The Effects of Ownership Structure on Business Groups' Financing Decisions

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Abstract

This article identifies the effect of reduced disparity between cash-flow and control rights by a controlling shareholder in the context of financing choice of internal and external financing. Using a regulatory change in Korea limiting cross-shareholdings, we find that the controlling shareholder's more direct ownership substitutes external equity investments with internal equity financing and intra-group loans with external debts. The substitution is due to the ultimate owner's motive for maintaining control over group firms and the decreasing number of interlinked affiliates, respectively. We further show that the financing changes improve the firms' debt-financing sensitivity to growth potential and investment efficiency by exposing the management to financial market discipline. Overall, these findings suggest that group firms' efficient capital allocation hinges on the ultimate owner's direct equity ownership deterring tunneling incentives and limiting access to internal capital markets.

1. Introduction

A recent case of Deliveroo, whose share price dropped by 26% after IPO on the London Stock Exchange on 31st of March 2021, presents the U.K. equity investors' concern about dual shares allowing a wider divergence between the controlling shareholder's cash-flow and control rights. By contrast, a recent study by Field and Lowry (2020) demonstrates the different benefits of dual-class equity according to firm age by showing the decline in S&P1500 firms with dual-class yet the increase in IPO firms with dual-class from 1988 to 2017. Furthermore, instead of dual-class shares, different control-enhancing tools such as pyramidal and cross-shareholdings are commonly observed in East Asian and European companies. Namely, the divergence between cash-flow and control rights is at the heart of different financial systems with a wide range of governance implications. The extant literature provides mixed evidence on the control-ownership wedge. One viewpoint refers to it as a tool for controlling shareholders[1] to divert firm resources for their private benefit (Bae, Kang, and Kim, 2002; Almeida & Wolfenzon, 2006a; Hwang and Kim, 2016) because of the easiness to externalize the costs of their moral hazard more progressively than direct equity stakes (Bebchuk, Kraakman, & Triantis, 2000). Another viewpoint emphasizes this ownership structure as a consequence of the strategic selection of firms to fund new investment opportunities faced with financing constraints (Khanna & Yafeh, 2007; Almeida, Kim, & Kim, 2015).

Unlike stand-alone companies, group-affiliated firms have additional access to internal capital markets amongst member firms. Despite the extensive attention to the internal capital markets, there is a lack of direct evidence on business groups' financing choices between internal and external capital markets and the causal impact on corporate capital allocation. Previous research on internal capital markets has centered on the benefits of internal funds compared to external financing or on outcomes such as investment and firm value (Almeida, Kim, & Kim, 2015; Buchuk, Larrain, Prem, & Urzúa, 2020). These studies assume that the choice between internal and external financing is uniformly determined within a business group. Instead, we investigate

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[1] We refer to the controlling shareholder as the family and related persons who exercise controlling influence over multiple firms, including the exchange of directors and managers and resource reallocation across companies even though the families own a small fraction of shares in the firms. This follows the broad criterion of a business group defined by the Korean Fair Trade Commission (KFTC).

how ownership structure differently affects group firms' financing choices. In particular, we focus on the increase in direct equity ownership by controlling shareholders, which reduces wedges between cash-flow and control rights after removing cross-shareholdings.

The key challenge in examining the effects of ownership structure on firms' financing decisions is endogeneity. Determining a firm's position within a business group is not randomly assigned but determined by firm strategy (Almeida, Park, Subrahmanyam, & Wolfenzon, 2011) or unobserved factors that might also affect firm behavior. To aid identification, we use a regulatory shock that induces a plausibly exogenous change in ownership structure. Specifically, we exploit a legal reform in Korea that prohibits new and existing cross-shareholdings of business groups over 5 trillion KRW in total aggregate assets since 2014. The passage of the new regulation by the National Assembly can be considered a salient shock in terms of unexpectedness and shock strength (Atanasov & Black, 2016). In this study, we exploit this as a shock to ownership structure to identify its causal relation to group firms' financing choice between internal and external capital markets and, resultantly, capital allocation efficiency.

To estimate the change in a firm's ownership structure after removing cross-shareholdings, we use a hand-collected dataset on ownership structure, including disparity, centrality, and position defined by Almeida et al. (2011). Using 5,121 firm-year observations of 770 firms belonging to targeted business groups over the years 2010-2017, we find evidence that the removal of cross-shareholdings increases ultimate owners' direct equity ownership. Specifically, treated firms of business groups removing cross-ownership experience a statistically significant reduction in the disparity[2] between cash-flow and control rights and fewer affiliates involved up to the controlling shareholder's equity ownership. In contrast, control firms affiliated with business groups irrelevant to cross-shareholdings observe no statistically significant ownership structure changes.

We then explore the effect of controllers' increasing direct ownership on group firms' financing decisions to complement the limited evidence on the determinants of choice between internal and external financing. We first hypothesize that the ultimate owner's enhanced direct ownership substitutes external equity financing with internal equity funds. The removal of cross-

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[2] A lower disparity means lower wedges between cash-flow and voting rights, indicating that controllers increase their equity claims under the same voting rights.

holdings decrease the control-ownership wedge, which allowed more control power to ultimate owners with fewer equity claims (Bebchuk, Kraakman, and Triantis, 2000). Therefore, if controlling shareholders intend to maintain the same control over group firms, controllers need to increase their equity investments through their own funds or a directly owned affiliate. This motive of maintaining control increases internal equity financing and decreases external equity financing needs that dilute ultimate owners' control. In contrast, we postulate that the enhanced direct ownership replaces internal loans with external debt financing. The advantage of accessing internal capital markets arises due to affiliates' operational and financial interlinkages within a business group (Gopalan, Nanda, & Seru, 2007). However, the increasing costs of direct equity investments rather than indirect ownership are likely to reduce the total and interlinked number of affiliates and constrain each other's access to internal capital. Moreover, the decrease in controllers' wedges between control and cash-flow rights expects to reduce the cost of debt financing due to reduced incentives for tunneling and moral hazard activities by controlling shareholders, and also decreased monitoring costs and credit risk of banks (Lin, Ma, Malatesta & Xuan, 2011). Resultantly the reduction in the cost of debt increases group firms' willingness to borrow externally.

To test the hypotheses, we employ a difference-in-difference (DiD) approach for 2010-2017 with two treatment variables, group-level and firm-level treatment. Using two treatment variables make it possible to differentiate the overall impact of removing cross-holdings across the whole affiliates within a business group from the effect on each member firm. Figure 1 describes two treatment variables in detail. Furthermore, to capture the overall change in internal capital markets, we also manually obtain intra-group debt and equity financing datasets for each group firm.

< Figure 1 here >

Interestingly, from the DiD regression results, we observe group firms' different financing behavior according to the types of financing (loans or equity funds) and the treatment levels (firm or group levels). First, at the firm-level treatment, we find that firms directly linked to cross-ownership replace external equity with intra-group equity financing and intra-group loans with external debt financing. In detail, the treatment firms significantly increase their intra-group equity financing by 0.6% of total assets but reduce external equity financing by 2.0% of assets for the post-period, compared to the control firms. In contrast, the treatment firms significantly reduce

their intra-group debt financing by 0.7% of assets but significantly increase external debt financing by 2.9% of total assets. The findings are consistent with the hypotheses of different motives affecting the choice between internal and external financing: controllers' motive for maintaining control in equity financing and the decreasing number of total and interlinked affiliates in debt financing.

On the contrary, at the group-level treatment, we find no significant change in internal financing as a whole except for external financing. Specifically, there is a significant increase in group-level external debts by 1.8% of total assets and a significant decrease in external equity financing by 1.3% of assets. Unlike firms directly linked to cross-ownership, group firms outside the cross-holdings have no change in wedges between cash-flow and voting rights so that controllers' motive to maintain control over those firms remain unchanged. Moreover, through pre-existent pyramidal ownership, the group firms outside the cross-ownership still access internal loans (Almeida et al., 2011). Therefore, the impact of removing cross-holdings on internal financing is limited within group firms linked to the cross-ownership but not as a whole.

Further, we find that the changes in financing significantly improve capital allocation efficiency at the firm-level treatment. Following Bhandari and Javakhadze (2017), Chen, Ghoul, Guedhami, & Wang (2017), and McLean, Zhang, & Zhao (2012), the financing sensitivity to firms' growth potential is significant and positive only for internal and external debt financing that has more dependence on external debt markets. In contrast, treatment firms have no significant improvement of financing sensitivity in internal and external equity funds that less dependent on external equity markets. Moreover, we also find a significant improvement in investment efficiency of treatment firms that is more sensitive to firms' growth opportunities over the post-period. These results suggest that the increased exposure of management to financial market discipline enhances controllers' sense of self-discipline and capital allocation efficiency. The findings are also explained by controllers' lower tunneling incentive because greater direct equity ownership reduces the control-ownership wedge and thus, internalizes more financial consequences of controllers' decisions (Bebchuck et al., 2000).

The findings on financing and investment efficiency are valid against robustness checks with a placebo test using an artificial event year and parallel-trends test. To alleviate the concern that

the results are driven by any pre-existing trend (Atanasov & Black, 2016), we use different pre- and post-periods around 2013 instead of 2014. The coefficient estimates of the variable of interest with the artificial periods are not statistically significant, supporting those potential pre-existing trends do not drive the capital allocative efficiency. We further show that the treatment and control firms mostly have similar trends in yearly coefficient estimates for debt financing sensitivity and investment efficiency over the pre-period but substantial jumps in the post-period for the treatment firms. This trend analysis validates the parallel-trend assumption necessary for reliable DiD specifications.

Finally, we provide evidence that the improvement of capital allocation efficiency comes from the increase in controlling shareholder's sense of self-discipline from the substitution of intra-group debts with relatively more expensive external loan financing. Business group firms tend to prefer intra-group loans to avoid external creditors' excessive monitoring (Lin et al., 2011) and obtain financial flexibility in decision making (He, Mao, Rin, & Zha, 2013). Accordingly, the group firms' dependence on external financing increases the exposure of management to financial market discipline due to higher monitoring by external creditors. This postulation is supported by the significant and positive investment efficiency in the post-period only for the treatment firms being publicly listed and highly dependent on external financing. An additional analysis of total debts also supports the conclusion that the capital allocation efficiency does not result from being over-leveraged but from the substitution effect.

