The structure and formation of business groups: Evidence from Korean *chaebols**

Heitor Almeida

Sang Yong Park

Marti G. Subrahmanyam

Daniel Wolfenzon

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Abstract

We study the evolution of Korean *chaebols* (business groups) using ownership data. *chaebols* grow vertically (as pyramids) when the controlling family uses well-established group firms ("central firms") to acquire firms with low pledgeable income and high acquisition premiums. *chaebols* grow horizontally (through direct ownership) when the family acquires firms with high pledgeable income and low acquisition premiums. Central firms trade at a relative discount, due to shareholders' anticipation of value-destroying acquisitions. Our evidence is consistent with the selection of firms into different positions in the *chaebol* and ascribes the underperformance of pyramidal firms to a selection effect rather than tunneling.

Key words: Business groups, family firms, pyramids, cross-shareholdings, tunneling, mergers and acquisitions.
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*Almeida (the corresponding author) is at the University of Illinois at Urbana-Champaign (email: halmeida@illinois.edu). Park is at Yonsei University, Subrahmanyam is at New York University, and Wolfenzon is at Columbia University. We wish to thank David Thesmar (the referee), Utpal Battacharya, Mara Faccio, Radha Gopalan, Raghu Rau (WFA discussant), Woochan Kim, Hannes Wagner (EFA discussant), Luigi Zingales (NBER discussant), Paolo Volpin (Paris Spring Corporate Finance discussant), and participants at the 2008 WFA meetings, the 2008 NBER Summer Institute (Corporate Finance), the 2008 EFA meetings, the 2008 Paris Spring Corporate Finance conference, the 2008 AsianFA-NFA International Conference, and seminars at Temple University, University of Minnesota, Notre Dame University, University of Texas at Austin, University of Melbourne, Washington University at St Louis, Indiana University, Purdue University, University of Toronto, University of Washington, Duke University, SIFR, FGV-Rio, Vienna University of Economics and Business Administration, and New York University for helpful comments. Ki Beom Binh, Yong Hyuk Choi, Jiyoon Lee, Quoc Nguyen, Seul-Ki Jung, Igor Cunha and Andre De Souza provided outstanding research assistance. All errors are our own.

1. Introduction

Groups of firms under common ownership are prevalent around the world. These so-called business groups account for a large fraction of the economic activity of many countries.[1] Most of these groups are controlled by families that hold equity stakes in group firms either directly or indirectly through other firms in the group. For example, one typical ownership structure is referred to as a pyramid. In this structure, the family achieves control of the constituent firms by a chain of ownership relations: the family directly controls a firm, which in turn controls another firm.[2]

The previous empirical literature has generally taken group structure as given, and studied the consequences induced by its ownership structure. The literature focuses mostly on the relationship between the controlling family's cash flow and voting rights and measures of accounting performance and valuation (see, e.g., Claessens, Djankov and Lang 2000; and Faccio and Lang, 2002). In particular, the findings in the literature suggest that pyramidal ownership may reduce firm performance (see, e.g., Claessens et al., 2002; and Joh, 2003), perhaps because of tunneling incentives created by pyramiding (Bertrand, Mehta, and Mullainathan, 2002; Bae, Kang, and Kim, 2002; Baek, Kang, and Lee, 2006). However, the causes that determine a group's ownership structure remain largely unexplored. In particular, while there have been some recent theoretical attempts to understand pyramidal ownership, there is little empirical research that focuses on how pyramids evolve over time.[3] We try to fill this gap in this paper.

Our tests draw mostly on Almeida and Wolfenzon's (2006) theory of pyramidal ownership. In their model, the controlling family chooses the optimal ownership structure of a new firm (call it firm B) which is to be added to the group (for example, through an acquisition). The choices are a pyramidal structure, whereby the family uses the equity of an existing group firm (call it firm A) to finance the investment in the new firm, and a direct ownership structure, whereby the investment is paid for with the family's personal wealth. The theory generates predictions about the characteristics of firms that are placed in pyramids rather than under direct control. First, firms that have cash flows and/or assets that are difficult to pledge to outside investors (low pledgeability) should be placed in pyramids. This relationship arises because group equity (such as the equity of firm A) is particularly valuable as a financing tool when the family is financially constrained. Since financial constraints are more likely to bind for low pledgeability firms, such firms are optimally controlled through pyramids. Second, the lower the net present value (NPV) of the new firm, the more likely it is that

[1] Claessens, Fan, and Lang (2002) find that, in eight out of the nine Asian countries they study, the top 15 family groups control more that 20% of the listed corporate assets. In a sample of 13 Western European countries, Faccio and Lang (2002) find that, in nine countries, the top 15 family groups control more than 20% of the listed corporate assets.

[2] Pyramids are very common throughout the world. See, among others, Claessens, Djankov, and Lang (2000), for the evidence on East Asia, Faccio and Lang (2002) and Barca and Becht (2001) for Western Europe, Khanna (2000) for emerging markets, and Morck, Stangeland, and Yeung (2000) for Canada.

[3] A recent paper by Fan, Wong, and Zhang (2009) focuses on the formation of state-owned pyramids in China. As discussed by those authors, state-owned Chinese firms are special in that they show no separation between ownership and control. Bertrand et al. (2008) use cross-sectional data on Thai business groups to study the role of family structure for group ownership structure and group firm performance. In particular, they find that groups that are controlled by larger families are more pyramidal in structure.

the new firm will be placed in a pyramid. Pyramidal ownership forces the family to share the NPV of firm B with minority shareholders of firm A. Thus, the family prefers to directly control high NPV firms. Third, the theory predicts that firms that are used by the family to set up and acquire other firms (such as firm A) should trade at a discount relative to other public group firms. The valuation discount arises because investors anticipate the selection of low NPV firms into pyramids and thus, discount firm A's shares to compensate for the poor returns associated with future pyramidal investments.

We use a unique data set of Korean business groups to test the theory's implications. The political and regulatory context of *chaebols* allows us to obtain extremely detailed ownership data on *chaebol* firms. Since the mid-1990s, the top Korean *chaebol*s have had to report their complete ownership information to the Korean Fair Trade Commission (KFTC). These reports include ownership and accounting data on all firms (public or private) in each *chaebol*. Another feature that distinguishes our data is their dynamic nature. We have a panel from 1998 to 2004, for a relatively comprehensive sample of *chaebol* firms. In most countries, these type of data are not generally available.[4]

The theoretical arguments above motivate new metrics of group ownership other than the standard measures of cash flow and voting rights. First, we provide a measure of the *position* of any group firm relative to the controlling shareholder. This metric allows us to distinguish pyramidal from direct ownership. In addition, to identify firms that the family uses to set up new firms (such as firm A in the description above), we compute the *centrality* of a firm for the group structure (e.g., whether a given firm is used by the family to control other group firms).[5] We also introduce a new metric to compute voting rights that we call *critical control threshold*. This metric is closely related to the concept of the weakest link that is used in existing literature. However, unlike the weakest link, it can be computed for group structures of any degree of complexity. We provide algorithms that generate these ownership measures. In our data, this is necessary because the complex ownership structures of Korean *chaebol*s with dozens of firms and several ownership links among them makes it difficult for the researcher to directly compute them.[6]

We start by describing the basic characteristics of Korean *chaebols*. We find that both pyramids and cross-shareholdings are common in Korean *chaebol*s. Nevertheless, pyramids in Korean *chaebols* are not "deep." A large majority of *chaebol* firms belong to pyramids with a total of two or three firms in the chain. Only a few group firms in each group are classified as being central, and they tend to be the older and larger firms in the group. These findings suggest that in a typical Korean *chaebol,* few central firms hold stakes in a large number of firms controlled through a pyramid involving the central firms. We also observe a substantial number of firms that are controlled directly by the family, with no ownership links to other *chaebol* firms. This cross-sectional variation in *chaebol* firm ownership structures allows us to test the predictions described above.

The empirical evidence on the characteristics of group firms is consistent with the the-

[4] Franks et al. (2008) assemble a data set that contains ownership information on private firms in France, Germany, Italy, and the UK. They focus on the trade-off between family and dispersed ownership, rather than on the ownership structure of groups.

[5] The measure of *centrality* that we derive is similar (but not identical) to that proposed by Kim and Sung (2006).

[6] Our algorithms can also be useful in other countries in which groups have complex ownership structures.

oretical predictions. First, we find that firms that are controlled through pyramids have lower profitability than directly controlled firms. This result is consistent with the selection of firms with low pledgeable income into pyramids. However, it is also consistent with the tunneling of profits away from pyramidal firms and towards firms in which the family has higher cash flow ownership (those at the top of the group).

