When Heirs Become Major Shareholders

Evidence on Pyramiding Financed by Related-Party Sales

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Abstract

This study investigates how related-party sales are used as a means to financially support the firms in which heirs become major shareholders and allow them to strengthen control over other firms in the group through pyramiding. From a universe of Korean chaebol firms during 2000-2011, we identify a subset of firms where heirs become major shareholders (treatment group) and compare them against their propensity-score-matched firms (control group) before and after the ownership change. A series of difference-in-differences tests with firm fixed effects reveal that treatment group firms experience greater related-party sales, benefit from them in terms of earnings, and gain importance in controlling other firms in the group. However, we do not find these results when non-heirs (e.g., controlling shareholders and other relatives) become major shareholders.

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1. Introduction

Family business owners who wish to see their business transferred to the next generation need to complete two tasks. One is to appoint their chosen heir to a top management position (hereafter "managerial succession") and the other is to transfer equity stakes to the heir (hereafter "ownership succession"). This second task is not trivial. Assuming that the family firm repeatedly relies on external equity financing, the equity stakes the heir inherits may not be large enough to ensure control over the firm. The existence of estate tax may further aggravate the problem. It would be interesting to investigate how these challenges affect the behavior of family firms and what alternative mechanisms may be devised to preserve control within the family when ownership succession is prohibitively costly. The variations in such mechanisms across countries with different legal settings also deserve serious investigation.

The existing literature, however, is uneven. Research, to date, has mainly focused on the appointment of family members to top management positions and its impact on firm performance (Smith and Amoako-Adu, 1999; Pérez-González, 2006; Bennedsen et al., 2007; Bertrand et al., 2008; Cucculelli and Micucci, 2008; Mehrotra et al., 2013). Exceptions to this include Ellul, Pagano, and Panunzi (2010) and Tsoutsoura (2015), who investigate how inheritance law or succession tax influences the investment decisions of family firms. Another exception is Villalonga and Amit (2009), who document the use of dual-class shares, trusts, foundations, and limited partnerships by US family firms. They suggest that founders may have introduced these mechanisms to perpetuate family control over subsequent generations.

In this study, we investigate how related-party transactions are used as a means to financially support the firms in which heirs become major shareholders, and allow them to strengthen control over other firms in the group through pyramiding. In other words, we explore

the possibility of another mechanism, besides dual-class shares, that may be employed by business groups to preserve family control when ownership succession is prohibitively costly. It is true that pyramiding is less efficient than dual class shares as a control-enhancement mechanism. According to Villalonga and Amit (2009), the wedge between control and cash flow rights in US family firms mainly comes from dual-class shares. They also show that indirect ownership through trusts, foundations, limited partnerships, and other corporations rarely creates a wedge. In certain jurisdictions, however, corporate pyramiding may be the only available alternative.

Consider a country where inheritance tax rates are high but dual-class shares are unavailable. In this setting, corporate pyramiding financed by intra-group, related-party transactions between member firms may serve as an alternative mechanism of preserving family control over subsequent generations. This involves setting up a small, privately held company with the heir as a major shareholder and instructing other firms in the group to purchase goods and services from that firm. Increased sales and earnings will enlarge the firm's asset size, eventually allowing it to acquire controlling equity stakes in other member firms. In the end, this pyramiding allows the heir to take control over the entire business group.

We test this possibility through a study of family-controlled business group firms in Korea, known as "chaebol" firms. We use Korean data for several reasons. First, Korea has a legal setting where ownership succession is costly (i.e., with inheritance and gift tax rates of 50%), dual-class shares are prohibited by law, and indirect ownership through trusts and foundations are heavily regulated, making corporate pyramiding the only remaining option. Second, family-controlled business groups dominate the Korean economy, and the two key elements of the control preservation mechanism that we examine in this study – pyramidal shareholdings and

related-party transactions – are prevalent in Korea. Third, Korea is one of the few countries where data on inter-corporate shareholdings and inter-corporate related-party transactions are available, even for non-listed firms. Such information is indispensable for addressing our research question.

From a universe of Korean chaebol firms during 2000-2011, we identify a subset of firms in which heirs have become major shareholders (treatment group) and compare them against their propensity-score-matched firms (control group) before and after the ownership change. A series of difference-in-differences tests with firm fixed effects reveal several results consistent with our predictions.

This study makes a number of contributions to the literature. Most importantly, to the best of our knowledge, this is the first study to explore the possibility that corporate pyramiding financed by related-party sales is used as a means of preserving family control when ownership succession is costly. As mentioned, research on family succession has focused mainly on managerial succession rather than on ownership succession. Moreover, research on ownership succession has focused mainly on dual class shares as an alternative mechanism when ownership succession is costly. By focusing on corporate pyramiding, we hope to shed light on a different mechanism that has not received much attention.

Second, our study contributes to family firm performance studies, which have gained in popularity since Anderson and Reeb (2003).[2] We contribute to this area by highlighting the importance of related-party transactions in performance assessments, especially when family firms are a part of a business group. More remotely, our study is also related to studies on managerial ownership and firm performance (Morck, Shleifer, and Vishny, 1988). Again, in a

[2] For studies on the relationship between family ownership and firm performance, see Maury (2006), Miller (2007), and Andres (2008).

business group setting, the relationship between ownership and performance cannot be assessed without considering related-party transactions.

Third, we enrich the literature on business group tunneling (Bae, Kang, and Kim, 2002; Bertrand, Mehta, and Mullainathan, 2002; Baek, Kang, and Lee, 2006; Cheung, Rau, and Stouraitis, 2006; Black et al., 2015).[3] We report empirical evidence that related-party transactions could benefit firms in which heirs become major shareholders, presumably at the expense of minority shareholders in counterparty firms. Our evidence on tunneling, however, remains indirect, as in other tunneling studies.

2. Pyramiding backed by related-party sales

A business owner wishing to hand over controlling equity stakes to the next generation generally faces two challenges: the risk of dilution and the risk of taxation.

If a family firm repeatedly relies on external equity financing, the equity stake that later generations inherit may not be large enough to warrant control over the firm (Helwege, Pirinsky, and Stulz, 2007). In certain jurisdictions, this challenge is overcome by the use of dual-class shares or voting agreements (Villalonga and Amit, 2009). Business owners holding shares with multiple voting rights or possessing contracts that revoke the voting rights of other shareholders may be free from the risk of dilution.

The risk of taxation is another major challenge. Although some jurisdictions have abolished inheritance tax, many others still impose it.[4] In the US, the tax rate is as high as 35%. Moreover, even in jurisdictions that have abolished inheritance tax, capital gains tax may still

[3] The literature also documents the bright side of intragroup transactions—helping to overcome market frictions; see Gopalan, Nanda, and Seru, 2007; Buchuk et al. (2014) and Gopalan, Nanda, and Seru (2014).
[4] Some jurisdictions use the term "estate tax" instead of "inheritance tax."

apply upon succession. Similarly, while some jurisdictions have abolished the gift tax, several jurisdictions have retained it. In certain jurisdictions, this challenge of taxation is resolved with the use of trusts or private foundations that receive shares as donations (Thomsen, 1999; Villalonga and Amit, 2009). As charitable entities, they are exempt from taxation but are still governed by family members who serve as trustees or are on their board of directors.

What would happen if dual-class shares were legally prohibited, the counterparties to voting agreement difficult to find, and trusts or private foundations heavily regulated? Founding families would then have a strong incentive to seek alternative ways of handing over controlling equity stake to their descendants. For families controlling business groups, one solution is to make its holding company or its *de facto* holding company (in the case of groups with no obvious holding companies due to circular shareholdings) issue new shares privately to the heir at a heavily discounted price. This would enable the heir to acquire a controlling equity stake in the holding company at minimal financial cost.[5] This is not possible for publicly traded companies, however, where the preemptive rights of existing shareholders are typically well protected. For privately held companies, tax implications will prevent the use of such a scheme.

An alternative solution is pyramiding financed by related-party sales – setting up a privately held firm where the heir is a major shareholder and instructing other firms to purchase goods and services from that firm. Increased sales and earnings will enlarge the firm's asset size,

[5] The same purpose could be served with a convertible bond or a bond with warrant, with a heavily discounted conversion ratio or exercise price. A good example of this is the case of Samsung Everland, which issued convertible bonds to the sons and daughters of the Samsung Group Chairman in 1996. Samsung Everland was considered a *de facto* holding company of Samsung Group for many years. This transaction, however, triggered a lawsuit that lasted for several years, until 2008 (*The Financial Times*, "Samsung Prosecutor Demands Jail for Lee," July 10, 2008).

eventually allowing it to acquire controlling equity stakes in other member firms.[6] In this manner, pyramiding allows the heir to take control over the entire business group.

Anecdotal evidence of pyramiding financed by related-party transactions abounds among Korean chaebols. An exemplary case is Hanwha S&C, an integrated IT service firm of Hanwha Group (see Figure 1). Originally, it was wholly owned by Kim Seung-youn (33.3% share), the group Chairman of Hanwha Group and Hanwha Corp (67.7% share). However, by 2007, the shares of Hanwha S&C were sold to the chairman's three sons, with each owning 50%, 25%, and 25% of all shares respectively.[7] Afterwards, Hanwha S&C's sales to member firms soared from 117 billion Korean won (approximately 117 million US dollars) in 2007 to 319 billion Korean won in 2010. Its earnings before interest and taxes (EBIT) also jumped from 11 billion Korean won in 2007 to 24 billion Korean won in 2010. This improved financial strength enabled Hanwha S&C to acquire shares in other member firms. As of 2012, it holds shares of Hancomm (70%), Hanwha Corporation (2.2%), Hanwha General Insurance (0.37%), Human Power (100%),

[6] Another possibility is merging the firm in which the heir is a major shareholder with another that already has significant equity stakes in other firms. A good example is the merger between Cheil Industry (formerly Samsung Everland) and Samsung C&T in July 2015. Before the merger, the heirs were holding 42.15% of Cheil Industry shares but had no holdings in Samsung Electronics. Samsung C&T, on the other hand, was holding 4% of Samsung Electronics shares. Elliott Associates, a US hedge fund, opposed the merger, arguing that the merger ratio was overly beneficial to Cheil Industry shareholders (*The Wall Street Journal*, "Samsung-Elliott Fight Will Go More Rounds," July 1, 2016).

[7] In May 2010, the shareholders of Hanwha Corp. filed a derivative suit against the directors of Hanwha Corp. for selling Hanwha S&C shares below the discounted cash flow (DCF) value (*The Korea Times*, Hanwha Sued Over Wealth Transfer, May 19, 2010). In this civil charge, the shareholders asked for a compensation of 45 billion Korean won (approximately, 45 million US dollars). In October 2013, Seoul Central District Court ordered the directors to return only 8.9 billion Korean won to the company, which was well below the damages originally estimated. On November 6, 2013, Seoul High Court reversed the district court's ruling and dismissed all the charges against Chairman Kim. At the time of writing, the case is before the Supreme Court. In a separate criminal case (embezzlement), Chairman Kim was sentenced to a three-year prison term with a five-year suspension (finalized in February 2014). However, he was acquitted of the charge of selling Hanwha S&C shares below the DCF value. These results indicate how difficult it is to prevent tunneling with *ex post* legal remedies in Korea.

Hanwha Solar Energy (20%), Hanwha Total Energy (100%), and Yeosu Cogeneration System (100%). Prior to 2007, Hancomm was the only firm in which Hanwha S&C held shares.[8]

3. Research design

In this study, our aim is to quantify the effect of ownership change on a firm's related-party sales, earnings, and control over other firms. An obvious challenge is the endogenous nature of our treatment variable (i.e., ownership change). This may be addressed by difference-in-differences (*DID*) or an instrumental variable (*IV*) approach using an exogenous shock to ownership change. However, such a shock is absent in our sample of Korean chaebol firms from 2000 to 2011.

Hence, we employ the next best approach of using propensity-score-matched control group firms. First, we identify firms that experienced a major increase in their respective heir's ownership. We label this set of firms the "treatment group" firms. Second, for each treatment group firm, we identify a set of firms that are in the same industry, do not experience any major change in family ownership during the entire sample period, and are not affiliated with the same chaebol group.[9] Given the dominance of manufacturing firms in Korea, we use 4-digit Korean Standard Industrial Classification (SIC) codes for manufacturing and 2-digit SIC codes for others.