The novelty of this study comes from providing direct evidence that links ownership structure to group firms' financing decisions between internal and external capital markets. Prior studies on internal capital markets have focused on the ultimate efficiency of internal funds by investigating the direction of transfers among member firms, especially during periods of financial market crisis, including the Asian crisis (Almeida, Kim, & Kim, 2015), the recent European crisis (Santioni, Schiantarelli & Strahan, 2020), and the 2008-09 recession (Buchuk, Larrain, Prem, & Urzúa, 2020). Unlike these findings, our study is the first to identify the effect of reduced wedges between cash-flow and voting rights by controlling shareholders in the context of financing choice of internal and external financing. Specifically, the findings suggest that group firms' efficient capital allocation hinges on more direct ownership by the controlling shareholder that deters tunneling incentives and limits access to internal capital markets.

This research also contributes to the broader literature on the bright and dark sides of internal capital markets. Exploiting plausibly exogenous variations in group firms' access to internal capital markets allows identifying more precisely the impact of internal funds and supporting the tunneling view on it. In particular, the evidence is strengthened by exploring both internal debt and equity financing so as to complement the previous literature focusing only on intra-group debt capital market (Gopalan et al., 2007; Lin et al., 2011; Buchuk et al., 2014; Thapa, Rao, Farag, & Koirala, 2020) or internal equity capital market (Gopalan, Nanda, & Seru, 2014; Almeida et al., 2015). In particular, this study demonstrates the effects of internal capital markets in normal times, which is not dealt with prior studies focusing on the role of internal capital markets during the financial market crisis (Almeida et al., 2015; Santioni et al., 2020). Furthermore, despite the potential drawback of expensive external finance (Gopalan et al., 2007) and the possible excessive monitoring by external creditors (Lin et al., 2011), our result suggests the benefit of substituting internal funds with external finance exposing the management to external market discipline.

Finally, this study can have important policy implications for governance mechanisms that increase the divergence between cash-flow and control rights of ultimate owners. Due to the concerns on agency problems of such a disparity, Japan enacted the Corporate Governance Code in 2015, which includes reducing cross-shares. On the contrary, several European countries, including Belgium, France, Italy, and the Netherlands, recently adopted tenure voting rights that double shareholders' voting rights if they continuously hold shares for at least two years, namely loyalty shares (Bajo, Barbi, Bigelli, & Croci, 2020). Especially, family firms actively adopted the new control-enhancing mechanism at the risk of control dilution in those countries where institutional shareholders' roles and power have substantially increased. Despite different institutional contexts to be considered, our empirical evidence informs that the policy decreasing wedges between cash-flow and control rights is reasonable for reducing agency costs and improving financing efficiency in business groups.

2. Background and Research Agenda

2.1. Institutional background

The Korean Fair Trade Commission (KFTC) defines a business group as a group of companies, more than 30% of whose shares are owned by the group's controlling shareholders or affiliated firms or practically controlled by them despite lower cash-flow rights. Usually, a founder-family or a controlling shareholder controls all affiliated companies in each business group. The controlling shareholder exercises controlling influence over intra-group affiliates through inter-corporate shareholdings, exchange of directors and managers, and substantial business transactions between affiliates. In these ways, the major decisions of subordinate member firms are conducted by the controlling shareholder rather than a professional manager. Namely, the Korean business group is equivalent to a multidivisional organization, with each affiliated company functioning as an operating division (Chang & Hong, 2000).

Due to the institutional background, cross-shareholdings have been pervasive in Korean business groups. In the past decades, the Korean government prohibited 'a pure holding company' whose purpose is to control affiliated subsidiaries and restricted the controlling shareholders' ownership by 5% in 1972. Consequently, the family shareholders of business groups maintained their control over affiliated firms and their resources, mainly through 'reciprocal shareholdings' or 'cross-shareholdings'. However, after establishing the Korea Fair Trade Commission (KFTC), the government prohibited reciprocal shareholdings in 1987. Then, the level of cross-shareholdings sharply increased. After the 1997 Asian financial crisis, there have been gradual changes in regulations because of the concerns on information asymmetry and ownership-control disparity from the complex cross-ownership. Therefore, the Korean government permitted a pure holding company with certain restrictions in April 1999 and then legislated a new law prohibiting a new cross-shareholding of business groups whose total combined assets exceed 5 trillion KRW and urging them to clear up previous cross-shareholdings on 31 December 2013 and enforced it on 1 July 2014.

The new regulation on cross-shareholdings comes from the government's concern on agency costs of increasing disparity between voting and cash-flow rights. According to Almeida et al. (2011), the controlling families in 47 Korean business groups hold 13% of the cash flows of the median firms, but 68% of voting rights of their affiliates. It is also found that since 2008, most of the equity investments by Korean business groups forming cross-shareholdings have not been the acquisition of new stocks. Instead, cross-shareholdings have been mainly used to acquire

previously issued stocks, consequently for investee firms' ownership change rather than investment fund (KFTC, 2013).

The regulatory change can be regarded as exogenous because of the following reasons. Over the year, there had been time-consuming amendments and disputes over the enforcement level and scope of limiting cross-shareholdings between the ruling party and the opposite parties. Moreover, there were five times more lobbying efforts by large firms' external business managers against the laws for economic democratization, including the prohibition of cross-shareholdings compared to the previous year. Another reason why the draft faced a risk of falling through the legislative process is that the ruling party is the conservative forming an unfavorable attitude toward tightening regulations. These uncertainties make the implications of the draft unexpected at the time of its passage. In line with this, there were no significant market responses around relevant event dates except the date when the National Assembly passed the government's bill. Furthermore, the law has significantly affected the business groups' ownership structure due to the substantial penalty: 1) commanding stock disposal, 2) fining 10% of the acquisition price for forming cross-shares, 3) prohibiting the exercise of voting rights of cross-shares, and 4) sentencing to 2 years or fining less than 2 billion won. The penalty is strong enough to affect the business groups' decision on cross-shareholdings. According to the Korea Fair Trade Commission (KFTC), the number of cross-shareholdings of the target business groups decreased from 97,658 in April 2013 to 16 in May 2021.

2.2. Related literature and empirical prediction

In this study, we examine the consequences of ownership change from the removal of cross-shareholdings for group-affiliated firms' financing and investment behavior. Along with dual-class shares and pyramidal ownership, cross-holdings are used to increase wedges between a controlling shareholder's voting and cash-flow rights (Bebchuk, Kraakman, and Triantis, 2000). Higher wedges enable the controlling shareholder to exercise more control with a small fraction of equity claims. Therefore, eliminating cross-holdings is expected to lower the control-ownership wedge and increase the controlling shareholder's direct ownership.

Hypothesis 1*: The removal of cross-shareholdings increases controlling shareholders' direct ownership of group firms holding cross-ownership compared to group firms with no cross-ownership.*

The increase in direct ownership by controlling shareholders should influence group firms' financing choice between internal and external funds. Instead of cross-shareholdings, controllers should increase direct equity investments through their own money or another affiliate directly owned by the controlling shareholders to maintain control over group firms. If the controllers intend to maintain the previous voting rights, they need to increase their equity investments, the same as the disparity between voting and cash-flow rights. Furthermore, the increase in internal equity financing declines the controllers' external equity financing needs that dilute their control. It is also supported by the expectation of external equity investors' discount on group-affiliated firms that causes expensive external equity financing (Almeida and Wolfenzon, 2006b).

Hypothesis 2*: The enhanced direct ownership by controllers increases internal equity financing and decreases external equity financing of group firms compared to group firms with no cross-ownership.*

In comparison with internal equity financing mainly motivated by the maintenance of control, internal debt financing tends to decline due to limited internal capital markets. The removal of cross-holdings is likely to reduce the number of interlinked affiliates accessible to each other's resources through ownership loops. In addition, the increasing costs of direct equity investments can lead controllers to decrease the total number of firms under control. Such rearrangements are possible because business-group firms are managed by a common group of insiders (Gopalan, Nanda, & Seru, 2007). Therefore, the decrease in the total and the interlinked number of affiliates limits group firms' access to internal funds, especially intra-group loans, and increases the need for external debt financing. Moreover, the finding by Lin, Ma, Malatesta & Xuan (2011) on the positive relationship between a firm's cost of debt financing and an ultimate owner's wider wedges between control and cash-flow rights also expect group firms' willingness to borrow externally due to a lower cost of external debt financing.

Hypothesis 3*: The enhanced direct ownership by controllers decreases internal debt financing and increases external debt financing of group firms compared to group firms with no cross-ownership.*

We further examine the consequences of the financing changes for the capital allocative efficiency of group firms. First, the increase in direct ownership by controlling shareholders should reduce the controller's tunneling activities. Tunneling refers to corporate activities that benefit the controlling shareholder at the cost of minority shareholders (Johnson, La Porta, Lopez-de-Silanes, & Shleifer, 2000). Especially when the controlling shareholder holds a small proportion of cash-flow rights, it increases the owner's incentive to divert firm resources for the private benefit due to lower costs of internalizing moral hazard activities (Bebchuck et al., 2000). In other words, controlling shareholders with excess control rights bear only a small fraction of the financial consequences of their decisions while entrenching their management against takeovers.

To tunnel resources away from the lending to borrowing firms, the controllers make intra-group loans from firms with low cash-flow rights to other member firms with high cash-flow rights (Bertrand et al., 2002). Moreover, the abuse by the controlling shareholder may misallocate capital across firms in the business group by making investments with low growth potential such as pet projects and leaving better projects unfunded so as to expropriate minority shareholders of the unfunded firms. Accordingly, the increasing direct ownership and reducing disparity in cash-flow and voting rights from the removal of cross-shareholdings should deter controlling shareholders' incentives to engage in tunneling due to the increasing costs of internalizing their decisions with more direct equity stakes. It would, in turn improve firms' capital allocation efficiency.