In order to distinguish between the tunneling and the selection explanations for the low profitability of pyramidal firms, we perform several additional empirical tests. First, we focus on instances of large changes in a firm's *position* in the group, and ask whether low (high) past profitability predicts large increases (decreases) in the degree of pyramiding in a firm's ownership structure. Examining large changes in *position* is useful because it allows us to rule out alternative explanations that rely on the fact that *position* does not change much over time. Second, we examine a sample of new firms that are added to *chaebols* during our sample period, and study the determinants of their ownership structure. A firm's profitability in the year prior to becoming a *chaebol* firm cannot be affected by the ownership structure chosen later by the *chaebol*'s controlling family. However, pre-*chaebol* profitability should explain the firm's ownership structure, according to the selection hypothesis. Third, we construct additional proxies for pledgeability other than profitability and ask whether these proxies also help predict a new firm's *position* in the group. These alternative proxies focus on the "asset" rather than the "cash flow" dimension of pledgeability (for which profitability is a natural proxy). Specifically, we ask whether the family tends to place firms with low tangibility and low collateral in pyramids. Fourth, we examine additional implications of the tunneling hypothesis. We use the sample of newly added firms, and analyze the change in their profitability in the year following their acquisition by the *chaebol*. The tunneling hypothesis predicts that if a new firm is placed in a pyramid, its profitability should decrease. We also examine predictions of the tunneling hypothesis for the distribution of dividends and accruals in *chaebol* firms. Specifically, firms at the top of the group should pay higher dividends and display lower accruals than firms that are owned through pyramids. In addition, we use the sample of newly added firms to ask whether dividends and accruals change from the year prior to the year following the firm's acquisition by a *chaebol*.

Our results are consistent with the selection hypothesis. First, poor past performance predicts an increase in the extent of pyramidal ownership in a firm's ownership structure. Second, pre-*chaebol* profitability is strongly related to a firm's initial *position* in the group—incoming low profitability firms are more likely to be placed lower down in pyramids. Third, there is some suggestive evidence that low asset pledgeability firms are selected into pyramids. Fourth, we find no support for specific implications of the tunneling hypothesis. New pyramidal firms' profitability does not decline after they are placed in a *chaebol*. Dividends and accruals are also unrelated to a firm's *position* in the *chaebol*, and they do not change after a new firm is added to a *chaebol*. These results suggest that the correlation between pyramidal ownership and profitability that is shown in the previous literature may be due to reverse causality. Low profitability firms are selected into pyramids, but pyramidal ownership does not appear to affect the relative performance of *chaebol* firms.

Next, we test the implication that low NPV firms are selected into pyramids while higher NPV firms are controlled directly by the family. To do so, we focus on a sample of acquisitions that were made by *chaebols* during our sample period, and use the *acquisition premium* as a proxy for the NPV of the transaction (the ratio of the acquisition price to the new firm's book value of equity). We find that the controlling family tends to place firms with high acquisition premiums in pyramids, and chooses to directly control firms with low acquisition premiums. This implication is specific to the selection hypothesis, and thus, provides further evidence that new *chaebol* firms are selected into different positions of the *chaebol* according to the financing and valuation consequences of these new acquisitions.

Finally, we test the implication that the *chaebol* firms that are used by the family to acquire other firms through pyramids ("central firms") should trade at a discount relative to other *chaebol* firms. To do so, we compare the market-to-book (Tobin's Q) ratios of central firms to those of other group firms that do not hold substantial equity in other firms ("non-central" firms). Consistent with this implication, we find a a robust negative correlation between *centrality* and market-to-book ratios (Tobin's Q). Central firms are valued at a discount relative to all other types of group firms (including both directly and pyramidally owned firms). This result indicates that the defining firm characteristic that generates the valuation discount is the fact that a firm holds significant equity in other firms, and not the firm's position in the group.

We also provide direct evidence that the central firm discount is due to the anticipation of value-destroying, pyramidal acquisitions by the *chaebol* central firms (as suggested by the selection hypothesis). First, while we cannot directly measure shareholders' expectations of *future* acquisitions, we can examine whether central firms did more acquisitions than other group firms during our sample period. Under the hypotheses that shareholders look at past acquisitions to predict future ones, a positive correlation between centrality and past acquisition activity can help validate the selection interpretation for the central firm discount. Second, if the selection interpretation is correct, central firms that have shown greater acquisition activity should trade at a larger discount than other central firms that have not been used as acquisition vehicles.

The evidence that we find supports the selection hypothesis. Central group firms are, in fact, the ones that are most likely to be used as acquisition vehicles. In addition, central firms that are active acquirers trade at larger discounts than other central firms. These results suggest that the selection of low NPV firms into pyramids is anticipated by shareholders, who discount the shares of central firms accordingly.

Overall, we believe that our paper contributes to the literature on business groups in five ways. First, our results shed new light on the process by which pyramids form (through the acquisition of low profitability, low asset pledgeability, high acquisition premia firms by the group's central firms). Second, we provide evidence that the relative performance of group firms is fundamentally affected by the selection of different types of firms into different positions in the group. In particular, we show evidence that the underperformance of pyramidal firms shown in previous literature could be due to a selection effect. Third, we present new results on the relative valuation of business group firms (the central firm valuation discount and its relationship to acquisition activity). Fourth, we develop new metrics of group ownership structure (e.g., *position*, *centrality,* and the *critical control threshold*) that can be useful for other researchers studying complex ownership structures of firms. Fifth, we use our metrics to describe and summarize the typical structure of a Korean *chaebol*.

The outline of the paper is as follows. Section 2 provides a brief review of the literature on the financial performance of family groups. Section 3 develops the empirical implications that we test in this paper. Section 4 introduces our methodology to compute ownership variables for group firms. In Section 5 we describe our data set. Section 6 presents our main empirical tests, and Section 7 concludes.

2. Literature review

There is a vast literature on family business groups.[7] In this section, we discuss briefly the part of the literature that links ownership structure to financial performance.

The existing literature points out that the ownership structure of business groups is a potential determinant of group firm performance and valuation. Most papers use cash flows and voting rights as the main metrics to describe group structure. For example, Bertrand, Mehta, and Mullainathan (2002) use a sample of Indian business groups to show that the value of group firms is affected by the controlling families' tunneling of resources from firms in which they have low cash flow rights to firms in which their ultimate stake is high.[8] In the context of Korean *chaebol*s, Baek, Kang, and Lee (2006) argue that discounted equity issues are more likely when the controlling shareholder has higher ultimate ownership in the acquirer than in the issuer. Bae, Kang, and Kim (2002) argue that intra-*chaebol* acquisitions transfer wealth from firms in which the family has low cash flow rights (typically the acquirer) to those in which the family has higher cash flow rights.[9] Claessens et al. (2002) show that firm value is negatively related to the separation between ownership and control in East Asia, while Lins (2003) finds similar results for a sample of firms from emerging markets. Joh (2003) finds that the separation between ownership and control is negatively related to profitability in Korea.[10]

Instead of focusing on measures of cash flow and voting rights, other papers examine variables that indicate whether a firm has some indirect (e.g., pyramidal) ownership. In particular, Claessens et al. (2002) and Volpin (2002) provide evidence that firms with indirect ownership have lower Tobin's Q than other firms. In contrast, Masulis, Pham, and Zein (2008) find that Tobin's Q is higher in pyramidal firms than in firms at the top of the group.

The literature has also examined whether group membership affects valuation (Khanna and Rivkin (2001); Khanna and Palepu (2000); Fisman and Khanna (2000); and Claessens, Fan, and Lang (2002)). Khanna and Palepu (2000), for example, find a positive effect of group membership in their sample from India. In contrast, Ferris, Kim, and Kitsabunnarat (2003) find a negative effect of Korean *chaebol* membership on firm value. Baek, Kang, and Park (2004) focus on the effects of the Asian crisis on Korean firms, and show evidence for a stronger impact of the crisis on *chaebol* firms. In a cross-country study, Masulis et al.

[7] For a detailed review, see Morck et al. (2005).

[8] In contrast, Gopalan, Nanda, and Seru (2006) examine intra-group loans in Indian business groups, and find little evidence of tunneling. They suggest that loans are used to support financially weaker firms in the group.

[9] In a related fashion, Cheung, Rau, and Stouraitis (2006) find that connected transactions between Hong Kong-listed companies and their controlling shareholders (such as transfer of assets across firms under the shareholders' control) result in value losses for minority shareholders. Their sample includes both group and non-group firms.

[10] Bennedsen and Nielsen (2006) find that valuation is negatively related to the separation between ownership and control in Continental Europe, but also that profitability is unrelated to measures of separation in the same region.

(2008) find that, after controlling for group membership choice, groups help improve firm value. In the Initial Public Offering (IPO) context, Marisetty and Subrahmanyam (2010) study underpricing of stand-alone and group firms.

