Capital Allocation Efficiency of Firms Outside the Business Group*

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by

Yunxiao Liu,† Woochan Kim,‡ and Taeyoon Sung§

Abstract

This study investigates the association between business groups' influence and the capital allocation efficiency of firms outside the business group. We use a sample of Korean firms (1987 to 2010) to compute an annual index of the collective strength and dominance of large business groups (LBGs) per industry. We discover that this index is negatively associated with non-LBG firms' industry-level capital allocation efficiency during a period characterized by underdeveloped financial markets and weak investor protection. The negative association is stronger in industries that may lack collateral or internal equity capital. We also find that the negative association strengthens when we limit our analyses to the index component exogenous to non-LBG firms' capital expenditures, suggesting that the relationship is causal. The results also survive a battery of robustness checks.

JEL classification: G3, G31, G32, G34
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† Korea University Business School; e-mail: liuyunxiao@korea.ac.kr.
‡ Corresponding Author. Associate Professor of Finance, Korea University Business School; Research Associate, European Corporate Governance Institute (ECGI); e-mail: wckim@korea.ac.kr.
§ Professor of Economics, Yonsei University, School of Economics; e-mail: tsung@yonsei.ac.kr.

1. Introduction

Studies on business groups have increased significantly in the past two decades, and their specific research questions have broadened over time.[1] They have documented the divergence between control and cash flow rights (Claessens, Djankov, and Lang, 2000; Claessens et al., 2002; Faccio and Lang, 2002), investigated the value relevance of such a disparity (La Porta et al., 2002; Mitton, 2002; Nenova, 2003; Ferris, Kim, and Kitsabunnarat, 2003; Lemmon and Lins, 2003; Baek, Kang, and Park, 2004; Lin et al., 2011; Bae et al., 2012), compared the performance of group-affiliated firms against the unaffiliated (Khanna and Palepu, 2000; Joh, 2003; Bertrand et al., 2008), or explained the factors behind business groups' formation and structure (Kim, Lim, and Sung, 2007; Almeida et al., 2011; Masulis, Pham, and Zein, 2011). Studies also investigate the efficiency of internal capital markets formed by diversified business groups, and these markets' role in attenuating financial constraints (Shin and Park, 1999; Gopalan, Nanda, and Seru, 2007; Lee, Park, and Shin, 2009; Gopalan, Nanda, and Seru, 2014; Buchuk et al., 2014; Almeida, Kim, and Kim, 2015). Other studies, in contrast, provide evidence of controlling shareholders' expropriating minority shareholders through intragroup transactions, known as tunneling (Bae, Kang, and Kim, 2002; Bertrand, Mehta, and Mullainathan, 2002; Cheung, Rau, and Stouraitis, 2006; Baek, Kang, and Lee, 2006; Black et al., 2015).

However, the existing literature scarcely investigates the influence that business groups exert on other economic sectors. Business groups do not exist in a vacuum; they coexist with other types of firms and compete against one another in product and input markets. Business group firms'

[1] We do not survey papers on conglomerates here, as they are not the focus of this study. "Conglomerates" are freestanding firms that engage in a diversified portfolio of businesses, whereas "business groups" are groups of legally independent firms connected through intragroup shareholdings.

successful input mobilization may actually imply a lack of necessary input for non-affiliated firms and the disruption of their investments in a country with scarce capital and labor input. Efficient capital allocation within business groups, in other words, may not guarantee economy-wide capital allocation efficiency. Hence, it is important that we focus on business groups as well as their influence on other economic sectors. However, existing literature on business groups is virtually silent on this subject.

The current study fills this gap in literature by investigating the association between business groups' influence and the capital allocation efficiency of firms outside the business group. We specifically ask the following questions: Can firms without group affiliations efficiently allocate capital in industries with dominant group-affiliated firms? If not, is this due to the group-affiliated firm's ability to mobilize capital from its internal capital market? If the financial constraint is what matters, can a country's financial market development or stronger investor protection alleviate such a negative spillover effect from business groups? Would non-affiliated firms in industries without collateral or internal equity capital suffer more?

We answer these questions by sampling Korean firms from 1987 to 2010, as Korea provides an ideal setting to investigate our research questions for many reasons. First, Korea is known for its large family-controlled business groups, or chaebols, which have been in existence for many decades. However, Korea is also populated with firms that do not belong to any of these business groups. This well-balanced composition of firms in Korea allows us to investigate the association between business groups' influence and the capital allocation efficiency of firms outside the business group.

Second, Korea experienced an extraordinary event—the Asian financial crisis of 1997–1998—that dramatically changed the nature of its financial markets. Capital was scarce prior to

the crisis, and dominated by business groups; after the crisis, financial constraints eased considerably as business group firms curtailed overinvestments and decreased financial leverage. Simultaneously, a series of corporate governance reform measures followed immediately after the crisis, which greatly restored investors' confidence in Korean firms and further eased their financial constraints. Such a regime change in the middle of our sample period allows us to investigate the influence of financial sector development or investor protection on the relationship between business group strength or dominance and the capital allocation efficiency of non-business group firms.

Third, Korea is a country in which detailed business group data is available for more than two decades. The Korean government (Fair Trade Commission) since 1987 has annually identified and released the names of large business groups (LBGs) and their individual member firms for regulatory purposes. Therefore, we can use 24 years (1987–2010) of large business group data in this study to investigate how LBGs' strength and dominance evolved over time in each industry, and how they relate to the capital allocation efficiency in non-LBG firms. Korea is also a country in which even privately held companies' financial statement data is available. This is due to a Korean law that subjects companies above a certain asset size to an external audit. Access to this financial statement data is critical for our study given the dominance of privately held companies, both inside and outside of business groups.

Our empirical analyses begin with the construction of an index that captures LBGs' influence in each industry. We name this index the Business Group Strength and Dominance Index (BSDI). As its name suggests, the index captures two distinct features: the collective size of the LBGs' internal capital market ("strength") and their collective market share ("dominance") in a particular industry. Using this index, we find a number of noteworthy results.

First, we discover evidence consistent with the perception that large business groups can harm capital allocation efficiency outside the LBG, and this is primarily accomplished by imposing greater financial constraints upon non-LBG firms. Specifically, we find that the industry-level capital allocation efficiency of non-LBG firms is negatively associated with the BSDI during a period characterized by an underdeveloped financial market and weak investor protection (i.e., before the 1997–1998 Asian financial crisis), but not during a later period.

Second, to see if BSDI *causes* non-LBG firm's capital allocation inefficiency, and not *vice versa*, we limit our analyses to the component of BSDI that is exogenous to non-LBG firm's capital expenditure, and find that the negative association strengthens. We believe that the collective size of LBGs' internal capital market ("strength") is exogenous to non-LBG firms' capital expenditures. It is difficult to imagine that non-LBG firms' underinvestment in a particular industry would trigger large business groups to increase their internal capital markets – measured by the sum of member firms' (excluding the firm in the industry under investigation) book assets – by acquiring firms in other industries or increasing the asset size of existing firms in other industries.

Third, to further emphasize that our finding comes from greater financial constraint, we conduct many subsample tests to discover that the negative association between BSDI and non-LBG firms' capital allocation efficiency is stronger in industries that may lack collateral (i.e., low asset tangibility) or internal equity capital (low cash flows).

Fourth, we observe evidence that low capital allocation efficiency translates into lower profitability. Specifically, we discover that the BSDI predicted non-LBG firms' lower profitability before the Asian financial crisis, but not so thereafter. We find that, in contrast, the BSDI predicted LBG firms' higher profitability before the Asian financial crisis, but not so much thereafter.

Fifth, we find that our key results are highly robust. They remain intact even when excluding non-LBG subcontractors of LBG firms from the sample of non-LBG firms. This allows us to exclude the competing hypothesis that our finding is driven by LBG firms' heightened collaboration with non-LBG subcontractors during the post-crisis period. Our falsification test demonstrates that a fake index, purely based on market share and unrelated to group affiliation, fails to replicate our results. We also observe that our results remain intact when limiting our analyses to a subsample of non-tradable sectors, in which our measure of market share is more reliable. The results are also robust to alternative measures of internal capital market and investment opportunity. Further, alternative industry and business group classifications do not matter. The results also remain intact when using different data sources. Finally, results from firm-level weighted least squares (WLS) regressions, in lieu of our baseline industry-level regressions, provide qualitatively similar results.

Our study contributes to the literature in several ways. First, we advance current literature by investigating the association between business groups' influence and the capital allocation efficiency of firms outside the business group. As aforementioned, few studies in existing literature investigate business groups' influence on other economic sectors, with the work of Boutin et al. (2013) as the closest to ours. The authors sample French firms to reveal that a firm's entry into new industries and its survival are influenced by the incumbent group's hoarded cash, relative to that hoarded by the entrant group. In other words, the authors assess the impact of the business group's financial strength on product market competition. However, they focus on the modes of entry and exit and not on capital allocation efficiency, which is the topic of this study. Additionally, they do not include an exogenous event in their study, which allows for an investigation of the influences of financial sector development or investor protection.

Second, we empirically support the theoretical predictions of Almeida and Wolfenzon (2006), which study the relationship between business groups' internal capital markets and the efficiency of economy-wide capital allocations. Their theoretical model notes that the effect of the business group's bias toward internal capital reallocation varies (i.e., non-monotonic) with the country's level of investor protection. It is beneficial in low-protection countries, harmful in medium-protection countries, and irrelevant in high-protection countries. The authors use Korea in the 1990s as anecdotal evidence to support their argument that the negative externality associated with business groups is particularly costly for countries in an intermediary financial development phase.

Third, we add to a strand of literature that studies the influences of financial sector development or investor protection on capital allocation efficiency (Wurgler, 2000; Beck and Levine, 2002; Love, 2003; Galindo, Schiantarelli, and Weiss, 2007; Abiad, Oomes, and Ueda, 2008; McLean, Zhang, and Zhao, 2012). We contribute to this literature by identifying a channel through which stronger investor protection or financial sector development can improve capital allocation efficiency. We demonstrate that this improvement occurs by alleviating the financial constraints that business group firms impose on non-business group firms.

Finally, we construct the aforementioned BSDI to capture the collective strength and dominance of large business groups in each industry. We believe that this index can be useful not only for our study's purposes, but also in other studies that must quantify business groups' influence.

The remainder of the paper is organized as follows: Section 2 describes the theoretical background for our research question. Section 3 introduces the Business Group Strength and

Dominance Index (BSDI). Section 4 describes the data used in the empirical analyses, Section 5 provides the results, and Section 6 concludes.

Our appendix defines the variables used in this paper (Section A1) and discusses the new developments in the financial sector and governance practices that considerably eased non-LBG firms' financial constraints after the crisis (Section A2). Finally, we report the results of the duration analysis, which investigates whether an LBG-inflicted financial constraint impedes non-LBG firms' "timely" investment (Section A3).

2. Theoretical Background

Our key hypothesis' theoretical foundation originates from the work of Almeida and Wolfenzon (2006). Their study notes that business groups' contribution to economy-wide capital allocation efficiency depends on the country's level of investor protection. This prediction is derived from the assumption that cash flow pledgeability to investors inside a business group is perfect, whereas pledgeability outside a business group depends on the country's level of investor protection.

We summarize here their simple model of three firms with different levels of productivity: the high-productivity (H), medium-productivity (M), and low-productivity (L) firms. If a country has a low investor protection level, stand-alone firms cannot raise external capital, regardless of their productivity level. In this case, forming a business group can improve economy-wide allocative efficiency, as perfect pledgeability inside a business group allows for capital reallocation to a higher productivity firm within the group (e.g., internal reallocation from firm L to firm M). If investor protection is at an intermediate level, H can pledge sufficiently high cash flows to raise external capital from firm L, but not enough to raise capital from firm M. Forming a business group composed of firms L and M can harm economy-wide allocative efficiency in this case, as

perfective pledgeability inside a business group allows firm M to pledge more cash flows to firm L than firm H (i.e., the business group's bias toward internal reallocation). If the investor protection level is high, stand-alone firm H can pledge sufficiently high cash flows to raise external capital from both firms L and M. In this case, forming a business group composed of firms L and M can do no harm to economy-wide allocative efficiency, because cash flow pledged by firm H to firm L is greater than that of firm M to firm L.

Almeida and Wolfenzon (2006) use Korea's recent history as anecdotal evidence to support their theoretical prediction. They note that until the 1990s, Korean business groups or chaebols were credited as an important factor in Korea's rapid growth; however, this view changed in the 1990s, as the chaebols were believed to inhibit small and medium-sized firms' growth (Financial Times, 1998). The authors also note that the Korean government has pressured the chaebols since the 1990s to slim their empires, and as the chaebol no longer dominated access to Korea's substantial pool of savings, credit began to flow to small and medium-sized firms (Economist, 2003).

However, as Korea's case suggests, business groups' biases toward internal reallocation are not the only reason for business group firms to attract more capital, or why non-business group firms suffer from financial constraints. A large internal capital market also helps member firms to raise capital from financial institutions outside the group. Business group firms are preferred over non-business group firms when borrowing from banks, as the former can secure debt guarantees from their sister firms, whereas non-business group firms cannot. Additionally, a banking industry under state control may favor larger business group firms, which tend to have greater political connections, in securing bank loans over non-business group firms, which typically lack such connections. Finally, large business groups can benefit from the "too big to fail" problem due to

their size. They can obtain financial support from the government in times of trouble, whereas non-business group firms cannot. We also consider these issues in constructing our index, which captures business groups' strength and dominance.

3. Construction of the Business Group Strength and Dominance Index

We construct in this section the Business Group Strength and Dominance Index (BSDI), a measure that captures the collective strength and dominance of business groups in each industry. We must consider two elements in this measure to explain the extent to which business groups can attract more capital, and consequently, the extent to which they financially constrain non-business group firms: the size of the groups' internal capital market (ICM), as well as their market share in the industries in which non-business group firms also operate.