In addition, the limited internal capital markets from eliminating cross-holdings expose the management to financial market discipline. A group firm prefers intra-group lending to avoid the excessive monitoring by external creditors (Lin et al., 2011), overcome the limitations of raising expensive external capital (Gopalan et al., 2007) and avoid losing financial flexibility in decision making (He, Mao, Rui, & Zha, 2013). Accordingly, higher constraints of firms' access to cheaper internal capital markets should increase the firms' dependence on external financing and enhance controllers' sense of self-discipline due to higher monitoring by external market investors.

> **Hypothesis 4**: *The removal of cross-holdings improves the affected group firms' capital allocative efficiency than group firms with no cross-ownership. It is driven by the reduced incentive of controllers' tunneling activities and the increased exposure of management to financial market discipline.*

3. Data and Measures

3.1. Sample

To study the effect of ownership structure on business groups' financing decisions, we use publicly listed in Korean Stock Exchange (KSE) or externally audited companies of business groups as a sample, targeted by the law limiting cross-holdings in Korea. To construct the sample, we start from all business groups with total combined assets over 5 trillion KRW for the 2010 to 2017 period (centered around the legislation), which are designated by the Korea Fair Trade Commission (KFTC) annually. From this sample, we delete business groups that are government-owned, non-family owned, financial business groups, or going into receivership.[3] We also delete business groups which have been assigned as the regulation target since 2014 or removed from the target list before 2014. These filters result in 36 out of 84 business groups.

We then delete financial firms and observations with missing values for ownership structure variables. We additionally delete firm-years with negative equity. The final dataset consists of a sample of 5,121 firm-year observations of 770 firms. Of these 770 sample firms, 311 firms belong to treated business groups holding cross-ownership and 459 are affiliated to control business groups without cross-shareholdings.

3.2. Measures for ownership structure

The ownership links amongst group-affiliated firms are measured by three variables: disparity, centrality, and position. First, *disparity* means the difference between voting rights and cash-flow rights. The *voting rights* are ultimate owner's control right (%), measured by a firm's direct votes held by its controlling shareholder plus all votes held by other group firms having control over it (La Porta & Lopez-de-Silanes, 1999; Lemon & Lins, 2003). The *cash flow rights* are ultimate ownership (%), defined as the fraction of dividend eventually received by the controlling shareholder. In this paper, we measure disparity as voting rights minus cash-flow rights and scaled by cash-flow rights. Second, *centrality* means a firm's importance for controlling other group firms,

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[3] We focus on family-controlled business groups. It is better to isolate the effect of the increase in direct ownership by the controlling shareholder on group-firms' financing and capital allocation when a single owner (family) has controlling rights of multiple firms and allocates resources across affiliates.

measured by aggregate equity stakes in other member firms. In specific, it is obtained from the difference in controlling thresholds, the maximum ownership required to control over all affiliates within the same ownership chain, with and without the relevant firm (Almeida et al., 2011). And then it is divided by the total number of affiliates under control. The higher centrality means being more connected and used to control other member firms. Third, *position* is a firm's distance from a controlling shareholder. A particular firm in the ownership metrics might have multiple ownership chains to the controlling shareholder. Thus, the position is measured by the weighted average of ownership chains by its ratio of cash-flow rights that the controlling shareholder receives (Almeida et al., 2011). The smaller value of position refers the closer to direct ownership by the controlling shareholder.

3.3. Data

Data on the ownership links between group-affiliated firms are manually collected from the KIS-LINE developed by Korea Investors Service (KIS) and the database of KFTC. The main measures of internal capital markets are intra-group loans and equity investments. In Korea, all public and externally audited firms are required to specify intra-group transactions in the footnotes to their financial statements. We hand collect each firm's loans provided to and received from other firms in the business group from the KIS-LINE. We also collect the amount of equities sold to and purchased from other affiliates from the e-group database of KFTC and voluntary disclosures of equity investments in affiliated companies available from the KIS-LINE.[4] Next, we merge these data with financial and accounting data from Bloomberg and KIS-LINE. To prevent outliers from affecting the results, we winsorize data at the 1% and 99% levels in all the analyses.

Table 1 provides summary statistics and definitions for the main and control variables in the analysis. It shows that controlling shareholders hold 32.6% of cash-flow rights but hold 73.7% of voting rights of the average firm for the period 2010-2017. Compared to the ownership structure data for the period 1998-2004 from Almeida et al. (2011), the sample has larger cash-flow rights than 21.0%, but similar voting rights to 68.0%. This finding suggests that business groups have

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[4] https://www.egroup.go.kr/egps/wi/stat/spo/psitnCmpnyStockHoldList.do

increased cash-flow rights while removing cross-shareholdings, but still have a substantial degree of *disparity* between cash-flow and voting rights, 4.3 on average.

In terms of *position*, the average position of affiliates is 2.5, indicating one and a half intermediate firms between the firm in question and the controlling family. The 75th percentile of the position is 3.1, such that most of group-affiliated firms are owned through pyramidal ownership chains which are not deep. The data on *Centrality* show that the average centrality is 0.119, but the median position is zero. This statistic suggests that only a small fraction of firms is central for controlling over other member firms.

< Table 1 here >

4. Empirical Models and Results

We first describe how the regulation removing cross-shareholdings has affected the ownership structure within business groups. Then we examine the consequences of this ownership change for the financing and investment activities of group-affiliated firms.

4.1. Changes in ownership structure

Table 2 contains a descriptive analysis of ownership structure for the pre- (2010-2013) and post-legislation (2014-2017) periods for firms classified into treatment group firms holding cross-shares and control group firms without cross-ownership. A statistically significant decrease in the disparity between cash-flow and voting rights (6.99 to 4.29) and in position (3.38 to 2.75) is observed during the post-period for the treatment group firms. On the contrary, there is no statistically significant change in ownership structure for the control group firms. The reduction in disparity and position for treatment group firms indicates that the removal of cross-shareholdings tends to increase a controlling shareholder's direct equity ownership rather than indirect ownership loops.

< Table 2 here >

In table 3, we show differences in ownership structure between intra-group loan/equity providers and receivers to explore how the removal of cross-holdings affects the controlling

shareholder's tunneling behavior. According to the previous literature on tunneling effects of internal capital markets (Bertrand et al., 2002; Buchuk et al., 2014), controlling shareholders make loans or equity transfers go to firms with higher ultimate ownership and upper (smaller) positions in receivers than in providers. Following Buchuk et al. (2014), providers (receivers) are defined as firm-year observations with net intra-group loans or equity investments smaller (larger) than -5% (5%) of the book value of total assets.[5]

Panel A of Table 3 reports the changes in ultimate ownership, position, and centrality of intra-group loan providers and receivers before and after the regulation with the results of difference-in-differences tests for the treatment and control group firms. The mean tests of position indicate that both intra-group loan providers and receivers of the treatment group tend to have smaller positions by -0.779 and -0.968, respectively, compared to the control group after removing cross-holdings. In other words, intra-group loan receivers of the treatment group are likely to be positioned higher in the pyramid ownership chain in which the controlling shareholder have direct ownership stakes. The mean value of centrality of intra-group loan receivers of the treated group significantly increases by 0.039 for the post-period, compared to the control group. These results imply that even after removing cross-shareholdings, controlling shareholders of business groups tend to have tunneling activities in the internal debt market.

Panel B also shows the significant decrease by 0.489 in the position of intra-group equity receivers of the treatment group for the post period compared to the control group, but no significant change in the position of providers. In contrast to position, intra-group equity receivers of the treatment group tend to have smaller ultimate ownership by -10.890%. These findings provide conflicting evidence of removing cross-shares on tunneling in the internal equity market. Taken together, it is hard to assert that the removal of cross-shareholdings deters the tunneling activities of the controlling shareholder in internal debt and equity capital markets at the business group level.

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[5] A firm's net intra-group loans (equity investments) are obtained from the total amount of borrowing loans minus lending loans (equity sold minus equity purchased) within the same business group. The definition and direction of net intra-group loans and equity investments are opposite to that of Buchuk et al. (2014), but the definition of providers and receivers remains the same.

< Table 3 here >

4.2. Effects of removing cross-shareholdings on internal and external financing

This section analyzes the effects of those changes in ownership structure after the removal of cross-shareholdings (CS) on group-affiliated firms' financing behavior. To examine this, we employ a difference-in-differences (DiD) design. We use a dummy variable *Post* which equals 1 from 2014 to 2017 (post-legislation) and 0 from 2010 to 2013 (pre-legislation). To compare the financing decisions of the CS-holding group firms with those of the control group firms (non-CS-holding), we construct two treatment variables, *G-Treatment* (group-level) and *F-Treatment* (firm-level) to differentiate the overall impact of removing CS across all the affiliates within a business group from the effect on each member firm. *G-Treatment* equals 1 for firms affiliated to the CS-holding business groups and 0 otherwise. *F-Treatment* equals 1 for firms that belong to CS directly and 0 otherwise. (See Figure 1 for details). The key variable of interest is the DiD estimator $[Treatment_{it} \times Post_t]$, which captures the causal effect of removing CS on the treatment group firms. The resulting DiD specification is as follows:

$$Y_{i,t} = \alpha + \beta_1 Treatment_{i,t} + \beta_2 Treatment_{i,t} \times Post_t + \gamma X_{i,t-1} + \tau_t + \varepsilon_{i,t} \qquad (1)$$

where *Treatment*_{i,t} can be *G-Treatment* or *F-Treatment*. We control for lagged firm characteristics in vector $X_{i,t-1}$ and time fixed effects τ_t. Time-invariant unobservable variables that could explain firms' financing behavior are captured by employing firm fixed effects in the regression model. Standard errors are clustered at the business group level to take into account within-group correlation across observations.