Finally, the literature provides some evidence on the correlation between ownership variables and firm characteristics. In particular, there is evidence that firms that are owned through pyramids are smaller and younger than firms at the top of the group (those that own shares in other firms). Aganin and Volpin (2005) describe the evolution of the Pesenti group in Italy, and show that it was created by adding new subsidiaries to the firms the Pesenti family already owned, through carve-outs of existing group firms. One of their conclusions is that, in Italy, business groups expand through acquisitions when they are large and have significant cash resources. Claessens, Fan, and Lang (2002) find that firms with the highest separation of votes and ownership (i.e., those most likely to be owned through pyramids) are younger than those with less separation. Pyramidal firms also seem to be associated with larger scales of capital investment (Attig, Fischer, and Gadhoum 2003). Claessens, Fan, and Lang (2002) also find that, in East Asia, group firms tend to be larger than unaffiliated firms. Bianchi, Bianco, and Enriques (2001) find similar evidence for Italy.[11] Finally, Bianco and Nicodano (2006) find that in Italian pyramids, pyramidal firms have lower leverage than firms at the top of the group.

3. Hypotheses regarding the formation of pyramids

The traditional informal explanation for pyramidal structures is based on the idea that families try to control as many firms as possible to enjoy private benefits of control. Pyramidal structures lead to a separation of cash flow from voting rights that allow these families to minimize their ultimate cash flow stake in the firms they control (see, e.g., Bebchuk, Kraakman and Triantis, 2000).[12] According to this argument, pyramidal structures are only a device to achieve the desired separation of cash flow from control rights. As discussed by Almeida and Wolfenzon (2006), while pyramids are generally associated with large deviations from "one share-one vote," this pattern is not universal (see, e.g., Franks and Mayer, 2001). In addition, despite the fact that the family can also use dual-class shares to separate ownership from control, the incidence of pyramids in different countries does not appear to be caused by restrictions on the use of dual-class shares (La Porta, Lopez-de-Silanes, and Shleifer, 1999). This evidence suggests that considerations other than the separation of cash flow from voting rights motivate the creation of pyramids.

Almeida and Wolfenzon (2006) present a model of pyramidal ownership that does not rely on separation between ownership and control. In their model, a family has the choice of setting up a new firm (call it firm B) either through a pyramid or directly. The total value created by the new firm has two components: the private benefits enjoyed by the controlling

[11] Kang, Park, and Jang (2006a) also analyze the family's choice of ownership structure in *chaebols*. However, they focus on average ownership characteristics of the entire group rather than on characteristics of individual *chaebol* firms.

[12] This argument goes back at least to the beginning of the 20th century: Berle and Means (1932) and Graham and Dodd (1934) use this argument to explain the creation of pyramids in the US in the early 20th century.

family, and the project's net present value that is shared by all owners (henceforth, the "NPV"). Under the pyramidal structure, firm B is owned by all the shareholders of the original firm (call it firm A). As a result, the family shares the NPV of the new firm with non-family shareholders of firm A. In addition, the family has access to all of the retained earnings (cash) of firm A to acquire equity stakes in firm B. Under direct ownership, non-family shareholders of firm A have no rights to the cash flows of firm B, and thus, the family captures all of its NPV. However, in this case, the family has access only to its share of the retained earnings of firm A (for example, through dividend payments).[13]

This argument generates a number of testable hypotheses. First, firms that generate low pledgeable income (for example, low cash flows) are more likely to be set up in pyramids. These firms find it harder to raise external finance, and thus, the family's ability to use the cash retained in firm A to finance the investment in firm B becomes very valuable. In addition, other firm characteristics that facilitate access to external financing should reduce the likelihood that a firm is placed in a pyramid. For example, firms that can pledge their assets as collateral to raise external finance may not require internal equity investments from the group's central firms and can be owned directly by the family.[14]

The second implication that arises from the theory is that projects with high NPV are more likely to be owned directly by the family. The family is more likely to choose a direct ownership structure for these firms to avoid sharing the high value created with the minority shareholders of firm A. By the same token, the family has incentives to use a pyramidal structure when acquiring a firm that provides high private benefits but low NPV.

Third, since the family places low NPV firms in pyramids, investors should expect low returns from pyramidal investments. If investors anticipate significant future pyramidal investments by a group firm, then they should discount the shares of this firm accordingly to compensate for the expected effects of future pyramidal investments on its equity returns.

We summarize this discussion with a list of the implications about the structure of business groups, which can be tested with our data on Korean *chaebol*s:

Implication 1. The controlling family places new firms with low pledgeability of cash flows/assets in pyramids and directly controls firms with high pledgeability.

[13] Gopalan, Nanda, and Seru (2007) develop a theory of dividends in business groups that uses arguments that resemble those in Almeida and Wolfenzon (2006). In particular, they show how families can use dividends as a way of transferring cash across group firms to finance group investments. Their focus is on explaining group dividend policy rather than ownership structure. See also de Jong et al. (2009), who study the link between dividend policy and leverage among group firms.

[14] It might seem that the family would prefer not to place low pledgeability firms in pyramids as this will only exacerbate the expropriation problem. However, the implication that low pledgeability firms are best placed in pyramids is robust to this effect. In Almeida and Wolfenzon (2006), the controlling family benefits from choosing an ownership structure that minimizes future expropriation of cash flows, since the costs of expropriation are internalized by the family when setting up the new firm. Still, the family may benefit from a pyramidal structure, since the pyramid allows the family to use more internal funds (the cash retained in firm A), and thereby to reduce the amount of external funds that are required to set up the new firm. This financing advantage, in turn, may allow the family to retain higher ownership of the new firm under a pyramidal structure, and thus, to minimize expropriation. In fact, Almeida and Wolfenzon show that when the new firm produces low pledgeable income (for example, when the new firm has low profitability), the pyramidal structure actually reduces expropriation when compared to a direct ownership structure.

Implication 2. The family places low NPV firms in pyramids and directly controls firms with high NPV.

Implication 3. Public group firms that are used by the family to set up and acquire new group firms should have lower valuations than public group firms that are not used for this purpose.

Testing Implication 1 requires a measure of pledgeability of cash flows and assets. We use *reported* profitability as a measure of the pledgeability of cash flows. The reason is that highly profitable firms require less external funds. In addition, it is reasonable to assume that firms can credibly commit to pay out cash flows that they report in audited financial statements. We use tangibility (defined as property, plant, and equipment normalized by assets), and collateral (defined as property, plant, and equipment plus inventories normalized by assets) as proxies for the pledgeability of assets. In addition, we use intangibles (defined as intangible assets normalized by total assets) as a proxy for non-pledgeability of assets.[15] Almeida and Campello (2007) provide evidence that asset tangibility relaxes firm financing constraints by allowing them to pledge a greater fraction of their assets as collateral. The specific collateral proxy that we use (property, plant, and equipment plus inventory) comes from Frank and Goyal (2009), who argue that this proxy is more robustly correlated with firms' leverage ratios than the standard proxy for tangibility.

Implication 1 predicts that high profitability firms are owned directly while low profitability firms are set up in pyramids. This prediction is consistent with evidence in previous studies (see Section 2). However, the interpretation so far has been that this association is evidence that pyramids reduce profitability because they induce tunneling behavior by the family (Bertrand, Mehta, and Mullainathan, 2002; Bae, Kang, and Kim, 2002; Baek, Kang, and Lee, 2006). In contrast, in our argument, the correlation is driven by the opposite direction of causality: lower profitability firms are selected into pyramids. We provide a battery of empirical tests to provide evidence on the direction of causality suggested by the selection hypothesis. First, we examine a sample of firms that are newly added to the *chaebol* during our sample period, and relate their *position* in the *chaebol* to their profitability in the year prior to the firm's addition. Since profitability is measured prior to the firm's acquisition, it cannot be affected by *chaebol* tunneling activities. Second, we also examine additional predictions from the tunneling hypothesis. For example, we use our sample of newly added firms and examine what happens to their profitability in the year following their acquisition by the *chaebol*. The tunneling hypothesis predicts that if a new firm is placed in a pyramid, its profitability should decrease. In contrast, the selection hypothesis makes no such prediction.

[15]We also experimented with other proxies for pledgeability, including capital expenditures over assets(CAPEX), capital-labor, and asset-employee ratios. We believe that the relationship of these variables to the firm's position in the group is less clear than for profitability and collateral-related proxies, since it is confounded by other effects. For example, a firm with high capital expenditures requires more external financing. However, capital expenditures on tangible assets may generate collateral which can be pledged to outside investors. A similar reasoning holds for capital-labor ratios. In our analysis (not reported), firms with high capital expenditures tend to be owned through pyramids. Also, there is no clear correlation between capital-labor ratios and firms' positions in the group.