First, the ICM's size matters for many reasons. The larger the ICM, the more likely firms in business groups will engage in internal reallocation, and the less likely they will provide capital to firms outside the business group. A large internal capital market also assists member firms in raising capital from financial institutions outside the group. Banks prefer to extend loans to business group firms that can secure debt guarantees from their sister firms, rather than to non-business group firms that cannot. Additionally, business groups with large internal capital markets tend to have greater political connections, which further assist them in raising external debt capital when the banking industry remains under state control (Khanna and Palepu, 2000; Khanna and Rivkin, 2001; Khanna and Yafeh, 2007). Moreover, large business groups can further benefit from the "too big to fail" problem because of their size, whereas non-business group firms cannot. Business groups in some countries may be so large and interconnected that their failure would be

disastrous to the greater economy, and therefore, the government must support them in times of trouble.

Second, business groups' market share also matters. Suppose that an industry sector includes only non-business group firms that operate alone, and business groups are completely absent. Banks, which must diversify their loan portfolios across different industries for risk management purposes, would extend loans to these non-business group firms despite the shortage of capital in the economy. Further, note that this is the case regardless of how large the business groups are, as they are not operating in that industry sector. However, if a business group firm enters this industry, banks may no longer extend loans to non-business group firms, as they would prefer to extend loans to business group firms that can secure debt guarantees from their sister firms, or that have more significant political connections. Moreover, if the business group's market share increases, reflecting their stronger competitiveness, the tendency to extend loans to business group firms over non-business group firms would strengthen.

We combine these two elements—size of business groups' internal capital market and their market share—by calculating the BSDI for industry k in year t with the following formula:

$$BSDI_{kt} = \left[\left(\frac{\sum_{i=1}^{n} S_{itk} * w_{it}}{\sum_{i=1}^{n} S_{itk} + \sum_{j=1}^{m} S_{jtk}}\right) / BSDI^{*}\right], where \ w_{it} = \frac{ICM_{it}}{ICM_{t}^{*}} \quad (1)$$

where the subscript i $(= 1, 2, \cdots, n)$ denotes the business group (e.g., the Top 30 chaebol) firms present in industry k in year t, and j $(= 1, 2, \cdots, m)$ denotes non-business group firms present in industry k in year t. $S_{itk}(S_{jtk})$ equals the total sales of firm i (j) in industry k in year t, and w_{it} equals $ICM_{\mathrm{it}}/ICM_{t}^{*}$, where $ICM_{\mathrm{i,t}}$ is the size of the business group's internal capital

market (*ICM*), to which firm i belongs in year t, and ICM_t^* is the sum of *ICM*s across all business groups in year t. The $BSDI^*$ is a constant scaling factor that equals the largest value of $[\sum_i S_{itk} \times w_{it}/(\sum_i S_{itk} + \sum_j S_{jtk})]$. We divide by this scaling factor because unscaled BSDI values are extremely small. Equation (1) reveals that the BSDI value increases with business group firms' sales volume, relative to that of non-business group firms, as well as with the size of their internal capital market relative to that of other business groups not operating in the industry.

Note that the two elements of strength and dominance are inseparable, as the interaction between dominance (market share) and strength (the internal capital market size) is what matters. A large business group with a small market share, or a small business group with a high market share, matters less to non-LBG firms than a large business group with a large market share. Thus, we combine the two ($S_{itk} \times w_{it}$) before aggregating over the firms within a given industry.

Moreover, note that we compute ICM_{it} by adding all the group members' book value of assets (excluding firm i) because almost all of a company's assets can be used to support other member firms. Typically, an internal capital market is formed through intragroup loans and equity investments (Gopalan, Nanda, and Seru, 2007; Gopalan, Nanda, and Seru, 2014; Buchuk et al., 2014; Almeida, Kim, and Kim, 2015). However, a company's physical assets can also assist other member firms, as greater investment in property, plant, and equipment (PP&E) can enhance sales, which can subsequently increase the volume of related-party purchases from other member firms (Black et al., 2015; Hwang and Kim, 2016). Cash is also useful, as it can be easily transformed into other asset forms, such as loans, equity investments, or physical assets, which can be used to support other member firms (Boutin et al., 2013).

A later section discusses our robustness test, which uses an alternative measure for ICM_{it}. Instead of aggregating the book asset values of other member firms in the same group, we aggregate only their cash holdings. This is the measure that Boutin et al. (2013) use in their study on group-affiliated firms' entry and exit decisions. We demonstrate that our results remain intact even if we use this narrowly defined measure of internal capital market when computing the BSDI.

4. Data

This section describes the data that we use in the empirical analyses. We provide data sources, variable definitions, and their descriptive statistics.

4.1 Data Sources

We must consistently identify business groups and their member firms, both public and private, to investigate the association between business groups' influence and the capital allocation efficiency of firms outside the business group. We collect this information from the Korea Fair Trade Commission (KFTC).

The KFTC annually designated and released a list of LBGs starting in 1987, as well as the names of those who control each group, and the list of firms under each group's control (i.e., member firms). The KFTC has adopted an elaborate method regarding the concept of control, the details of which are explicitly defined in the Monopoly Regulation and Fair Trade Act and its enforcement decree. Both directly owned shares and those indirectly owned through related parties (e.g., relatives, not-for-profit entities, or for-profit member firms) are considered. The KFTC also considers channels of influence that do not rely on share ownership.

A person in control could be a natural person or a legal person (in case the shares of the apex firm are dispersedly owned, and therefore do not have a controlling shareholder). In this study, we exclude business groups controlled by a legal person from our analyses. We refer to the work of Kim, Lim, and Sung (2007) for details on the identification of member firms and persons in control.

The KFTC's identification of LBGs depends on the aggregate size of member firms' assets, or net assets in the case of financial firms. From 1987 to 1992, the KFTC used a threshold of 400 billion KRW, and groups above this threshold were designated as LBGs. From 1993 to 2002, the KFTC designated the 30 largest business groups, without any size threshold. From 2002 to 2008, the KFTC reverted to its earlier method, with a threshold of two trillion KRW. Starting in 2009, the KFTC has used a threshold of five trillion KRW.

Our empirical analyses follow existing literature and use those affiliated with the 30 largest business groups (i.e., the Top 30 chaebols) as a proxy for business group firms, and all others for non-business group firms.[2] Our proxy for business group firms includes only those from large business groups, and our proxy for non-business group firms includes both stand-alone firms and those from smaller business groups. Therefore, we label them hereafter as LBG firms and non-LBG firms, respectively.

It is also crucial for our research purposes to have financial statement data for privately traded companies, as a predominant fraction of firms in our sample are privately held, regardless

[2] Bae, Kang, and Kim (2002)'s study of chaebols during the pre-crisis period compares the Top 30 chaebols against other smaller business groups and stand-alone firms. The authors conclude that chaebols are more diversified, include more member firms, have greater economic power, are more heavily leveraged, and rely more heavily on debt guarantees. Therefore, nearly all prior studies on Korean business groups use Top 30 chaebols as their sample of business groups (Shin and Park, 1999; Bae, Kang, and Kim, 2002; Hong, Lee, and Lee, 2004; Kim, Lim, and Sung, 2007; Lee, Park, and Shin, 2009; Almeida, Kim, and Kim, 2015).

of whether they are group-affiliated. Due to Korea's External Audit of Stock Companies Act, firms with assets above a certain threshold are subject to external auditing, and their financial statement data becomes available to the public.[3] Our study uses the data provided by TS2000, a database compiled by the Korea Listed Companies Association, and D&B Korea;[4] we use the former for publicly traded companies throughout our sample period (1987–2010) and privately traded companies from 1999. We rely on a unique data set purchased from D&B Korea for privately traded companies before 1999. Both databases are free from survivorship bias.

Our analyses exclude firms from the financial or utility industries for obvious reasons, as they do not make capital expenditures, or their capital expenditures are heavily regulated by the government.

4.2 Definition of Variables

Most of the analyses in this study are conducted with industry-level regressions. Accordingly, our key variables are also defined at the industry-level: the Business Group Strength and Dominance Index (BSDI), Industry CAPEX Ratio, Industry Sales Growth, and Industry EBITDA Ratio. We use industry-level data because the distribution of our non-business group firms is heavily skewed toward small firms (the book asset value has a mean of 39 billion KRW and a median of 15 billion KRW). If we used firm-level data, our results would be primarily driven by firms that may not be individually significant in the economy. Moreover, two of the investment opportunity measures

[3] The threshold gradually increased over the years in our sample period: 3 billion KRW during 1987–1989, 4 billion KRW during 1990–1992, 6 billion KRW during 1993–1997, 7 billion KRW during 1998–2008, and 10 billion KRW in 2009.

[4] Established in 2002, D&B Korea is a joint venture between National Information & Credit Evaluation (NICE) Inc. (Korea's first credit information service provider) and Dun & Bradstreet (D&B) International, a business information provider in the United States.

used in our robustness tests, Tobin's q and the industry's value-added growth, are available only at the industry-level.[5]

The previous section defines the BSDI. The industry CAPEX ratio is the median value of firm-level CAPEX ratios, calculated for three different sets of firms (LBG-firms, non-LBG firms, and all firms combined), in a given industry k in year t, expressed in percentage terms. The CAPEX ratio of firm i in year t equals $(CAPEX_{i,t}/Trailing\ Assets_{i,t})$, where $CAPEX_{i,t}$ is the net capital expenditure for firm i in year t, and $Trailing\ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using a GDP deflator).

Industry sales growth is our measure of investment opportunity, defined as the median value of firm-level sales growth measures calculated across all firms (both LBG firms and non-LBG firms), in a given industry k in year t, expressed in percentage terms. The sales growth of firm i in year t equals $ln(Sales_{i,t}/Sales_{i,t-1})$, where $Sales_t$ and $Sales_{t-1}$ (adjusted for inflation using the GDP deflator) are firm i's total sales at fiscal year-end t and $t-1$, respectively. We use the sales growth over Tobin's q as our primary measure of investment opportunity to avoid the problem that arises when regressing investment on marginal q with measurement errors and cash flows. As Erickson and Whited (2000) noted, when the marginal q has a measurement error, cash flow becomes significant even in the absence of financial constraints. Nevertheless, our robustness tests use three alternative measures for investment opportunities: the Industry Tobin's q, Industry Intangible Ratio, and Industry Value-Added Growth. We discovered that they provide qualitatively similar results; the Appendix provides detailed definitions of these alternative variables.

[5] Our robustness tests section indicates that our key results remain intact even when running firm level weighted least squares (WLS) regressions.

The Industry EBITDA Ratio is the median value of firm-level EBITDA ratios, calculated for three different sets of firms (LBG-firms, non-LBG firms, and all firms combined) in a given industry k in year t, expressed in percentage terms. The EBITDA ratio of firm i in year t equals $(EBITDA_{i,t}/Trailing\ Assets_{i,t})$, where $EBITDA_{i,t}$ is the earnings before interest, taxes, depreciation, and amortization for firm i in year t, and $Trailing\ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using the GDP deflator).

Regarding industry classification, we begin with two-digit Korea Standard Industrial Classification (KSIC) codes. However, we ensure that each industry has a sufficient and balanced number of firms by using four-digit codes if the number of firm-years in a given two-digit industry is greater than 10,000 (e.g., the manufacturing sector). If the number of firm-years in a given two-digit industry is greater than 3,000 but less than 10,000, we use three-digit codes for that industry. In unreported analyses (available upon request), we conduct a series of robustness tests using alternative industry classification methods (two-digit, three-digit, or four-digit industry codes throughout, regardless of the number of firms in a given industry), and we discover qualitatively similar results.

4.3 Descriptive Statistics

Table 1 reports the summary statistics for the BSDI, calculated annually for each industry (excluding the financial or utility industries) from 1987 to 2010 (24 years). One can see that the collective strength and dominance of large business groups in Korea falls within our sample period on average. The mean index value of 0.132 in 1987 declines slightly, to 0.127 in 2010. However, hidden in this overall downward trend is the cross-sectional variation, which declines considerably in later years. The BDSI's maximum value, which is 0.69 in 1987, declines to 0.53 in 2010 and

the standard deviation of 0.173 as of 1987 declines to 0.136 in 2010. Accordingly, we discover that the median index value, as opposed to mean value, rises slightly during our sample period, from 0.069 in 1987 to 0.079 in 2010. Also, the trend is not monotonous; the median index value peaks in the crisis years (0.10 in 1997), reaches a minimum in 2003 (0.035), then gradually increases (0.079 in 2010). We believe that these are all novel findings that literature has not previously reported, and are important for policymakers in Korea.

Further, Table 1 indicates that the maximum value of the BSDI is 1.000 in 1994. This means that there is an industry in 1994 that has the highest un-scaled BSDI value throughout our sample period (its un-scaled BSDI value is 0.147). This is the "Sale of Motor Vehicle Parts and Accessories" industry, where five large business group firms are present. They jointly comprise 94.78 percent of the market share. Hyundai Motor Service, with an 87.58 percent market share, belongs to the Hyundai Group, which was the largest business group in 1994.

Figure 1 graphically presents Table 1 by illustrating the yearly mean and median values for the BSDI over our entire sample period. We superimpose fitted lines to indicate the time trend. The figure reveals that the BSDI slightly decreases over time, as evidenced by the two downward sloping fitted lines, consistent with our findings in Table 1. Further, a sudden decline seems to occur in the BSDI immediately after the Asian financial crisis (1997–1998), which may reflect large business groups becoming more focused in response to the crisis (compared to the pre-crisis period).

Table 1 also reports the number of industries in each year for which the BSDI is calculated (second column), and the mean and median number of firms within individual industries (third and fourth columns). One can observe that the number of industries in a given year ranges from 38 to 44, and the entire sample period includes 1,029 industry-year observations. The median number

of firms within an industry ranges from 69.5 in the beginning of our sample period to 285 at the end.

We confirm that this index can effectively capture important corporate or group events that change large business groups' strength and dominance by examining six real cases: two acquisitions, two divestures, and two group splits. The first example is SK Group's acquisition of Loen Entertainment in late 2005. This acquisition led the BSDI of the industry in which Loen Entertainment operated (i.e., Printing and Service Activities related to Print and the Reproduction of Recorded Media) to increase from 0.0001 in 2005 to 0.0229 in 2006. Second, the Doosan Group acquired Hankook Heavy Industries & Construction in late 2000 when the government sold its stakes in the company as a part of its privatization program. This led the BSDI of the industry in which Hankook Heavy Industries & Construction operated (i.e., Fabricated Metal Products Manufacturing) to increase from 0.0021 in 2000 to 0.0086 in 2001.