$Y_{i,t}$ represents firm variables of internal and external debt or equity financing. The first outcome variable is *intra-group debt financing,* measured by the total amount of borrowing loans from other affiliates in the group scaled by lagged total assets. The second one is *external debt financing*, obtained from financial debts to lagged total assets (Buchuk et al., 2014). The third measure is *intra-group equity financing*, the total amount of equities sold to other affiliates divided by lagged total assets. The last one is *external equity financing*, which is the growth of equity net of increases in retained earnings and internal equity sold over lagged total assets (Almeida et al., 2015).

In line with the evidence offered by the existing literature (Gopalan et al., 2007; Buchuk et al., 2014; Almeida et al., 2015), we use several control variables that may contest the variable of interest in explaining the variations in financing decisions. We control for *firm size* by taking the natural logarithm of the book value of total assets. We also control for the firm-level operating performance, measured by earnings before interest and taxes (*EBIT*) scaled by total assets (Gopalan et al., 2007). We further consider financial constraints such as capital-intensity (*PPE* over total assets), *leverage* (total debts over total assets), and *cash holdings* (cash and cash equivalents over total assets). All control variables are lagged.

First, we examine the changes in group-affiliated firms' equity financing behavior. To resolve the cross-ownership, an affected firm should sell out its cross-shares to the stock market or hand over the stakes to the controlling shareholder or a third party. This motivation will resultantly influence the firm's equity finance. Table 4 reports DiD regression results of firm-level intra-group and external equity financing. At the business-group level treatment (*G-Treatment*), the treated groups experience no significant change in intra-group equity financing, but a significant reduction in external equity financing by 1.3% of assets for the post-legislation period compared to the control groups. At the firm-level treatment (*F-Treatment*), the treatment firms engaging in CS significantly increase their intra-group equity financing by 0.6% of assets while reducing external equity financing by 2.0% of assets compared to the control firms not directly linked to CS. The results indicate that the removal of CS makes the group-affiliated firms replace external equity investments with intra-group equity transfers. The findings with the firm-level treatment support *Hypothesis 2* postulating controlling shareholders' motive to maintain control by enhancing their direct equity investments. Further, the substitution effect is pronounced and concentrated for firms directly involving in CS.

< Table 4 here >

Table 5 shows DiD regression results of firm-level intra-group and external debt financing. At the business-group level treatment (*G-Treatment*), the treated groups experience no significant change in intra-group debt financing yet a significant increase by 1.8% of total assets in external debt financing for the post-legislation period compared to the control groups. At the firm-level treatment (*F-Treatment*), the treatment firms belonging to CS significantly reduce their intra-group debt financing by 0.7% of assets after the removal of CS compared to the control firms outside CS.

In contrast, the treatment firms significantly increase their external debt financing by 2.9% of total assets. These results imply that group-affiliated firms replace intra-group loans with external debt financing after removing CS. The substitution effect is pronounced and concentrated for firms directly involving in CS.[6] These findings support *Hypothesis 3*, expecting the replacement of internal debts with external debt financing due to the decrease in the total and the interlinked number of affiliates limiting the access of group firms to internal funds. In unreported results, we find that the number of group-affiliated firms in the treatment group consistently decreases by -2.9%, -8.6%, -3.5%, and -1.3% annually from 2014 to 2017. In contrast, the number of affiliates in the control group inconsistently changes from 0.4%, -2.9%, 3.0% to -2.6% during the same period.

< Table 5 here >

In sum, we can draw some implications from the above results. First, the increase in controlling shareholders' direct ownership from the removal of CS has a significant substitution effect between internal and external financing at the firm-level treatment. The substitution effect is different according to the types of financing: loans or equity transfers. Internal equity investments substitute external equity financing because of maintaining controlling shareholders' control rights without CS. In contrast, the replacement of internal loans with external debt financing is due to the limited access to internal capital markets by decreasing interlinked and total affiliates.

However, at the group-level treatment, the treated group firms experience no significant changes in internal financing activities as a whole except for external financing. Unlike group firms directly engaging in CS, the control-ownership wedge of group firms outside CS would not be affected by the removal of CS. Therefore, the motive of controllers to maintain control over those firms might not be changed. Accordingly, it makes the change in internal equity financing at the group level not statistically significant. Regarding the group-level internal debt financing, group firms outside CS still access internal loans through their pre-existent pyramidal ownership. According to Almeida et al. (2011), in a typical Korean business group, a few central firms hold

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[6] In unreported results, we also conduct a sub-sample analysis including only the affiliates which belong to the treated business groups holding CS (*G-Treatment=1*). In this case, the DiD regression results remain the same as those of Table 4.4 and 4.5 at the firm level.

stakes in many affiliates not only through CS but also through pyramids. The pre-existent pyramidal ownership restricts the impact of removing CS on internal debt financing only within the firms engaging in CS but not as a whole.

We also combine the DiD design with covariate balancing to ensure that the observations in the treated group firms (*G-Treatment=1*) and control group firms (*G-Treatment=0*) are similar across several covariates. Specifically, we use entropy balancing (Hainmueller, 2012; Hainmueller & Xu, 2013) to impose a weighting scheme on the observations in which the means and variances of all matching covariates are identical across the treatment and control groups. Using the entropy balancing, we match the observations along with key covariates that can influence a firm's financing behavior: firm size, EBIT, PPE, leverage, cash holdings, cash flow, total investments, capital expenditure, and firm age. The definitions of the covariates are specified in Table 1 and the balanced covariates are reported in Appendix A. The DiD estimation using the entropy-matched sample is presented in Table 6. Consistent with the baseline results at the firm-level treatment, the coefficients for *F-Treatment × Post* show a significant reduction in intra-group borrowing and external equity financing, but a significant increase in external debt financing and intra-group equity financing. This balanced sample result provides evidence that the main findings on group-affiliated firms' financing behavior after removing CS are not likely to be driven by differences between the treatment and control firms.

< Table 6 here >

4.3. Effects of the financing behavior on capital allocation efficiency

We now examine the consequences of the changes in internal and external financing for capital allocation efficiency. To explore the sensitivity of internal and external financing to firms' growth opportunities, we follow and adapt the model from Bhandari and Javakhadze (2017), Chen, Ghoul, Guedhami, & Wang (2017), and McLean, Zhang, & Zhao (2012). Specifically, the estimation model is as follows:

$$Financing_{i,t} = \alpha + \beta_1 CF_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 CF_{i,t-1} \times Treatment_{i,t} +$$
$$\beta_4 Q_{i,t-1} \times Treatment_{i,t} + \tau_t + \gamma_t + \varepsilon_{it} \qquad (2)$$

where *Financing*$_{i,t}$ can be one of four different financing sources: intra-group debt, external debt, intra-group equity or external equity financing. $CF_{i,t-1}$ is lagged cash flow, measured by the sum of net income, amortization and depreciation over total assets. $Q_{i,t-1}$ captures corporate growth potential using a firm's sales growth rate instead of Tobin's q because Tobin's q can be obtained only for publicly listed companies. In this analysis, *Treatment*$_{i,t}$ represents the firm-level treatment variable (*F-Treatment*).[7] We employ firm fixed effects γ_t and time fixed effects τ_t. The major variable of interest is the coefficient β_4 of $[Q_{i,t-1} \times Treatment_{i,t}]$, which captures the financing sensitivity of treatment firms to their growth potential. To compare the financing sensitivity before and after the removal of cross-shareholdings, we split the sample based on pre-period (2010-2013) and post-period (2014-2017).

Table 7 reports the results of estimating Equation (2). The coefficient estimates of β_4 in columns (2) and (4) are significantly positive suggesting that the relation between sales growth and intra-group and external debt financing is more substantial for treatment firms engaging in CS over the post-period. The coefficient estimates of β_4 in columns (1) and (3) are significant negative or not significant implying that the sensitivity of intra-group and external debt financing to sales growth is not higher for treatment firms over the pre-period. On the contrary, as seen from the coefficient estimates of β_4 in columns (5)-(8), there is no statistically significant impact on the sensitivity of intra-group and external equity financing to sales growth for treatment firms in both pre- and post-periods.

These results suggest that the increasing dependence on external debt makes both internal and external debt financing more sensitive to firms' growth potential removing cross-shareholdings. In contrast, lower external equity dependence does not improve the sensitivity of internal and external equity financing to growth opportunities for treatment firms after removing cross-ownership. These findings support *Hypothesis, 4* postulating the improvement of affected group firms' capital allocative efficiency mainly due to the increased exposure of management to financial market discipline by substituting cheap intra-group debts by expensive external debt financing (Gopalan et al., 2007; Lin et al., 2011). This result is also explained by the reducing

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[7] In unreported results, we do not find that the group-level treatment (*G-Treatment*) has a statistically significant relation with the efficiency of internal and external financing and also with the investment efficiency over the post-period.

tunneling motive of controllers because greater direct equity ownership reducing the control-ownership wedge internalizes the financial consequences of their decisions (Bebchuck et al., 2000).

< Table 7 here >

4.4. Effects of the financing behavior on investment efficiency

We analyze the effect of the changes in internal and external financing on the investment efficiency to growth potential. The financing sensitivity measures how intra-group and external financing is allocated according to firms' growth opportunities, whereas investment efficiency represents how the funds are utilized in firms' investment expenditure. To estimate the investment efficiency, we use the Equation (2) replacing the dependent variable with investment expenditure, obtained from the yearly growth in PPE and inventory plus R&D expenditure over lagged total assets. We include industry- and business group-fixed effects instead of firm-fixed effects. Justification for the inclusion of industry-fixed effects is that time-invariant industry-specific factors might be more important determinants of investment efficiency rather than time-invariant firm-level heterogeneity.

Table 8 reports the estimation results of investment efficiency to growth potential. The coefficient estimate of β_4 in column (1) is not significant, but the estimate in column (2) is significant and positive. The result implies that the treatment firms belonged to cross-ownership are associated with the improvement of investment efficiency only over the post-period. The estimation result remains the same when additional control variables are included in the baseline model in column (3), following Richardson (2006) and Rajkovic (2020). We also use an alternative proxy of investment, which is capital expenditure (CAPEX) over lagged total assets in columns (4) and (5). The estimation result is also consistent with the baseline result. In sum, the overall results in Tables 7 and 8 highlight the positive effect of substituting intra-group loans by external debt financing on group-affiliated firms' debt capital allocation and investment efficiency for firms having removed their cross-shareholdings.