[8] From Figure 1, one can see that Hanwha S&C reduced its holdings in three firms that it acquired earlier. For Hancomm, the stake fell from 100% to 69.87% in 2007 as Hanwha S&C sold 31.13% of Hancomm shares to Chairman Kim's spouse. In 2015, 100% of Hancomm shares were sold to Oricom, an advertising company controlled by a completely separate business group (Doosan). The proceedings from the sales of Hancomm shares in 2007 and 2015 must have allowed Hanwha S&C to strengthen its control over other member firms. For Dangjin Technopolis, the stake fell from 80% to 0% in 2009 as Hanwha S&C sold all of its shares in Dangjin Technopolis to Dream Pharma (Hanwha Group's pharmaceutical firm wholly owned by Hanwha Galleria, in which the controlling family has no direct equity stake). However, Dangjin Technopolis was liquidated in 2011. We suspect that Hanwha S&C's preemptive divestment of Dangjin Technopolis shares was meant to minimize the loss that could have accrued to the heirs. For Hanwha ITC, the stake fell from 100% to 0% in 2009 as Hanwha ITC merged with Hanwha S&C.

[9] A major family ownership change refers to a change in the net ownership of heirs, controlling shareholders, or other remote relatives by more than 10 percentage points cumulatively over the entire sample period.

From this set of firms, we identify up to five whose propensity scores are closest to that of the treated firm (i.e., five nearest neighbors or 5-NN) within a caliper (maximum propensity score distance) of 0.0008.[10] We label this set of firms the "control group" firms and expect that such matching significantly lowers the risk of self-selection bias. Third, by conducting difference-in-differences test, we compare these two groups of firms before and after the treatment.

To estimate propensity scores, we run a probit regression where we regress a binary treatment variable (1 for the treated firm in the year of treatment and 0 otherwise) on the lagged values of firm profitability (EBITDA/sales) and firm size (natural logarithm of assets size). When using propensity scores for matching, we match more than one nearest neighbor ("oversampling") because it reduces variance by using more information to construct the counterfactual.[11] At the same time, we impose a caliper to avoid bad matches and hence raise our matching quality. We set the caliper level sufficiently narrow to avoid bad matches but not to a degree that considerably increases the number of treated firms with no match. These two criteria led us to choose a caliper of 0.0008[12] (also, a caliper of 0.008 is roughly half of the propensity score's standard deviation calculated over the entire sample). We allow an untreated firm to be a match for two different treated firms (matching with replacement).

It is worth noting that matching by industry and profitability helps us to rule out the

[10] In our unreported analyses (available upon request), we confirm that our results are robust to different matching algorithms: nearest neighbor matching (1-NN without a caliper) and radius matching (using all firms within a caliper). When using 1-NN without a caliper, we have slightly lower t-values compared against the baseline algorithm of 5-NN with a caliper of 0.0008. This suggests that using multiple matching firms helps reduce coefficient standard errors. We also find that our key results survive even if we mandate publicly traded (privately held) treated firms to be matched only with publicly traded (privately held) firms.

[11] In our unreported analyses (available upon request), we confirm that our key results are robust to the number of nearest neighbors within a caliper of 0.0008 (i.e., using 2-NN, 3-NN, 4-NN, and 5-NN).

[12] In our unreported analyses (available upon request), we also confirm that our key findings are robust to different choices of caliper levels, ranging from 0.0001 to 0.0010.

alternative hypothesis that heirs deliberately increase ownership in firms with better industry prospects and such a choice subsequently results in the firm's higher earnings or stronger control over other firms. Such matching also reduces the risk of breaching the parallel trends assumption, which is the key identifying assumption for the consistency of DID estimators.

Equation (1) specifies the DID regression to verify whether related-party sales (as a fraction of total revenue) in treatment group firms increase after the treatment, relative to that in control group firms:

$$RPS_{it} = \alpha + \beta_0 TG_i + \beta_1 TP_{it} + \beta_2 TG_i \times TP_{it}(t \geq k_i) + X\Phi + \mu_i + \upsilon_t + \varepsilon_{it} \qquad (1)$$

RPS_{it} is the related-party sales (as a fraction of total revenue) of firm i with other member firms in year t. We explain the details of its measurement in Section 4.C. TG_i is a treatment group dummy variable that takes a value of 1 if firm i is treated (i.e., experiences a major increase in heir's ownership during 2000–2011) and 0 otherwise. We explain precisely what we mean by "a major increase in heir's ownership" in Section 4.C. TP_{it} is a treatment period dummy variable for firm i that takes a value of 1 during the treatment period ($t \geq k_i$) and 0 otherwise. Note that k_i is the year at which the treatment is being switched on in firm i. Firm i and its match share a common treatment period dummy.

X is a column vector of control variables. μ_i and υ_t represent the fixed effects of firm and year respectively. The coefficient of interest is β_2, which captures the increase in related-party sales (as a fraction of total revenue) of treatment group firms after the treatment relative to that in control group firms. Consistent with our prediction, we expect this coefficient to be positive and statistically significant. Since the same firms appear multiple times in this panel regression, we use coefficient standard errors clustered at the firm level. Control variables include

firm size, firm age, and leverage. Table 1, Panel A provides detailed definitions of all these variables.

To see whether earnings respond to related-party sales (as a fraction of total revenue) more strongly in treatment group firms after the treatment than in control group firms, we run a regression with triple interactions as shown in Equation (2):

$$EBITDA_{it} = \alpha + \beta_0 TG_i + \beta_1 TP_{it} + \beta_2 RPS_{it} + \beta_3 TG_i \times TP_{it} + \beta_4 TG_i \times RPS_{it} + \beta_5 TP_{it} \times RPS_{it} + \beta_6 TG_i \times TP_{it} \times RPS_{it} + X\Phi + \mu_i + \upsilon_t + \varepsilon_{it} \quad (2)$$

$EBITDA_{it}$ is earnings before interest, tax, depreciation, and amortization of firm i in year t. We explain the details of its measurement in Section 4.C. The coefficient of interest is β_6, which captures the responsiveness of earnings to the increase in related-party sales (as a fraction of total revenue) in treatment group firms after the treatment, relative to that in control group firms. Consistent with our prediction, we expect this coefficient to be positive and statistically significant. Control variables include firm size, firm age, leverage, cash holdings, research and development (R&D) expenditure, and advertising expenditure. In our empirical analysis, we also use scale-adjusted EBITDA (i.e.,$EBITDA_{it}/Sales_{it}$) to see if related-party sales benefit the heir not only through the increase in sales volume but also through higher profitability.

To see whether marginal contribution to group control (MCI) responds to related-party sales (as a fraction of total revenue) more strongly in treated firms after the treatment than in control group firms, we run a regression with triple interactions as shown in Equation (3):

$$MCI_{it} = \alpha + \beta_0 TG_i + \beta_1 TP_{it} + \beta_2 RPS_{it} + \beta_3 TG_i \times TP_{it} + \beta_4 TG_i \times RPS_{it} + \beta_5 TP_{it} \times RPS_{it} + \beta_6 TG_i \times TP_{it} \times RPS_{it} + X\Phi + \mu_i + \upsilon_t + \varepsilon_{it} \quad (3)$$

MCI_{it} is the marginal contribution to the group control index of firm i in year t. We provide details on this measure in Section 4.C and Appendix 1. As a robustness check, we use the book value of equity shareholdings in other member firms (ESI_{it}), as a fraction of total assets, in addition to MCI_{it}.

To test the existence of parallel trends before the treatment and to map out the treatment effect over the years after the treatment, we also run a series of leads and lags model first used in Autor (2003) and later recommended by others (Angrist and Pischke, 2008; Atanasov and Black, 2016). That is, interacting the treatment group dummy with a number of year dummies around the treatment year. The leads and lags model for RPS_{it} is specified as follows:

$$RPS_{it} = \alpha + \beta_0 TG_i + \sum_{j=-m}^{q} \lambda_j TG_i \times TY_{it}^{j} \, (t = k_i + j) + X\Phi + \mu_i + \upsilon_t + \varepsilon_{it} \qquad (1)'$$

One can see that a single treatment period dummy (TP_{it}) is replaced with a number ($m + q + 1$) of treatment year dummies (TY_{it}^{j}). $\lambda_j s$ capture the treatment effect on the jth lead or lag, where j runs from $-m$ to q. A test of parallel trends assumption is $\lambda_j = 0 \; \forall j < 0$: the coefficients on all leads of the treatment should be zero. We omit TY_{it}^{-1} because the 1st lead year ($j = -1$) is used as the base year, from which the treatment effects are measured against. We also use four leads and four lags, where the 4th lead dummy (TY_{it}^{-4}) captures not only the 4th lead year, but also the preceding years and the 4th lag dummy (TY_{it}^{+4}) captures not only the 4th lag year, but also the following years. The leads and lags model for $EBITDA_{it}$ and MCI_{it} are specified similarly.

We conduct two falsification tests. First, we run similar DID regressions using treatment group firms where "non-heirs" (i.e., controlling shareholder or remote relatives) become a major shareholder. In these regressions, TG_i takes a value of 1 if firm i experiences a major increase in

non-heir ownership from 2000 to 2011 and 0 otherwise. Theoretically, if the increase in related-party sales is solely for the benefit of the heir's succession, such increase should not take place upon changes in ownership of non-heirs. Similarly, no increase in earnings or in marginal contribution to group control should take place.

Second, we run similar DID regressions, in which the counterparty firms of the original treatment group firm (i.e., all the firms that purchase goods or services from the treated firm) are used as our new treatment group firms. TG_i takes a value of 1 if firm i is the counterparty of the original treated firm and 0 otherwise. TP_{it} takes a value of 1 if firm i's original treated firm experiences a major increase in heir's ownership at year t or before, and 0 otherwise (i.e., a treated firm and its respective set of counterparty firms share a common treatment period dummy). Note that if an identical firm is a counterparty of two different treated firms, we allow them to appear twice in the sample of counterparty firms. We also ensure that the sample of counterparty firms does not include any of the original treated firms. Again, if the increase in related-party transactions is solely for the benefit of the heir's succession, then firms on the other side of the transaction should not experience an increase in earnings or greater control over other firms.

4. Data and key variables

4.1 Sample Firms

The treatment and control group firms are from 34 chaebol groups that have been classified as large business groups by Korea Fair Trade Commission (KFTC) for at least seven years within our sample period from 2000 to 2011 (to be exact, designated in April of each year from 2001 to 2012). Table 2 lists the names of the 34 chaebol groups and their respective number of member

firms in each year. Since 1987, the KFTC has been designating large business groups and their member firms in April of every year. This designation depends on the aggregate size of member firms' assets (net assets in the case of financial firms), measured at the end of the preceding December of each year. From 1993 to 2002, the KFTC designated the 30 largest business groups without using any size threshold, while, from 2002 to 2008, the KFTC used an explicit threshold of 2 trillion Korean won and designated groups above this threshold as large business groups. Since 2009, the KFTC has been using a threshold of 5 trillion Korean won for this purpose.

Together with the list of large business groups, the KFTC also announces the names of the persons who control each of the groups and the list of firms under each group's control. This convenient feature allows us to avoid having to devise our own algorithm to identify such firms. The concept of control, adopted by KFTC, is defined explicitly in the *Monopoly Regulation and Fair Trade Act* and its enforcement decree. It considers not only directly owned shares but also the shares indirectly owned through related parties (e.g., relatives, not-for-profit entities, for-profit member firms). It 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 this study, we exclude business groups controlled by the latter, as we are interested only in family-controlled business groups. For details on the identification of member firms and the persons in control, refer to Kim, Lim, and Sung (2007).

By using KFTC-designated business groups, we in effect leave out smaller business groups below the KFTC threshold. This is inevitable for two reasons. First, KFTC does not require them to report the list of member firms, the shareholdings among them, or the shareholding of individual family members in each member firm. Second, we do not know of other sources from which we may collect the necessary information to include them in our analyses. The question is

whether our limitation to KFTC-designated business groups causes any sample selection bias. The direction of bias is a priori ambiguous. On the one hand, the bias may work in our favor, as KFTC-designated business groups typically have a greater number of large firms that can easily boost up related-party sales of heir-owned treated firms. On the other hand, however, the bias may work against us, as the presence of regulation and close monitoring by KFTC may lead KFTC-designated business groups to engage less heavily in RPS-driven pyramiding. KFTC regulations include, but are not limited to, the upper limit on equity investments in other member firms (repealed in 2008), board approval of related-party transactions, a ban on mutual shareholdings, and a ban on debt guarantees. The upper limit on equity investments must have made pyramiding more difficult for KFTC-designated business groups, despite its repeal in 2008 and the extensive list of exemptions allowed prior to the repeal. Likewise, the need for board approval of related-party transactions must have made related-party sales to heir-owned treated firms more difficult for KFTC-designated business groups. For details on these regulations, see Kim, Lim, and Sung (2007).