Third, SK Group and Daewoo Group respectively sold Dongryung Chemicals and Kyungwoo Purification Technology, which operated in the Rubber and Plastic Products Manufacturing industry, in the second half of 1999. This divesture led to a decrease in the industry's BSDI, from 0.0307 in 1999 to 0.0176 in 2000. Fourth, Daewoo Group lost control over Daewoo Heavy Industry and Construction in late 1999, and the latter had to enter a workout program. This led the BSDI of the industry in which Daewoo Heavy Industry and Construction operated (i.e., Other Machinery and Equipment Manufacturing) to decrease, from 0.0981 in 1999 to 0.0632 in 2000.

The fifth example comes from the separation of Hyundai Motor Group from Hyundai Group in late 2000. This led to a decrease in the BSDI of the Motor Vehicle, Trailer, and Semitrailer Manufacturing industry, in which the Hyundai Motor Company (a leading company of Hyundai

Motor Group) operates, from 0.534 in 2000 to 0.188 in 2001. Finally, the GS Group's split from LG Group in early 2005 also led to a decrease in BSDI, from 0.174 in 2004 to 0.047 in 2005, in GS Caltex's (a leading company of GS Group) industry: the Manufacture of Coke, Hard Coal and Lignite Fuel Briquettes, and Refined Petroleum Products.

Table 2 reports the descriptive statistics for the key industry-level variables used in this study: the BSDI, industry CAPEX ratio, industry sales growth, and industry EBITDA ratio. This information spans a full sample period (1987 to 2010, including 1997 and 1998) and two sub-periods: one before the 1997–1998 Asian financial crisis (1987–1996) and one thereafter (1999–2010). First, one can observe that the BSDI's mean value is lower during the post-crisis period (reduced from 0.139 to 0.117 in the combined sample), providing evidence consistent with that in Table 1 and Figure 1. Second, the mean and median BSDI values by construction are greater when computed using industries in which large business group firms operate (0.164 versus 0.129, in the case of mean values during the full sample period).

Third, the industry CAPEX ratio significantly decreases overall after the crisis, but more so in industries where large business group firms operate. The average industry CAPEX ratio decreases from 3.69 percent (during the pre-crisis period) to 1.35 percent (during the post-crisis period) in industries where large business group firms operate, whereas it decreases from 2.44 percent (during the pre-crisis period) to 1.58 percent (during the post-crisis period) in industries where non-LBG firms operate. This is consistent with the view that large business group firms in Korea engaged in overinvestments before the crisis (Chang, Park, and Yoo, 1998). Median values indicate a similar pattern.

Fourth, industry sales growth also declines after the crisis, but more so in industries where non-LBG firms operate. The average industry sales growth decreases from 7.95 percent (during

the pre-crisis period) to 5.95 percent (during the post-crisis period) in industries where non-LBG firms operate, whereas it decreases from 6.89 percent (during the pre-crisis period) to 6.58 percent (during the post-crisis period) in industries where large business group firms operate. Median values indicate a similar pattern.

Fifth, the industry EBITDA ratio increases after the crisis in industries where large business group firms operate, but decreases in industries where non-LBG firms operate. The average industry EBITDA ratio increases from 5.89 percent (during the pre-crisis period) to 7.45 percent (during the post-crisis period) in industries where large business group firms operate, whereas it decreases from 7.28 percent (during the pre-crisis period) to 5.66 percent (during the post-crisis period) in industries where non-LBG firms operate. Median values indicate a similar pattern.

5. Results

5.1 Industry-Level Capital Allocation Efficiency over Time

This subsection, before delving into our primary results regarding the effect of large business groups' strength and dominance, first confirms the findings in prior literature. Specifically, Korean firms' capital allocation efficiencies improved and their financial constraints eased after the Asian financial crisis (Hong, Lee, and Lee, 2004; Lee, Park, and Shin, 2009). We accomplish this by estimating industry-level regressions, in which we regress the industry CAPEX ratio on industry sales growth, industry EBITDA ratio, and year and industry fixed effects. We run regressions in which the variables are calculated using all firms combined, non-LBG firms only, and large business group firms only. To see how efficiency and financial constraints evolve over time, we also run regressions separately for years before the crisis (1987–1996) and years thereafter (1999–

2010). When using a sample that combines both periods (before + after), we construct a period dummy that takes a value of one before the crisis and zero thereafter, and interact it with our two key regressors (industry sales growth and industry EBITDA ratio).

The first three columns in Table 3 report the results when all firms are combined, with standard errors clustered at the industry level. One can observe that Korean firms before the crisis did not efficiently allocate capital and suffered from financial constraints, as evidenced by the insignificant coefficient on industry sales growth, but a significant coefficient on the industry EBITDA ratio (Column 1). The coefficient of 0.174 on the industry EBITDA ratio before the crisis suggests that a 1-SD (one standard deviation) increase in the industry EBITDA ratio (3.7) increases the industry CAPEX ratio by 0.64, or 26 percent of the industry CAPEX ratio's mean value of 2.44. However, this is not the case after the crisis, as the industry CAPEX ratio becomes significantly sensitive to industry sales growth, but not to the industry EBITDA ratio (Column 2). Further, a statistically significant decline can be observed in the coefficient on the industry EBITDA ratio after the crisis. When we add the period dummy and interact it with the industry EBITDA ratio, the coefficient on the interaction term is negative and statistically significant at the one percent level, suggesting an easing of financial constraints after the crisis.

However, the results are primarily driven by non-LBG firms. As Columns 4–5 illustrate, the coefficient on industry sales growth, which is insignificant before the crisis, becomes significant thereafter. Additionally, the coefficient on industry EBITDA ratio, which is significant at 0.219 before the crisis, declines to 0.081 after the crisis. Further, the decrease in the coefficient on the industry EBITDA ratio and the increase on the coefficient for industry sales growth are significant at the 1 and 10 percent levels, respectively (see the coefficients on the interaction terms in Column 6).

Large business group firms' investments, in contrast, behave quite differently. First, the coefficient on industry sales growth is positive and statistically significant throughout the sample period. The coefficient of 0.106 on industry sales growth before the crisis suggests that a 1-SD increase in industry sales growth (6.7) increases the industry CAPEX ratio by 0.71, or 19 percent of the industry CAPEX ratio's mean value of 3.69. Second, the industry EBITDA ratio's coefficient is never statistically significant, which suggests that large business group firms did not suffer from financial constraints, neither before nor after the crisis. None of the interaction terms in Column 9 are significant.

It is worth noting that the results in Table 3 are consistent with our assumption that the advancement in financial sector development and the strengthening of investor protection take place around the crisis period (1997/98). In borrowing the terms used by Almeida and Wolfenzon (2006), our findings provide us a rationale in using 1997–1998 as years to separate the "intermediate investor protection" and "high investor protection" periods. The results from a series of Chow's tests using differently defined period dummies demonstrate that the level of F-statistics is highest (at 8.55, with a p-value of 0.0001) when the period dummy takes a value of one, from 1999 onwards.[6]

5.2 The BSDI and Industry-Level Capital Allocation Efficiency

Tables 4 and 5 examine how our index for large business groups' collective strength and dominance relate to industry-level capital allocation efficiency over time. We accomplish this by including in our regression BSDI and its interactions with our two key regressors (industry sales

[6] We experiment with 13 different period dummies, each taking a value of one starting at different points in time (1992, 1993, 1994, 1995, 1996, 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006).

growth and industry EBITDA ratio). We first use a sample that combines all firms (LBG and non-LBG firms) when constructing the industry-level variables. In other words, we first test the BSDI's economy-wide equilibrium effect.

Table 4 reports the results, from which we can observe that the BSDI is hardly associated with capital allocation efficiency throughout our sample period. Specifically, the coefficients on the interaction terms between the BSDI and industry sales growth ([a] × [b]) are always negative, but never statistically significant. Additionally, the coefficients for the interaction terms between the BSDI and the industry EBITDA ratio ([b] × [c]) as well as the triple interaction terms ([a] × [b] × [d] and [b] × [c] × [d]) are statistically insignificant. These results suggest that large business group firms' greater strength and dominance do not necessarily improve or deteriorate economy-wide capital allocation efficiency. There can be two explanations. One involves the BSDI having no effect on either firm type; the other involves the BSDI having an opposite effect, and that the two completely offset each other. For example, the BSDI may improve large business group firms' efficiency, but this may be completely offset by the deterioration of non-LBG firms' efficiency.

5.3 Negative Externality of Business Groups' Strength and Dominance

To uncover what is actually taking place underneath this combined result, we investigate non-LBG and large business group firms separately (see Table 5). Columns 1–4 include only non-LBG firms when constructing the industry-level variables.[7] We find that the coefficient on the interaction term [a] × [b] is negative (-0.188) and statistically significant at the five percent level before the crisis (Column 2), but loses significance after the crisis (Column 3). In other words, the industry

[7] Industry sales growth is an exception. It uses the combined sample as it intends to capture growth opportunity at the industry level.

CAPEX ratio's sensitivity relative to the industry sales growth declines by half if the BSDI of the industry non-LBG firms operates in increments from zero to its mean value of 0.139 during the pre-crisis period.[8] Accordingly, the triple interaction term [a] × [b] × [d] is also statistically significant at the 10 percent level (Column 4). This suggests that the BSDI was negatively associated with non-LBG firms' capital allocation efficiency before the crisis, when the financial sector was underdeveloped and investor protection was weak. Namely, we discover evidence consistent with large business groups' inflicting a negative externality on firms outside the large business group.

Columns 5–6 include only large business group firms when constructing the industry-level variables.[9] We note that the coefficient on the interaction term [a] × [b] is positive (0.134) before the crisis (Column 6), but becomes negative after the crisis (Column 7). Although statistically insignificant, this positive interaction effect of 0.134 from the large business group result and the negative interaction effect of -0.188 from the non-LBG result explain why we have a moderately negative interaction effect of -0.096 from the combined result. In other words, if we put the results in Tables 4 and 5 together, we can conclude that the BSDI's moderately positive effect on large business group firms was completely offset by its negative effect on non-LBG firms before the crisis.

Figure 2 shows a similar result graphically. It plots the yearly estimated coefficients of the interaction term between industry sales growth and the BSDI when conducting regressions similar to that of column 1 in Table 5, year-by-year, for non-LBG firms. As we calculate these regressions

[8] If the BSDI = 0, the sensitivity is 0.05 (coefficient on industry sales growth). If the BSDI = 0.139, the sensitivity is 0.05 - 0.188 x 0.139 = 0.0239.

[9] For the reason explained in footnote 7, industry sales growth is calculated at the industry level.

yearly, we omit year and industry fixed effects. Further, we report standardized coefficients to make coefficients' magnitudes comparable over the years, and superimpose horizontal fitted lines to display how the coefficients differ before and after the crisis. One can observe that the coefficients on the interaction terms have large variations over the sample period, which is anticipated given the few industries in our yearly cross-sectional regressions. However, one can clearly observe that the coefficients are lower and negative before the crisis, suggesting that non-LBG firms' capital allocation efficiency is negatively associated with large business groups' collective dominance and strength before the crisis.

One example of large business groups harming non-LBG firms' investment efficiency during the pre-crisis period can be found in the Sale of Motor Vehicles and Parts industry. This industry's BSDI increased in 1993 to 0.9576 from the previous year's 0.8683 (a 10.3 percent increase. Accordingly, and despite the increase in the industry sales growth ratio from 0.53 percent in 1993 to 11.27 percent in 1994, non-LBG firms' industry CAPEX ratio decreased from 3.69 percent in 1993 to -1.79 percent in 1994.

In unreported analyses, we calculate the regression of Column 4 in Table 5 with differently defined period dummies, and we discover that the triple interaction term ([a] × [b] × [d]) is statistically significant at the 10 percent level only when using the original period dummy that takes a value of one, starting from 1999.[10] This result suggests that the LBG-inflicted financial constraints on non-LBG firms considerably eased immediately after the crisis.

[10] As in our earlier Chow's tests, we experiment with 13 different period dummies, each taking a value of one starting at different points in time (1992, 1993, 1994, 1995, 1996, 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006).

5.4 Endogeneity Concern and the Decomposition of BSDI

As aforementioned, the BSDI captures two distinct features: the collective size of LBGs' internal capital market ("strength") and their collective market share ("dominance"). This subsection limits our analyses to a BSDI component exogenous to non-LBG firms' capital expenditures to see if BSDI *causes* non-LBG firm's capital allocation inefficiency, and not *vice versa*. We believe that the collective size of LBGs' internal capital market ("strength") is an exogenous component to non-LBG firms' capital expenditures.

One can easily work out a reverse causality story that runs from the capital expenditure of non-LBG firms in a particular industry to the market share of LBG firms in that industry ("dominance"). For example, LBG firms may be simply expanding more aggressively in high growth industries when non-LBG firms fail to do so. This can also explain the negative association between BSDI and non-LBG firms' capital allocation efficiency, even in the absence of any financial constraint that LBG firms may impose on non-LBG firms. However, it is difficult to explain why this association disappears during the post-crisis period. Even in the absence of financial constraint (i.e., during the post-crisis period), it should still be beneficial for LBG firms to more aggressively expand in high growth industries when non-LBG firms fail to do so.

Moreover, it is difficult to flesh out a reverse causality story that runs from the capital expenditure of non-LBG firms in a particular industry to the size of LBGs' internal capital market. It is extremely difficult to imagine that underinvestment by non-LBG firms in a particular industry would trigger large business groups to increase the size of their internal capital markets—measured by the sum of member firms' book assets (excluding the firm in the industry under investigation)—

by acquiring firms in other industries or increasing the asset size of existing firms in other industries.