< Table 8 here >

5. Robustness Checks and Additional Analysis

5.1. Placebo test

One potential concern with the findings above is the possibility that the results are driven by any pre-existing trend (Atanasov & Black, 2016). To resolve the concern, we repeat the regressions of debt financing sensitivity and investment efficiency using different pre- and post-periods around 2013 instead of 2014. Table 9 present the results of the placebo test with the artificial pre-period (2010-2012) and post-period (2013-2017). The coefficient estimates of β_4 in Equation (2) over the artificial post-period in columns (2), (4), and (6) are not statistically significant for treatment firms having engaged in CS. These results suggest that the main findings are not driven by potential pre-existing trends.

< Table 9 here >

5.2. Parallel-trends test

Another concern is whether the treatment and control firms differ in their financing and investment sensitivities to growth potential before the enforcement of CS-regulation. The validity of shock-based DiD design depends on the assumption of a parallel trend (Atanasov & Black, 2016; Roberts & Whited, 201). Specifically, the financing sensitivity and investment efficiency for all the sample firms should move in the same way regardless of belonging to cross-ownership prior to the regulation. We next examine whether this assumption is valid.

To present the graphical trend, Figure 2 plots the coefficient estimates of debt financing sensitivity (2-A and 2-B) and investment efficiency (2-C) to corporate growth potential throughout the sample period separately for firm-level treatment and control firms. We observe that the treatment and control firms mostly have similar trends in internal and external debt financing sensitivity and investment efficiency before the regulation (2010-2013). However, following the regulatory reform, this virtually parallel trend changes for the treatment firms as seen in substantial jumps in their debt financing and investment efficiencies in the post-period. Otherwise, control firms appear to have similar patterns in these variables of interest before and after the regulation. In conclusion, the trend analyses suggest that the parallel-trend assumption is valid for the sample and the DiD specifications are reliable.

< Figure 2 here >

5.3. *A potential factor influencing the link between ownership structure and capital allocation efficiency*

The main findings suggest that the changes in internal and external debt/equity financing from the removal of cross-shareholdings improve group-affiliated firms' debt capital allocation and investment efficiency. As a potential mechanism, we postulate that this improvement is due to exposing the management to financial market discipline. As discussed in section 4.3, the capital allocation efficiency is improved not for equity financing but debt financing due to higher dependence on external debt financing. The substitution of cheap intra-group loans with expensive external debts should increase controlling shareholders' sense of self-discipline, so as to enhance firms' capital allocation efficiency (Lin et al., 2011).

To test this implication, we use two approaches. Firstly, we split firms according to being publicly listed or unlisted on the Korean Stock Exchange (KSE) in columns (1) and (2) of Table 10. Secondly, we use the median value of external finance dependence and split the sample into two sub-groups in columns (3) and (4). The *external finance dependence* captures the amount of capital expenditure that cannot be funded through internal sources, measured by the ratio of capital expenditure minus cash flow from operations scaled by capital expenditure (Rajan and Zingales, 1998; Almeida et al., 2015). If the treatment firms' greater exposure to financial market discipline through more expensive external debt financing relates to increasing capital allocation efficiency, the coefficient estimate on the interaction term of interest should be significantly positive for the subsample with being listed and higher external finance dependence.

The coefficient estimates of the interaction term in columns (1) and (2) show that the investment efficiency is significant and positive 0.146 for listed treatment firms compared to control firms, but not statistically significant for unlisted treatments over the post-period. The coefficient estimates of the interaction term in columns (3) and (4) indicate that the positive investment efficiency after the removal of cross-shares is more pronounced only for the treatment firms with higher external finance. These findings offer evidence that the increasing exposure to the financial market discipline of treatment firms is associated with the improvement of capital allocation efficiency.

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< Table 10 here >

An alternative explanation is that the investment efficiency is not because of substituting cheap intra-group debts with expensive external loans but because of being over-leveraged. To test this, we examine the change in leverage of treatment firms after removing cross-ownership using the Equation (2) with total debts as a dependent variable. The regression result in column (6) shows no significant change in leverage of the treatment firms over the post-period. At the same time, their external debt financing significantly increases in column (5) as discussed in section 4.2. From these results, we can conclude that the increase in capital allocation efficiency is explained by the increase in exposure to market discipline of treatment firms after eliminating cross-ownership.

6. Conclusion

In this paper, we study the effect of ownership structure on business groups' financing choices and its subsequent effect on capital allocation and investment efficiency, which has not been explored in finance literature on internal capital markets. To measure these effects, we use a quasi-natural experiment of a regulatory change requiring the removal of cross-shareholdings by Korean business groups. We find that the removal of cross-ownership reduces treatment firms' disparity in cash-flow and voting rights and increases controlling shareholders' direct equity ownership. These changes in ownership structure substitute group-affiliated firms' internal debt by external debt financing and external equity by internal equity financing. This substitution improves the firms' debt financing sensitivity to growth potential and investment efficiency due to the increasing dependence on external debt markets while not influencing on equity financing sensitivity with lower reliance on external equity markets. Further, the improvement of capital allocation and investment efficiency is associated with deterring the incentive of controlling shareholders' tunneling activities with their greater direct ownership and exposing the management to financial market discipline. Considering the economic importance of business groups, the findings of group firms' financing choices in a way to improve their capital allocative efficiency have implications for economy-wide productivity and growth.

However, the impact of removing cross-shareholdings is limited to the firms directly engaging in cross-ownership. Therefore, further research on business groups' financing decisions

with a widely impacting shock needs to be examined. Another meaningful study can analyze how the reduced tunneling incentive of controllers through more direct equity ownership influences group firms' payout policy such as dividends and repurchases or information asymmetry. Finally, the change in the time-frame of investments (i.e., short-term vs long-term projects) affected by higher dependence on external debt financing and limited internal capital markets can be explored.

Appendix A: Differences in covariates before/after entropy balancing

Before weighting variables	Treatment Group		Control Group	
	Mean	Variance	Mean	Variance
Firm Size	19.390	3.988	19.350	4.056
EBIT	0.044	0.006	0.044	0.005
PPE	0.322	0.082	0.371	0.086
Leverage	0.472	0.063	0.541	0.051
Cash Holdings	0.083	0.010	0.084	0.011
Cash Flow	0.041	0.009	0.049	0.009
Investment Expenditure	0.028	0.017	0.037	0.021
Capital Expenditure	0.028	0.016	0.046	0.021
Firm Age	21.720	280.900	21.120	290.100

After weighting variables	Treatment Group		Control Group	
	Mean	Variance	Mean	Variance
Firm Size	19.390	3.988	19.390	3.988
EBIT	0.044	0.006	0.044	0.006
PPE	0.322	0.082	0.322	0.082
Leverage	0.472	0.063	0.472	0.063
Cash Holdings	0.083	0.010	0.083	0.010
Cash Flow	0.041	0.009	0.041	0.009
Total Investment	0.028	0.017	0.028	0.017
Capital Expenditure	0.028	0.016	0.028	0.016
Firm Age	21.720	280.900	21.720	280.900

This table presents the pre- and post-weighting mean and variance for treatment (affiliates of business groups holding cross-ownership) and control group firms (affiliates of business groups without cross-holdings) using an entropy balancing matching. 9 different covariates are matched and are defined in Table 1.

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Table 1. Summary Statistics

Variable	Definition	N	Mean	SD	p25	p50	p75
Cash-Flow Rights	Ultimate ownership (%) obtained from the fraction of dividend eventually received by a controlling shareholder	5121	32.558	27.005	12.260	24.581	47.077
Voting Rights	Ultimate owner's control rights (%) obtained from the sum of direct votes held by a controlling shareholder and indirect votes held by other affiliated firms within the same business group	5121	73.659	28.791	50.000	85.700	100.000
Disparity	Ratio of the difference between voting rights and cash-flow rights over cash-flow rights	5121	4.345	19.901	0.482	1.614	4.741
Position	A firm's distance from a controlling shareholder's direct ownership, measured by the weighted average of ownership chains by its ratio of cash-flow rights received by the controlling shareholders	5121	2.517	1.416	1.706	2.475	3.080
Centrality	A firm's importance for controlling other member firms, obtained from the difference in controlling thresholds with and without the relevant firm	5121	0.119	0.589	0	0	0.123
Intra-group Debt Financing	Total amount of borrowing loans from other member firms over lagged total assets	5121	0.057	0.108	0.002	0.016	0.057
External Debt Financing	Financial debts over lagged total assets	5121	0.186	0.234	0	0.101	0.278
Intra-group Equity Financing	Total amount of equities sold to other member firms over lagged total assets	5121	0.014	0.063	0	0	0
External Equity Financing	Growth of equity minus the sum of changes in retained earnings and intra-group equity financing over lagged total assets	5121	0.027	0.090	0	0	0.004
Investment Expenditure	Yearly growth in PPE and inventory plus R&D expenditure over lagged total assets	5121	0.040	0.160	-0.013	0.004	0.052
Capital Expenditure	CAPEX over lagged total assets	5121	0.039	0.139	-0.005	0.005	0.046
Firm Size	Natural logarithm of the book value of total assets	5121	19.290	2.015	17.654	19.024	20.695
EBIT	Earnings before interest and taxes (EBIT) over total assets	5121	0.044	0.077	0.004	0.035	0.078
PPE	Property, plant, and equipment (PPE) over total assets	5121	0.359	0.292	0.085	0.324	0.561
Leverage	Total debts over total assets	5121	0.518	0.240	0.336	0.542	0.693

Cash Holdings	Cash and cash equivalents over total assets	5121	0.084	0.104	0.016	0.049	0.110
Sales Growth	Ratio of yearly growth in sales to sales at the previous year	4698	0.229	0.994	-0.047	0.057	0.200
Cash Flow	Sum of net income, amortization, and depreciation over total assets	4907	0.047	0.094	0.004	0.036	0.087
Firm Age	Number of years since the establishment year of the firm	5116	21.352	16.928	8.000	16.000	31.000
External Finance Dependence	Ratio of capital expenditure minus cash flow from operation to capital expenditure	4944	-4.764	147.627	-2.735	0.489	2.729

This table reports summary statistics of the main and control variables in the sample, which consists of 5,121 firm-year observations of 770 companies. Of 770 sample firms, 311 firms are affiliated to treatment business groups holding cross-ownership and 459 firms belong to control business groups without cross-ownership. The sample whose sales growth rate is available for the test period (2010-2017) is smaller than 5,121 due to firms having no sales data in 2009.