4.2 Major Increase in Heir Ownership

Since 2007, the KFTC has made public the detailed ownership structure of the groups that it designates as large business groups for 2000 onwards through a web portal, "Online Provision of Enterprises Information System" (OPNI), from which we download the necessary data for this study. This data provide a complete picture of share ownership among member firms. The complicated web of intra-group ownership structures is summarized in a simple $n \times n$ matrix, where n is the number of member firms. In this matrix, element s_{ij} is the fraction of shares firm j owns in firm i.

However, the data on share ownership by the family members of the controlling persons are incomplete and do not offer information for each individual family member. For data privacy reasons, family-owned shares are broken down into three groups: shares held by the controlling shareholder (the person in control of the group), the immediate family members, and the other remote relatives. Immediate family members include the spouse, the parents, and the children of the controlling shareholder. Other remote relatives include those within certain degrees of kinship (specifically, six degrees with the controlling shareholder or four with the spouse).

We regard the shares held by immediate family members as those held by the heir. Two potential issues arise in doing so. One is that this could include the shares held by the controlling shareholder's spouse and parents. Another issue involves the possibility of younger siblings, and not the children, succeeding family ownership. The first problem is trivial since spouses and parents own hardly any shares in chaebol firms.[13] Among the treatment group firms we analyze, only one features share ownership by a spouse, and none features share ownership by the parents of controlling shareholders. In our robustness check, we obtain virtually the same results after excluding this firm from the sample.[14]

The second problem is not a concern either since there are only a few cases in which the Group Chairman position is succeeded to a younger sibling. One such rare example is Doosan, where five brothers have taken turns assuming this position. Even in this case, however, shares

[13] According to the Economic Reform Research Institute (ERRI, 2012) the average (median) fraction of spousal ownership out of that of the immediate family is only 5.7% (0.1%) as of 2011 for the top 20 chaebol groups. In addition, the controlling shareholder's parents hardly ever own shares after succession.

[14] Since 2009, each individual family member is required to disclose his/her detailed share ownership in each member firm. However, we do not use these data in our study, as they cover only three of the 12 years of our sample period and do not provide sufficient data to allow us to investigate the key hypotheses of this study.

have not changed hands between brothers: each brother inherited shares from their parents, and in turn, are bequeathing their shares to their respective children.

The treatment group dummy TG_i takes a value of 1 if firm i experiences a major increase in heir's ownership from 2000 to 2011 and 0 otherwise. A "major increase in the heir's ownership" in firm i at year t refers to a major increase not only relative to the heir's own ownership in other member firms at year t, but also relative to the ownership of other family members (controlling shareholder and other remote relatives) in firm i. It is defined as follows:

$$\Delta ROWN_{it}^{H} > 0.05 \quad \text{and} \quad NOWN_{it}^{H} > NOWN_{it}^{C} (\text{or } NOWN_{it}^{R}) \tag{4}$$

$$ROWN_{it}^{H} = NOWN_{it}^{H} - (NOWN_{it}^{C} + NOWN_{it}^{R}) \tag{5}$$

$$NOWN_{it}^{H} = OWN_{it}^{H} - median(OWN_{t}^{H}) \tag{6}$$

Note that $NOWN_{it}^{H}$ is heir's ownership in firm i at year t (OWN_{it}^{H}) net of its median ownership in all member firms at year t (Equation [6]). $ROWN_{it}^{H}$ is net heir ownership in firm i at year t ($NOWN_{it}^{H}$) relative to the sum of the controlling shareholder's and other remote relatives' net ownership in firm i at year t (Equation [5]). A "major increase in the heir's ownership" in firm i at year t takes place when the heir's relative ownership ($ROWN_{it}^{H}$) increases by more than five percentage points and the resulting heir's net ownership ($NOWN_{it}^{H}$) is greater than that of both the controlling shareholder's and other remote relatives' (Equation [4]).

Two points are worth noting here. First, we focus on ownership relative to the heir's own ownership in other member firms. If the heir increases its ownership in firm i at year t but more so in firm j, firm i may not be the firm designated for RPS-driven pyramiding. Thus, when identifying treated firms, it is important to consider how large the heir's ownership is in other member firms. Second, we focus on ownership relative to that of other family members. If

ownership in firm i increases not only for the heir but also for others, the subsequent increase in related-party sales cannot be considered to be solely for the heir's benefit. Likewise, the subsequent increase in the firm's importance in group control cannot be regarded as that for the heir's succession. By focusing on ownership *relative* to other family members, we can effectively rule out such alternative explanations. However, we do not exclude the possibility that the ownership of both the heir and others may drop while the drop for others is greater.[15] Other treatment group dummies used in our falsification tests are similarly defined.

Out of 34 chaebol groups, we identify 84 firms with major increases in heir's ownership (treated firms) during our sample period (62 privately held and 22 publicly traded). However, treated firms are present in only 24 groups, of which seven have only one treated firm, and the remaining 17 have multiple treated firms. The maximum number of treated firms per group is 11. To the extent that there is a limit to how much a group can support a treated firm in a certain industry, it may make sense to have multiple treated firms across different industries as a way to maximize the benefit that can accrue to the heir.

However, the presence of multiple treated firms within a group does not imply that each and every one of them will eventually control group core firms. Many disappear in the later part of our sample period, as they are merged with other treated firms, group core firms, or firms that are already at the top of the pyramid.[16] For example, Dongbu CNI (treated in 2007), a member firm of Dongbu group, merged in 2010 with another member firm, Dongbu Fine Chemicals (treated in 2004).

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[15] Three such cases exist in our sample. If we exclude them, the statistical significance of our results weakens slightly, but our basic results remain intact.

[16] Note that a stock-for-stock merger with group core firms or firms that are already at the top of the pyramid allows the heir to directly hold the shares in such firms

We also find that it is common to see multiple firms within a group experiencing major increases in heir's ownership in the same year. Out of 17 groups with multiple treated firms, this simultaneous treatment occurs in 10 groups. This concentration of treatment in a given year may indicate that ownership succession through RPS-backed pyramiding is planned in advance.

It is not a common practice, however, to utilize different firms for different children. Out of 40 treated firms where we have a list of each individual family shareholder, 26 are collectively owned by a group of children, and 14 are solely owned by a single child.[17] An example of the former case is Samsung SDS, the shares of which were collectively acquired by the four children of Chairman Kun-Hee Lee in 2001. An example of the latter case is Hyundai Emco, the shares of which were solely acquired by the son of Chairman Mong-Koo Chung in 2004.

4.3 Others

We use three measures of related-party tractions (RPT): related-party total transactions ($RPTT_{it}$), related-party sales (RPS_{it}), and related-party purchases (RPP_{it}). $RPTT_{it}$ is firm i's sales to member firms plus its purchases from them in year t scaled by the sum of its total revenue and costs. Total revenue includes not only operating, but also non-operating revenue. Likewise, total costs include both, operating and non-operating costs. RPS_{it} is firm i's sales to member firms in year t scaled by its total revenue. Note that sales to member firms include not only firm i's sales of goods and services to them, but also firm i's non-operating income from them. RPP_{it} is firm i's purchases from member firms in year t scaled by firm i's total costs. Likewise, purchases from member firms include both, firm i's operating and non-operating expenses paid to member firms.

[17] The list is available only from firms that voluntarily disclose the names of individual family shareholders in their company audit reports.

$EBITDA_{it}$ is the signed natural logarithm of earnings before interest, tax, depreciation, and amortization (EBITDA) of firm i in year t. EBITDA is expressed in million Korean won and is adjusted for inflation using the Bank of Korea's GDP deflator (base year = 2005). A signed logarithm takes the logarithm of the absolute value of the variable and assigns it the original sign. Absolute values less than one are set to zero (Zumel, Mount, and Porzak, 2014). In other words, we multiply the natural logarithm of the absolute value of earnings before interest, tax, depreciation, and amortization by -1 if EBITDA $\leq$ -1, +1 if EBITDA $\geq$ 1, and 0 if |EBITDA| < 1. We use EBITDA instead of Tobin's q as our performance measure due to the presence of many privately held firms in our sample.

As mentioned, we also use scale-adjusted EBITDA (i.e., $EBITDA_{it}/Sales_{it}$) to determine if related-party sales benefit the heir not only through the increase in sales volume (volume channel) but also through higher profitability (price channel). An increase in both measures after the treatment would be evidence that both channels (volume and price channels) are at work. An increase in the un-scaled measure but not the scaled one would suggest that only the volume channel is at work. An increase in the scaled measure but not the un-scaled one would be evidence that a negative volume effect is perfectly offsetting the positive price effect. Finally, an increase in neither of the measures would indicate the absence of any treatment effect.

It is important to note here that the increase in un-scaled EBITDA is the necessary condition for the heir to benefit from related-party sales and to increase the firm's control over other member firms. This can be easily shown by the following analysis. Suppose there is a firm with an initial cash flow of $EBITDA_1$ (for simplicity, assume no debt, no new investments, and no tax). If we assume this cash flow to be constant over time, the value of this firm is $EBITDA_1/r$,

where r is the firm's cost of equity, constant over time.[18] Now, let us suppose an heir increases the fraction of shares held in this firm from α_0 to α_1 ($\alpha_1 > \alpha_0$). This means that the heir must pay $(\alpha_1-\alpha_0)EBITDA_1/r$ to increase the equity holding in the firm. Upon this ownership change, let us suppose this firm's related-party sales volume increases or their terms improve, such that they increase the firm's cash flows to $EBITDA_2$ ($> EBITDA_1$). Then, the value of the heir's newly acquired equity holding becomes $(\alpha_1-\alpha_0)EBITDA_2/r$, for a capital gain of $(\alpha_1-\alpha_0)(EBITDA_2 - EBITDA_1)/r$. Note that this capital gain is positive if and only if $EBITDA_2 > EBITDA_1$, given that $\alpha_1 > \alpha_0$ and that r is constant. With a greater firm value of $EBITDA_2/r$ ($> EBITDA_1/r$), the firm would also have greater resources to invest in the shares of other member firms.

The increase in scale-adjusted EBITDA (i.e., $EBITDA_{it}/Sales_{it}$) is, however, not a necessary condition for the heir to benefit from related-party sales or increase the firm's control over other member firms. This can be easily shown from the fact that EBITDA can increase with a greater quantity of goods and services sold (or produced) even if (EBITDA/Sales) is kept constant. Note that EBITDA = (EBITDA/Sales) x (Sales) = [(p-c)/p][p·Q], where p and c are, respectively, the unit price and cost of goods, and Q is the quantity of goods sold (or produced). We also assume that p > c. From the equation, one can easily see that EBITDA can increase with the increase in Q even when profitability ((p-c)/p = EBITDA/Sales) is kept constant.

MCI_{it} is the marginal contribution to group control index of firm j in year t, in natural logarithm. Since it can take a value of 0, we add 1 before taking logs. This index, first introduced in Kim, Lim, and Sung (2007), is devised to identify the firms through which a controlling shareholder family could most efficiently strengthen their control over other member firms. To be

[18] We also exclude the possibility of acquisition prices being influenced by the existence of control premium or the information environment faced by the acquirer, as such factors do not play an important role in intra-group acquisitions.

an efficient control vehicle, this firm must directly or indirectly hold a significant fraction of shares in other firms. One way to quantify it is to compute the additional cash flow rights a controlling family could obtain from other firms when the vehicle firm becomes a part of the group. Scaling these additional cash flow rights by the vehicle firm's book equity provides a measure of its marginal contribution to group control (i.e., the additional dollar value of equity that could be obtained, directly or indirectly, in other firms by investing one dollar of equity in the vehicle firm). It is noteworthy that this measure is not designed to identify firms that already hold the largest equity stakes in other firms but, rather, to identify the firms that could most easily grow into this role.

ESI_{it} is the book value of equity shares firm i holds in other member firms as a fraction of firm $i's$ book asset value in year t. An increase in ESI_{it} suggests that a larger proportion of the firm's assets are being used to control other firms within the group. We use the book value of equity, as opposed to market value of equity, as we have a significant fraction of privately held firms in our sample. The ESI_{it} measure is, however, a crude one; it ignores whether the investee companies hold shares in other firms. Certainly, those that hold shares in other companies are more important in controlling the group. The marginal contribution to group control index (MCI) helps overcome this shortcoming.