We decompose BSDI into "strength" and "dominance" to limit our analyses to the BSDI component exogenous to non-LBG firms' capital expenditures. This decomposition can be easily conducted by regressing the BSDI on large business groups' collective market share in the industry without year or industry fixed effects; this is done separately for the entire sample period, the pre-crisis sample, and the post-crisis sample. The regression's fitted value is referred to as the BSDI component that relates to large business groups' collective market share in the industry (LBG MKT Share), whereas the orthogonal residual term is referred to as the BSDI component that relates to the size of large business groups' internal capital market (ICM Size).

Table 6 reports the results, in which we run regressions that are the same as those in Columns 1–4 in Table 5, except that we split the BSDI into LBG MKT Share and ICM Size.[11] One can observe that the coefficient of interest ([a] × [c]) is negative and statistically significant before the crisis (Column 2), but loses significance after the crisis (Column 3). Accordingly, the coefficient on the triple interaction term involving ICM Size ([a] × [c] × [e]) is positive and significant at the 10 percent level. These results suggest that the negative association between the BSDI and non-LBG firms' capital allocation efficiency can be causal, to the extent that the size of LBG firms' internal capital markets is exogenous to non-LBG firms' capital expenditures. The results also

[11] Note that ICM Size and LBG MKT Share are both generated regressors, subject to a problem with biased coefficient standard errors. As a robustness check, we take an alternative approach that is free from this problem. Namely, we simultaneously include the BSDI and LBG's collective market share as a regressor. In controlling for the LBG's collective market share, the BSDI should pick up the BSDI component that the LBG's collective market share cannot explain, or the "strength." The results are similar to those in our original approach. The coefficient on (BSDI × Industry Sales Growth) is negative and statistically significant before the crisis, but loses significance after the crisis.

indicate that ICM Size matters more than LBG MKT Share. The coefficient of the triple interaction term involving LBG MKT Share ([a] × [b] × [e]) is insignificant.

5.5 The Financial Constraint Channel of Negative Externality

If the period dummy used in earlier tables (Tables 5 and 6)—which is one after the Asian financial crisis, and zero before—captures only the degree of financial sector development or the strength of investor protection, we can conclude that the negative externality, which LBG firms impose on non-LBG firms' investment efficiency, solely occurs due to financial constraints. However, the period dummy that we use in earlier tables may capture many other factors. For example, large business groups could have been better positioned before the crisis to attract skilled labor or secure government approval to enter promising industries. This could have consequently enhanced their investment efficiency at the expense of non-LBG firms.

To verify that the main underlying reason behind negative externality is coming from financial constraints, we re-estimate the regression equations in Table 5, for different sets of subsamples. First, we split the sample into low and high tangibility industries. Industries with a median tangibility ratio (during 1987–2010 for a given industry) below (or above) the global median (during 1987–2010 across all industries) are categorized as low (or high) tangibility industries. The tangibility ratio is defined as tangible assets over trailing assets, adjusted for inflation using the GDP deflator. We anticipate that the negative externality on the investment efficiency of non-LBG firms occurs only in industries with low tangibility, as they may have insufficient collateral to secure bank loans. Table 7 reports the results. Consistent with our expectation, we discover a negative and statistically significant coefficient (at the 5 percent level) on the interaction term of interest ([a] × [b]); this holds only before the crisis in industries with

low asset tangibility (Column 3). Accordingly, the coefficient of the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the one percent level only in industries with low asset tangibility (Column 4).

Second, we split the sample into low and high cash flow industries. Industries with the median (during 1987–2010 for a given industry) EBITDA ratio below (or above) the global median (during 1987–2010 across all industries) are categorized as low (or high) cash flow industries. The EBITDA ratio is defined as the EBITDA over trailing assets adjusted for inflation, using the GDP deflator. We expect that the negative externality on the investment efficiency of non-LBG firms only occurs in industries with low cash flows, as they may have insufficient retained earnings to internally finance their investment projects. Table 8 reports the results. Consistent with our expectation, we discover a negative and statistically significant coefficient (at the 10 percent level) on the interaction term of interest ([a] × [b]); this holds only before the crisis in industries with low cash flow levels (Column 3), and nowhere else. Accordingly, the coefficient on the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the 10 percent level only in industries with low cash flow levels (Column 4). We omit the industry EBITDA ratio from our regression as it is used to divide the sample into high and low cash flow industries.

Third, in unreported analyses (available upon request), we split the sample into low- and high-export industries. Industries with median (during 1987–2010 for a given industry) values for the industry-wide export ratio below (or above) the global median (during 1987–2010 across all industries) are categorized as low- (or high-) export industries. Industry-wide export ratios are computed for a given industry at a given year by dividing the sum of exports across all firms within that industry by the sum of sales across all firms within the same industry. We expect non-LBG firms with high export ratios during the pre-crisis period to suffer less from financial constraints

despite the presence of LBG firms, as they experienced various export subsidies, and the results confirm this conjecture.[12] We discover that before the crisis, the negative coefficient on the interaction between industry sales growth and the BSDI declines in magnitude for industries with high export ratios.

5.6 The BSDI and Firm-Level Profitability

This subsection investigates whether non-LBG firms' low capital allocation efficiency translates into lower profitability, and whether LBG firms' high capital allocation efficiency translates into higher profitability. Specifically, we regress the firm-level EBITDA ratio on the BSDI while controlling for firm size (log of total assets) and leverage ratio (debt-to-assets ratio). We do this for the entire sample period, before and after the crisis, for both LBG and non-LBG firms.

Table 9 reports the results; specifically, we discover that the BSDI predicts non-LBG firms' lower profitability before the Asian financial crisis, but not as such thereafter. The BSDI coefficient of -3.913 (statistically significant at the five percent level) before the crisis for non-LBG firms suggests that a 1-SD increase in the BSDI (0.194) decreases profitability by 0.76, or 11.4 percent of the EBITDA ratio's mean value of 6.65. In contrast, we further discover that the BSDI predicts LBG firms' higher profitability before the Asian financial crisis, but only moderately so thereafter. The BSDI coefficient of 10.074 (statistically significant at the five percent level) for large business group firms before the crisis suggests that a 1-SD increase in the BSDI (0.194) increases profitability by 1.95, or 33 percent of the EBITDA ratio's mean value of 5.92.

[12] Such export subsidies disappeared in Korea during the post-crisis period, as it joined the World Trade Organization (WTO) in 1995.

5.7 Additional Tests

5.7.1 Excluding Alternative Hypotheses

Kim, Lee, and Liu (2016) use a sample during the post-crisis period (2001–2011) to demonstrate that large business groups in Korea *de facto* control their subcontractors. If their investment policies are coordinated by the partnering chaebols, and if they comprise a significant portion of non-LBG firms in our sample, the earlier finding that LBG firms do not harm non-LBG firms' investment efficiency during the post-crisis period can simply be an artifact of close collaboration between LBG firms and their respective non-LBG subcontractors. Our unreported analyses (available upon request) indicate that this is not the case. We re-estimate the regression in Table 5, Column 3 after excluding LBG firms' non-LBG subcontractors from the sample of non-LBG firms, and find that the interaction term between industry sales growth and BSDI remains statistically insignificant during the post-crisis period.

Our earlier regressions include industry and year fixed effects and a limited number of time-varying controls on the right-hand side. A possibility certainly exists that our finding is driven by factors that we failed to control for; one way to address this is to control for year-industry interactions, which allows the industry effect to change over time, or the year effect to vary across different industries. In unreported analyses (available upon request), we run the regressions in Table 5 with such interactions, and find that our results are qualitatively similar.

5.7.2 Falsification Test

We construct an alternative index for each industry-year pair that simply adds the top five firms' market share, regardless of group affiliation; we then determine if this index can explain the

investment inefficiency of firms that rank lower in terms of market share. If it does, we cannot argue that our earlier findings are solely derived from the presence of large business groups. In our unreported analyses (available upon request), we show that this is not the case. The interaction term between industry sales growth and Top 5 MKT Share (i.e., the top five firms' combined market share) is insignificant in a regression for non-top five firms during the pre-crisis period. This finding confirms that the presence of large business groups does matter, and that our earlier finding on negative externality only emerges between LBG and non-LBG firms.

5.7.3 Measurement Issue of Market Share in the Tradable Sector

Our key variable of interest, BSDI, relies on the measure of market share, which we compute solely using Korean firms. Our measure of market share can be misleading in a tradable sector, in which competition occurs among both Korean and non-Korean firms. A way to address this issue involves limiting our sample to the non-tradable sector, in which our measure of market share is reliable, and see if our results survive. Our unreported analyses (available upon request) run the regressions in Table 5 by limiting our sample to low-export industries' firms (i.e., non-tradable sectors), and we find qualitatively similar results.

Related to this, it is worth noting that product market globalization is unlikely to have driven our results. It is well known that Korea has had a large export sector since the 1970s, and no material change occurred during our sample period (1987–2010). In contrast, factor market globalization did intensify after the crisis; for example, cross-border capital flows and local financing by overseas subsidiaries increased after the crisis. However, these changes are simply examples of financial sector development, which we intend to capture by the post-crisis dummy.

5.7.4 Alternative Measure of Internal Capital Market

We try an alternative measure of the BSDI that calculates the size of the internal capital market in a different way. Instead of aggregating the book asset values of other member firms in the same group, we aggregate their cash holdings. This measure is used by Boutin et al. (2013) in their study on group-affiliated firms' entry and exit decisions, but this alternative measure is incomplete for two reasons. First, it includes only the assets with the potential for extension (i.e., cash holdings), but not those that have already been extended to other member firms (i.e., lending and equity investments). Second, it omits fixed assets, which can be used to enhance the volume of related-party sales, and eventually, other member firms' earnings. If earnings accumulate, they become a source of internal capital. We believe that this mechanism of extending capital indirectly through related-party sales is equivalent to extending capital directly through loans or equity investments.

Nevertheless, we confirm here whether our earlier results remain intact, even if we use a narrowly defined measure of the internal capital market when computing the BSDI. Table 10 reports the results; similar to Table 5, the interaction term between industry sales growth and the BSDI ([a] × [b]) for non-LBG firms is negative and statistically significant, with a coefficient of -0.215 during the pre-crisis period, but insignificant thereafter. Accordingly, the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the 10 percent level. As expected, none of these interaction terms are statistically significant for LBG firms.

5.7.5 Alternative Measures of Investment Opportunity

We next assess alternative measures of investment opportunity. The first measure that we examine is Tobin's q. Although Tobin's q has several well-known problems, it is still the primary measure

of growth opportunity in many studies. As our sample includes both public and private firms, we use the median value of Tobin's *q* for all publicly traded firms within the same industry (Industry Tobin's *q*). The results using Tobin's *q* parallel those in Table 5, and are displayed in the first three columns of Table 11. Similar to Table 5, the interaction term between the Industry Tobin's *q* and the BSDI ([a] × [b]) is negative and statistically significant, with a coefficient of -0.081 during the pre-crisis period, but is insignificant thereafter. Accordingly, the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the 10 percent level.

The second measure of growth opportunity that we used is the industry intangible ratio, following the work of Acharya, Davydenko, and Strebulaev (2012). We define the industry intangible ratio as the sum of intangible assets across all firms within a given industry over the sum of trailing assets across all firms within the same industry. The results are reported in Columns 4–6 of Table 11. The primary variable of interest, or the interaction term between the industry intangible ratio and the BSDI ([a] × [b]), is also negative and statistically significant, with a coefficient of -1.514 during the pre-crisis period, but is insignificant thereafter. Accordingly, the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the one percent level.

The final growth opportunity measure that we use is the industry value added growth. Following Wurgler (2000) we collect Korea's industry value added data from the United Nations' INDSTAT-3 database. The industry value added growth is defined as the logarithm of a given year's industry value added, minus the logarithm of the previous year's industry value added.[13]

[13] The United Nations' INDSTAT database also reports an industry-wide gross capital formation, from which Wurgler (2000) calculates the industry-level investment. However, we do not use this measure, as it does not allow us to separately calculate industry-wide investments for LBGs and non-LBG firms. Thus, we use the industry CAPEX ratio, as in our earlier analyses.

Note that the United Nations' INDSTAT-3 database allows us to cover only a subset of manufacturing industries (22) over a subset of our sample period (1990–2008).

The last three columns in Table 11 report the results. One can observe that the coefficient on the interaction term between the industry value added growth and the BSDI ([a] × [b]) is still negative and statistically significant, with a coefficient of -0.040 before the crisis, but it loses significance thereafter. Accordingly, the triple interaction term ([a] × [b] × [d]) is positive and statistically significant at the 10 percent level.

5.7.6 Alternative Classification of Top 30 Chaebols and Industries

Large business groups (LBGs) in our earlier analyses refer to the 30 largest chaebols (i.e., Top 30 chaebols). However, some of these 30 largest chaebols share the same family root. For example, CJ, Shinsegae, and Seahan are business groups split from the Samsung Group. Given their family ties, it is possible that these groups form an internal capital market comprised of all four groups. If so, our measure of internal capital market (ICM) size is downward-biased. To see if this measurement error makes any difference, we re-estimate the regression in Table 5, Columns 1-4 using a new measure of BSDI that combines large business groups with the same family root as a single business group. Our unreported analyses (available upon request) reveal that the results remain virtually intact.

The Top 30 chaebols' composition, although quite stable, changes over time. As a robustness check, we use business groups limited to those that appear in the Top 30 chaebol list every year, and those that separate themselves from such groups. In our unreported analyses (available upon request), we obtain results that are similar to what we find with our original sample of Top 30 chaebols.

Our earlier analyses use four-digit codes if the number of firm-years in a given two-digit industry is greater than 10,000 (e.g., the manufacturing sector); three-digit codes if greater than 3,000 but less than 10,000; and two-digit codes for the rest. Our unreported analyses (available upon request) also conduct a series of robustness tests using alternative industry classification methods (using two-, three-, or four-digit industry codes throughout, regardless of the number of firms in a given industry) and find qualitatively similar results.