Testing Implication 2 requires a measure of NPV that can be operationalized in a relatively large sample of firms. In the empirical analysis, we focus on a subsample of firms for which a reasonable proxy for NPV can be constructed. Specifically, we use the sample of newly added firms for which we can obtain data on the acquisition price. The new firm's NPV can then be proxied by the *acquisition premium*. We compute this premium as the ratio of the acquisition price to the book value of the equity of the new firm.[16] The argument above would then predict that the family will use pyramids to acquire a new firm, when the acquisition premium is high. In other words, the family would tend to place firms with high acquisition premia in pyramids, and directly control firms with low acquisition premiums.

Testing Implication 3 requires us to identify the group firms that shareholders expect will be used for acquiring new firms. As Section 5.1.1 shows, there are only a few firms in each group that hold substantial equity stakes in other group firms. We call them the group's central firms. Under the assumption that the family will continue to use the central firms to set up and acquire new firms, these are the firms that should trade at a discount. In order to validate this assumption, we construct a measure of a group firm's *acquisition intensity* during our sample period, defined as the sum of the value of equity stakes acquired by each group firm in the event of an acquisition of a new group firm, divided by the book value of the equity of the acquirer. We then examine whether a group firm's *centrality* helps predict its future *acquisition intensity*. In addition, Implication 3 also suggests that central firms that have shown greater acquisition activity should trade at a larger discount than other central firms that have not been used as acquisitions devices. We examine this implication as well in our empirical tests.

4. Metrics of group ownership structures

In order to test the empirical implications described in Section 3, we develop some new metrics of group structure. Specifically, the theory models the family's choice of whether to set up a new firm as a partial subsidiary of an established firm, or to hold stakes directly. To capture this notion, we define the variable *position*. We also define the variable *centrality* to identify firms that the controlling family uses to set up and acquire new firms. In addition, we argue that the standard measure of voting rights (the weakest link) is difficult to apply to groups with complex ownership structures such as the Korean *chaebol*s. We propose an alternative measure of control in a group, the *critical control threshold*.

We provide formulae and simple algorithms to compute all the metrics we propose. This is crucial for the case of Korea, where the web of ownership relations among group firms can be quite complex. As an illustration of this complexity, in Fig. 1, we have selected only 11 of the 27 firms that form part of the Hyundai Motor group and drawn its ownership structure as of 2004. Needless to say, computing ownership metrics in this group can be a daunting task. Importantly, the formulae we propose can easily deal with any type of ownership structure.

FIGURE 1 ABOUT HERE

[16] Almost all of the newly acquired firms are private, and thus, we cannot compute an acquisition premium using the pre-acquisition market value of these firms.

In Appendix A, we show a numerical example that illustrates the computation of several of the ownership variables described here, including *position*, the *critical control threshold*, and *centrality*.

4.1. Ultimate cash flow rights, position*, and loops*

We start by considering a business groups with N firms. We define the matrix of intercorporate holdings A as follows:

$$A = \begin{bmatrix} 0 & s_{12} & \dots & s_{1N} \\ s_{21} & 0 & \dots & s_{2N} \\ \vdots & \vdots & \vdots & \vdots \\ s_{N1} & \dots & s_{N\,N-1} & 0 \end{bmatrix},$$

where s_{ij} is the stake of firm i in firm j. We also define a vector with the direct stakes of the family in each of the N firms:[17]

$$\mathbf{f}' = \left[\begin{array}{cccc} f_1 & f_2 & \cdots & f_N \end{array} \right]. \tag{1}$$

The key insight to derive all formulas in this section is to follow one dollar of dividends paid by firm i. We write the dividend as a vector of zeroes with a one in the ith position, $\mathbf{d}_i'$. The family receives $\mathbf{f}'\mathbf{d}_i$ when the dividend is paid and group firms receive $A\mathbf{d}_i$. Now suppose group firms pay out to shareholders what they themselves receive as dividends from other companies, i.e., the new dividend is now $A\mathbf{d}_i$. The family receives an additional $\mathbf{f}'(A\mathbf{d}_i)$ and the cash in group firms out of the original dollar paid is $A(A\mathbf{d}_i) = A^2\mathbf{d}_i$. A simple pattern emerges: After n rounds of dividends, the cash position of group firms is $A^n\mathbf{d}_i$.[18]

4.1.1. Ultimate cash flow rights

We can now compute the family's ultimate cash flow rights in firm i, u_i, which is defined as the fraction of the dividend originally paid by firm i that is (eventually) received by the family:

Proposition 1. *The ultimate ownership of the family in each of the n firms is given by $\mathbf{u} = [u_1\ u_2\ \dots\ u_N]'$:*

$$\mathbf{u}' = \mathbf{f}'(I_N - A), \tag{2}$$

where I_N is the $N \times N$ identity matrix.

This formula is easy to use and can accommodate any group structure, regardless of its complexity.[19] Brioschi, Buzzacchi, and Colombo (1989) use a different method to derive this

[17] For brevity, we refer to the controlling shareholder as the "family" in the ensuing discussion.

[18] This argument does not presume that dividends are actually paid. If the dollar is retained in firm i, the formulas will tell us the fraction of the dollar that is owned by the family and the other group firms (e.g., the cash flow rights of the family and group firms).

[19] Most papers in the literature compute cash flow rights by multiplying the stakes along the ownership chain. This is correct under the assumption that no cross-shareholdings exist. Under this assumption, the chain multiplication formula is a special case of Eq. (2).

formula. Essentially the formula works through the matrix of cross-shareholdings to arrive at the ultimate ownership. This is very much in the same spirit as input-output analysis (Leontief, 1986) where the share of an industry or sector in the aggregate economy is being computed.

4.1.2. Position

Using the same idea, we can now compute the *position* of a firm in a group. We define *position* as the distance between the family and a firm in the group. For example, in the case of a simple pyramid with two firms, the firm at the top of the pyramid is in *position* 1 and the one at the bottom is in *position* 2. Since there might be multiple chains from a particular firm to the family, we weigh each chain by its importance in terms of the cash flows the family receives. Note that the family receives $\mathbf{f}'\mathbf{d}_i$ from firm i directly (*position* 1). It also receives $\mathbf{f}'A\mathbf{d}_i$ from firm i through chains that contain one intermediate firm (*position* 2) and so on. Therefore, the *position* of firm i is defined by

$$position_i = \frac{\mathbf{f}'\mathbf{d}_i}{u_i} \cdot 1 + \frac{\mathbf{f}'A\mathbf{d}_i}{u_i} \cdot 2 + \frac{\mathbf{f}'A^2\mathbf{d}_i}{u_i} \cdot 3 \cdots = \sum_{n=1}^{\infty} \frac{\mathbf{f}'A^{n-1}\mathbf{d}_i}{u_i} \cdot n. \tag{3}$$

Simplifying this expression leads to:[20]

Proposition 2. *The* position *of firm i can be written as :*

$$pos_i = \frac{1}{u_i}\mathbf{f}'(I_N - A)^{-2}\mathbf{d}_i \tag{4}$$

where I_N is the $N \times N$ identity matrix.

4.1.3. Loops

While it is not the main focus of the empirical tests, we can also use these calculations to check whether a firm is part of a cross-ownership pattern and to compute the number of firms involved in this loop. Essentially, if a dividend paid by firm i eventually reappears in firm i, then i is part of a loop. Also, the number of chains that it takes for funds to reappear for the first time in firm i measures the number of firms in the shortest loop, which we define as *loop*:

Definition 1. *Let*

$$loop_i = \min\{n | n \geq 1 \text{ and } \mathbf{d}_i'A^n\mathbf{d}_i > 0\}, \tag{5}$$

then firm i is in a loop if and only if $loop_i < \infty$. The number of firms in the shortest loop firm i is involved in is given by $loop_i$.

[20] Kang, Park, and Jang (2006b) derive an alternative measure of a firm's position in a group based on whether a firm owns significant equity in other group firms, or whether other firms own a large fraction of the firm's equity. The first component of the definition creates a mechanical correlation with our centrality variable (defined below), and so we believe our definition is more appropriate to the general case of complex ownership structures.

4.2. Control rights and centrality

The computation of control rights in a complex group is challenging because it is not clear what fraction of the votes held by intermediate firms is ultimately controlled by the family. The most frequently used measure in the literature is the weakest link, which is defined as the minimum stake along the chain of control. This measure is intuitive for simple pyramids: the controlling family must have a better grip on the control of a firm that is higher up in the pyramid than over a firm lower down that is controlled via the initial one. Yet, this measure has some drawbacks. First, when there are multiple chains used to control a firm, the definition calls for adding up the minimums over all chains. The intuition for this is not as clear. Second, in groups where there are multiple chains leading to one firm, this definition can generate numbers above 100%.[21] Finally, the weakest link is not well-defined for firms that are part of loops as there are infinite chains leading to these firms.