Table 2. Changes in ownership structure

	Treatment group holding cross-shares				
	Ultimate Ownership (%)	Control Rights (%)	Disparity	Position	Centrality
Pre-period	29.186	69.906	6.990	3.382	0.089
Post-period	31.552	73.254	4.290	2.752	0.138
Diff	2.365	3.348	-2.700**	-0.630***	0.049
	Control group without cross-shares				
	Ultimate Ownership (%)	Control Rights (%)	Disparity	Position	Centrality
Pre-period	33.682	72.838	3.495	2.187	0.127
Post-period	34.178	76.906	3.547	2.152	0.119
Diff	0.496	4.067	0.052	-0.034	-0.008

This table reports the mean values of ownership structure variables classified into treatment group firms holding cross-shares and control group firms without cross-shareholdings. *Ultimate Ownership* (%) is cash-flow rights, measured by the fraction of dividend eventually received by the controlling shareholder. *Control Rights* (%) are voting rights, obtained from the sum of direct votes (%) held by the controlling shareholder and indirect votes (%) held by other affiliated firms. *Disparity* is defined as the difference between voting rights and cash-flow rights over cash-flow rights. *Position* measures a firm's distance from a controlling shareholder's direct ownership. *Centrality* is the difference in controlling thresholds with and without the relevant firm, which measures a firm's importance for controlling other member firms. The sample period is 2010-2013 (pre-period) and 2014-2017 (post-period). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 3. Ownership structure comparing intra-group loan/equity providers and receivers
Panel A. Intra-group loan providers and receivers

| | Intra-group loan providers | | | | | | | | |
| | Ultimate Ownership (%) | | | Position | | | Centrality | | |
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
Treatment	25.829	24.705	-1.124	3.610	2.888	-0.722***	0.062	0.061	-0.001
Control	35.082	33.362	-1.720	2.171	2.229	0.058	0.101	0.088	-0.013
Diff	-9.253***	-8.657***	**0.596**	1.439	0.659	**-0.779*****	-0.039***	-0.027**	**0.012**
	Intra-group loan receivers								
	Ultimate Ownership (%)			Position			Centrality		
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
Treatment	29.525	32.342	2.817	4.011	3.146	-0.865**	0.033	0.059	0.025
Control	33.787	33.400	-0.387	2.148	2.251	0.103	0.071	0.057	-0.014
Diff	-4.262	-1.058	**3.204**	1.863	0.895	**-0.968*****	-0.038**	0.002	**0.039***

Panel B. Intra-group equity providers and receivers

| | Intra-group equity providers | | | | | | | | |
| | Ultimate Ownership (%) | | | Position | | | Centrality | | |
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
Treatment	33.640	33.217	-0.423	2.012	1.875	-0.137	0.245	0.270	0.025
Control	33.486	32.970	-0.516	1.950	2.051	0.101	0.256	0.342	0.085
Diff	0.154	0.247	**0.093**	0.062	-0.176	**-0.238**	-0.011	-0.072	**-0.060**
	Intra-group equity receivers								
	Ultimate Ownership (%)			Position			Centrality		
	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
Treatment	34.569	25.747	-8.823*	3.335	2.994	-0.342	0.079	0.036	-0.043
Control	26.053	28.126	2.073	2.488	2.635	0.147	0.027	0.020	-0.008
Diff	8.516	-2.379	**-10.890***	0.847	0.359	**-0.489***	0.0515	0.016	**-0.035**

This table presents the results of difference-in-differences tests in ownership structure for the treatment (holding cross-shares) and control group (without cross-ownership) firms before and after the regulation. Panel A shows the mean tests for intra-group loan providers and receivers, and Panel B reports the mean tests for intra-group equity providers and receivers. In both cases, providers (receivers) are defined as firm-year observations with borrowing loans (equity sold) net of lending loans (equity purchased) smaller (larger) than -5% (5%) of the book value of total assets. *Ultimate Ownership* (%) are cash-flow rights, measured by the fraction of dividend eventually received by the controlling shareholder. *Position* measures a firm's distance from a controlling shareholder's direct ownership. *Centrality* is the difference in controlling thresholds with and without the relevant firm, which measures a firm's importance for controlling other member firms. The sample period is 2010-2013 (pre-period) and 2014-2017 (post-period). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 4. DiD regression results of internal and external equity financing

VARIABLES	D.V. = Intra-group Equity Financing (intra-group equity investment/ lagged total assets)		D.V. = External Equity Financing ((Δbook value of equity-Δretained earnings-intragroup equity investment)/ lagged total assets)	
	(1)	(2)	(3)	(4)
G-Treatment t* Post	-0.002		-0.013**	
	(0.004)		(0.005)	
F-Treatment t* Post		0.006**		-0.020*
		(0.003)		(0.011)
G-Treatment	0.014		0.007	
	(0.011)		(0.009)	
Firm Size t-1	-0.006***	-0.023***	-0.003***	-0.069***
	(0.001)	(0.005)	(0.001)	(0.008)
EBIT t-1	-0.123***	-0.077***	-0.155***	-0.056
	(0.019)	(0.024)	(0.027)	(0.038)
PPE t-1	0.012***	-0.007	0.005	-0.033**
	(0.005)	(0.012)	(0.006)	(0.014)
Leverage t-1	0.011*	0.061**	0.003	0.134***
	(0.006)	(0.022)	(0.008)	(0.026)
Cash Holdings t-1	0.010	0.025	0.024	0.049*
	(0.013)	(0.025)	(0.017)	(0.025)
Year FE	Y	Y	Y	Y
Business-Group FE	Y	N	Y	N
Industry FE	Y	N	Y	N
Firm FE	N	Y	N	Y
Observations	5,121	5,121	5,121	5,121
Number of Firms	770	770	770	770
Adjusted R^2	0.061	0.034	0.045	0.094

This table reports DiD regression results of intra-group and external equity financing. The dependent variable of columns (1) & (2) is *intra-group equity financing*, which is measured by the total amount of equities sold to other affiliated firms scaled by lagged total assets. The dependent variable of columns (3) & (4) is *external equity financing*, obtained from the growth of equity minus the sum of the change in retained earnings and intra-group equity sold over lagged total assets. There are two treatment variables: 1) *G-Treatment* (group-level treatment) is a dummy variable which equals 1 for all affiliates of the treatment business groups with cross-shareholdings and 0 otherwise. 2) *F-Treatment* (firm-level treatment) is a dummy variable which assigns 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. *Post* is a dummy variable which equals 1 in 2014-2017, and 0 in 2010-2013. Control variables are the one-year lags of *firm size* (ln total assets), *EBIT* over total assets, *PPE* over total assets, *leverage* (total debts over total assets), and *cash holdings* (cash and cash equivalents) over total assets. Columns (1) & (3) use business-group and industry-fixed effects, while columns (2) & (4) include firm-fixed effects. All regressions include year dummies and robust standard errors clustered at the business-group level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 5. DiD regression results of internal and external debt financing

VARIABLES	D.V. = Intra-group Debt Financing (intra-group borrowing/ lagged total assets)		D.V. = External Debt Financing (financial debts/ lagged total assets)	
	(1)	(2)	(3)	(4)
G-Treatment t* Post	-0.008		0.018*	
	(0.006)		(0.010)	
F-Treatment t* Post		-0.007*		0.029**
		(0.004)		(0.012)
G-Treatment	-0.027***		-0.055	
	(0.009)		(0.045)	
Firm Size t-1	-0.008***	-0.017***	-0.014***	-0.031***
	(0.001)	(0.005)	(0.002)	(0.011)
EBIT t-1	-0.036*	-0.031	-0.270***	-0.176***
	(0.021)	(0.024)	(0.041)	(0.050)
PPE t-1	-0.006	-0.026	0.190***	0.148***
	(0.008)	(0.021)	(0.014)	(0.029)
Leverage t-1	0.121***	0.070***	0.375***	0.184***
	(0.009)	(0.020)	(0.016)	(0.039)
Cash Holdings t-1	0.023	-0.009	-0.212***	-0.052
	(0.019)	(0.021)	(0.031)	(0.035)
Year FE	Y	Y	Y	Y
Business-Group FE	Y	N	Y	N
Industry FE	Y	N	Y	N
Firm FE	N	Y	N	Y
Observations	5,121	5,121	5,121	5,121
Number of Firms	770	770	770	770
Adjusted R^2	0.185	0.024	0.388	0.079

This table presents difference-in-differences (DiD) regression results of intra-group and external debt financing. The dependent variable of columns (1) & (2) is *intra-group debt financing*, obtained from the total amount of borrowing loans from other group-affiliated firms scaled by lagged total assets. The dependent variable of columns (3) & (4) is *external debt financing*, which is measured by financial debts over lagged total assets. There are two treatment variables: 1) *G-Treatment* (group-level treatment) is a dummy variable assigning 1 for all affiliates of the treatment business groups with cross-shareholdings and 0 otherwise. *2) F-Treatment* (firm-level treatment) is a dummy variable which equals 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. *Post* is a dummy variable which equals 1 in 2014-2017, and 0 in 2010-2013. Control variables are the one-year lags of *firm size* (ln total assets), *EBIT* over total assets, *PPE* over total assets, *leverage* (total debts over total assets), and *cash holdings* (cash and cash equivalents) over total assets. Columns (1) & (3) use business-group and industry-fixed effects, while columns (2) & (4) include firm-fixed effects. All regressions include year dummies and robust standard errors clustered at the business-group level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 6. DiD regression results of financing with a covariate-balanced sample