5.7.7 Different Data Sources

Our earlier analyses rely on two different data sources. We use the TS2000 database for publicly traded companies throughout our sample period (1987–2010) and for privately traded companies from 1999. We rely on a unique data set purchased from D&B Korea for privately held companies before 1999. Thus, one may raise the concern that our result can be an artifact of using two different data sources for privately held companies. We address this concern by running the regressions in Table 5 again using data solely from D&B Korea for both company types during a sample period of 1987–2005.[14] We find qualitatively similar results.

5.7.8 Firm-Level Analyses

Our earlier analyses conducted regression analyses not at the firm level, but at the industry level, with the concern that our results would be primarily driven by many small non-LBG firms. We conduct firm-level weighted least squares (WLS) regressions as a robustness check in this subsection, where the weights are derived from firms' asset size. In unreported analyses (available

[14] We only have data available from D&B Korea up to 2005.

upon request), we show that the new results using firm-level data for Tables 5 and 6 weaken slightly, but remain qualitatively unchanged.

6. Conclusion

This study investigates the association between business groups' influence and the capital allocation efficiency of firms outside the business group. We sample Korean firms from 1987 to 2010 to compute an annual index that captures the collective strength and dominance of large business groups in each industry. We discover that this index (the BSDI) is negatively associated with non-LBG firms' industry-level capital allocation efficiency during a period characterized by underdeveloped financial markets and weak investor protection (i.e., before the Asian financial crisis of 1997–1998), but not so during a later period. This negative association is stronger in industries that may lack collateral or internal equity capital. We also find that the negative association strengthens when we limit our analyses to an index component exogenous to non-LBG firms' capital expenditures, suggesting that the relationship is causal. Our results survive from a battery of robustness checks.

This study contributes to literature in a number of ways. First, we fill a gap in the literature by investigating the association between business groups' influence and the capital allocation efficiency of firms outside the business group, a question that has not been adequately addressed in the literature. Second, we provide empirical support for the theoretical predictions of Almeida and Wolfenzon (2006) that business groups' contribution to economy-wide investment efficiency depends on the country's level of investor protection. Third, we add to a strand of literature that studies the influence of financial sector development or investor protection on capital allocation efficiency. Finally, we construct an index that captures the collective strength and dominance of

business groups in each industry. We believe that this index, which we name the Business Group Strength and Dominance Index (BSDI), can be useful for the purposes of both our study and those that must quantify business groups' influence.

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Figure 1: Evolution of Business Group Strength and Dominance Index (BSDI) over Time

This figure presents the yearly mean and median values of BSDI over our entire sample period (1987–2010). We superimpose fitted lines to indicate the time trend. We calculate the index based on the Top 30 business groups in Korea.

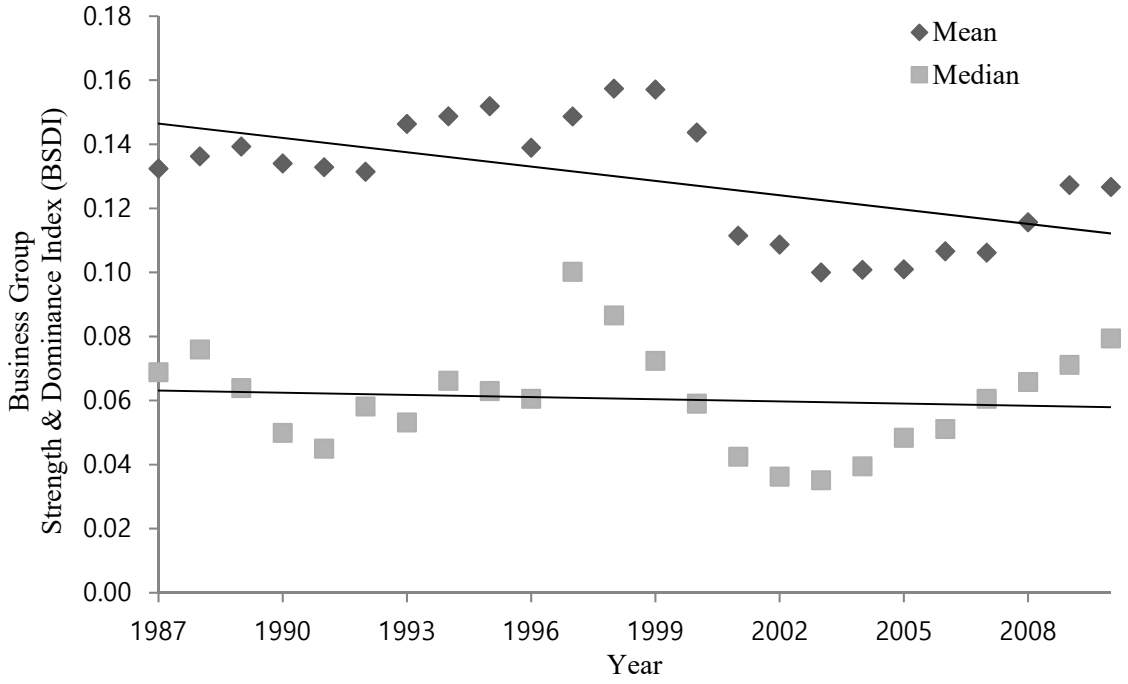


Figure 2: BSDI on Industry-Level Capital Allocation Efficiency (Non-LBG Firms)

This figure plots yearly estimated (standardized) coefficients on the interaction term between Industry Sales Growth and BSDI when running regressions similar to that of Column (1) in Table 5, year by year, for non-LBG firms; these regressions omit year and industry fixed effects. We superimpose horizontally fitted lines to demonstrate the coefficients' differences before and after the crisis. Variable definitions are reported in the Appendix.

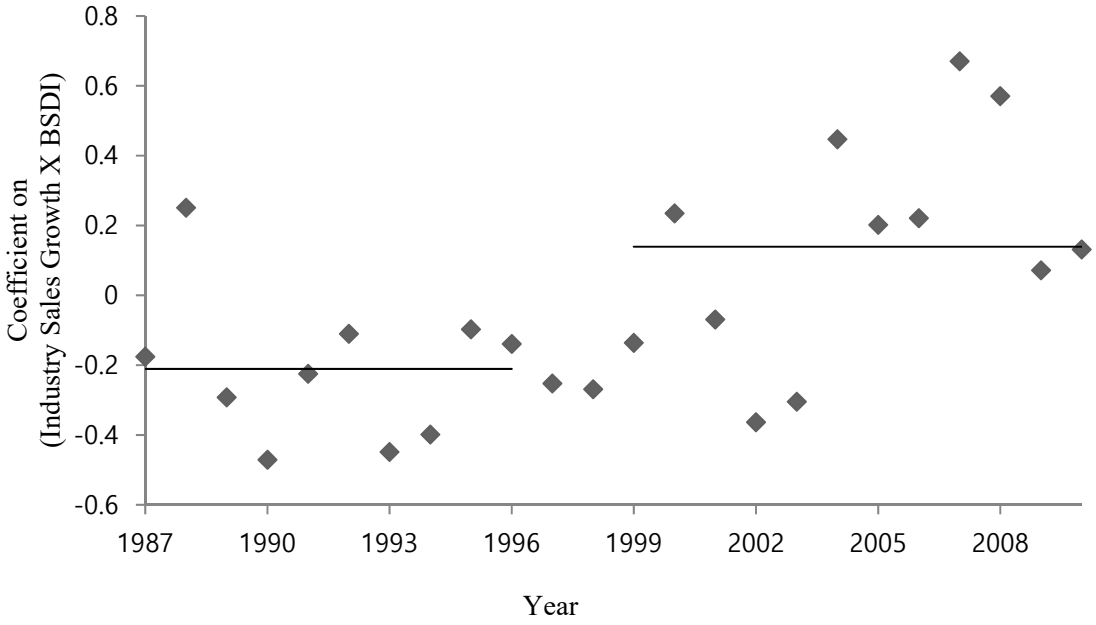


Table 1: Business Group Strength and Dominance Index (BSDI)

This table reports the summary statistics for the Business Group Strength and Dominance Index (BSDI), calculated for each industry (excluding the financial or utility industries) every year from 1987 to 2010 (24 years). We calculate the index based on the Top 30 business groups in Korea.

		No. of Firms within Industry		BSDI				
Year	No. of Industries	Mean	Median	Mean	Median	S.D.	Max.	Min.
1987	38	87.4	69.5	0.132	0.069	0.173	0.687	0
1988	39	99.0	83.0	0.136	0.076	0.172	0.641	0
1989	40	107.2	82.5	0.139	0.064	0.186	0.700	0
1990	41	116.9	90.0	0.134	0.050	0.199	0.872	0
1991	42	136.8	108.0	0.133	0.045	0.193	0.824	0
1992	43	137.8	110.0	0.131	0.058	0.195	0.868	0
1993	43	126.0	93.0	0.146	0.053	0.212	0.958	0
1994	43	143.2	113.0	0.149	0.066	0.217	1.000	0
1995	44	161.5	113.5	0.152	0.063	0.218	0.924	0
1996	44	167.5	112.0	0.139	0.061	0.186	0.696	0
1997	44	184.9	133.5	0.149	0.100	0.184	0.807	0
1998	44	161.9	111.0	0.157	0.087	0.212	0.885	0
1999	44	205.5	155.0	0.157	0.072	0.222	0.869	0
2000	44	236.4	165.5	0.144	0.059	0.207	0.860	0
2001	44	269.0	191.0	0.111	0.042	0.142	0.535	0
2002	44	309.6	215.5	0.109	0.036	0.134	0.507	0
2003	44	328.2	223.5	0.100	0.035	0.121	0.430	0
2004	44	346.6	233.0	0.101	0.039	0.119	0.433	0
2005	44	364.0	236.0	0.101	0.048	0.113	0.384	0
2006	44	360.8	233.5	0.107	0.051	0.110	0.352	0
2007	43	424.5	268.0	0.106	0.061	0.108	0.362	0
2008	43	427.3	270.0	0.116	0.066	0.126	0.512	0
2009	43	413.8	270.0	0.127	0.071	0.133	0.487	0
2010	43	437.7	285.0	0.127	0.079	0.136	0.534	0

Table 2: Summary Statistics of Key Variables

This table reports the descriptive statistics of key variables (BSDI, Industry CAPEX Ratio, Industry Sales Growth, and Industry EBITDA Ratio) used in this study over a full sample period (1987 to 2010; including 1997 and 1998) and over two sub-periods: one before the 1997–1998 Asian financial crisis (1987–1996) and one thereafter (1999–2010). We exclude firms that belong to the financial or utility industries from the sample. "Large Business Group (LBG) Firms" refers to firms affiliated with the Top 30 business groups, and "Non-LBG Firms" refers to those that are not. The Appendix provides a detailed definition of each variable.

	All Firms Combined				Non-LBG Firms				LBG Firms			
	N	Mean	Median	Std.	*N*	Mean	Median	Std.	*N*	Mean	Median	Std.
Full Sample Period (1987–2010)												
BSDI	1,029	0.129	0.062	0.171	1,029	0.129	0.062	0.171	778	0.164	0.114	0.178
Industry CAPEX Ratio	1,029	2.141	1.489	3.714	1,029	1.945	1.419	3.503	778	2.427	1.074	6.009
Industry Sales Growth	1,029	6.002	5.477	8.583	1,029	6.002	5.477	8.583	778	5.723	5.471	7.853
Industry EBITDA Ratio	1,029	6.518	6.405	3.830	1,029	6.218	6.400	3.635	778	6.693	6.142	5.180
Before 1997 (1987–1996)												
BSDI	417	0.139	0.058	0.194	417	0.139	0.058	0.194	296	0.179	0.114	0.206
Industry CAPEX Ratio	417	2.980	2.443	4.221	417	2.444	2.075	4.116	296	3.686	2.621	7.432
Industry Sales Growth	417	7.951	6.795	8.762	417	7.951	6.795	8.762	296	6.890	6.450	6.705
Industry EBITDA Ratio	417	7.016	6.757	3.700	417	7.282	7.261	4.227	296	5.892	6.233	3.845
After 1998 (1999–2010)												
BSDI	524	0.117	0.056	0.143	524	0.117	0.056	0.143	412	0.149	0.112	0.147
Industry CAPEX Ratio	524	1.337	0.844	3.166	524	1.577	1.001	2.951	412	1.351	0.217	4.950
Industry Sales Growth	524	5.947	5.183	7.078	524	5.947	5.183	7.078	412	6.579	5.518	6.869
Industry EBITDA Ratio	524	6.412	6.022	3.903	524	5.659	5.979	3.200	412	7.446	6.306	5.913

Table 3: Industry-Level Capital Allocation Efficiency over Time

This table reports the results of an industry-level regression that examines how efficiently capital is allocated across industries. We run regressions in which variables are calculated using all firms combined, non-LBG firms only, and LBG firms only. Further, we conduct regressions using years before the Asian financial crisis (1987–1996) and after (1999–2010) to observe how industry-level capital allocation efficiency evolves over time. We exclude firms that belong to the financial or utility industries from the sample. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Firms Combined			Non-LBG Firms			LBG Firms		
Dependent Variable:	Before	After	Before +	Before	After	Before +	Before	After	Before +
Industry CAPEX Ratio	1997	1998	After	1997	1998	After	1997	1998	After
Industry Sales Growth [a]	0.010	0.032***	0.030*	-0.009	0.031***	0.007	0.106*	0.084***	0.090**
	(0.018)	(0.008)	(0.015)	(0.016)	(0.006)	(0.011)	(0.055)	(0.024)	(0.044)
Industry EBITDA Ratio [b]	0.174**	0.040	0.149***	0.219***	0.081**	0.195***	-0.076	0.053	0.044
	(0.067)	(0.033)	(0.052)	(0.043)	(0.032)	(0.036)	(0.115)	(0.056)	(0.081)
Period Dummy [c]			1.380**			1.062**			-3.523**
			(0.564)			(0.460)			(1.423)
[a] × [c]			0.001			0.025*			0.005
			(0.016)			(0.013)			(0.050)
[b] × [c]			-0.137***			-0.117***			-0.020
			(0.046)			(0.038)			(0.088)
Constant	-1.536**	0.125	-1.660***	-1.809**	-0.083	-1.851***	3.980***	0.881	3.442***
	(0.693)	(0.261)	(0.583)	(0.689)	(0.252)	(0.554)	(1.271)	(0.835)	(1.023)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	417	524	941	417	524	941	296	412	708
Within R-squared	0.245	0.466	0.307	0.244	0.441	0.294	0.126	0.132	0.148

