket. \*\*\*, \*\*, and \* indicate that the coefficients are statistically significant at 0.01, 0.05 and 0.10 level, respectively.

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
RPTtoSales	0.1656*** [4.974]	0.2712*** [4.953]	0.2664*** [4.682]	0.2343*** [4.353]	0.2507*** [4.917]	0.2717*** [4.992]
ln(avgmktcap)	0.0318*** [23.004]	0.0313*** [22.585]	0.0289*** [20.365]	0.0633*** [19.276]	0.0317*** [22.994]	0.0313*** [22.224]
avg(turnover)	0.7737** [2.078]	0.8261** [2.235]	-1.0360*** [-3.257]	0.6563* [1.786]	12.3174*** [6.613]	0.9064** [2.454]
avg(stdret)	2.6001*** [4.955]	2.5656*** [4.930]	6.4509*** [18.325]	2.6789*** [5.116]	2.3722*** [4.651]	3.7586** [1.966]
samesic3	0.0447*** [9.570]	0.0462*** [9.912]	0.0428*** [8.421]	0.0465*** [10.078]	0.0450*** [9.694]	0.0463*** [9.938]
RPTtosales * after1998		-0.2521*** [-3.577]	-0.2385*** [-3.163]	-0.2311*** [-3.320]	-0.2255*** [-3.344]	-0.2524*** [-3.598]
after1998			-0.1415*** [-20.752]			
ln(avgmktcap) * after1998				-0.0377*** [-10.759]		
avg(turnover) * after1998					-11.6536*** [-6.277]	
avg(stdret) *after1998						-1.4324 [-0.752]
constant	0.0207 [0.846]	0.0171 [0.712]	0.0632*** [4.912]	-0.1091*** [-4.209]	-0.0150 [-0.645]	-0.0103 [-0.211]
dummy	year	year	no	year	year	year
Observations	5,618	5,618	5,618	5,618	5,618	5,618
R-squared	0.318	0.321	0.163	0.335	0.329	0.321

Figure 1. Time series of Return correlations

Each figure shows the time series of return correlation of daily return belonging to the same business group and in the same industry code. The “difference” denotes the excess average group correlation minus the average correlation in a given industry code.