In our empirical analyses, we log-transform variables only when this transformation reduces the degree of their skewness considerably. Log transformed variables include $EBITDA_{it}$, MCI_{it}, firm size, leverage, R&D expenditure, and advertisement expenditure. Log-transformation follows four rules: (1) if a variable takes only positive values, we simply take natural logarithm of the original variable; (2) if a variable takes only positive values, but in extremely small fractions, we transform them into percentage terms (multiplying by 100) before taking the natural

logarithm; (3) if a variable can take a value of 0, we add 1 before taking the natural logarithm of the original variable; (4) if a variable can take negative values, we obtain the signed natural logarithm of the original variable (i.e., 0 if the original variables takes a value between -1 and 1, and the natural logarithm of the original variable's absolute value, assigned with the original variable's sign, if the original variable takes a value greater than 1 or less than -1). Firm size follows the first rule, R&D expenditure and advertisement expenditure follow the second, MCI_{it} and leverage follow the third, and $EBITDA_{it}$ follows the fourth rule.

The data on related-party transactions are available in each company's business reports (similar to the Form 10-K in the US) but can also be downloaded in aggregate from *KIS-Value*, a financial database administered by NICE Credit Information Service Co., Ltd.[19] *KIS-Value* provides RPT data for not only publicly traded listed firms, but also externally audited private firms. TS2000, a financial database administered by the Korea Listed Companies Association (KLCA), provides RPT data limited to publicly traded, listed firms, but also provides a breakdown of RPT data for each counterparty firm. The accounting variables used as controls in this study are all from TS2000.

5. Results

5.1. Preview of parallel trends

The existence of parallel trends before the treatment is formally tested in the next subsection. We provide a preview in Figure 2. The plots on the left (right) compare the average values of un-scaled (scaled) RPS between treatment and control group firms during a nine-year period that

[19] Black et al., (2015) use related-party transaction data from the same source.

includes four years before and after the treatment. The upper left-hand plot clearly depicts that, during the pre-treatment period, there is a mild parallel increase in un-scaled RPS for both the treatment and the control group firms. During the post-treatment period, however, the plot shows that this trend continues for control group firms but not for treatment group firms that experience a sudden jump in their un-scaled RPS. The upper right-hand plot shows no obvious trend in scaled RPS for either the treatment or the control group firms during the pre-treatment period. Upon treatment, this remains the case for control group firms but not for treatment group firms, which instead experience a sharp increase in their scaled RPS.

The bottom plots show the difference in un-scaled (scaled) RPS between treatment and control group firms. The dotted vertical lines indicate 95% confidence intervals around each estimated difference. They show that, while the differences are statistically insignificant during the pre-treatment period, they become statistically significant starting from the first year of treatment.

5.2. Ownership change and related-party transactions

Table 3 reports our first set of difference-in-differences (DID) regression results, where we estimate how scale-adjusted related-party transactions change in treated firms after the treatment relative to those in control group firms. We run fixed effects (FE) regressions of related-party transactions ($RPTT_{it}$, RPS_{it}, and RPP_{it}) on the treatment group dummy (TG_i), treatment period dummy (TP_{it}), their interaction ($TG_i \times TP_{it}$), covariates, and year dummies (Equation [1] in Section 3). The treatment group dummy (TG_i) is absorbed in firm fixed effects. The original sample includes 84 treatment group firms that experienced major increases in heir's ownership and 325 control group firms. As mentioned, the latter comprises up to five firms that have

propensity scores (estimated based on the lagged values of asset size and profitability) closest to that of the treated firm, are in the same industry (4-digit code for manufacturing and 2-digit code for others), do not experience any major change in ownership, and are not affiliated with the same chaebol group. The *t*-values based on standard errors clustered at the firm level are reported in the parentheses accompanying the estimated coefficients.

The coefficient of interest (i.e., the coefficient on $TG_i \times TP_{it}$ when regressing RPS_{it}) is positive and statistically significant at the 5% level. The -0.0104 coefficient of TP_{it} and 0.0447 of $TG_i \times TP_{it}$ in Column (3) imply that a firm treated with a major increase in heir ownership experiences a jump in RPS_{it} by 0.0343 (= 0.0447 – 0.0104), whereas its matching firms experience a 0.0104 drop in RPS_{it}. A jump of 0.0343 is equivalent to a 23% jump from its median value of 0.15 (see Table 1 Panel B for summary statistics).

In Column (4), we report the results of the leads and lags model, where we replace a single treatment period dummy (TP_{it}) with a number of treatment year dummies (TY_{it}^{-j}). Note that TY_{it}^{-1} is the omitted treatment year dummy. The results clearly show that the interaction terms are close to 0 and statistically insignificant before the treatment ($j = -4, -3, \text{and } -2$) but positive and larger in magnitude thereafter ($j = 0, +1, +2, +3, \text{ and} + 4$) and statistically significant form the second treatment year ($j = +2$). These findings suggest that the gap in RPS_{it} between the two groups of firms do not vary over time before the treatment (i.e., the existence of a parallel trend) but widens thereafter (i.e., the existence of a treatment effect). Note that the coefficients on the interaction terms increase gradually during the post-treatment period up to 0.0794 ($j = +4$). This suggests that the treatment effect strengthens over time. Figure 3 plots the yearly treatment effects before and after the treatment for RPS_{it} (upper left-hand figure).

However, we do not find any evidence for RPP_{it}. The coefficient on $TG_i \times TP_{it}$ (Column [5]) and the coefficients on $TG_i \times TY_{it}^{j}$ (Column [6]) during the post-treatment period ($j = 0, +1, +2, +3,$ and $+4$) are close to 0 and statistically insignificant. Our findings for RPS_{it} and RPP_{it} together suggest that it is related-party sales rather than related-party purchases that are used to finance treated firms' pyramiding. These findings are also consistent with the accusations made by non-governmental organizations (NGO) and popular press that heirs benefit from their equity stakes in firms that heavily rely on related-party sales to member firms.[20] These firms are mostly found in the IT services, logistics, advertising, and construction industries. Related-party purchases are, however, never mentioned in their accusations.

Columns (1) and (2) show the results for $RPTT_{it}$, which are similar to those for RPS_{it} but slightly weaker. This is natural given that $RPTT_{it}$ is simply a combination of RPS_{it} and RPP_{it}.

5.3. Ownership change, related-party sales, and earnings

Table 4 reports our second set of DID regression results, where we estimate how the sensitivity of the treated firm's earnings in respect to related-party sales (as a fraction of total revenue) changes after the treatment relative to that in control group firms. We run firm fixed effects regressions of earnings ($EBITDA_{it}$) and scale-adjusted earnings ($EBITDA_{it}/Sales_{it}$) on the treatment group dummy (TG_i), treatment period dummy (TP_{it}), related-party sales (RPS_{it}), their interactions, covariates, and year dummies (Equation [2] in Section 3).

The coefficient of interest (i.e., the coefficient on $TG_i \times TP_{it} \times RPS_{it}$) is positive and statistically significant for $EBITDA_{it}$ (Columns [1] and [2]) at the 5% level but is not significant

[20] Solidarity for Economic Reform (SER) and its sister organization, the Economic Reform Research Institute (ERRI), are the two pioneering NGOs in this area. Since 2006, they have been publishing a number of reports on related-party sales aimed at benefiting controlling family members.

for $EBITDA_{it}/Sales_{it}$ (Columns [3] and [4]). This means that the jump in related-party sales (as a fraction of total revenue) after the treatment increases the treated firm's earnings but not necessarily its profitability. This also suggests that the jump in related-party sales (as a fraction of total revenue) is mainly from the volume effect (larger volume of goods and services sold) and not from the price effect (higher unit price of goods and services sold). For treated firms, the coefficients in Column (1) suggest that a 1-SD increase in RPS_{it} (0.32) leads to an increase in $EBITDA_{it}$ (in logs) during the post-treatment period by 0.32 × 1.9694 (= –1.6131 + 0.4413 – 0.2113 + 3.3525) = 0.63. This is an 88% jump in earnings ($e^{0.63} - 1$).

In Column (2), we report the results of the leads and lags model. The results clearly show that the triple interaction terms are close to 0 and are statistically insignificant before the treatment ($j = -4, -3, \text{and } -2$), but positive and greater thereafter ($j = 0, +1, +2, +3, \text{ and } +4$) and statistically significant from the second treatment year ($j = +2$). This suggests that the sensitivity of $EBITDA_{it}$ in respect to RPS_{it} between the two groups of firms does not vary over time before the treatment (i.e., the existence of a parallel trend) but increases thereafter (i.e., the existence of a treatment effect). The coefficients on interaction terms gradually rise during the post-treatment period, peaking at 5.4569 in the third year ($j = +3$) and ending at 3.8201 on the fourth year ($j = +4$). Figure 3 plots the yearly treatment effects before and after the treatment for $EBITDA_{it}$ (upper right-hand figure).

5.4. Ownership change, related-party sales, and group control

Table 5 reports our third set of DID regression results – the firm fixed effects regressions of marginal contribution to group control (MCI_{it}) and the equity shareholding index (ESI_{it}) on the

treatment group dummy (TG_i), treatment period dummy (TP_{it}), related-party sales (RPS_{it}), their interactions, covariates, and year dummies (Equation [3] in Section 3).

The results in Columns (1) and (2) of regressing marginal contribution to group control are very similar to those of earnings. The coefficient of interest (i.e., the coefficient on $TG_i \times TP_{it} \times RPS_{it}$) is positive and statistically significant at the 5% level, and the leads and lags model shows that the triple interaction terms are close to 0 and statistically insignificant before the treatment ($j = -4, -3, \text{and } -2$) but positive and greater thereafter ($j = 0, +1, +2, +3, \text{ and } +4$) as well as statistically significant from the second treatment year ($j = +2$). This suggests that the sensitivity of MCI_{it} in respect to RPS_{it} between the two groups of firms does not vary over time before the treatment (i.e., the existence of a parallel trend) but increases thereafter (i.e., the existence of a treatment effect).

For treated firms, the coefficients in Column (1) suggest that a 1-SD increase in RPS_{it} (0.32) leads to an increase in MCI_{it} during post-treatment period by 0.32 × 0.3146 (= 0.0497 + 0.0418 – 0.0396 + 0.2627) = 0.10, a 67% jump from its mean value of 0.15 (see Table 1 Panel B for summary statistics); the median value of MCI_{it} is 0. The leads and lags model in Column (2) shows that the coefficients on the interaction terms gradually rise during the post-treatment period, peaking at 0.2897 on the third year ($j = +3$) and ending at 0.2858 on the fourth year ($j = +4$). Figure 3 plots the yearly treatment effects before and after the treatment for MCI_{it} (bottom left-hand figure).

As a robustness check, we also use the equity shareholding index (ESI) as a measure of group control. Columns (3) and (4) report the results. The coefficient of interest (i.e., the coefficient on $TG_i \times TP_{it} \times RPS_{it}$) in Column (3) is positive and significant at the 1% level. The reported coefficients suggest that, for treated firms, a 1-SD increase in RPS_{it} (0.32) leads to an

increase in ESI_{it} during the post-treatment period by 0.32×0.1620 (= 0.0513 – 0.0301 – 0.0389 + 0.1797) = 0.0518. This is again a 65% jump from its mean value of 0.08 (see Table 1 Panel B for summary statistics). Note that the median value of ESI_{it} is 0. The results of the leads and lags model reported in Column (4) also show that most of the triple interaction terms are close to 0 and statistically insignificant before the treatment ($j = -4, -3, \text{and } -2$) but positive and greater thereafter ($j = 0, +1, +2, +3, \text{ and } +4$) and statistically significant form the second treatment year ($j = +2$). Figure 3 plots the yearly treatment effects before and after the treatment for ESI_{it} (bottom right-hand figure).

5.5. Do treated firms ascend to control group core firms?

In this subsection, we investigate how many treated firms ascend to control group core firms during our sample period (2000–2011). To this end, we classify each treated firm into four quartiles according to how highly it ranks in its group in terms of un-scaled MCI (i.e. $MCI_{it} \times BE_{it}$, where BE_{it} measures the size of the firm by its book equity value) at a year just before the treatment ($j = -1$) and at the latest year it appears in our sample, and check how many treated firms move from a lower quartile to a higher one (a significant proportion of our treated firms disappear from our sample in later years as they are merged with other firms, such as other treated firms, group core firms, or firms already at the top of the pyramid).

Table 6 shows the result in a transition matrix. The shaded cells at the bottom-right report the number of firms that ascend from a lower to a higher quartile. Similarly, the upper-left cells report the number of firms that descend from a higher to a lower quartile. The former (18 firms) outnumbers the latter (11 firms), suggesting that our treated firms, on average, increase their control over other firms in the group. However, the number of firms that ascend to the first

quartile is limited (only five), suggesting that a 12-year sample period is not long enough to capture the full effect of the treatment. Therefore, our study should be understood as one that documents the early stage of pyramiding backed by related-party transactions.