Table 4: BSDI and Industry-Level Capital Allocation Efficiency (All Firms)

This table reports the results of an industry-level regression that examines how large business groups' collective strength and dominance index (BSDI) is associated with industry-level capital allocation efficiency over time. We exclude firms that belong to the financial or utility industries from the sample. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.062***	0.055*	0.066***	0.067***
	(0.016)	(0.031)	(0.017)	(0.022)
BSDI [b]	0.893	-0.771	-1.323	1.079
	(1.078)	(1.515)	(1.309)	(1.354)
Industry EBITDA Ratio [c]	0.041	0.149*	-0.022	0.099
	(0.037)	(0.082)	(0.038)	(0.067)
Period Dummy [d]				0.355
				(0.622)
[a] × [b]	-0.061	-0.096	-0.024	-0.089
	(0.041)	(0.074)	(0.054)	(0.076)
[a] × [d]				-0.014
				(0.021)
[b] × [c]	-0.194	-0.079	0.065	-0.122
	(0.189)	(0.189)	(0.238)	(0.207)
[b] × [d]				-0.479
				(2.009)
[c] × [d]				-0.095
				(0.068)
[a] × [b] × [d]				0.060
				(0.096)
[b] × [c] × [d]				-0.080
				(0.327)
Constant	-0.564	-1.239*	0.602**	-1.197**
	(0.434)	(0.704)	(0.279)	(0.582)
Year & Industry FE	Yes	Yes	Yes	Yes
No. of Observations	1,029	417	524	941
With R-squared	0.288	0.240	0.412	0.283

Table 5: BSDI and Industry-Level Capital Allocation Efficiency (Non-LBG vs. LBG Firms)

This table reports the results of an industry-level regression that examines how large business groups' collective strength and dominance index (BSDI) is associated with industry-level capital allocation efficiency of non-LBG and LBG firms over time. We exclude firms that belong to the financial or utility industries from the sample. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Non-LBG Firms				LBG Firms			
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.052***	0.050	0.055***	0.073***	0.096***	0.073	0.095***	0.089
	(0.011)	(0.040)	(0.014)	(0.026)	(0.026)	(0.067)	(0.032)	(0.055)
BSDI [b]	-0.183	-0.189	-1.311	0.225	-1.984	-2.806	-2.431	-3.678
	(1.012)	(2.122)	(1.265)	(1.321)	(2.336)	(12.152)	(3.659)	(3.831)
Industry EBITDA Ratio [c]	0.086*	0.135*	0.013	0.171**	0.000	-0.213	0.033	-0.056
	(0.049)	(0.071)	(0.040)	(0.076)	(0.049)	(0.132)	(0.078)	(0.124)
Period Dummy [d]				1.629***				-3.500**
				(0.585)				(1.414)
[a] × [b]	-0.091**	-0.188**	-0.034	-0.200**	-0.018	0.134	-0.076	0.060
	(0.040)	(0.081)	(0.047)	(0.081)	(0.078)	(0.177)	(0.095)	(0.157)
[a] × [d]				-0.024				0.015
				(0.019)				(0.060)
[b] × [c]	0.042	0.002	0.202	0.002	0.307	0.699	0.198	0.417
	(0.143)	(0.187)	(0.203)	(0.232)	(0.316)	(0.436)	(0.389)	(0.402)
[b] × [d]				-0.378				3.229
				(2.385)				(4.809)
[c] × [d]				-0.146**				0.093
				(0.061)				(0.126)
[a] × [b] × [d]				0.154*				-0.197
				(0.089)				(0.157)
[b] × [c] × [d]				0.087				-0.408
				(0.350)				(0.481)
Constant	-1.081*	-1.188	0.365	-2.007***	3.713***	4.920**	1.263	4.274***
	(0.549)	(0.962)	(0.228)	(0.709)	(1.000)	(2.157)	(1.119)	(1.119)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1,029	417	524	941	778	296	412	708
Within R-squared	0.290	0.144	0.437	0.206	0.140	0.138	0.135	0.136

Table 6: Decomposition of BSDI into Strength and Dominance

This table reports the results of an industry-level regression that examines how large business groups' collective strength and dominance are separately associated with the industry-level capital allocation efficiency of non-LBG firms over time. We regress the BSDI on large business groups' collective market share in the industry to decompose the BSDI into strength (size of the internal capital market) and dominance (market share). The regression's fitted value is the component related to the large business groups' collective market share (LBG MKT Share), whereas the orthogonal residual term is the component related to the large business groups' collective internal capital market size (ICM Size). Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.055***	0.050	0.043***	0.048***
	(0.014)	(0.031)	(0.011)	(0.015)
LBG MKT Share [b]	1.127	5.619	-3.007	-0.233
	(1.539)	(6.320)	(1.980)	(1.454)
ICM Size [c]	-2.169	-7.559	-0.084	-1.146
	(1.321)	(6.205)	(1.984)	(2.174)
Industry EBITDA Ratio [d]	0.103*	0.218***	0.013	0.120***
	(0.055)	(0.077)	(0.035)	(0.042)
Period Dummy [e]				1.067**
				(0.472)
[a] × [b]	-0.056	-0.165*	0.030	-0.094
	(0.072)	(0.097)	(0.051)	(0.065)
[a] × [c]	-0.195*	-0.284**	-0.173	-0.324***
	(0.115)	(0.135)	(0.141)	(0.095)
[a] × [e]				-0.009
				(0.019)
[b] × [d]	-0.061	-0.219	0.186	0.051
	(0.172)	(0.290)	(0.228)	(0.179)
[b] × [e]				0.609
				(2.407)
[c] × [d]	0.309	0.415	0.288	0.384
	(0.214)	(0.494)	(0.361)	(0.268)
[c] × [e]				-1.339
				(2.513)
[d] × [e]				-0.087*
				(0.045)
[a] × [b] × [e]				0.124
				(0.085)
[a] × [c] × [e]				0.244*
				(0.142)
[b] × [d] × [e]				-0.241
				(0.344)
[c] × [d] × [e]				0.138
				(0.451)
Constant	-1.325**	-2.573***	0.590**	-1.391***
	(0.604)	(0.898)	(0.291)	(0.502)
Year & Industry FE	Yes	Yes	Yes	Yes
No. of Observations	1,029	417	524	941
Within R-squared	0.269	0.218	0.453	0.284

Table 7: BSDI and Industry-Level Capital Allocation Efficiency (High vs. Low Tangibility)

This table reports the results of an industry-level regression that examines how tangibility attenuates the association between the BSDI and the industry-level capital allocation efficiency of non-LBG firms. Industries with the median (during 1987–2010 for a given industry) tangibility ratio below (or above) the global median (during 1987–2010 across all industries) are categorized as low (or high) tangibility industries. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Low Tangibility				High Tangibility			
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.033***	0.043	0.030***	0.043	0.065***	0.061	0.062**	0.120***
	(0.012)	(0.036)	(0.009)	(0.028)	(0.016)	(0.053)	(0.025)	(0.033)
BGDI [b]	-0.685	-2.806	-4.534*	0.881	-0.607	8.074	-0.436	1.026
	(0.821)	(2.165)	(2.196)	(1.182)	(1.773)	(12.011)	(1.561)	(4.138)
Industry EBITDA Ratio [c]	0.105**	0.189***	-0.001	0.251***	0.043	-0.036	0.009	0.083
	(0.050)	(0.016)	(0.020)	(0.056)	(0.076)	(0.131)	(0.060)	(0.114)
Period Dummy [d]				2.118***				2.102*
				(0.737)				(1.051)
[a] × [b]	-0.081*	-0.225**	0.074	-0.200***	-0.041	-0.118	-0.085	-0.159
	(0.044)	(0.091)	(0.054)	(0.072)	(0.072)	(0.165)	(0.088)	(0.188)
[a] × [d]				-0.021				-0.067**
				(0.029)				(0.030)
[b] × [c]	0.035	0.095	0.356	-0.091	0.145	0.091	0.211	0.048
	(0.151)	(0.159)	(0.261)	(0.222)	(0.332)	(0.523)	(0.316)	(0.541)
[b] × [d]				-6.661**				0.174
				(3.034)				(5.177)
[c] × [d]				-0.253***				-0.114
				(0.068)				(0.076)
[a] × [b] × [d]				0.248***				0.090
				(0.089)				(0.213)
[b] × [c] × [d]				0.513				0.084
				(0.382)				(0.606)
Constant	-1.259	-1.673	0.404*	-2.407***	-0.521	0.081	0.653*	-1.489
	(0.749)	(0.980)	(0.217)	(0.669)	(0.728)	(1.396)	(0.329)	(1.062)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	529	213	272	485	500	204	252	456
Within R-squared	0.297	0.201	0.530	0.278	0.351	0.181	0.472	0.229

Table 8: BSDI and Industry-Level Capital Allocation Efficiency (High vs. Low Cash Flow)

This table reports the results of an industry-level regression that examines how cash flow attenuates the association between the BSDI and the industry-level capital allocation efficiency of non-LBG firms. Industries with the median (during 1987–2010 for a given industry) EBITDA ratio below (or above) the global median (during 1987–2010 across all industries) are categorized as low (or high) cash flow industries. Note that we omit from our regressions the industry EBITDA ratio, as it is used to divide the sample into high and low cash flow industries. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Low Cash Flow				High Cash Flow			
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.063***	0.070	0.047***	0.060***	0.035***	0.041	0.059***	0.033*
	(0.017)	(0.048)	(0.013)	(0.021)	(0.010)	(0.033)	(0.019)	(0.018)
BSDI [b]	-0.001	0.014	-0.003	0.007	-0.003	-0.016	-0.008	-0.009
	(0.008)	(0.025)	(0.007)	(0.007)	(0.007)	(0.033)	(0.009)	(0.014)
Period Dummy [c]				0.000				-0.017***
				(0.006)				(0.005)
[a] × [b]	-0.090**	-0.196*	-0.026	-0.147*	-0.038	-0.038	-0.021	-0.028
	(0.042)	(0.101)	(0.036)	(0.075)	(0.068)	(0.130)	(0.097)	(0.104)
[a] × [c]				-0.028				0.019
				(0.020)				(0.031)
[b] × [c]				-0.019**				0.007
				(0.008)				(0.016)
[a] × [b] × [c]				0.235*				-0.006
				(0.134)				(0.126)
Constant	-0.010	-0.011	0.003	-0.010**	0.007	0.009	0.006**	0.008*
	(0.006)	(0.006)	(0.003)	(0.005)	(0.004)	(0.007)	(0.003)	(0.004)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	507	203	260	463	522	214	264	478
Within R-squared	0.265	0.142	0.442	0.239	0.340	0.222	0.448	0.300

Table 9: BSDI and Firm-Level Profitability

This table reports the results of firm-level regressions that examine the association between the BSDI and firm profitability separately for non-LBG and LBG firms. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	Non-LBG Firms			LBG Firms		
Variable:	Entire	Before	After	Entire	Before	After
Firm Profitability	Period	1997	1998	Period	1997	1998
BSDI	-1.553***	-3.913**	-0.748	2.274	10.074**	3.098*
	(0.501)	(1.759)	(0.517)	(1.517)	(4.032)	(1.866)
Log Total Assets	0.775***	-0.305**	1.339***	-0.775***	-1.400***	-1.625***
	(0.082)	(0.139)	(0.106)	(0.268)	(0.494)	(0.463)
Leverage Ratio	-11.463***	-10.718***	-13.242***	-4.894***	-2.314	-5.531***
	(0.237)	(0.496)	(0.293)	(0.970)	(1.440)	(1.340)
Constant	12.553***	22.379***	2.579**	21.230***	25.965***	33.515***
	(0.946)	(1.670)	(1.269)	(3.701)	(7.084)	(6.417)
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	206,797	42,584	153,603	8,869	3,099	5,054
Within R-squared	0.088	0.088	0.090	0.027	0.027	0.032

Table 10: BSDI and Industry-Level Capital Allocation Efficiency (Alternative Measure of ICM)

This table reports the results of an industry-level regression that examines how large business groups' collective strength and dominance index (BSDI) is associated with the industry-level capital allocation efficiency of non-LBG and LBG firms over time. When measuring the size of the internal capital market that factors into the BSDI calculation, we aggregate the cash holdings (as opposed to the entire book assets) across all other group members. We exclude firms belonging to the financial or utility industries from the sample. Variable definitions are reported in the Appendix. Numbers in parentheses are robust standard errors clustered at the industry-level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Non-LBG Firms				LBG Firms			
Industry CAPEX Ratio	Entire Period	Before 1997	After 1998	Before + After	Entire Period	Before 1997	After 1998	Before + After
Industry Sales Growth [a]	0.051***	0.057	0.053***	0.082**	0.095***	0.080	0.102***	0.089*
	(0.012)	(0.048)	(0.015)	(0.033)	(0.026)	(0.065)	(0.033)	(0.053)
BSDI [b]	-0.375	0.673	-1.794	0.590	-2.257	1.251	-3.895	-3.572
	(1.086)	(2.006)	(1.518)	(1.439)	(2.607)	(11.399)	(4.707)	(4.166)
Industry EBITDA Ratio [c]	0.085*	0.154*	0.010	0.185**	0.006	-0.203	0.027	-0.053
	(0.050)	(0.081)	(0.042)	(0.085)	(0.048)	(0.125)	(0.074)	(0.120)
Period Dummy [d]				1.794***				-3.372**
				(0.635)				(1.364)
[a] × [b]	-0.095*	-0.215**	-0.022	-0.236**	-0.011	0.118	-0.148	0.068
	(0.051)	(0.100)	(0.067)	(0.098)	(0.107)	(0.192)	(0.144)	(0.180)
[a] × [d]				-0.032				0.022
				(0.024)				(0.059)
[b] × [c]	0.049	-0.104	0.247	-0.075	0.304	0.756	0.322	0.442
	(0.167)	(0.254)	(0.213)	(0.287)	(0.317)	(0.475)	(0.400)	(0.427)
[b] × [d]				-0.545				1.884
				(3.026)				(5.225)
[c] × [d]				-0.152**				0.075
				(0.067)				(0.122)
[a] × [b] × [d]				0.156*				-0.302
				(0.092)				(0.203)
[b] × [c] × [d]				0.187				-0.231
				(0.414)				(0.486)
Constant	-1.076*	-1.495	0.394	-2.251***	3.714***	4.343**	1.367	4.199***
	(0.546)	(1.151)	(0.238)	(0.792)	(0.986)	(1.721)	(1.184)	(1.070)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1,029	417	524	941	778	296	412	708
Within R-squared	0.289	0.126	0.437	0.183	0.140	0.140	0.137	0.137