In light of these problems, we define our own measure of control, the *critical control threshold*. Essentially, the *critical control threshold*, or CC in short, is the maximum control threshold for which the firm belongs to the set of firms controlled by the family. This new definition has several appealing features. First, it can be defined for any group structure, regardless of its complexity. Second, it is derived from clearly stated assumptions about the characteristics of control. Finally, it turns out that this measure is equivalent to the weakest link when cross-shareholdings and multiple links are absent (that is, for simple pyramids).[22] In that sense, it is a reasonable generalization of that simple, intuitive concept.

4.2.1. The set of firms controlled by the family

To compute the set of firms controlled by the family, we make two assumptions:

Assumption 1. *A family controls a firm if and only if it holds more than T votes in it, directly or indirectly.*

Assumption 2. *The votes that a family holds in a firm are the sum of its direct votes, plus all the direct votes of firms under family control, where control is defined in Assumption 1.*

This definition of control is a combination of the idea of a control threshold (Assumption 1), plus the assumption that, if a family controls a firm, it controls the votes that this firm holds in other firms. The following proposition establishes the formal condition that the set of firms controlled by the family must satisfy (for a given control threshold T). Suppose we start the analysis with a set N, which contains the universe of all candidate firms that could be controlled by the family. For example, this set can represent all firms in a country, or a pre-identified subset of those firms. We then have:

[21] Simple examples are available from the authors upon request.

[22] In particular, if cross-shareholdings and multiple links are absent or not very substantial the weakest link methodology can be used to compute control rights. For example, Faccio and Lang (2002) show that neither problem is very prevalent in Europe, justifying the use of the weakest link as a measure of control in their sample.

Proposition 3. *For a given threshold T, the set of firms controlled by the family is given by:*

$$C(T) = \{i \in N : f_i + \sum_{j \in C(T),\ j \neq i} s_{ji} \geq T\}. \tag{6}$$

In Appendix B we describe an algorithm that can be used to find $C(T)$.

4.2.2. Critical control threshold: Definition

We can now define our measure of control rights:

Definition 2. *For any firm $i \in N$, the* critical control threshold *is given by*

$$CC_i = \max\{T \mid i \in C(T)\} \tag{7}$$

The *critical control threshold* is the highest control threshold that is consistent with family control of firm i. In other words, if the control threshold were higher than CC_i, then firm i would not be part of the set of firms controlled by the family.

4.2.3. Centrality of a firm for the control of the group

In the empirical tests, we need to identify group firms that the controlling family uses to set up and control new firms. We identify such firms as those that are important for the control of other firms. This leads to the following definition.[23]

Definition 3. *We define the* centrality *of a firm i as:*

$$central_i = \frac{\sum_{j \neq i} CC_j - \sum_{j \neq i} CC_j^{-i}}{\sharp N - 1}, \tag{8}$$

where CC_j^{-i} is the critical control threshold *of firm j, computed as if firm i held no shares in the other group firms.*

In words, we compute the *centrality* of firm i as the average decrease in CC across all group firms other than firm i, after we exclude firm i from the group. This computation essentially determines how central a firm is, by comparing the average *critical control treshold* with and without including the stakes the firm holds in other firms.

In order to show that the empirical results are not driven by the control proxy that we use, we also experiment with an alternative measure of *centrality* that is based only on the direct equity stakes that each firm holds in other group firms. If we let A_j be the total assets and E_j be the total equity of firm j, we have the following definition:

[23] Kim and Sung (2006) compute a similar variable for Korea, using cash flow rights instead of voting rights. They show that their measure of centrality is inversely related to the probability that the firm goes public. In contrast, we show below that firms with a high centrality value are much more likely to be public in our sample.

Definition 4. *We define the aggregate equity* stake *of firm i in other group firms as:*

$$stake_i = \frac{\sum_j s_{ij} E_j}{A_i}. \tag{9}$$

This measure is essentially the total size of the equity stake that firm i holds in other group firms, normalized by the total assets of firm i. We normalize by the assets of firm i because firm i's valuation is more likely to be affected when the equity stakes are large relative to the size of firm i.

4.2.4. Consistent voting rights

Besides the weakest link, the previous literature has also used an alternative measure of voting rights (VR), namely the sum of the direct stakes held by the controlling shareholder, and all stakes held by firms controlled by this shareholder (La Porta et al., 1999; and Lins, 2003).[24]

Definition 5. *Given a threshold T, the* consistent voting rights *of the family in firm $i \in C(T)$ are defined as:*

$$VR_i(T) = f_i + \sum_{j \in C(T),\ j \neq i} s_{ji}. \tag{10}$$

In words, to compute the sum of the votes held by the family in firm i, we simply add the direct votes held by the family in firm i with all the votes held by other firms that belong to $C(T)$. Since we only count indirect votes of firms provided that they belong to the control set, this definition of voting rights is (internally) consistent. The VR measure is also the measure that is used by Korean regulators to compute the separation between ownership and control in *chaebol* firms.

5. Data description

This section describes the sources for the ownership, accounting, and financial data that we use in this study.

5.1. Ownership data

The ownership data for our study are from the Korean Fair Trade Commission (KFTC), which was established in 1981 with the purpose of regulating competition. In particular, the KFTC's stated goal is to deter excessive concentration of economic power in a small number of large companies, including *chaebols.* Among other regulatory constraints, the KFTC

[24] Some researchers attribute the weakest-link measure to the paper by La Porta et al. (1999), but, in fact, they use a different definition of voting rights which is closer to the VR measure. Specifically, they measure indirect ownership in a firm i as the percentage of votes that other group firms hold directly in firm i, provided that these other group firms are also controlled by the family (under control thresholds of either 10% or 20%). See Table I on p. 478 of their paper.

requires that *chaebol* firms report complete ownership data. *chaebols* are required to report the status of affiliate shareholders and persons with special interest and the financial status of group companies as of April 1 of each year. Shareholders are categorized into seven types; family owner, the relatives of the family owner, affiliates, nonprofit affiliate, group officer, treasury stock, and others. In addition, our data contain the name, the holding quantity, and the ratio of common stocks and preferred stocks of each individual shareholder.

The KFTC defines a *chaebol* in two steps.[25] In the first step, the KFTC defines the set of firms that belong to a business group. There are two criteria for this. The first is based on stock ownership. According to this criterion, a firm belongs to a business group if ownership by the controlling shareholder and related persons (relatives and other affiliated companies of the same business group) amounts to more than 30%, excluding preferred shares. The second criterion is qualitative. Firms are also classified as belonging to a business group when the controlling shareholder exercises "controlling influence" over it. The latter criterion is further detailed to include cases of exchange of directors and managers, and also substantial business transactions between a firm that belongs to the business group and the company in question. Because this criterion of controlling influence is interpreted broadly, some companies legally belong to a group even though neither the families, nor other affiliated companies in the group, own shares in those companies.

In the second step, some business groups are designated as *chaebols* based on size, which is defined as the value of the combined total assets of affiliated companies in the group. From 1987 to 2001, the KFTC annually designated the 30 largest business groups as *chaebols*. From 2002 onwards, the KFTC started using a new category by including any group with total combined assets greater than a certain cutoff, which currently is two trillion won.[26]

From the ownership and financial database that the KFTC has maintained, we obtained data for the period 1998–2004. We focus only on business groups with the ownership of a natural person (i.e., family business groups), and exclude other business groups such as government-controlled business groups. Our ownership data contain 3,545 firm-year observations.

In some tests we use the subsample of firms that were newly added to the *chaebol* during our sample period. We describe these data later.

5.1.1. *Summary statistics: Ownership variables and firm characteristics*

Table 1 shows the average values for the ownership variables across all firm-years in our sample (Panel A), and the cross-correlation matrix (Panel B). We also include other firm characteristics that we use in the analysis.

TABLE 1 ABOUT HERE

Panel A shows that there are a total of 47 groups and 1,085 firms that were present at some point in the sample between 1998 and 2004. The controlling family holds 13% of the

[25] To be more precise, the KFTC's definition that we describe here is that of a *large business group*. A *chaebol* is a *large business group* that is controlled by a family. Because our sample contains only family controlled groups, we refer to *chaebols* and *large business groups* interchangeably.

[26] Based on the won/dollar exchange rate of 946 on March 9, 2007, two trillion won amounts to approximately 2.1 billion US dollars.

cash flows of the median firm, but it holds substantially more votes according to our two alternative measures of voting power. The *consistent voting rights* measure (VR) yields the largest voting power. The family and the affiliate firms hold 68% of the votes of the median firm in the sample. In contrast, the *critical control threshold* (CC) of the median firm is 30%.