D.V.=	Intra-group Debt Financing		External Debt Financing		Intra-group Equity Financing		External Equity Financing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
G-Treatment $_t$ * Post	-0.005		0.010		-0.001		-0.017*	
	(0.005)		(0.013)		(0.004)		(0.008)	
F-Treatment $_t$ * Post		-0.008**		0.026**		0.007***		-0.020*
		(0.004)		(0.013)		(0.003)		(0.011)
Firm Size $_{t-1}$	-0.005***	-0.011***	-0.011***	-0.027**	-0.004***	-0.022***	-0.002**	-0.073***
	(0.002)	(0.003)	(0.003)	(0.011)	(0.000)	(0.005)	(0.001)	(0.009)
EBIT $_{t-1}$	-0.061**	-0.027	-0.244***	-0.175***	-0.097***	-0.073***	-0.221***	-0.062
	(0.027)	(0.019)	(0.051)	(0.053)	(0.025)	(0.025)	(0.036)	(0.039)
PPE $_{t-1}$	-0.006	-0.013	0.155***	0.119***	0.013***	-0.006	0.003	-0.025
	(0.011)	(0.015)	(0.022)	(0.026)	(0.005)	(0.013)	(0.006)	(0.020)
Leverage $_{t-1}$	0.118***	0.064***	0.386***	0.202***	0.011*	0.057***	-0.011	0.147***
	(0.018)	(0.020)	(0.030)	(0.038)	(0.006)	(0.020)	(0.008)	(0.030)
Cash Holdings $_{t-1}$	0.039	0.004	-0.224***	-0.060	0.005	0.017	0.021	0.039
	(0.028)	(0.018)	(0.049)	(0.038)	(0.015)	(0.021)	(0.023)	(0.031)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Business-Group FE	Y	N	Y	N	Y	N	Y	N
Firm FE	N	Y	N	Y	N	Y	N	Y
Observations	5,116	5,107	5,116	5,107	5,116	5,107	5,116	5,107
Adjusted R^2	0.133	0.678	0.339	0.713	0.044	0.160	0.049	0.186

This table presents DiD regression results of internal and external debt/equity financing on an entropy balanced sample (Hainmueller, 2012; Hainmueller and Xu, 2013). Using the e-balancing, the treated group firms (*G-Treatment* = 1) and control group firms (*G-Treatment* = 0) are similar across key covariates which can affect a firm's financing behavior including firm size, EBIT, PPE, leverage, cash holdings, cash flow, total investments, capital expenditure, and firm age. *F-Treatment* (firm-level treatment) is a dummy variable which equals 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. *Post* is a dummy variable which equals 1 in 2014-2017, and 0 in 2010-2013. Columns (1), (3), (5) & (7) use business-group and industry-fixed effects, while columns (2), (4), (6) & (8) include firm-fixed effects. All regressions include year dummies and robust standard errors clustered at the business-group level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 7. Financing sensitivity to growth potential (sales growth)

D.V.=	Intra-group Debt Financing		External Debt Financing		Intra-group Equity Financing		External Equity Financing	
	Pre-period	Post-period	Pre-period	Post-period	Pre-period	Post-period	Pre-period	Post-period
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sales Growth $_{t-1}$ *	-0.013**	0.023*	0.019	0.090**	-0.001	-0.007	-0.003	-0.045
F-Treatment $_t$	(0.006)	(0.012)	(0.013)	(0.041)	(0.002)	(0.006)	(0.006)	(0.062)
Cash Flow $_{t-1}$ *	0.063	-0.015	-0.013	-0.328*	0.113*	0.017	0.062	-0.083
F-Treatment $_t$	(0.061)	(0.071)	(0.096)	(0.175)	(0.066)	(0.025)	(0.089)	(0.159)
Sales Growth $_{t-1}$	-0.000	0.001	-0.006	-0.002	0.000	-0.001	-0.006*	-0.004**
	(0.002)	(0.001)	(0.005)	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)
Cash Flow $_{t-1}$	-0.016	-0.056*	-0.194***	-0.080*	-0.053**	-0.076**	0.038	-0.063
	(0.027)	(0.030)	(0.071)	(0.047)	(0.027)	(0.030)	(0.058)	(0.047)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,202	2,496	2,202	2,496	2,202	2,496	2,202	2,496
Number of Firms	636	732	636	732	636	732	636	732
Adjusted R2	0.013	0.008	0.014	0.030	0.007	0.010	0.033	0.006

This table presents the regression results of internal or external financing on firms' growth potential by splitting firms over pre-period (2010-2013) and post-period (2014-2017). The dependent variable of columns (1) & (2) is *intra-group debt financing*, obtained from the total amount of borrowing loans from other group-affiliated firms over lagged total assets. The dependent variable of columns (3) & (4) is *external debt financing*, measured by financial debts over lagged total assets. The dependent variable of columns (5) & (6) is *intra-group equity financing*, obtained from the total amount of equities sold to other affiliates over lagged total assets. The dependent variable of columns (7) & (8) is *external equity financing*, measured by the growth of equity minus the sum of the change in retained earnings and intra-group equity sold over lagged total assets. The growth potential is measured by a firm's sales *growth rate*. *Cash Flow* measures the sum of net income, amortization, and depreciation over total assets. *F-Treatment* (firm-level treatment) is a dummy variable which assigns 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. All regressions include year- and firm-fixed effects and robust standard errors are corrected for heteroskedasticity and clustered at the firm level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 8. Changes in investment efficiency

D.V.=	Investment Expenditure = (ΔPPE+R&D+ΔInventory)/ lagged Total Assets			Capital Expenditure = CAPEX/ lagged Total Assets	
	Pre-period	Post-period	Post-period with Additional Controls	Pre-period	Post-period
VARIABLES	(1)	(2)	(3)	(4)	(5)
Sales Growth $_{t-1}$ *	0.003	0.105*	0.110*	0.007	0.084*
F-Treatment $_t$	(0.018)	(0.063)	(0.063)	(0.018)	(0.051)
Cash Flow $_{t-1}$ *	-0.140	-0.292	-0.330	-0.100	-0.331**
F-Treatment $_t$	(0.109)	(0.206)	(0.208)	(0.097)	(0.164)
Cash Flow $_{t-1}$	0.185***	0.082**	0.031	0.147***	0.103***
	(0.057)	(0.033)	(0.039)	(0.048)	(0.026)
Sales Growth $_{t-1}$	0.000	-0.002	-0.002	-0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
Firm Size $_{t-1}$			0.003**		
			(0.002)		
Cash Holdings $_{t-1}$			0.031		
			(0.029)		
Leverage $_{t-1}$			-0.017		
			(0.014)		
Negative Income Dummy $_{t-1}$			-0.013		
			(0.008)		
Firm Age $_{t-1}$			-0.000		
			(0.000)		
Year FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Business Group FE	Y	Y	Y	Y	Y
Observations	2,202	2,496	2,492	2,202	2,496
Adjusted R-squared	0.038	0.023	0.025	0.059	0.063

This table presents the regression results of investment expenditure on firms' growth potential by splitting firms over pre-period (2010-2013) and post-period (2014-2017). The dependent variable of columns (1)-(3) is *investment expenditure*, measured by the yearly growth in PPE and inventory plus R&D expenditure over lagged total assets. Additional control variables are included in column (3): *firm size* by taking the natural logarithm of the book value of total assets; *cash holdings* obtained from scaling cash and cash equivalents by total assets; *leverage* measured by total debts over total assets; *negative income dummy* assigning 1 for negative net income and 0 otherwise; and firm age. The dependent variable of columns (4) & (5) is *capital expenditure (CAPEX)* scaled by lagged total assets as an alternative proxy for the total investment. The growth potential is measured by a firm's sales growth rate. *Cash Flow* measures the sum of net income, amortization, and depreciation over total assets. *F-Treatment* (firm-level treatment) is a dummy variable which assigns 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. All regressions include year-, industry, and group-fixed effects and robust standard errors are corrected for heteroskedasticity and clustered at the firm level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 9. Placebo tests with an artificial event year

D.V.=	Intra-group Debt Financing		External Debt Financing		Investment Expenditure	
	Pre-period	Post-period	Pre-period	Post-period	Pre-period	Post-period
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Sales Growth $_{t-1}$ * F-Treatment $_t$	-0.015	0.002	0.066**	0.012	0.028	0.007
	(0.015)	(0.006)	(0.030)	(0.008)	(0.031)	(0.011)
Cash Flow $_{t-1}$ * F-Treatment $_t$	0.192**	0.043	0.217	-0.164*	-0.103	-0.071
	(0.078)	(0.064)	(0.184)	(0.100)	(0.164)	(0.085)
Cash Flow $_{t-1}$	-0.120*	-0.023	-0.297*	-0.115**	0.110	0.135***
	(0.070)	(0.025)	(0.155)	(0.049)	(0.076)	(0.036)
Sales Growth $_{t-1}$	0.001	0.002*	0.001	0.001	0.003	-0.002
	(0.003)	(0.001)	(0.005)	(0.003)	(0.004)	(0.003)
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	N	N
Industry FE	N	N	N	N	Y	Y
Business-Group FE	N	N	N	N	Y	Y
Observations	1,012	3,686	1,012	3,686	1,012	3,686
Adjusted R-squared	0.018	0.002	0.043	0.036	0.052	0.038