This does not mean that none of our treated firm succeeds in controlling group core firms during our sample period. Dongbu Fine Chemicals is a good example of one that succeeded in doing so. Originally, it was heavily owned by Kim Joon-ki (46.21%), the group Chairman of Dongbu Group. In 2004, however, the shares of Dongbu Fine Chemicals were sold to the chairman's two children, who then owned 21.14% (son) and 11.21% (daughter). Afterwards, Dongbu Fine Chemicals' sales to member firms increased from 21 billion Korean won in 2004 to 31 billion Korean won in 2007. Its earnings (EBIT) also jumped from 6 billion Korean won in 2004 to 9 billion Korean won in 2007. This improved financial strength enabled Dongbu Fine Chemicals to acquire shares in other member firms. Accordingly, by 2011, it became the Dongbu Group firm with the highest value of un-scaled MCI, completing the RPS-driven pyramiding process.

More specifically, it significantly increased its equity holdings in the second largest non-financial firm in the group (Dongbu Construction). It also acquired shares in Dongbu Life Insurance, the largest financial firm in the group. It also acquired significant fractions of shares in Dongbu Hitech, Dongbu Hannon, and Dongbu Metal, which rank very high in the group in terms of asset size (see Figure 4 for details).

What makes Dongbu Fine Chemicals and Hanwha S&C different is their stage of RPS-driven pyramiding during our sample period. Dongbu Fine Chemicals was already holding non-trivial fractions of shares in group core firms (two largest non-financial firms in the group) before the treatment, whereas Hanwha S&C was holding shares in only one firm that cannot be

considered as a group core firm (Hancomm). Moreover, the treatment took place earlier (in 2004) for Dongbu Fine Chemicals than for Hanwha S&C (during 2005–2007).

5.6. Falsification tests

Table 7 reports the results of our first falsification test. We run a series of DID regressions identical to those reported in Tables 3-5 but using treatment group firms where "non-heirs" (controlling shareholders or other remote relatives) become major shareholders. In odd (even) numbered columns, we use 63 (61) treated firms with 299 (300) control group firms. We obtain control group firms using the same propensity score matching method used in previous subsections. The results show that there is no statistically significant increase in RPS_{it} (Columns [1] and [2]), $EBITDA_{it}$ (Columns [3] and [4]), MCI_{it} (Columns [5] and [6]), or ESI_{it} (Columns [7] and [8]) in treatment group firms after the treatment relative to those in control group firms. This shows that pyramiding through related-party sales is conducted for the sole purpose of succession.

Table 8 reports the results of our second falsification test, where we run a series of DID regressions identical to those reported in Tables 3-5 but using counterparties of the original treatment group firms (i.e., all the firms that purchase goods or services from the treated firm) as our new treatment group. For this second falsification test, we utilize TS2000, the financial database administered by KLCA, which provides the names of counterparties (including privately held firms) that engage in related-party transactions with publicly traded firms. We exclude individuals and overseas subsidiaries from the list of these counterparties. We ensure that the counterparty firm sample does not include any of the original treatment group firms. The remaining firms become our new treatment group firms (27 firms), and we again identify their

matching firms using the same procedure we used in previous analyses, to form the control group firms (111 firms).[21]

If related-party transactions are conducted not for the benefit of the heir but for the mutual benefit of the firms involved in related-party transactions, one should observe the $EBITDA_{it}$ of counterparty firms rising with RPP_{it} after the treatment; if the increasing equity stakes in other member firms are not for the benefit of the heir but a natural outcome after increased related-party transactions, one should also observe the MCI_{it} and ESI_{it} of counterparty firms rising with RPP_{it} after the treatment.

We do not find any of these phenomena in our analyses. For $EBITDA_{it}$, the coefficient is negative, small, and statistically insignificant on the triple interaction term (i.e., $TG_i \times TP_{it} \times RPS_{it}$).[22] For MCI_{it} and ESI_{it}, the coefficients are negative and statistically significant at the 10% level on the triple interaction terms (i.e., $TG_i \times TP_{it} \times RPS_{it}$).

6. Conclusion

In this study, we investigate how related-party sales are used as a means to financially support the firms where heirs become major shareholders and allow them to control other member firms in the group through pyramiding. From a universe of Korean chaebol firms from 2000 to 2011, we

[21] Our sample of counterparty firms is not fully comprehensive, however. Given that our data source (TS2000) lists the counterparty firms only for publicly traded firms, we do not know the privately held counterparties of privately held treated firms. From TS2000, we can identify the publicly traded counterparties of publicly traded treated firms, the privately held counterparties of publicly traded treated firms, and the publicly traded counterparties of privately held treated firms (inferred from the list of privately held firms that transact with publicly traded firms).

[22] We are not surprised by the insignificant coefficient in our earnings regression. If large and profitable firms are deliberately chosen as counterparty firms, it is unlikely that their earnings will deteriorate even when they transact with heir-owned firms. In unreported analyses (available upon request), we find that our sample of counterparty firms is approximately nine times larger (in terms of book value of total assets) than our sample of treated firms.

identify a subset of firms in which the heirs become major shareholders (treatment group) and compare them against their propensity-score-matched firms (control group) before and after the ownership change. A series of difference-in-differences tests with firm fixed effects reveals that treatment group firms experience greater related-party sales, benefit from them in terms of earnings, and gain importance in controlling other firms in the group. However, we do not find these results when non-heirs (controlling shareholder or other relatives) become the major shareholders.

These findings confirm the non-academic allegations made by NGOs and the media in Korea. It also justifies the new regulatory actions taken by the Korean government in recent years to curb such related-party transactions. In December 2011, the National Assembly passed a bill revising the Inheritance and Gift Tax Act and allowing the National Tax Office to levy a gift tax on expropriated income from related party sales. More specifically, shareholders individually owning (directly or indirectly) more than 3% of the total outstanding shares of a company in which related-party sales comprise more than 30% of total sales are subject to a gift tax. The taxable gift income is equal to earnings less adjusted tax, or Net Operating Profit after Taxes (NOPAT) × (percentage of related-party sales out of total sales – 15%) × (percentage of shareholding – 3%).

Another regulatory action took place in August 2013. The National Assembly passed a bill revising the Monopoly Regulation and Fair Trade Act and allowing the Fair Trade Commission to levy penalties on related-party transactions that favored controlling family members. The new rule applies to members of large business groups designated by the KFTC. To be identified as a beneficiary firm, controlling family members must directly own an aggregate of more than 30%

of outstanding shares (20% in privately held firms) and must have entered related-party transactions on significantly favorable terms.

We believe that our findings are relevant not only to Korea but also to many other countries. Family-controlled business groups are prevalent in emerging markets and even in some developed economies (Khanna and Yafeh, 2007). Families controlling these business groups may have an incentive to use pyramiding financed by related-party transactions as a means of perpetuating family control over subsequent generations, especially when ownership succession is costly and other control-enhancement mechanisms such as dual-class shares are prohibited by law. Accordingly, we believe that a study that explores the differences in the laws governing inheritance and control-enhancing mechanisms across countries may be a fruitful topic for future research.

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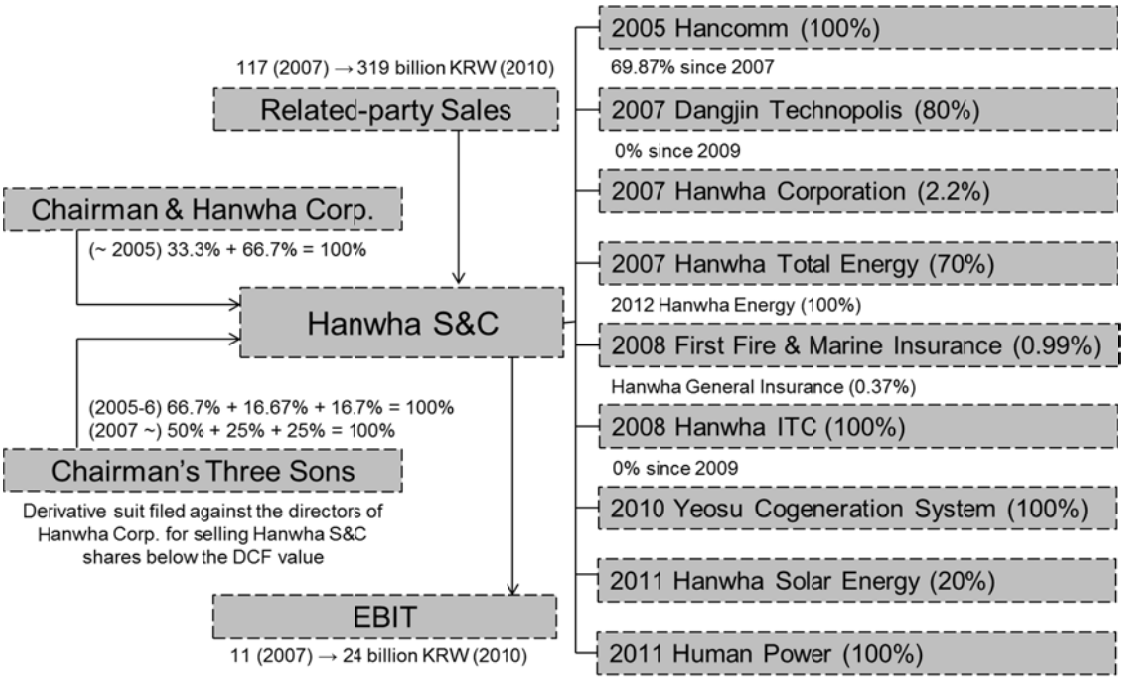

Fig. 1. Hanwha S&C's use of related-party transactions for control-enhancement. This figure depicts how a major change in Hanwha S&C's ownership structure prompted an increase in its related-party sales, earnings, and control over other member firms in the group. Hanwha S&C's sales to member firms soared from 117 billion Korean won (approximately 117 million US dollars) in 2007 to 319 billion Korean won in 2010. Its earnings (EBIT) also jumped from 11 billion Korean won in 2007 to 24 billion Korean won in 2010. This improved financial strength enabled Hanwha S&C to acquire shares in other member firms. In 2012, it held shares of Hancomm (70%), Hanwha Corporation (2.2%), Hanwha General Insurance (0.37%), Human Power (100%), Hanwha Solar Energy (20%), Hanwha Total Energy (100%), and Yeosu Cogeneration System (100%). Prior to 2007, Hancomm was the only firm in which Hanwha S&C held shares.