The data also indicate a substantial degree of pyramiding in Korean *chaebols* (the median *position* of a firm is 2.06), but with substantial cross-sectional variation (for example, 25% of the firms show an average *position* lower than 1.40). The typical pyramid is not deep (the 75th percentile of the *position* variable is approximately 2.5). Thus, while many *chaebol* firms are owned through pyramids, most of the time there is only one intermediate firm between the firm in question and the family.

Regarding *centrality*, the main pattern is that only a few firms are central for the group structure. The 75th percentile of *centrality* is zero. Similarly, the median aggregate *stake* held by group firms in other firms is zero, and the 75th percentile is just 3.5%. This statistic suggests that only a small fraction of firms hold substantial stakes in other firms.

The relatively flat structure of Korean *chaebols*, coupled with the fact that only a few *chaebol* firms are central, helps us in the design of the empirical test of Implication 3 (the valuation implication). Implication 3 states that firms that are used by the family to set up and acquire new group firms (firm A in the theory) should trade at a discount, due to the anticipation of *future* pyramidal investments. The structure of Korean *chaebols* suggests that we can indeed identify firm A in the data using the *centrality* variable. If a typical *chaebol* had several layers and many central firms, then it would be difficult to predict which firms are likely to make future pyramidal investments. We also confirm this assumption by studying whether central firms are more active acquirers than other firms.

Most *chaebol* firms are private (74% of firm-years involve unlisted firms). The median *chaebol* firm is 13 years old and has 190 employees. Therefore, despite the presence of a few very large firms in the sample, a typical *chaebol* involves many firms that are small, young, and privately held. The summary statistics also show that 25% of the firm-years involve firms in indirect cross-shareholding loops.[27] The high incidence of cross-shareholdings underscores the importance of taking cross-shareholdings into account when computing the other ownership measures.

In Panel B, we present the simple correlations among the ownership variables and the other firm characteristics in Panel A. The correlations show that public firms, central firms, and firms in cross-shareholding loops tend to be higher up in the group structure (negative correlation with *position*). These variables are also correlated among themselves, that is, central firms are more likely to be public and belong to loops. Regarding firm characteristics, central firms are, on average, older, larger, and more likely to be public than other group firms. The same pattern holds for *cross-shareholdings*, which are more common among public, larger, and older firms. *Position*, in turn, is negatively correlated with age, public

[27] The fraction of firms participating in cross-shareholding loops may seem surprising, given the fact that Korean regulation prohibits direct cross-shareholdings in *chaebols*. However, out of the 893 firm-years in which firms are involved in cross-shareholdings, we find that 72% belong to loops involving three firms, 13% are in loops involving four firms, and 6% are in loops involving five firms or more. Thus, Korean *chaebols* appear to circumvent the regulations prohibiting cross-shareholdings by creating loops of three or more firms.

status, and the number of employees.[28]

The measures of cash flow rights and separation between ownership and control display expected patterns. The family has higher *ultimate ownership* in private, and smaller firms. *Position* is highly positively correlated with both of the separation measures, indicating that firms in pyramids have higher separation between ownership and control.

5.1.2. The typical structure of a Korean chaebol

Fig. 2 summarizes the statistics above by charting the ownership structure of the typical *chaebol*. We can think of a typical *chaebol* structure as being organized in three layers. Some firms (firms 1, 2 in the figure) are owned directly at the very top of the group (a *position* value close to one), without ownership links to the other firms. The middle layer contains firms that belong to cross-shareholding loops, and also central firms (firms 3, 4 and 5). Unlike the firms in the top layer, firms in this middle layer hold equity stakes in other *chaebol* firms, including other firms in the middle layer and firms in the bottom layer (such as firms 6, 7, etc.). Central firms in the middle layer tend to be public, and they are, on average, larger and older than other *chaebol* firms. In the bottom layer, in contrast, we observe firms that are more likely to be private, smaller, and younger. These firms do not own substantial stakes in other firms.

<u>FIGURE 2 ABOUT HERE</u>

Overall, this snapshot of *chaebol* structure is largely consistent with a historical evolution of *chaebol*s. *chaebol*s appear to have grown as the controlling family used successful (e.g., large, public) group firms to set up and acquire new group firms that are placed at the bottom of the group, i.e., those with high *position* values.[29]

5.2. Accounting and financial data

In addition to the data obtained from the KFTC, we also used two other databases developed by Korea Listed Companies Association (KLCA) and Korea Investors Service (KIS), respectively, to obtain additional financial information. KLCA and KIS's databases contain information not only on listed companies, but also on some private firms that are subject to external audit. We follow the standard procedure of dropping the data on financial institutions (insurance, brokerage, and other financial institutions), which comprise 316 firm-years of the 3,545 firm-years of the sample. These firms are subject to specific regulations and accounting rules that make their financial statements less comparable to the other *chaebol* firms, which are mostly in the manufacturing sector.

Our measure of profitability is profits before interest and taxes normalized by assets. However, to correctly measure the profitability of each individual *chaebol* firm, we need

[28] Despite the negative correlation between *centrality* and *position*, we note that there is also a significant amount of variation in position among non-central firms. This variation is important, because it allows us to test some of the theoretical predictions described above. To illustrate this point, we compute the standard deviation in *position* for firms that have a *centrality* value lower than the mean (0.02). This standard deviation is 0.81, which is virtually identical to the standard deviation in the entire sample reported in Table 1 (0.82).

[29] Aganin and Volpin (2005) also report similar evidence for one particular Italian business group (the Pesenti group).

to ensure that reported figures are not affected by equity stakes that a *chaebol* firm holds in other firms. Starting in 1999, the financial statements of Korean *chaebol* firms became subject to the equity method reporting rule. The basic idea behind this accounting rule is to record firm A's share of firm B's equity as an asset for firm A, and firm A's share of firm B's profits as a source of non-operating income for firm A. The financial statements contain enough information to allow us to back out the exact amount by which accounting figures have been adjusted because of these equity stakes. We use this information to calculate our measures of assets and profitability for *chaebol* firms, which we denote *stand alone assets* and *stand-alone profitability.* The details are provided in Appendix C.

There are similar issues involved in the computation of a measure of Tobin's Q for *chaebol* firms. The market value of a publicly listed *chaebol* firm includes the value of the equity stakes that this firm holds in other *chaebol* firms, both listed and unlisted. However, adjusting for the value of equity stakes is more difficult because the market value of private firms (which comprise a large fraction of the sample) is not observable. Therefore, our preferred measure of valuation is a measure of Q that is unadjusted for the value of equity stakes:

$$Q = \frac{EV + \text{Book value of liabilities}}{\text{Book value of assets}}, \tag{11}$$

where EV is the market value of equity.

To show that the results are not driven by mismeasurement, we also experiment with a measure of Q that takes the value of equity stakes into account, "stand-alone Q ":

$$Q_{sa} = \frac{EV + \text{Book value of liabilities - Value of equity stakes}}{\textit{Stand-alone assets}}. \tag{12}$$

To compute Q_{sa}, we assume that private firms are valued at book value. Provided this assumption is correct, Q_{sa} can be interpreted as the Q that a group firm would have if it were valued as a stand-alone entity.

We use non-current liabilities divided by *stand-alone assets* to measure *leverage*, the absolute value of the difference between operating cash flows over *stand-alone assets* and net income over *stand-alone assets* to measure *accruals*, and we normalize *dividends* and *capital expenditures* by *stand-alone assets.*[30] We define *tangibility* as property, plant, and equipment divided by *stand-alone assets*, *intangibles* as the ratio of intangible assets to *stand-alone assets*, and *collateral* as the ratio of the sum of property, plant and equipment and inventories to *stand-alone assets.*[31]

Finally, we use acquisition data to test some of the implications of the theory. We estimate the NPV of acquisitions of new firms by the *chaebol* using the *acquisition premium*:

$$\textit{Acquisition premium} = \frac{\text{Acquisition price}}{\text{Book value of equity}}.$$

In order to compute this variable, we first identify those firms that appear for the first time in the ownership data of the KFTC. There are 303 firms that are newly added to a *chaebol*

[30] Korean cash flow statements disaggregate gross investments in tangible assets (e.g., increase in buildings) from the liquidation of tangible assets (e.g., decrease in buildings). Our *capital expenditure* measure is the sum of all gross investment items minus the sum of all liquidation items (e.g., net capital expenditures).