This table presents the regression results of placebo test with an artificial year. In this analysis, the pre-period is 2010-2012 and the post-period is 2013-2017 instead of 2010-2013 and 2014-2017, respectively. The dependent variable of columns (1) & (2) is *intra-group debt financing*, obtained from the total amount of borrowing loans from other group-affiliated firms over lagged total assets. The dependent variable of columns (3) & (4) is *external debt financing*, measured by financial debts over lagged total assets. The dependent variable of columns (5) & (6) is *investment expenditure*, measured by the yearly growth in PPE and inventory plus R&D expenditure over lagged total assets. *F-Treatment* (firm-level treatment) is a dummy variable which assigns 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. *Cash Flow* measures the sum of net income, amortization, and depreciation over total assets. Columns (1)-(4) include year- and firm-fixed effects same as Table 7 whereas column (5) & (6) include year-, industry-, and group-fixed effects same as Table 8. In all regressions, robust standard errors are corrected for heteroskedasticity and clustered at the firm level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Table 10. Management exposure to financial market discipline and capital allocation efficiency

D.V. =	Investment Expenditure = (ΔPPE+R&D+ΔInventory)/lagged Total Assets				External Debt Financing	Total Debts
Sample =	Unlisted Firms	Listed Firms	Lower External Finance Dependence	Higher External Finance Dependence	All Firms	All Firms
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Sales Growth t-1 *	0.029	0.146*	0.002	0.153*		
F-Treatment t * Post	(0.050)	(0.078)	(0.023)	(0.091)		
F-Treatment t * Post					0.035***	0.005
					(0.013)	(0.007)
F-Treatment t	-0.005	-0.016	-0.005	-0.022	-0.046***	0.003
	(0.011)	(0.014)	(0.006)	(0.015)	(0.009)	(0.005)
Sales Growth t-1 *	0.014	-0.034	0.011	0.007		
F-Treatment t	(0.018)	(0.034)	(0.014)	(0.035)		
Cash Flow t-1 *	-0.249**	0.163	0.021	-0.256		
F-Treatment t	(0.097)	(0.138)	(0.046)	(0.187)		
Cash Flow t-1	0.109***	0.252***	0.137***	0.152**		
	(0.035)	(0.088)	(0.025)	(0.064)		
Sales Growth t-1	-0.002	0.001	-0.001	-0.002		
	(0.002)	(0.004)	(0.003)	(0.003)		
Firm Size t-1					-0.013***	0.002**
					(0.002)	(0.001)
EBIT t-1					-0.267***	-0.124***
					(0.041)	(0.025)
PPE t-1					0.187***	0.013*
					(0.014)	(0.007)
Leverage t-1					0.374***	0.872***
					(0.016)	(0.008)
Cash Holdings t-1					-0.215***	0.014
					(0.031)	(0.019)
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Business Group FE	Y	Y	Y	Y	Y	Y
Observations	3,315	1,383	2,325	2,373	5,121	5,121
Adjusted R-squared	0.040	0.071	0.164	0.044	0.389	0.857

The first part of this table reports the regression results of investment expenditure on firms' growth potential splitting the sample according to being publicly listed or not in columns (1) & (2) and the median value of external financing dependence in columns (3) & (4). The dependent variable is *investment expenditure*, measured by the yearly growth in PPE and inventory plus R&D expenditure over lagged total assets. The growth potential is measured by a firm's *sales growth* rate. *Cash Flow* measures the sum of net income, amortization, and depreciation over total assets. *F-Treatment* (firm-level treatment) is a dummy variable which assigns 1 for the treatment firms directly engaging in cross-ownership and 0 otherwise. *Post* is a dummy variable which equals 1 in 2014-2017, and 0 in 2010-2013. The sub-sample of column (1) is unlisted companies and the sub-sample of column (2) is publicly listed firms in the Korean Stock Exchange (KSE). The sub-samples of columns (3) and (4) are firms which are respectively lower or higher than the median value of *external finance dependence*, obtained from the ratio of capital expenditure minus cash flow from operation to capital expenditure. To compare the investment efficiency between sub-samples for the post-period, an interaction term of lagged *sales growth*, *F-Treatment* and *Post* dummies is included into the regression. The later part of this table reports the DiD regression of *external debt financing* in column (5) and of *total debts* in column (6) on the firm-level treatment. The *external debt financing* is measured by financial debts over lagged total assets and the total debts are obtained from both short-term and long-term debts over total assets. Control variables are the one-year lags of *firm size* (ln total assets), *EBIT* over total assets, *PPE* over total assets, *leverage* (total debts over total assets), and *cash holdings* (cash and cash equivalents) over total assets. All regressions include year-, industry, and group-fixed effects and robust standard errors are corrected for heteroskedasticity and clustered at the firm level (in parentheses). *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively.

Figure 1. Group-level and firm-level treatment and control groups
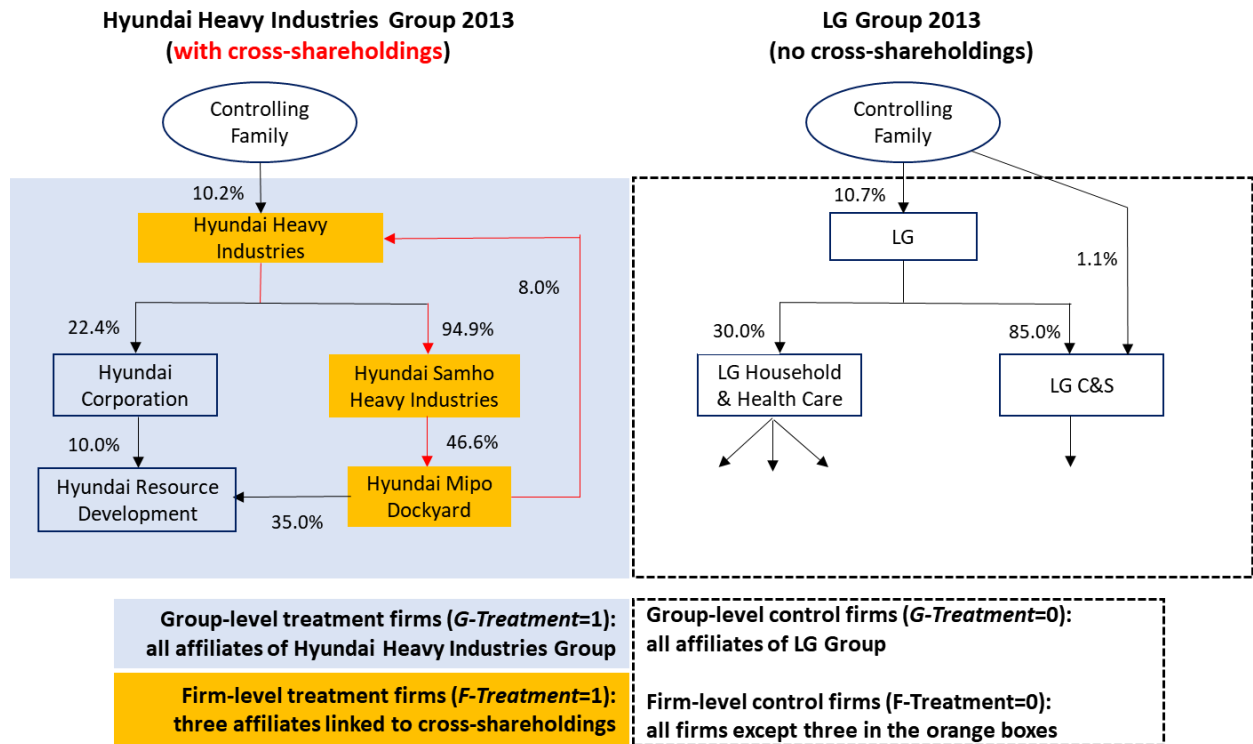
This figure shows the part of companies affiliated to the Hyundai Heavy Industries Group and LG Group in 2013. The arrows indicate ownership links and the percentage number over each arrow shows the percentage of equity ownership. The red arrows of the Hyundai Heavy Industries indicate cross-ownership amongst three affiliated firms. At the group level, treatment firms (*G-Treatment* = 1) are all affiliates of the Hyundai Heavy Industries Group holding the cross-ownership and control firms (*G-Treatment* = 0) are all affiliates of the LG group. At the firm level, three affiliates belonging to the cross-shareholdings, Hyundai Heavy Industries, Hyundai Samho Heavy Industries and Hyundai Mipo Dockyard are treatment firms (*F-Treatment* = 1), while the rest are control firms (*F-Treatment* = 0).

Figure 2. Parallel trends in debt financing sensitivity and investment efficiency between firm-level treatment and control firms (2010-2013 vs. 2014-2017)

2-A. TRENDS OF THE COEFFICIENT ESTIMATES OF INTERNAL DEBT EFFICIENCY BETWEEN FIRM-LEVEL TREATMENT AND CONTROL FIRMS

2-B. TRENDS OF THE COEFFICIENT ESTIMATES OF EXTERNAL DEBT EFFICIENCY BETWEEN FIRM-LEVEL TREATMENT AND CONTROL FIRMS

2-C. TRENDS OF THE COEFFICIENT ESTIMATES OF INVESTMENT EFFICIENCY BETWEEN FIRM-LEVEL TREATMENT AND CONTROL FIRMS

The figures depict the coefficient estimates of debt financing sensitivity (2-A and 2-B) and investment efficiency (2-C) to firms' growth opportunities across firm-level treatment (F-Treatment) and control firms (F-Control) for each year. The firm-level treatment firms belong to cross-shareholding, whereas the control firms are not directly linked to cross-ownership. The coefficient estimates of internal and external debt financing sensitivity β_4 are obtained by estimating the Equation (2): $Financing_{i,t} = \alpha + \beta_1 CF_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 CF_{i,t-1} \times Treatment_{i,t} + \beta_4 Q_{i,t-1} \times Treatment_{i,t} + \tau_t + \gamma_t + \varepsilon_{it}$ where $CF_{i,t-1}$ is lagged cash flow, measured by the sum of net income, amortization and depreciation over lagged total assets. $Q_{i,t-1}$ represents corporate growth potential using a firm's sales growth rate. *F-Treatment* equals 1 for firms that belong to CS directly and 0 otherwise. The coefficient estimates of investment efficiency are obtained by repeating the Equation (2) with a replacement of debt financing with investment expenditure.