Panel A: raw return



Panel B: adjusted return

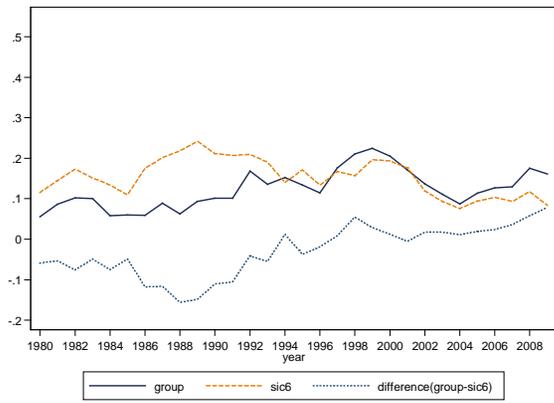
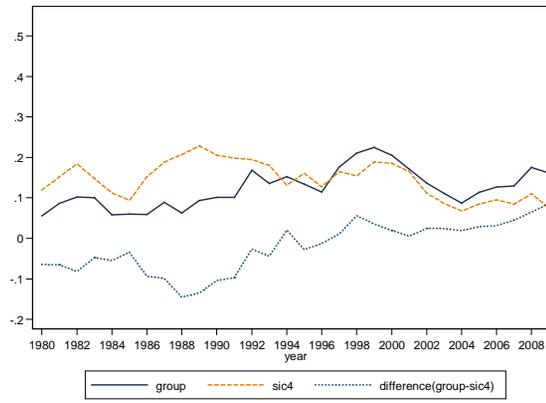
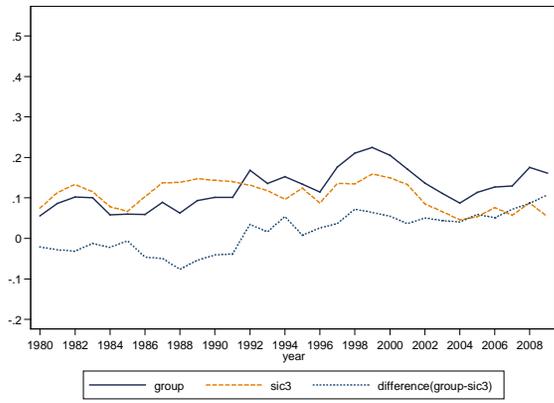
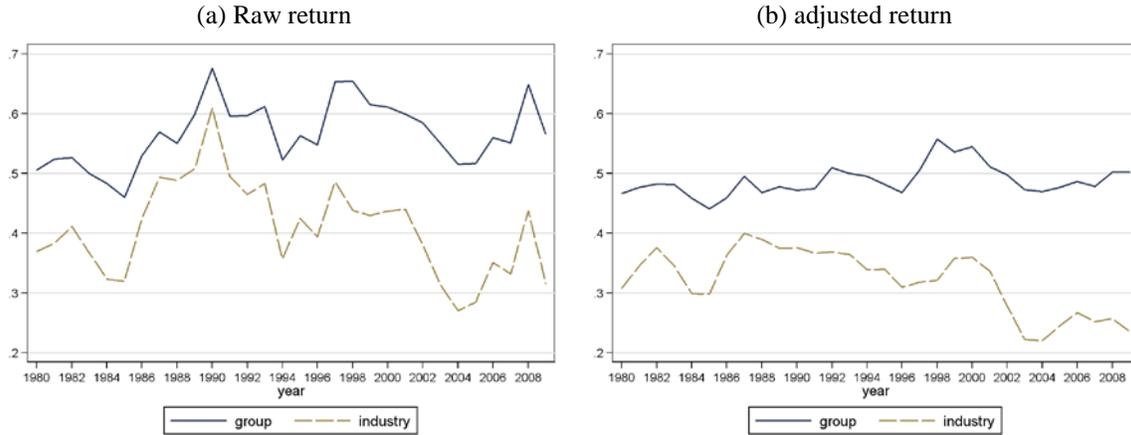


Figure 2. Return PCA results

Figures in Panel A show time series of the first component in principal component analysis using daily raw and market-model-adjusted return, respectively. Group (industry) denotes the average of the proportion of first principal component from the daily return of stocks that belong to a business group (industry (SIC4)). Figures in Panel B report the proportions of *i*-th component for stocks from the same business group and Industry.

Panel A: Time series of the first component



Panel B. Proportions of *i*-th component

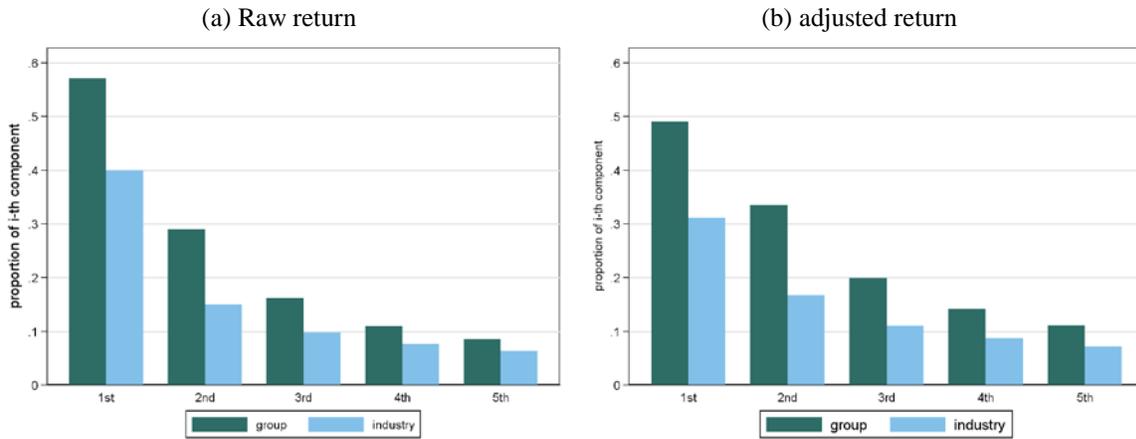


Figure 3. Time Series of Return correlation (using various time intervals)

Group\_daily, \_weekly, and \_biweekly represent average correlation of return measured in day, week, and 2 weeks, respectively. Difference\_daily, \_weekly, and \_biweekly is the difference between average correlation among the same business group firms and average correlation among the same industry (sic4) firms for each firm-year using daily, weekly and biweekly return, respectively.