[31] Frank and Goyal (2009) propose the use of this collateral variable in lieu of a standard tangibility measure in the context of capital structure regressions.

during our sample period (1998–2004). Calculation of the *acquisition premium* requires the book value of equity and the acquisition price. Out of 303 firms, there are 214 firms for which the accounting data are available from KLCA and KIS. Out of these 214 firms, acquisition prices are obtained for 144 firms from the electronic disclosure system, DART (Data Analysis, Retrieval and Transfer System) of the Korean FSS (Financial Supervisory Service). In some cases, the new firms represent new establishments, and not acquisitions of existing firms. In other cases, the data on the acquisition price are not available. The book value of equity is obtained from KLCA and KIS.

We also estimate the extent to which a *chaebol* firm is used by the family to acquire stakes in other firms with the variable *acquisition intensity*, which is the sum of the value of equity stakes acquired by each group firm in the event of an acquisition of a new group firm, divided by the book value of the equity of the acquirer. We use the same sample of acquisitions of new firms with available accounting data (described above) to compute this variable.

5.2.1. Summary statistics: Accounting and valuation data

Table 2, Panel A, reports the summary statistics for the accounting and valuation variables. Given data availability, we end up with a sample of 2,695 firm-years between 1998 and 2004.[32] *Stand-alone assets* are lower than total assets because of the adjustment for equity stakes (approximately by 10%, on average). There are a total of 823 firm-years available for public firms between 1998 and 2004. Notice that Q_{sa} and Q have very similar distributions.[33] Finally, notice that the median *acquisition premium* is 1.07, and the mean is 1.54, indicating that the family pays large premiums for some of the acquisitions.

TABLE 2 ABOUT HERE

Panel B displays some of the correlations between the financial and ownership variables. Some patterns worth noting are as follows. *Stand-alone assets* are positively correlated with *centrality* and negatively correlated with *position*. Q is negatively correlated with both *centrality* and separation between ownership and control, but only if such separation is measured using the CC measure of control. *Capital expenditures* and the *acquisition premium* are positively correlated with *position*, and *centrality* is positively correlated with *acquisition intensity*.

6. Empirical tests

In this section we test the hypotheses that relate group structure to accounting and financial variables (Implications 1 to 3). These implications are all based on the selection

[32] The data for *stand-alone profitability*, *stand-alone Q*, *dividends*, *accruals*, and *acquisition premium* are winsorized at the 1th and 99th percentiles.

[33] This is consistent with the results in Bohren and Michalsen (1994), who compute distortions due to double-counting of value of firms with cross-shareholdings in Norway. Valuation metrics such as price-earnings ratio are relatively unaffected by cross-shareholdings, since there is double-counting in both the numerator and the denominator. In contrast, French and Poterba (1991) report a substantial effect of cross-shareholdings on price-earnings ratios in Japan in the 1980s.

hypothesis that we develop in Section 3. In addition, we test some implications that are specific to the tunneling hypothesis, with the goal of evaluating the relative importance of these two hypotheses in our data.

6.1. Family ownership and profitability

The previous literature shows a positive correlation between profitability and ultimate ownership. In this section we estimate the following empirical model and show that we are able to replicate previous results in our data:

$$\begin{aligned} \textit{Stand-alone profitability}_{i,t} &= \beta_1 \text{ Ownership variable}_{it} + \boldsymbol{\beta}\mathbf{Controls}_{it} + \\ &+ \sum_j \textit{industry}_j + \sum_t \textit{year}_t + \varepsilon_{i,t}, \end{aligned} \tag{13}$$

where we use both ultimate ownership and the measures of separation between ownership and control as alternative ownership variables. The vector of controls includes firm size (measured by the log of stand-alone assets), age, public status, and leverage. In some specifications, we include other measures of group structure (namely *centrality* and *cross-shareholdings*) to examine their correlations with profitability. In addition, we control for industry and year fixed effects. The industry classification corresponds roughly to a two-digit standard industrial classification (SIC) in the US (there are 45 different industries in the sample). In some specifications, we also include group fixed effects to measure within-group effects. The standard errors are clustered at the level of the firm.

The results are presented in Table 3. Column 1 shows the standard positive correlation between ultimate ownership and profitability. This correlation is robust to the inclusion of group dummies (column 2). Interestingly, ultimate ownership appears to be more robustly related to profitability than the measures of separation between ownership and control (columns 3 to 6). These results show that we can replicate previous findings in our data.

TABLE 3 ABOUT HERE

A result to be noted in Table 3 is the negative correlation between *centrality* and profitability (columns 7 and 8). Despite the fact that central firms are higher up in the group structure relative to pyramidal firms, this finding does not contradict standard findings in the literature. In fact, notice that the positive correlation between ultimate ownership and profitability continues to hold after including *centrality* in the regressions. In other words, central group firms have lower profitability than other group firms, irrespective of the family's ultimate ownership. We discuss this finding further in Section 7.

6.2. Pyramids and profitability

In order to examine the family's choice of where to place a firm in the group structure, we estimate empirical models in which position is the dependent variable:

$$\textit{Position}_{i,t} = \alpha_1 \textit{Stand-alone profitability}_{i,t-1} + \boldsymbol{\Phi}\mathbf{Controls}_{it} + \tag{14}$$

$$+ \sum_j \textit{industry}_j + \sum_t \textit{year}_t + \varepsilon_{i,t}. \tag{15}$$

The selection hypothesis predicts that the controlling family is more likely to place a firm in a pyramid (high *position*) if the firm has low profitability, as per Implication 1. Thus, the coefficient α_1 should be negative. We use lagged profitability because the theory on group formation suggests that profitability should predict pyramidal ownership. We recognize, though, that simply lagging this variable is not sufficient to provide evidence on causality, and we address the issue of causality in greater detail below. The controls are identical to those used in Table 3 above (firm size, age, public status, *leverage*, and dummies for year, industry, and group in some specifications).

The selection hypothesis has no clear prediction about the relative profitability of central firms (those at the middle layer of Fig. 2, such as "firm 3"). Instead, it predicts that firms that are owned directly by the family (such as "firm 1") should have higher profitability than firms that the family places in pyramids (such as "firm 6"). This observation suggests that the effect of profitability on a firm's *position* should be driven by variations in *position* among non-central firms. In order to verify whether this is true, we also estimate Eq. (14) separately for central and non-central firms. We divide the sample in central and non-central firms using the mean value of *centrality* as a cutoff. In the following tables, *central* firms (*non-central* firms) are those for which *centrality* is greater (lower) than its mean value of 0.02 (see Table 1).

In addition, we also use the sample of *non-central* firms but replace the position variable with a dummy variable (*pyramid*) that takes the value of one if a firm is owned through a pyramid, and zero if the firm is owned directly. We classify a firm as being owned through a pyramid if its *position* is greater than or equal to 2.0 (recall that a *position* of 2.0 characterizes a pure pyramid). The firm is owned directly if its *position* is lower than 1.5. This discrete classification of firms into pyramidal versus direct ownership ensures that the results are, in fact, driven by a comparison between *non-central* firms at the top, with *non-central* firms at the bottom of the group. Since the dependent variable is a dummy, we use a probit specification in these regressions.

The results are reported in Table 4. Columns 1 and 2, which include both *central* and *non-central* firms, show that lagged profitability is correlated with *position* in a way that is consistent with the selection hypothesis, both before and after controlling for group fixed effects. The control variables have the expected sign. For example, older and larger firms are more likely to be found at the top of the group.

TABLE 4 ABOUT HERE

Consistent with Implication 1, these correlations are driven mostly by variation among *non-central* firms (columns 3 and 4). This result is further confirmed by the probit regressions in columns 5 and 6. *Non-central* pyramidal firms do appear to have lower profitability than *non-central*, directly owned firms.

6.3. Does profitability predict pyramidal ownership?

The lower profitability of *non-central* firms placed at the bottom of the group reported in Table 4 is consistent with the selection hypothesis. However, these results are not sufficient to rule out an alternative explanation due to the tunneling hypothesis, which predicts that the family will divert resources away from firms that are placed in pyramids. In this subsection, we provide two additional tests that attempt to distinguish between the selection and the tunneling stories. Both tests exploit the dynamic nature of our data, in that they both focus on large shocks to the group structure.

6.3.1. Evidence from large changes in position

One of the challenges in interpreting the results in Table 4 is that lagging profitability is not sufficient to show that it influences a firm's *position* because the *position* of an individual group firm does not vary much over time. It could also be the case that past profitability was determined by the firm's relative *position* in the group, which might be very similar to the current *position*. In fact, in most firm-years, *position* changes very little. The 25th percentile of the distribution of annual firm-level changes in the *position* variable is -0.024, while the 75th percentile is 0.04. Thus, most of the variation in *position* is cross-sectional.