Table 11: BSDI and Industry-Level Capital Allocation Efficiency (Alternative Measures of Investment Opportunity)

This table reports the results of an industry-level regression that examines how large business groups' collective strength and dominance index (BSDI) is associated with the industry-level capital allocation efficiency of non-LBG firms over time, using alternative measures of investment opportunity. These measures include the industry Tobin's *q*, industry intangible ratio, and industry value added growth. Variable definitions are reported in the Appendix. Each regression includes year and industry fixed effects. Numbers in parentheses are robust standard errors clustered at the industry level. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Industry CAPEX Ratio	Before 1997	After 1998	Before + After	Before 1997	After 1998	Before + After	Before 1997	After 1998	Before + After
Industry Tobin's *q* [a]	0.014	0.001	0.018						
	(0.021)	(0.007)	(0.022)						
Industry Intangible Ratio [a]				0.206	-0.312	-0.018			
				(0.240)	(0.198)	(0.203)			
Industry Value Added Growth [a]							0.010	0.000	0.019*
							(0.010)	(0.009)	(0.010)
BSDI[b]	15.060**	-7.011	7.581	-1.470	-3.683	1.079	1.028	-3.784	-1.962
	(6.271)	(4.986)	(5.347)	(4.249)	(3.359)	(1.449)	(1.686)	(4.047)	(1.855)
Industry EBITDA Ratio[c]	0.198	0.142	0.348***	0.365***	0.280***	0.383***	0.271***	0.166***	0.139**
	(0.132)	(0.157)	(0.099)	(0.052)	(0.063)	(0.052)	(0.080)	(0.051)	(0.067)
Period Dummy[d]			6.697**			3.917***			0.873
			(2.641)			(1.090)			(0.590)
[a] × [b]	-0.081**	0.017	-0.088*	-1.514**	0.992	-1.124***	-0.040**	0.019	-0.054***
	(0.039)	(0.021)	(0.045)	(0.628)	(0.789)	(0.381)	(0.014)	(0.031)	(0.014)
[a] × [d]			-0.020			-0.131			-0.015
			(0.015)			(0.252)			(0.012)
[b] × [c]	0.234	0.124	0.004	-0.295	-0.014	-0.310	0.014	0.340	0.270
	(0.367)	(0.682)	(0.351)	(0.301)	(0.323)	(0.252)	(0.167)	(0.555)	(0.236)
[b] × [d]			-13.788***			-5.148*			0.786
			(4.694)			(2.676)			(4.404)
[c] × [d]			-0.162			-0.205***			0.100
			(0.165)			(0.075)			(0.126)
[a] × [b] × [d]			0.112*			1.995***			0.068*
			(0.059)			(0.703)			(0.039)
[b] × [c] × [d]			-0.190			0.353			-0.223
			(0.710)			(0.367)			(0.654)
Constant	-1.879	3.527**	-2.248	0.310	3.374***	-0.058	-2.772***	-0.231	-1.701***
	(2.539)	(1.626)	(2.592)	(1.107)	(0.787)	(0.740)	(0.642)	(0.276)	(0.405)
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of Observations	328	483	811	411	524	935	135	220	355
Within R-squared	0.141	0.356	0.249	0.234	0.415	0.287	0.280	0.583	0.447

Appendix

A1. Variable Definitions

A2.Governance Reform and Financial Sector Development in Korea

A3.The BSDI and the Likelihood to Make Large Investments

A1. Variable Definitions

This table defines the main variables examined in this study.

Variables	Definition
Industry CAPEX Ratio	Industry median value of firm-level CAPEX ratios, calculated for three different sets of firms (LBG firms, non-LBG firms, and all firms) for a given industry k in year t, expressed in percentage terms. The CAPEX ratio of firm i in year t = $(CAPEX_{i,t}/Trailing\ Assets_{i,t})$, where $CAPEX_{i,t}$ is the net capital expenditure for firm i in year t and $Trailing\ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using a GDP deflator).
Industry Sales Growth	Industry median value of firm-level sales growth measures, calculated for all firms (both LBG firms and non-LBG firms) for a given industry k in year t, expressed in percentage terms. The sales growth of firm i in year t = $ln(Sales_{i,t}/Sales_{i,t-1})$, where $Sales_t$ and $Sales_{t-1}$ (adjusted for inflation using a GDP deflator) are firm i's total sales at fiscal year-ends t and $t-1$, respectively.
Industry Tobin's q	Industry median value of firm-level Tobin's q measures, calculated for all firms (both LBG firms and non-LBG firms) for a given industry k in year t. Tobin's q for firm i in year t = $(MVE_{i,t} + PS_{i,t} + DEBT_{i,t})/TA_{i,t}$, where MVE is the market value of common stocks, PS is the market value of preferred stocks, $DEBT$ is the book value of total debt, and TA is the book value of total assets.
Industry Intangible Ratio	Industry intangible ratio for industry k in year t, defined as $(\sum_i Intangible\ Assets_i/\sum_i Trailing\ Assets_i)$, where i denotes all firms within industry k in year t, expressed in percentage terms. $Trailing\ Assets_i$ is adjusted for inflation using a GDP deflator. This ratio is also calculated for all firms (both LBG firms and non-LBG firms) within industry k.
Industry Value Added Growth	Industry value added growth for industry k in year t, defined as $ln(Industry\ Value\ Added)_t - ln(Industry\ Value\ Added)_{t-1}$, expressed in percentage terms. The industry value added data comes

Variables	Definition
	from the United Nations' INDSTAT-3 for a subset of manufacturing industries (22 sectors). Lagged terms are adjusted for inflation using a GDP deflator. This ratio is also calculated for all firms (both LBG firms and non-LBG firms) within industry k.
Business Group Strength and Dominance Index (BSDI)	The BSDI of industry k in year t = $[\sum_i S_{itk} \times w_{it}/(\sum_i S_{itk} + \sum_j S_{jtk})]/BSDI^*$, where subscript i $(= 1, 2, \cdots, n)$ denotes large business group firms (in the Top 30 chaebols) present in industry k in year t. Further, j $(= 1, 2, \cdots, m)$ denotes non-LBG firms present in industry k in year t. $S_{itk}(S_{jtk})$ equals the total sales of firm $i(j)$ in industry k in year t, and w_{it} equals $ICM_{\mathrm{it}}/ICM_t^*$, where $ICM_{\mathrm{i,t}}$ is the size of the business group's internal capital market (*ICM*), to which firm i belongs, in year t; ICM_t^* is the sum of *ICM*s across all business groups in year t. Note that we compute ICM_{it} by adding all the group members' book asset values (excluding firm i). The $BSDI^*$ is a constant scaling factor that equals the largest value of $[\sum_i S_{itk} \times w_{it}/(\sum_i S_{itk} + \sum_j S_{jtk})]$.
Industry EBITDA Ratio	Industry median value of firm-level EBITDA ratios, calculated for three different sets of firms (LBG firms, non-LBG firms, and all firms) for a given industry k in year t, expressed in percentage terms. The EBITDA ratio for firm i in year t = $(EBITDA_{i,t}/Trailing\ \ Assets_{i,t})$, where $EBITDA_{i,t}$ is the earnings before interest, taxes, depreciation, and amortization for firm i in year t; and $Trailing\ \ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using a GDP deflator).
Period Dummy	An indicator variable that takes a value of zero during the period of 1987–1996 (the years before the Asian financial crisis), and a value of one during 1999–2010 (the years after the crisis).
Firm Profitability	Profitability of firm i in year t = $(EBITDA_{i,t}/Trailing\ \ Assets_{i,t})$, where $Trailing\ \ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using a GDP deflator).

Variables	Definition
Leverage	Leverage of firm i in year t = $(Total\ \ Liabilities_{i,t}/Total\ \ Assets_{i,t})$.
Tangibility Ratio	Tangibility ratio of firm i in year t = $(Tangible\ \ \ Assets_{i,t}/Trailing\ \ Assets_{i,t})$, where $Trailing\ \ Assets_i$ is the book value of firm i's assets in year $t-1$ (adjusted for inflation using a GDP deflator).
Firm Size	Size of firm i in year t = $\ln(Total\ \ Assets_{i,t})$

A2. Governance Reform and Financial Sector Development in Korea

This appendix discusses various governance reform measures and new financial sector developments that occurred immediately after the crisis. We believe that such reform measures and new developments strengthened investor protection in Korea, and considerably eased the financial constraints that Korean companies faced before the crisis.

A. Corporate Governance Reform

Immediately after the Asian financial crisis, Korea introduced a series of corporate governance reform measures (Kim and Kim, 2008). Korea revised the Securities and Exchange Act in late 1999 regarding board structure, and mandated that listed companies elect outside directors, the ratio of which must be at least 50 percent for firms with assets over 2 trillion Korean won (KRW) (approximately 2 billion USD), and 25 percent for others. The same law mandates that firms with assets over 2 trillion KRW must have an audit committee with an outside chair, and at least two-thirds of its members from outside the firm, as well as a committee to nominate outside directors. A few studies investigate the valuation effect of this regulatory reform and discover evidence that the legal shock produced economically large share price increases for large firms with assets of over 2 trillion KRW (Black, Jang, and Kim, 2006; Black and Kim, 2012). One study investigates the channel through which this board structure reform increases value, and finds evidence that reform reduces tunneling (Black et al., 2015).

Regarding chaebol reforms, Korea revised the Monopoly Regulation and Fair Trade Act in 1998 to ban any new provisions for debt guarantees to domestic affiliates. Korea revised the Act again in late 1999, mandating board approval and disclosure of related-party transactions. The revision also reintroduced an upper ceiling on the amount of equity investment by a group

member firm in domestic affiliates (i.e., 25 percent of a firm's net assets, which equals the total assets minus the book equity invested by other affiliates). This regulation aims to limit reckless group expansion through pyramiding or circular shareholding, which eventually increases the disparity between the control and cash flow rights of controlling shareholders in member firms; Kim, Lim, and Sung (2007) further detail these reform measures.

Many other measures were enacted to empower shareholders. For example, Korea revised the *Securities and Exchange Act* in 1998, lowering shareholding requirements for the filing of derivative suits, director dismissals, and the convocation of extraordinary shareholders' meetings, among many others. Korea also revised the Commercial Code in the same year so shareholders can elect directors through cumulative voting. Moreover, Korea revised the Securities and Exchange Act in 2001 and imposed a three percent cap on shareholders' voting rights when electing audit committee members; thus, no single shareholder can have a dominant influence over their appointment. This three percent cap has been applied since 1963 regarding the electing of statutory auditors. Measures to increase corporate transparency were also put in place; the most noteworthy endeavor was the Financial Supervisory Service's introduction of the Data Analysis, Retrieval, and Transfer (DART) System in 1999 by the Financial Supervisory Service. The DART System is an electronic disclosure system that allows companies to submit disclosures online, where they become immediately available to investors and other users.[15]

Shareholders noticed these changes and made use of their empowerment. The increase in foreign investors' ownership of listed Korean companies is particularly noteworthy, from 10

[15] The website address is http://dart.fss.or.kr (in Korean) or http://englishdart.fss.or.kr (in English).

percent in 1996 to 39 percent in 2004. Anecdotal evidence and academic studies confirm that there is growing pressure from foreign investors for better governance. For example, SK, a leading firm of the SK Group (the fourth largest chaebol at the time) increased its outside director ratio from 50 to 70 percent in response to the engagement activities of Sovereign Asset Management (a Monaco-based activist investor). It also introduced a Corporate Governance Committee, Transparent Management Committee, and a separate meeting of outside directors (Kim, Sung, and Wei, 2017). Accordingly, SK's share price increased from 8,000 KRW to 70,000 KRW during this engagement period (March 2003–July 2005). Academic findings also illustrate that foreign investors are pressuring Korean firms for better governance. Kim, Sung, and Wei (2017) applied an event study approach to block purchase announcements made by foreign portfolio investors in the Korean stock market, and found that stock prices increase upon block purchase announcements when investors declare themselves activists.

Grass-roots minority shareholder movements have also emerged, and most notably the People's Solidarity for Participatory Democracy (PSPD), a public interest group known for utilizing various minority shareholders' rights that were dormant for most of Korea's modern history (Kim and Kim, 2001; Jang and Kim, 2002; Rho, 2007). One such minority shareholders' right is a derivative action filed against board members to seek their liability on behalf of shareholders. The PSPD's derivative action, filed against former officers of Korea First Bank in 1997, is recorded as the first derivative suit ever filed in Korea. Its second derivative action in 1998 is also well-known, as it was filed against the board members of Samsung Electronics, the largest company in Korea, and later the 13th largest company worldwide (Fortune, 2015).

At the time of this writing, PSPD and its successor—Solidarity for Economic Reform (SER)—remain leading organizations in filing derivative actions against Korean corporate directors.[16]

B. Financial Sector Development

Various charts in Figure A1 note how Korea's financial sector changed after the Asian financial crisis. The first two charts illustrate the size of Korea's capital market, a typical measure of financial sector development. Market capitalization as a fraction of GDP increases from 24 percent in 1987 to 90 percent in 2010, and bonds outstanding as a fraction of GDP also increases, from 12 percent in 1987 to 60 percent in 2010 (Source: Bank of Korea).