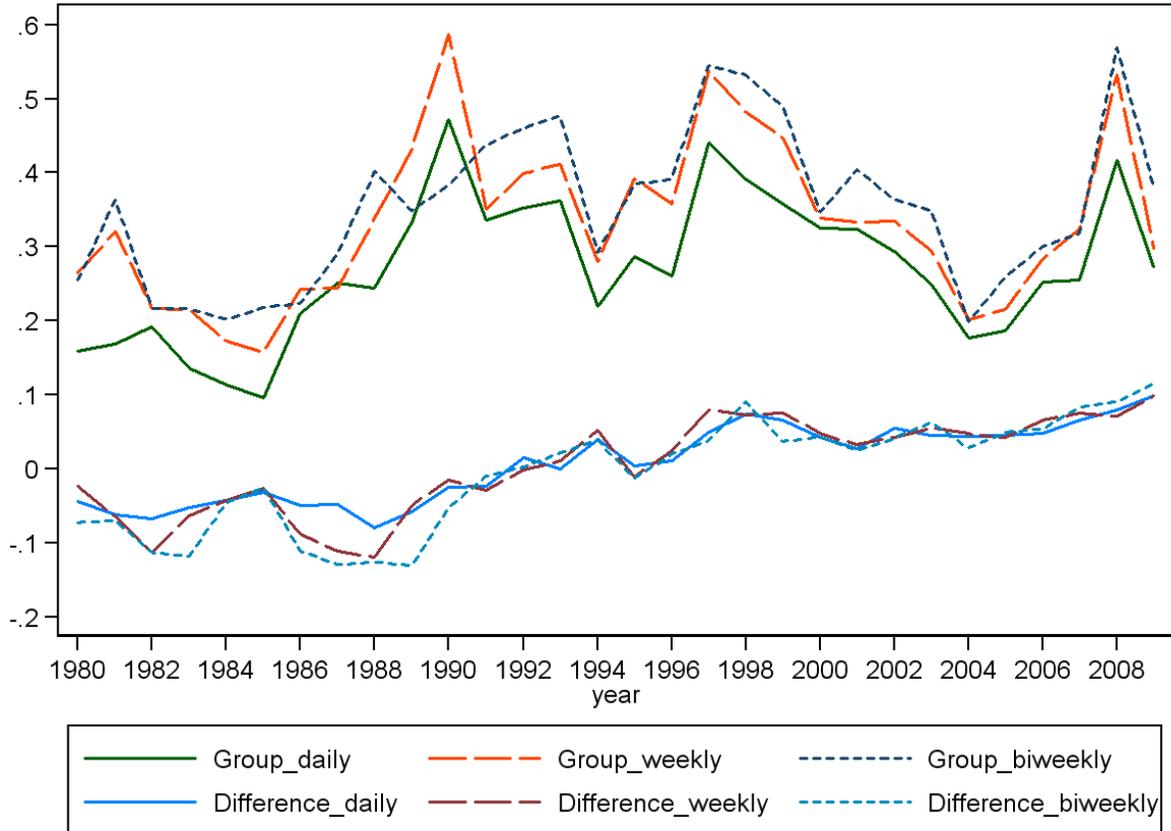


Figure 4. Time Series of Portfolio Autocorrelation of Daily return

Each figure shows trend of average AR(1) coefficients of portfolios that consist of stocks belonging to the same business group and the same industry (SIC4).