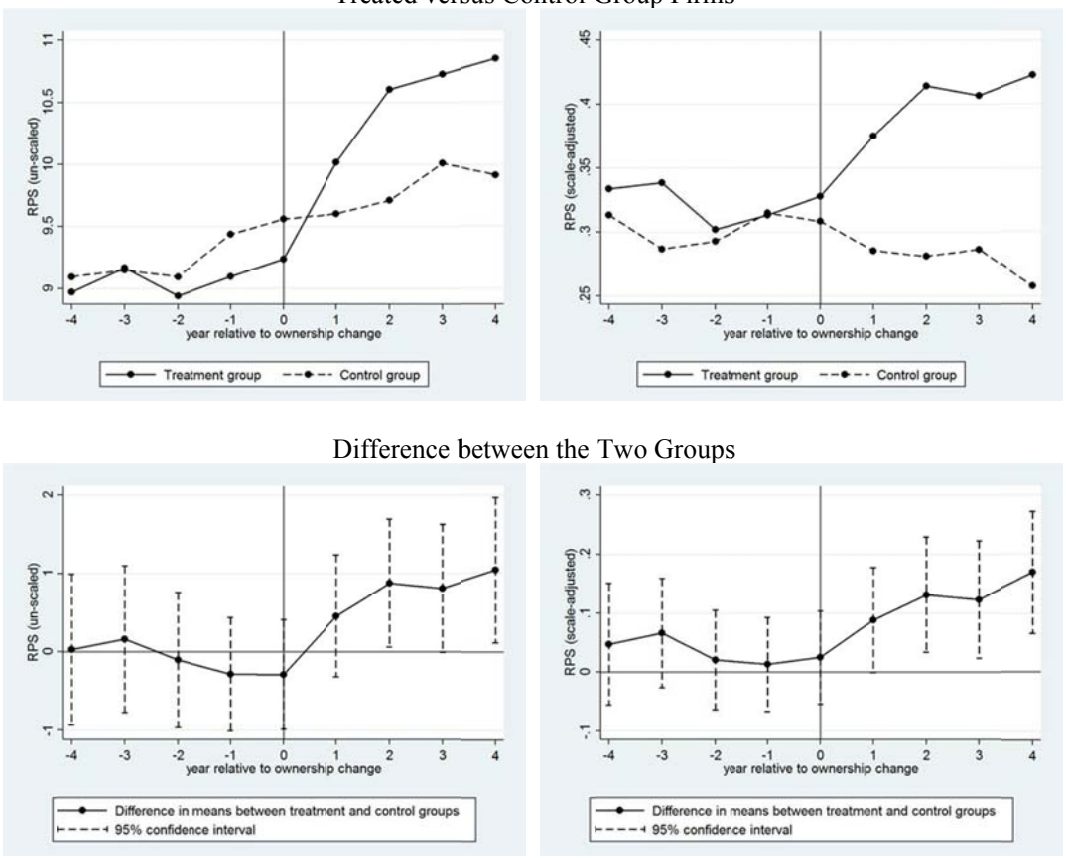

Fig. 2. Pre-treatment parallel trends. The plots on the left (right) compares the average values of un-scaled (scaled) RPS between treatment (N = 84) and control group firms (N = 325) during a nine-year period that includes four years before and after the treatment. Un-scaled RPS is defined as *ln*[(related-party sales/ GDP deflator) + 1], where related-party sales (in million Korean won) include not only sales of goods and services to member firms, but also non-operating income from them. Scaled RPS is defined as (related-party sales/total revenue), where total revenue includes not only operating but also non-operating revenue. Treatment group firms are firms that experience a major increase in heir ownership during our sample period (2000–2011). A "major increase in the heir's ownership" takes place when the heir's relative ownership (heir's net ownership – controlling shareholder's net ownership – other remote relatives' net ownership) increases by more than 5 percentage points and the resulting heir's net ownership is greater than those of the controlling shareholder's and the other remote relatives'. Control group firms comprise up to five firms that have propensity scores (estimated based on the lagged values of asset size and profitability) closest to that of the treated firm, are in the same industry (4-digit code for manufacturing and 2-digit code for others), do not experience any major change in ownership, and are not affiliated with the same chaebol group. The bottom plots show the difference in un-scaled (scaled) RPS between treatment and control group firms. The dotted vertical lines indicate the 95% confidence intervals around each estimated difference.

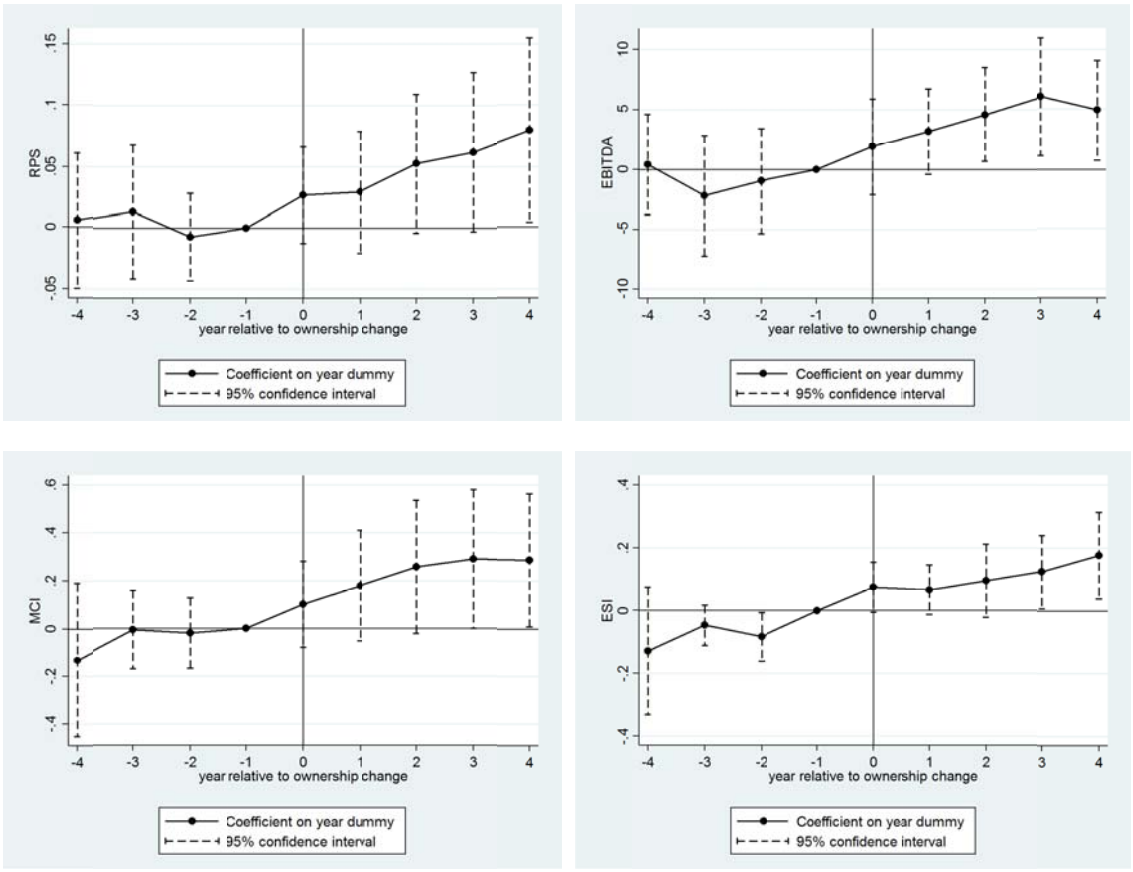

Fig. 3: Yearly treatment effects before and after the treatment. The figures below plot the yearly treatment effects estimated in the leads and lags models for RPS_{it}, $EBITDA_{it}$, MCI_{it}, and ESI_{it}. The dotted vertical lines indicate the 95% confidence intervals around each estimated coefficients. RPS_{it} is firm i's sales to member firms in year t scaled by its total revenue. Note that sales to member firms include not only firm i's sales of goods and services to them but also firm i's non-operating income from them. $EBITDA_{it}$ is the signed natural logarithm of earnings before interest, tax, depreciation, and amortization (EBITDA) of firm i in year t. EBITDA is in million Korean won and adjusted for inflation using Bank of Korea's GDP deflator (base year = 2005). MCI_{it} is the marginal contribution to group control index of firm j in year t, in natural logarithm. Since it can take a value of 0, we add 1 before taking logs. ESI_{it} is the book value of equity shares firm i holds in other member firms as a fraction of firm $i's$ book asset value in year t.

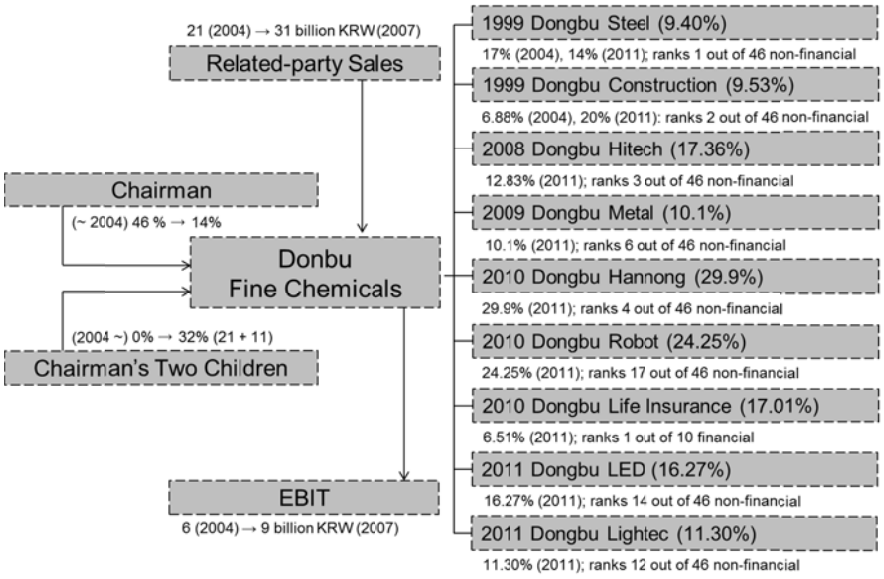

Fig. 4. Dongbu Fine Chemicals' use of related-party transactions for control enhancement. This figure depicts how a major change in Dongbu Fine Chemicals' ownership structure prompted an increase in its related-party sales, earnings, and control over other member firms in the group. Dongbu Fine Chemicals' sales to member firms increased from 21 billion Korean won in 2004 to 31 billion Korean won in 2007. Its earnings (EBIT) also jumped from 6 billion Korean won in 2004 to 9 billion Korean won in 2007. This improved financial strength enabled Dongbu Fine Chemicals to acquire shares in other member firms. Accordingly, by 2011, it became the firm with the highest value of un-scaled MCI in Dongbu group, completing the RPS-driven pyramiding process. More specifically, it significantly increased its equity holdings in the second largest non-financial firm in the group (Dongbu Construction). It also newly acquired the shares of Dongbu Life Insurance, which is the largest financial firm in the group. It also newly acquired significant fractions of shares in Dongbu Hitech, Dongbu Hannon, and Dongbu Metal, which rank very high in terms of their asset sizes.

Table 1
Variable definitions and summary statistics. This table gives definition and summary statistics of variables used in this study. *Panel A* defines each variable and *Panel B* provides their summary statistics. We use nonfinancial firms from 34 chaebol groups (see Table 2) during 2000–2011.

Panel A. Variable Definitions

Variable	Definition
Outcome Variable	
$RPTT_{it}$	Sum of firm i's related-party sales and purchases in year t scaled by the sum of its total revenue and costs in year t; total revenue includes operating and non-operating revenue; total costs also include both, operating and non-operating costs.
RPS_{it}	Firm i's related-party sales in year t scaled by its total revenue in year t; related-party sales include not only sales of goods and services to members firms, but also non-operating income from them.
RPP_{it}	Firm i's related-party purchases in year t scaled by its total costs in year t; related-party purchases include both operating and non-operating expenses paid to member firms.
$EBITDA_{it}$	Signed natural logarithm of earnings before interest, tax, depreciation, and amortization (EBITDA) of firm i in year t. EBITDA is in million Korean won and adjusted for inflation using Bank of Korea's GDP deflator (base year = 2005); *ln*(absolute value of EBITDA/GDP deflator) x (-1 if $EBITDA \leq -1$, +1 if $EBITDA \geq 1$ and 0 if $\lvert EBITDA \rvert < 1$).
MCI_{it}	*ln*(marginal contribution to group control index + 1); see Section 4.C and Appendix 1 for detailed definition.
ESI_{it}	Equity shareholding index is the book value of equity shares firm i holds in other member firms as a fraction of firm i's book asset value in year t.
Explanatory Variable	
TG_{it}	A treatment group dummy that takes a value of 1 if firm i experiences a major increase in heir's ownership and 0 otherwise. Major increase in heir's ownership takes place when its *relative* ownership (heir's net ownership – controlling shareholder's net ownership – other remote relatives' net ownership) increases by more than 5 percentage points and the resulting *net* ownership is greater than both the controlling shareholder's ownership and the other remote relatives' ownership. Other treatment group dummies used in our falsification tests are similarly defined.
TP_{it}	A treatment period dummy that takes a value of 1 during post-treatment period years and 0 otherwise. Notice that this treatment period dummy is defined separately for each treatment group firm i. Also note that firm i and its matching firm share the same treatment period dummy.
$NOWN_{it}^{H}$	Heir's net ownership in firm i at year t; heir's ownership (OWN_{it}^{H}) – its median at year t.
$ROWN_{it}^{H}$	Heir's relative ownership in firm i at year t; heir's net ownership ($NOWN_{it}^{H}$) – controlling shareholders' net ownership ($NOWN_{it}^{C}$) – other remote relatives' net ownership ($NOWN_{it}^{R}$).
Firm size	*ln*(Total assets/GDP deflator); total assets are measured in million Korean won (approximately thousand US dollars)
Firm age	Number of years since a firm's establishment, measured by year minus year of establishment
Leverage	*ln*[(Book value of debt /total assets)+1]
Cash holdings	Cash and cash equivalents / total assets
R&D expenditure	*ln*[(R&D/ Sales) x 100 +1]
Advertising expenditure	*ln*[(Advertising / Sales) x 100 +1]

Panel B. Summary Statistics

Variable	Full Heir Sample				Heir Subsample (w/o treated years for treated firms)			
	N	Mean	Med.	S.D.	N	Mean	Med.	S.D.
$RPTT_{it}$	3757	0.27	0.22	0.23	3408	0.27	0.21	0.23
RPS_{it}	3757	0.30	0.17	0.32	3408	0.29	0.15	0.32
RPP_{it}	3755	0.07	0.00	0.18	3406	0.26	0.12	0.32
$EBITDA_{it}$	3979	7.47	9.10	5.66	3621	7.44	9.09	5.70
MCI_{it}	3640	0.16	0.00	0.32	3301	0.15	0.00	0.31
ESI_{it}	3475	0.08	0.00	0.18	3140	0.08	0.00	0.17
TG_{it}	4369	0.19	0.00	0.39	3987	0.11	0.00	0.31
TP_{it}	4369	0.50	1.00	0.50	3987	0.46	0.00	0.50
$NOWN_{it}^{H}$	3667	0.04	0.00	0.14	3322	0.03	0.00	0.21
$ROWN_{it}^{H}$	3667	-0.02	0.00	0.22	3322	-0.03	0.00	0.21
Firm size	3970	11.90	11.87	1.57	3613	11.88	11.83	1.58
Firm age	4369	17.16	13.00	13.85	3987	16.89	12.00	14.06
Leverage	3970	0.42	0.43	0.15	3613	0.41	0.42	0.15
Cash holdings	3970	0.08	0.04	0.10	3613	0.08	0.04	0.11
R&D	4369	0.04	0.00	0.18	3987	0.04	0.00	0.17
Advertising	4369	0.29	0.04	0.55	3987	0.29	0.04	0.55

Table 2

List of chaebol groups and the number of their member firms in each year. Column (1) lists a total of 34 groups designated by the KFTC for at least seven years during the sample period of 2000–2011 (i.e., designated in April of each year from 2001 to 2012). Column (2) counts the number of member firms in each group in each year. Column (3) shows the controlling shareholders' names and column (4) the generations (1, 2, and 3 indicates 1st , 2nd, and 3rd generation).