The third chart indicates foreign investors' presence in the Korean stock market. Foreign ownership as a fraction of GDP increased from one percent in 1992 (the market's opening year) to 31 percent in 2010, and as a fraction of total market capitalization, increased from three percent in 1992 to 31 percent in 2010 (Source: Financial Supervisory Service). Clearly, foreign ownership as a fraction of total market capitalization increases exponentially from 1998, which coincides with the year in which Korea completely lifted the remaining foreign ownership limits.

The fourth chart notes the net savings (i.e., saving minus investments) in the household and corporate sectors, as a fraction of Korea's total savings (Source: Bank of Korea). Households before the crisis were clearly net savers, providing capital to corporations that were short on savings. However, this relationship dramatically changes after the crisis. The household sector is no longer a net capital provider, and the corporate sector is only a moderate

[16] The Participatory Economy Committee (PEC), an action body that led the PSPD shareholder activist movement, separated from PSPD in 2006 to launch the Solidarity for Economic Reform (SER) organization.

net capital receiver. This change reflects the fact that households borrow as much as they save, and corporations hoard cash as much as they invest. Capital, in other words, is no longer scarce for corporations in Korea.

The fifth chart displays the yield of three-year investment grade (AA-) corporate bonds (Source: Bank of Korea). The yield used to be 13 percent in 1987, and peaked at 19 percent in 1991; it stands at 5 percent in 2010. While other countries' corporate bond rates also fell during this period, Korea is unique in that the drop occurred in 1999, a year after the crisis, whereas other countries experienced the drop starting in 2000, the year the dot-com bubble burst. Bond financing, with its low bond rates, became an important alternative funding source for Korean corporations. This is consistent with the second chart, which indicates an increase in outstanding bond amounts as a fraction of GDP.

The sixth chart reveals manufacturing firms' debt-to-equity ratios (Source: Bank of Korea).[17] The ratio was 340 percent in 1987, and peaked at 400 percent in 1997 before decreasing to 102 percent in 2010. The initial decline occurred as banks withdrew their earlier lending, but the ratio continued to decline as Korean firms began to more heavily rely on internal equity financing (i.e., using accumulated retained earnings). Companies' lower reliance on debt financing, and specifically bank financing, led many Korean banks to expand their household lending businesses.

The last two charts demonstrate the amount of liquidity that manufacturing firms hold. Cash and cash equivalents, as a fraction of total assets, increase from 6.3 percent in 1990 to 9.7 percent in 2010, and the current ratio, defined as current assets over current liabilities, increases

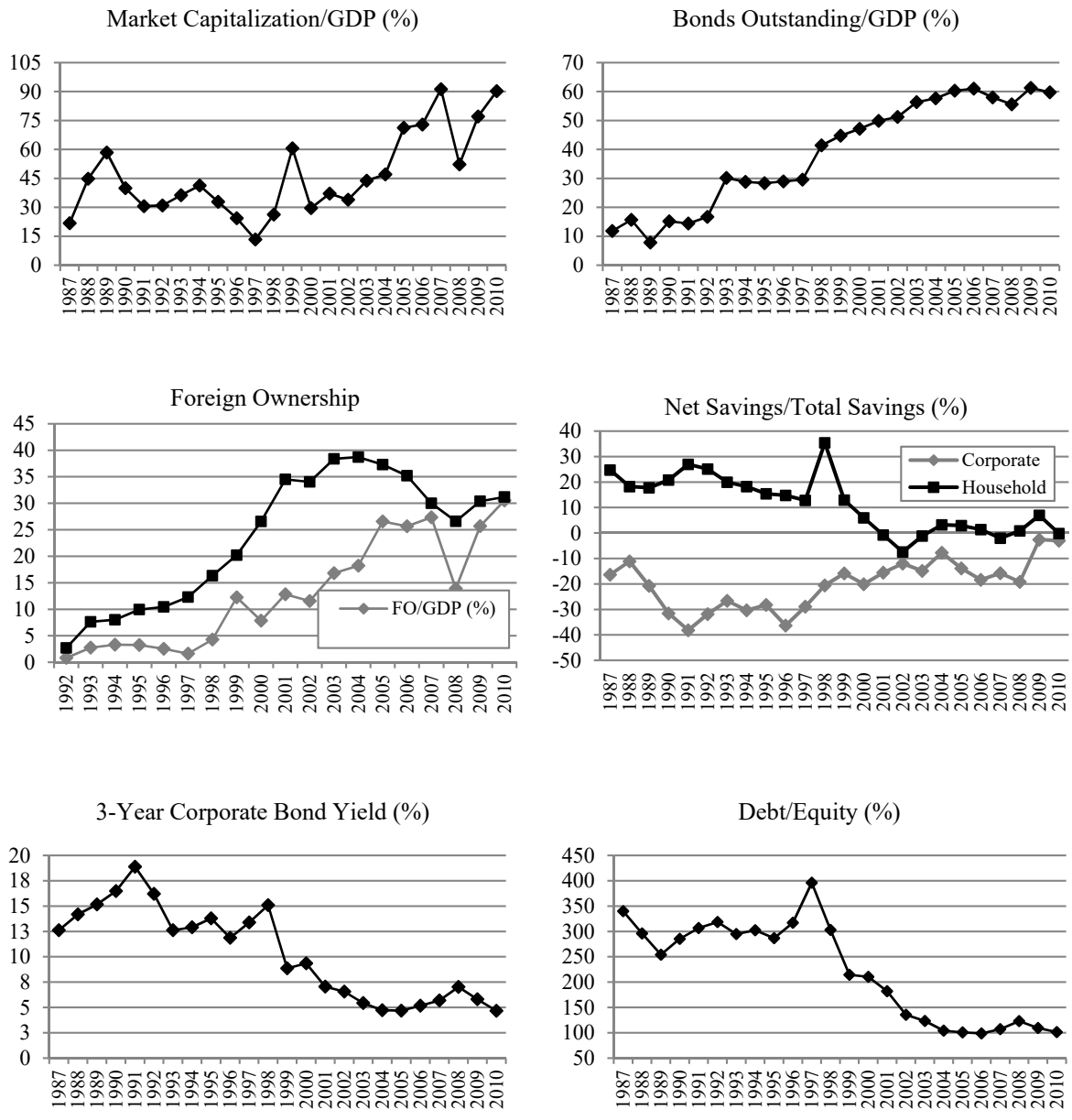
[17] The Bank of Korea measures the debt-to-equity ratio as the debt aggregated across all manufacturing firms that file corporate income tax, over the equity aggregated across the same set of firms.

from 100 percent in 1987 to 121 percent in 2010 (source: Bank of Korea).[18] This is consistent with the fourth chart, which illustrates that corporations save as much as they invest after the crisis.

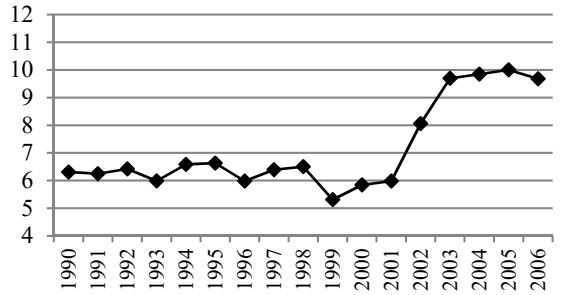
[18] The Bank of Korea measures the cash ratio as the cash and cash equivalents aggregated across all manufacturing firms that file corporate income tax, over the total assets aggregated across the same set of firms. The current ratio is the current assets aggregated across all manufacturing firms that file corporate income tax, over the current liabilities aggregated across the same set of firms.

Figure A1: Financial Sector Development in Korea

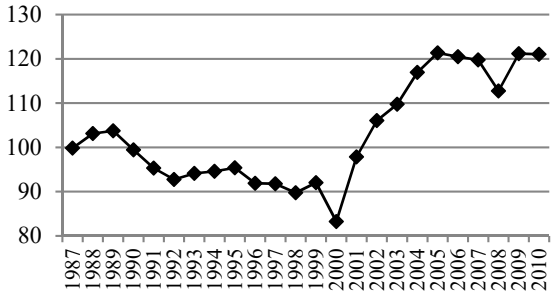
These figures present the total market capitalization over GDP, total bonds outstanding over GDP, fraction of foreign ownership (over GDP and over total market capitalization), net savings of corporate and household sectors as a fraction of the country's total savings, three-year corporate bond yield (investment grade), debt-to-equity ratio, cash over assets, and current ratio of Korean firms before and after the Asian financial crisis. Foreign ownership data comes from the Financial Supervisory Service, and all other data comes from the Bank of Korea. The debt-to-equity, cash, and current ratios all use manufacturing sector firms filing corporate income tax.



Cash Ratio (%)



Current Ratio (%)



A3. The BSDI and the Likelihood to Make Large Investments

This Appendix employs a different set of tests to examine the external effect of large business groups, namely the duration analysis. That is, we examine how the level of large business groups' collective strength and dominance is associated with the probability of making large investment decisions conditional on not having done so in the past.

Recently, duration analysis has been adopted by many studies to examine firms' investment behavior (for example, Whited, 2006; Akdoğu and MacKay, 2008; Billett, Garfinkel, and Jiang, 2011). This has several advantages over regression analysis, which examines the relationship between investment and growth opportunity, as in our earlier sections. First, it does not use a growth opportunity prone to measurement concerns. Second, and as Whited (2006) mentions, corporate investments tend to be sporadic, a property suitable for a duration analysis.

Following Whited (2006), we use the mixed proportional hazard model first developed by Meyer (1990). Its specification is as follows:

$$\lambda_i(t) = \varpi_i \lambda_0(t) \exp[x_i(t)'\beta] \qquad (2)$$

where t denotes the number of years that firm i has not reached a certain investment threshold. We follow Whited (2006) and assume that a spike (i.e., a large investment above a threshold) occurs when a firm's CAPEX ratio exceeds two times its median value.[19] The hazard function

[19] Our unreported analysis also uses the model to estimate when the spike occurs when a firm's CAPEX Ratio exceeds its median value; we find essentially the same results.

$\lambda_i(t)$, which measures the probability that firm i will make a large investment exceeding the threshold in a given year t conditional on not having done so in the past t years, could then be represented as the product of three parts: ϖ_i captures the unobserved heterogeneity, similar to random effects in standard linear regressions; $\lambda_0(t)$ is the baseline hazard, a function solely determined by the duration t; and $x_i(t)$ is the time-varying covariate vector, in which the corresponding coefficient vector is denoted as β. As Whited (2006) discusses, Meyer's (1990) partial parametric model is advantageous, in that it handles interval-censored data as we have here. For example, the parametric portion in this model comes from β and the assumption that ϖ_i is normally distributed; the nonparametric portion comes from the baseline hazard $\lambda_0(t)$, which is restricted to be only a discrete step function.

Specifically, we first divide our firm-level data for non-LBG firms into two subsamples: low- and high-BSDI industries. Industries with a median (before 1996 and after 1999) BSDI value below (or above) the global median (before 1996 and after 1999, across all industries) are categorized as low (or high) BSDI industries. We then conduct a duration analysis for both subsample periods: before the crisis (1987–1996) and after (1999–2010). Our covariates include the EBITDA ratio and the two fixed effects (year and industry). Further, note that we require at least four consecutive years of data to be available for a firm to be included in the sample.

We predict that non-LBG firms in high-BSDI industries would exhibit lower hazards than those in low-BSDI industries during the pre-crisis period (1987–1996). This is because they would invest less, not more, if financial constraints render non-LBG firms' investments insensitive to growth opportunities.

Table A2 reports our duration analysis' results. When we compare the baseline hazards between low- and high-BSDI industries, we observe that the former's hazards are always greater than those of the latter during the pre-crisis period (1987–1996). For example, the respective three-year hazards of 0.128 and 0.067 for low- and high-BSDI industries suggest that a firm's probability to make a large investment in a low-BSDI industry is twice as high as that of a firm in a high-BSDI industry, if both firms have equally not done so in the past three years. Moreover, the baseline hazards' differences are statistically significant in most cases, with the exception of a two-year hazard. However, the results substantially differ after the crisis. The significant differences in baseline hazards between the two subsamples disappear entirely during the post-crisis period.

In other words, during the pre-crisis period we find that large business groups' strength and dominance not only render the investments of non-LBG firms insensitive to growth opportunities, but also delay them. The mutually consistent findings of our duration analyses and of our other analyses based on investment sensitivity to growth opportunities reinforce the reliability of both results.

Table A2: BSDI and Investment (Proportional Hazard Model)

This table reports the results of a discrete proportional hazard model that examines how large business groups' levels of collective strength and dominance are associated with the probability of making a large investment decision if the firm has not done so in the past. A spike (i.e., a large investment above a threshold) occurs when a firm's CAPEX ratio exceeds two times the median value of its CAPEX ratio. Industries with the median (before 1996 and after 1999) BSDI below (or above) the global median (before 1996 and after 1999, across all industries) are categorized as low (or high) BSDI industries. We exclude firms belonging to the financial or utility industries from the sample. Numbers in parentheses are standard errors. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Before 1997			After 1998		
	Low BSDI	High BSDI	Low - High	Low BSDI	High BSDI	Low - High
EBITDA Ratio	0.204	1.959***		1.582***	1.193***	
	(0.700)	(0.749)		(0.422)	(0.220)	
1 year hazard	0.256***	0.153***	0.103**	0.108***	0.117***	-0.009
	(0.030)	(0.014)		(0.023)	(0.016)	
2 year hazard	0.120***	0.081***	0.039	0.076***	0.068***	0.008
	(0.011)	(0.006)		(0.014)	(0.008)	
3 year hazard	0.128***	0.067***	0.061**	0.076***	0.069***	0.007
	(0.014)	(0.005)		(0.014)	(0.008)	
4 year hazard	0.181***	0.081***	0.100**	0.068***	0.081***	-0.013
	(0.025)	(0.007)		(0.012)	(0.010)	
Year Fixed Effect	Yes	Yes		Yes	Yes	
Industry Fixed Effect	Yes	Yes		Yes	Yes	
Log likelihood	-1038.24	-1149.52		-1834.83	-4573.94	
Number of Spells	1,107	1,243		2,020	4,789	