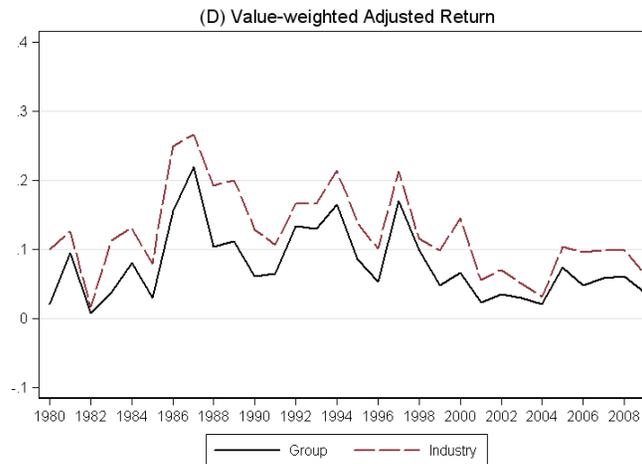
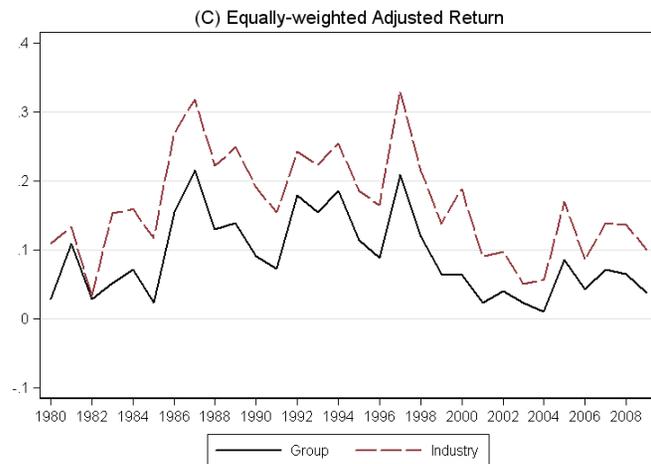
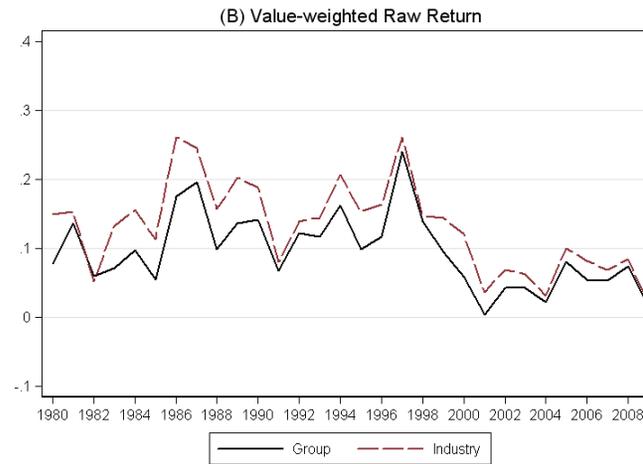
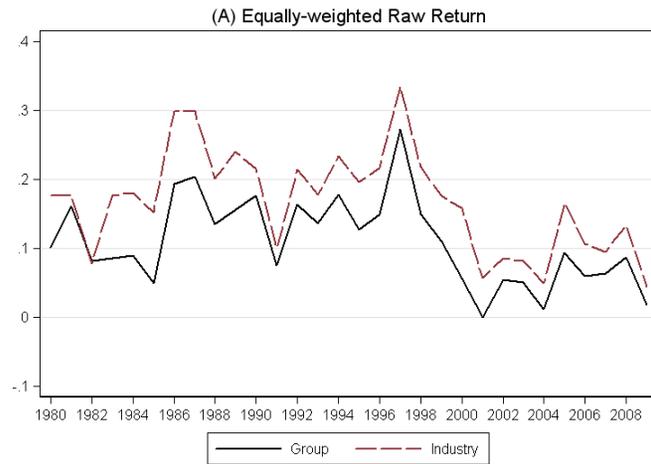


Figure 5. Turnover PCA result

This figure shows time series of the first component in principal component analysis using daily turnover. Group (industry) denotes the average of the proportion of first principal component from the daily turnover of stocks that belong to a business group (industry)