No	(1)	(2)												(3)	(4)
	Chaebol Name	Number of Member Firms												Controlling Shareholder	Gener-ation
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
1	Booyoung	-	3	10	3	5	5	5	5	-	6	15	16	Lee Nam-Hyung(~2006), Lee Joong-Keun (2007~)	**2,1**
2	CJ	26	24	30	38	45	53	61	63	60	53	64	81	Lee Jae-Hyun	3
3	Daelim	14	14	14	11	11	12	14	14	16	16	19	17	Lee Joon-Yong	2
4	Dongbu	13	15	17	16	14	15	15	20	25	24	28	45	Kim Jun-Ki	1
5	Dongkuk Steel	8	6	7	8	8	12	11	12	13	12	13	16	Jang Se-Joo	3
6	Doosan	16	16	20	21	17	17	18	16	20	23	21	20	Park Yong-Gon	3
7	GS	-	-	-	-	50	50	48	45	54	58	75	72	Huh Chang-Soo	3
8	Hanjin	17	19	21	21	22	21	25	26	33	36	40	45	Cho Joong-Hoon (~2002), Cho Yang-Ho (2003~)	1, 2
9	Hanjin Heavy Industries	-	-	-	-	-	3	4	5	6	7	8	8	Cho Nam-Ho	2
10	Hankook Tire	-	6	7	7	8	8	9	9	-	-	-	15	Cho Yang-Rae	2
11	Hansol	15	9	10	10	10	12	12	16	-	-	-	-	Lee In-Hee	1
12	Hanwha	21	22	27	25	25	24	27	33	34	40	45	44	Kim Seung-Youn	2
13	Hite Jinro	-	-	9	12	11	13	13	15	-	16	15	15	Park Moon-Deok	2
14	Hyosung	14	14	14	15	15	16	22	24	36	34	38	43	Cho Suk-Rae	2
15	Hyundai	19	9	9	6	6	8	8	8	9	10	12	15	Chung Mong-Hun (~2003), Hyun Jeong-Eun (2004~)	2, 3
16	Hyundai Department Store	15	10	18	17	20	23	24	25	22	28	26	35	Chung Mong-Keun (~2006), Chung Ji-Sun (2007~)	2, 3
17	Hyundai Development Co.	8	9	10	11	11	12	15	14	15	14	14	14	Chung Se-Young (~2006), Chung Mong-Kyu (2007~)	1, 2
18	Hyundai Heavy Industries	-	-	3	3	4	4	4	6	10	11	16	19	Chung Mong-Joon	2
19	Hyundai Motor Company	15	21	21	26	26	38	34	29	33	34	59	51	Chung Mong-Koo	2
20	KCC	-	6	7	7	5	5	5	7	10	10	9	9	Chung Sang-Yong	1
21	Kolon	23	27	30	29	26	22	32	33	37	34	37	38	Lee Dong-Chan (~2006), Lee Woong-Yeol (2007~)	2, 3
22	Kumho	14	13	13	14	16	21	35	50	47	45	36	25	Park Sung-Yong (~2005), Park Sam-Koo (2006~)	2, 2
23	LG	38	46	45	42	37	30	31	36	51	52	58	62	Koo Bon-Moo	3
24	Lotte	30	31	33	34	39	41	42	43	51	56	71	72	Shin Kyuk-Ho	1
25	LS	-	-	-	11	17	19	19	22	30	43	46	49	Koo Tae-Hoi	1
26	OCI	22	19	19	19	18	19	18	15	18	17	17	19	Lee Hoi-Rim (~2007), Lee Soo-Young (2008~)	1, 2
27	Samsung	56	54	54	55	53	49	49	48	52	55	66	68	Lee Kun-Hee	2
28	Seah	-	-	-	27	28	23	22	23	23	17	21	24	Lee Woon-Hyung	2
29	Shinsegae	9	10	12	12	13	14	15	15	14	12	13	19	Lee Myung-Hee	2
30	SK	50	57	55	54	47	54	56	63	75	73	84	93	Chey Tae-Won	2
31	STX	-	-	-	-	14	10	11	14	16	15	20	25	Kang Deok-Soo	1
32	Taekwang	12	15	17	34	40	46	40	39	-	-	42	36	Lee Sik-Jin (~2002), Lee Ho-Jin (2003~)	2,3
33	Tongyang	21	8	7	8	8	8	14	13	15	18	24	27	Hyun Jae-Hyun	2
34	Youngpoong	23	24	23	20	19	26	22	21	-	23	24	23	Jang Byung-Hee (~2002), Jang Hyung-Jin (2003~)	1, 2
Total number of chaebols		24	27	29	31	33	34	34	34	28	31	32	31		
Total number of group firms		499	507	562	616	688	733	780	827	825	892	1076	1160		

Table 3

Ownership change and related-party transactions. Firm fixed effects regressions of scale-adjusted related-party total transactions, sales, and purchases ($RPTT_{it}$ RPS_{it} and RPP_{it}) on treatment group dummy (TG_i), treatment period dummy (TP_{it}), their interaction ($TG_i \times TP_{it}$), covariates, and year fixed effects. Treatment group dummy (TG_i) is absorbed in firm FE. The sample includes 84 treatment group firms that experienced major increases in heir ownership and 325 control group firms comprising up to five firms that have propensity scores (estimated based on the lagged values of asset size and profitability) closest to that of the treated firm, are in the same industry (4-digit code for manufacturing and 2-digit code for others), do not experience any major change in ownership, and are not affiliated with the same chaebol group. *t*-values based on standard errors clustered at firm-level are reported in the parenthesis, and *, **, and *** indicate significance at 10%, 5%, and 1% levels respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Related-party Total Transactions ($RPTT_{it}$)		Related-party Sales (RPS_{it})		Related-party Purchases (RPP_{it})	
TP_{it}	-0.0095		-0.0104		0.0128	
	(-0.95)		(-0.82)		(0.85)	
$TG_i \times TP_{it}$	0.0390**		0.0447**		-0.0012	
	(2.46)		(2.24)		(-0.04)	
$TG_i \times TY_{it}^{-4}$		-0.0053		0.0058		-0.0412
		(-0.20)		(0.21)		(-1.38)
$TG_i \times TY_{it}^{-3}$		-0.0021		0.0134		-0.0518***
		(-0.10)		(0.48)		(-2.66)
$TG_i \times TY_{it}^{-2}$		-0.0093		-0.0069		-0.0003
		(-0.53)		(-0.38)		(-0.02)
$TG_i \times TY_{it}^{0}$		0.0150		0.0268		-0.0127
		(1.02)		(1.34)		(-0.67)
$TG_i \times TY_{it}^{+1}$		0.0207		0.0296		-0.0269
		(1.10)		(1.17)		(-0.95)
$TG_i \times TY_{it}^{+2}$		0.0401*		0.0526*		0.0003
		(1.87)		(1.82)		(0.01)
$TG_i \times TY_{it}^{+3}$		0.0437*		0.0618*		-0.0047
		(1.87)		(1.88)		(-0.16)
$TG_i \times TY_{it}^{+4}$		0.0624**		0.0794**		0.0028
		(2.19)		(2.06)		(0.06)
Firm size	0.0169*	0.0162*	-0.0074	-0.0083	-0.0055	-0.0068
	(1.89)	(1.84)	(-0.61)	(-0.70)	(-0.50)	(-0.62)
Firm age	-0.0014	-0.0001	0.0001	-0.0005	-0.0050***	-0.0041
	(-0.81)	(-0.04)	(0.05)	(-0.12)	(-2.61)	(-1.25)
Leverage	-0.0043	-0.0023	0.0270	0.0302	0.0323	0.0268
	(-0.11)	(-0.06)	(0.64)	(0.71)	(0.89)	(0.75)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,757	3,757	3,757	3,757	3,755	3,755
Number of firms	409	409	409	409	409	409
Within R^2	0.00902	0.00964	0.0120	0.0101	0.0169	0.0188

Table 4

Ownership change, related-party transactions, and earnings. In Columns (1) and (3), we have firm fixed effects regressions of earnings ($EBITDA_{it}$) and scale-adjusted earnings ($EBITDA_{it}/Sales_{it}$) on treatment group dummy (TG_i), treatment period dummy (TP_{it}), related-party sales (RPS_{it}), their interactions, covariates, and year fixed effects. In Columns (2) and (4), we have leads and lags model, where we replace the single treatment period dummy (TP_{it}) with a number of treatment year dummies. Treatment group dummy (TG_i) is absorbed in firm FE. The sample include 84 treatment group firms that experienced major increase in heir's ownership and 325 control group firms that are identified in the same way as in Table 3. *t*-values are reported in the parenthesis and are based on standard errors clustered at the firm level and *, **, and *** indicate significance at 10%, 5%, and 1% levels respectively.

	(1)	(2)	(3)	(4)
Dependent Var.	$EBITDA_{it}$		$EBITDA_{it}/Sales_{it}$	
TP_{it}	-0.2508		0.0242	
	(-0.71)		(0.74)	
RPS_{it}	-1.6131	-1.9798*	0.0041	0.0014
	(-1.50)	(-1.76)	(1.47)	(0.40)
$TG_i \times TP_{it}$	-1.0664		0.0365	
	(-1.43)		(0.70)	
$RPS_{it} \times TG_i$	0.4413	0.7045	-0.0133*	-0.0146*
	(0.20)	(0.33)	(-1.87)	(-1.87)
$RPS_{it} \times TP_{it}$	-0.2113		-0.0031	
	(-0.30)		(-1.05)	
$RPS_{it} \times TG_i \times TP_{it}$	3.3525**		-0.0032	
	(2.19)		(-0.68)	
$RPS_{it} \times TG_i \times TY_{it}^{-4}$		0.6513		0.0085
		(0.30)		(0.98)
$RPS_{it} \times TG_i \times TY_{it}^{-3}$		-2.0712		0.0029
		(-0.84)		(0.54)
$RPS_{it} \times TG_i \times TY_{it}^{-2}$		-0.9742		-0.0041
		(-0.45)		(-0.95)
$RPS_{it} \times TG_i \times TY_{it}^{0}$		1.8334		-0.0067
		(0.93)		(-1.15)
$RPS_{it} \times TG_i \times TY_{it}^{+1}$		2.6845		-0.0161
		(1.53)		(-1.35)
$RPS_{it} \times TG_i \times TY_{it}^{+2}$		3.8284**		0.0109*
		(2.01)		(1.70)
$RPS_{it} \times TG_i \times TY_{it}^{+3}$		5.4569**		0.0053
		(2.24)		(0.75)
$RPS_{it} \times TG_i \times TY_{it}^{+4}$		3.8201*		0.0068
		(1.87)		(0.86)
Firm size	1.0011***	1.0189***	0.0254**	0.0253**
	(3.85)	(3.85)	(2.20)	(2.17)
Firm age	-0.0443	-0.0521	-0.0006	-0.0015
	(-0.72)	(-0.49)	(-0.43)	(-0.47)
Leverage	-7.3724***	-7.1831***	-0.1284***	-0.1221***
	(-5.06)	(-4.93)	(-2.63)	(-2.64)
Cash holdings	2.4949*	2.6540**	0.0347	0.0412
	(1.94)	(2.05)	(0.53)	(0.64)
R&D expenditure	1.2882**	1.3717**	0.0397***	0.0416***
	(2.26)	(2.34)	(2.91)	(2.83)
Advertising expenditure	-0.8067*	-0.8533*	-0.0230	-0.0238
	(-1.71)	(-1.82)	(-0.83)	(-0.86)
Constant	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
$TY_{it}^{j} \times TG_i$	No	Yes	No	Yes
$TY_{it}^{j} \times RPS_{it}$	No	Yes	No	Yes
Observations	3,757	3,757	3,738	3,738
Number of firms	409	409	409	409
Within R^2	0.0491	0.0555	0.0313	0.0442

Table 5

Ownership change, related-party transactions, and group control. In Columns (1) and (3), we have firm fixed effects regressions of marginal contribution to group control index (MCI_{it}) and equity shareholding index (ESI_{it}) on treatment group dummy (TG_i), treatment period dummy (TP_{it}), related-party sales (RPS_{it}), their interactions, covariates, and year fixed effects. In Columns (2) and (4), we have leads and lags model, where we replace the single treatment period dummy (TP_{it}) with a number of treatment year dummies. Treatment group dummy (TG_i) is absorbed in firm FE. The sample includes 84 treatment group firms that experienced major increase in heir's ownership and 325 control group firms that are identified in the same way as in Table 3. *t*-values are reported in the parentheses and are based on standard errors clustered at the firm level, and *, **, and *** indicate significance at 10%, 5%, and 1% levels respectively.

	(1)	(2)	(3)	(4)
Dependent Var.	MCI_{it}		ESI_{it}	
TP_{it}	0.0495***		0.0325***	
	(2.67)		(3.31)	
RPS_{it}	0.0497**	0.0667**	0.0513***	0.0520***
	(2.09)	(2.18)	(3.79)	(3.24)
$TG_i \times TP_{it}$	-0.0172		-0.0301*	
	(-0.40)		(-1.67)	
$RPS_{it} \times TG_i$	0.0418	0.0922	-0.0876	-0.0214
	(0.30)	(0.74)	(-0.91)	(-0.36)
$RPS_{it} \times TP_{it}$	-0.0396		-0.0389**	
	(-1.19)		(-2.32)	
$RPS_{it} \times TG_i \times TP_{it}$	0.2627**		0.1797***	
	(2.01)		(2.98)	
$RPS_{it} \times TG_i \times TY_{it}^{-4}$		-0.1310		-0.1285
		(-0.80)		(-1.24)
$RPS_{it} \times TG_i \times TY_{it}^{-3}$		-0.0052		-0.0466
		(-0.06)		(-1.42)
$RPS_{it} \times TG_i \times TY_{it}^{-2}$		-0.0199		-0.0837**
		(-0.26)		(-2.12)
$RPS_{it} \times TG_i \times TY_{it}^{0}$		0.1002		0.0743*
		(1.09)		(1.83)
$RPS_{it} \times TG_i \times TY_{it}^{+1}$		0.1787		0.0661
		(1.51)		(1.64)
$RPS_{it} \times TG_i \times TY_{it}^{+2}$		0.2578*		0.0957
		(1.81)		(1.61)
$RPS_{it} \times TG_i \times TY_{it}^{+3}$		0.2897*		0.1238**
		(1.95)		(2.09)
$RPS_{it} \times TG_i \times TY_{it}^{+4}$		0.2858**		0.1763**
		(2.03)		(2.53)
Constant	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
$TY_{it}^{j} \times TG_i$	No	Yes	No	Yes
$TY_{it}^{j} \times RPS_{it}$	No	Yes	No	Yes
Observations	3,378	3,378	3,378	3,378
Number of firms	409	409	409	409
Within R^2	0.0411	0.0483	0.0430	0.0630

Table 6

Do treated firms ascend to control group core firms? A transition matrix showing the number of treated firms that move from one quartile to another in terms of un-scaled MCI ($MCI_{it} \times BE_{it}$) between a year before the treatment ($j = -1$) and the latest year they appear in the sample.

		Latest Year in Sample				Total
		4th quartile	3rd quartile	2nd quartile	1st quartile	
$j = -1$	1st quartile	0	0	2	3	5
	2nd quartile	2	2	6	2	12
	3rd quartile	5	3	2	2	12
	4th quartile	43	6	5	1	55
Total		50	11	15	8	84

Table 7

Falsification tests using non-heir ownership changes. Firm fixed effects regressions, identical to those reported in Table 3 (Column [3]), Table 4 (Column [1]), and Table 5 (Columns [1] and [3]) but using treatment group dummy (TG_i), where non-heirs (controlling shareholder or other remote relatives) become a major shareholder. Other covariates are suppressed. Odd (even) numbered columns use 63 (61) treatment group firms that experienced a major increase in controlling shareholder's (other relative's) ownership and 299 (300) control group firms that are identified in the same manner as in Table 3. *t*-values are reported in the parenthesis and are based on standard errors clustered at the firm level, and *, **, and *** indicate significance at 10%, 5%, and 1% levels respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var.	RPS_{it}		$EBITDA_{it}$		MCI_{it}		ESI_{it}	
Non-heirs	Controlling Shareholder	Other Remote Relatives	Controlling Shareholder	Other Remote Relatives	Controlling Shareholder	Other Remote Relatives	Controlling Shareholder	Other Remote Relatives
TP_{it}	0.0035	0.0063	-0.3751	0.6937*	0.0419**	0.0599***	0.0381***	0.0414***
	(0.28)	(0.49)	(-0.86)	(1.87)	(2.42)	(3.53)	(4.44)	(5.59)
RPS_{it}			-2.0064	-1.8483	0.1081**	0.0558	0.0739**	0.0523**
			(-1.55)	(-1.51)	(2.41)	(1.29)	(2.15)	(2.35)
$TG_i \times TP_{it}$	0.0392	0.0184	1.2272	-0.2637	0.0836*	-0.0672	0.0420	-0.0135
	(1.43)	(0.63)	(1.42)	(-0.30)	(1.67)	(-1.06)	(1.56)	(-0.37)
$RPS_{it} \times TG_i$			-0.3196	0.9336	-0.0016	0.0823	-0.0320	0.0153
			(-0.14)	(0.27)	(-0.01)	(0.51)	(-0.38)	(0.11)
$RPS_{it} \times TP_{it}$			1.7967*	-0.1025	-0.0478	0.0261	-0.0209	0.0214
			(1.96)	(-0.15)	(-1.62)	(0.56)	(-1.34)	(0.77)
$RPS_{it} \times TG_i \times TP_{it}$			-1.7361	0.3555	0.1388	0.2785	0.0601	0.0580
			(-0.99)	(0.14)	(0.75)	(1.59)	(0.67)	(0.79)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other covariates	Yes	Yes	Yes	Yes	No	No	No	No
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,594	3,533	3,594	3,533	3,316	3,159	3,316	3,159
Number of firms	362	361	362	361	362	361	362	361
Within R^2	0.0137	0.00666	0.0466	0.0452	0.0331	0.0375	0.0580	0.0514

Table 8

Falsification tests using counterparties. Firm fixed effects regressions, identical to those reported in Table 3 (column [5]), Table 4 (column [1]), and Table 5 (columns [1] and [3]) but using counterparties of original treatment group firms (i.e., all the firms that purchase goods or services from the treated firm) as our new treatment group. TG_i takes a value of 1 if firm i is the counterparty of the original treatment group firm and 0 otherwise. TP_{it} takes a value of 1 if firm i's original treatment group firm experiences a major increase in heir ownership at year t or before and 0 otherwise. If an identical firm is a counterparty of two different original treatment group firms, we allow them to appear twice in the sample. Other covariates are suppressed. The sample include 27 treatment group firms and 111 control group firms that are identified in the same manner as in Table 3. *t*-values are reported in the parenthesis and are based on standard errors clustered at the firm level, and *, **, and *** indicate significance at 10%, 5%, and 1% levels respectively.

	(1)	(2)	(3)	(4)
Dependent Variables	RPP_{it}	$EBITDA_{it}$	MCI_{it}	ESI_{it}
TP_{it}	-0.0020	-0.3745	0.0299	0.0138
	(-0.08)	(-0.80)	(1.21)	(1.19)
RPT_{it}		-1.0792	-0.0534	-0.0973
		(-0.57)	(-0.83)	(-1.64)
TG_i x TP_{it}	0.0472	-0.6496	0.0835	0.0351
	(1.43)	(-0.70)	(1.55)	(1.40)
TG_i x RPP_{it}		0.3558	0.1430	0.1264
		(0.13)	(1.01)	(1.29)
TP_{it} x RPP_{it}		2.3168	0.0393	0.0811
		(1.17)	(0.54)	(1.45)
TG_i x TP_{it} x RPP_{it}		-0.1455	-0.2887*	-0.1981*
		(-0.05)	(-1.89)	(-1.96)
Constant	Yes	Yes	Yes	Yes
Other Covariate	Yes	Yes	No	No
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,471	1,471	1,351	1,351
Number of firms	138	138	138	138
Within R^2	0.0529	0.0807	0.0303	0.0334

Appendix: Marginal Contribution to Group Control Index (MCI)

MCI_{it} identifies the firms through which a controlling shareholder family could most efficiently strengthen their control over other member firms. To be an efficient control vehicle, this firm must directly or indirectly hold a significant fraction of shares in other firms. One way to quantify this is to compute the additional cash flow rights a controlling shareholder family could obtain from other firms when the vehicle firm becomes a part of the group. Scaling these additional cash flow rights by the vehicle firm's book equity provides a measure of its marginal contribution to group control (i.e., the additional dollar value of equity that could be obtained, directly or indirectly, in other firms by investing one dollar of equity in the vehicle firm). This measure is not designed to identify firms that already hold the largest equity stakes in other firms but rather to identify firms that could most easily grow into this role. Equation (A1) shows the formula of firm *i*'s marginal contribution to group control index:

$$MCI_{it} = \frac{\sum_{j=1, j\neq i}^{n} BE_{jt} cfr_{jt} - \sum_{j=1, j\neq i}^{n} BE_{jt} cfr_{jt}^{-i}}{BE_{it}} \quad \text{(A1)}$$

BE_{it} is firm i's book value of equity in year t. cfr_{jt} represents the cash flow rights that the controlling family has in firm *j* when all member firms are included in the group, while cfr_{jt}^{-i} represents the cash flow rights that the controlling family has in firm *j* when all member firms, excluding firm i are included in the group. The first (second) term in the numerator measures the aggregate cash flow rights that the controlling family would receive from other firms (denoted as $j = 1, \cdots, n$) when firm i ($i \neq j$) is included in (removed from) the group. We divide the difference

by the firm's book equity to control for any size effect, since larger firms are more likely to have greater contributions to group control.[23] The index can have a value equal to zero; this happens when firm *i* does not have any equity investment in other member firms. Moreover, the index has no upper bound; if there is no restriction on debt or length of equity investment chain, the index may be well above 1.

Cash flow rights (cfr_{jt}) is the sum of the controlling family's direct and indirect ownership. Again, we follow Kim, Lim, and Sung (2007) and compute cash flow rights as follows:

$$cfr_{jt} = d_j + \sum_{k=1}^{n} s_{jk} d_k + \sum_{k=1}^{n} s_{jk} \sum_{l=1}^{n} s_{kl} d_l + \cdots \quad \text{(A2)}$$

d_j is the controlling family's direct ownership in firm *j* in year t. Family includes the controlling shareholder, his/her spouse, and relatives within certain degrees of kinship (six with the controlling shareholder or four with the spouse). The subsequent terms capture indirect ownership through member firms under the control of the same controlling shareholder. For example, the second term represents the family's indirect ownership in firm *j* through firm k ($k = 1, \cdots, n$).

[23] Our measure is similar, but not identical, to the "centrality" measure introduced by Almeida et al. (2011), who identify firms by computing the average reduction in critical control (CC) thresholds across all group firms other than firm *i*, after excluding firm *i* from the group. The *CC* threshold is the highest control threshold that is consistent with family control of a firm. Control threshold *T* is the minimum votes that a family needs to (directly or indirectly) hold to control a firm. This measure is not, however, adjusted for firm size and therefore tends to favor large firms that already have significant control over others. In other words, this measure cannot capture how much equity a firm could obtain in other firms, directly or indirectly, by investing one dollar of equity in firm *i*.