In order to provide additional evidence for the selection hypothesis, we experiment with instances of large changes in a firm's *position* in a group. Specifically, we create dummy variables that capture cases in which a firm's *position* changed by more than 0.10 from one year to the next. This cutoff represents more than 10% of the total standard deviation in the *position* variable.[34] The variable *position increase* takes the value of one if *position* increased by more than 0.10 from one year to the next, and zero otherwise (there are 388 firm-years that satisfy this criterion). The variable *position decrease* takes the value of one if *position* decreased by more than 0.10 from one year to the next, and zero otherwise (there are 278 firm-years that satisfy this criterion). We then replace the variable *position* with *position increase* and *position decrease* in Eq. (14). Since our dependent variable is a dummy, we use a probit model for these regressions.

The results from these regressions are reported in the first four columns of Table 5. Clearly, lagged profitability helps predict large changes in *position* in a way that is consistent with the selection hypothesis. The first two columns show that low past profitability predicts increases in a firm's *position* in the group structure, both before and after controlling for group fixed effects. Thus, poor past performance predicts that a firm will be moved to the bottom of the pyramid. High past profitability is also positively correlated with decreases in *position*, though the coefficients are not statistically significant.

TABLE 5 ABOUT HERE

6.3.2. Evidence from new chaebol firms

A different way to overcome the lack of time-series variability in the *position* variable is to examine cases in which the family decides for the first time where to place a firm in the group structure. Specifically, there are 303 firms in our data that appear as *chaebol* firms for the first time in the sample window of 1998–2004. For 163 of these firms, we also have performance data the year prior to their inclusion. While the size of the sample is drastically reduced if we study only these firms, examining a firm's profitability before it is added to

[34] The results that we present are invariant to the particular cutoff used. We have also experimented with using changes larger than the mean change in *position* (0.03), or changes larger than certain percentiles of the distribution of the *position* variable (25*th* and 75*th* for example).

a *chaebol* allows for sharper tests of causality. To wit, if lower profitability does predict pyramidal ownership (Implication 1), then the relationship uncovered in Table 4 should also hold if we measure the firm's profitability before it became a *chaebol* firm. Presumably, a firm's profitability in the year prior to becoming a *chaebol* firm cannot be affected by the ownership structure chosen later by the *chaebol*'s controlling family. However, pre-*chaebol* profitability should explain the firm's ownership structure, according to Implication 1.[35]

The last four columns of Table 5 contain the results. In columns 5 and 6, we run the regression in Eq. (14) using only the sample of new *chaebol* firms. Low profitability continues to predict that a new firm will be controlled through a pyramid (high *position*), before and after including group dummies. These results suggest that when the family adds a new firm to the group that has low profitability relative to other group firms, it is more likely to place such a firm in a pyramidal structure. These results support the direction of causality suggested by the selection story. The economic magnitude of the profitability effect also appears to be large. In column 5, for example, the estimates imply that a one-standard-deviation decrease in *stand-alone profitability* (0.12, according to Table 2) increases the firm's first *position* in the group by approximately 0.18 (which corresponds to 22% of the overall standard deviation of the *position* variable, which is equal to 0.82 in Table 1).

In columns 7 to 8, we perform two robustness checks. First, notice that our argument rests on the assumption that a firm's profitability in the year prior to becoming a *chaebol* firm cannot be affected by its ownership structure. Nevertheless, in some cases, a firm might have been owned by another *chaebol* in the year prior to its acquisition, and through a pyramid. In these cases, the firm's lagged profitability might have been affected by its placement in a pyramidal structure. To ensure that this story does not explain our results, we eliminate all cases in which we can determine that a firm belonged to another *chaebol* in the year prior to its first appearance in a new *chaebol*. There are 16 of these cases. As column 7 shows, eliminating these firms does not affect the previous results. Second, we replicate the results using the dummy variable *pyramid* defined above, rather than *position*. Column 8, which uses a probit specification, shows that low pre-*chaebol* profitability predicts that a firm will be placed in a pyramid by the *chaebol*.

6.4. Position and stock measures of pledgeability

We interpret the negative effect of profitability on *position* reported above as a result of the selection hypothesis. Since firms with low profitability produce a smaller flow of pledgeable income, the family finds it valuable to use the internal equity of other group firms (rather than external funds) to finance investment in new firms added to the group. In contrast, firms with high profitability require less external funding and thus less internal group equity. This argument suggests that the nature of the assets of new group firms can also affect their *position* in the group. Specifically, firms that have a larger stock of pledgeable assets could find it easier to raise funds in external capital markets, and thus require less group equity. In this subsection, we examine whether stock-based proxies for pledgeability are also related to the firm's *position* in the group in a way that is consistent with the selection hypothesis.

In order to do this, we estimate the following empirical model, which relates the firm's

[35] When running these regressions, we also lag the values of the other control variables that are available in the year prior to the firm's addition to the chaebol (size and *leverage*).

position in the group to stock-based proxies for pledgeability (denoted by *stock variable*):

$$\begin{aligned} Position_{i,t} &= \delta_1 Stock\ variable_{i,t-1} + \mathbf{\Phi Controls}_{it} + \\ &\quad + \sum_j industry_j + \sum_t year_t + \varepsilon_{i,t}. \end{aligned} \tag{16}$$

We use three alternative proxies for the stock of pledgeable assets, namely *tangibility*, *collateral*, and *intangibles*. Firms with low *tangibility* and *collateral* and high *intangibles* (which are all measured relative to the firm's *stand-alone assets*) should be placed in pyramids. As in Section 6.3.2, we use the sample of new firms for these tests, so that all stock variables are measured prior to the firm's inclusion in the *chaebol* to mitigate endogeneity concerns. As in Table 5, we also measure the new firm's size and *leverage* in the year prior to *chaebol* inclusion. In addition, since profitability could be correlated with these stock variables, we include pre-*chaebol* profitability in the regressions. We use both *position* and also the *pyramid* dummy in the regressions.

TABLE 6 ABOUT HERE

The results are presented in Table 6. Consistent with the selection hypothesis, there is a negative correlation between pre-*chaebol tangibility* and *collateral* and a new firm's *position* in the *chaebol*, and a positive correlation between *intangibles* and *position*. Nevertheless, with the exception of *collateral* in column 4, which is significant at a 10% level, the coefficients are statistically insignificant. Thus, while the empirical evidence is suggestive of a selection of firms with low asset pledgeability into pyramids, the evidence is inconclusive.

6.5. Testing predictions of the tunneling argument

While the previous results support the selection hypothesis, they do not directly refute the tunneling argument. In order to provide a more direct test of the tunneling hypothesis, we would need exogenous variation in a firm's *position* to test whether changes in *position* have a causal effect on profitability. In the absence of such variation, we experiment with an alternative strategy, which involves testing auxiliary predictions of the tunneling hypothesis.

First, in the sample of firms added to the group, we examine the change in profitability around group inclusion. While the selection argument makes no specific prediction about this change, the tunneling story predicts that profitability should go down if the firm is placed in a pyramid, rather than in a direct ownership structure. In addition, because tunneling might increase when the firm is placed in a group (irrespective of its *position*), we examine whether profitability decreases, on average, from the year prior to the year following the firm's addition to the *chaebol*.

Second, we examine dividends paid by group firms. The tunneling story predicts that subsidiaries at the bottom of the group are likely to pay lower dividends than firms at the top of the group, as cash flows are diverted to other group firms. We test this implication by examining the relationship between dividends and the firm's *position* in the *chaebol*, for the entire sample of *chaebol* firms. In addition, we use the smaller sample of newly added *chaebol* firms and examine the change in dividends from the year prior to the year following the firm's addition to the *chaebol*. As with the profitability tests, we look at both the average change in dividends, and also whether this change is related to the firm's *position* in the *chaebol* in a way that might suggest tunneling (e.g., greater decrease in dividends for firms that are placed in pyramids).

Third, we look at whether financial statements are manipulated to hide potential tunneling activities. In particular, one might expect to find a large difference between earnings and cash flows due to accruals in firms that are placed in pyramids, as the family attempts to hide the impact of tunneling activities on pyramidal firms' cash flows. To see whether this holds in our data, we implement the same tests that we do for dividends. In other words, we look at the relationship between *accruals* and *position* in the full sample of *chaebol* firms, and also examine the pre- to post-*chaebol* change in *accruals*, and whether this change is associated with the firm's initial *position* in the *chaebol*.

The results are reported in Table 7. The first two columns examine the relationship between *dividends*, *accruals*, and *position* in the full sample of firms. In these regressions, we use the same controls as those used above (*firm age*, size, public status, and *leverage*). In addition, in the dividend regressions we include profitability among the controls, since profitable firms are likely to be able to pay higher dividends. We note, however, that the results that we report do not change if we exclude profitability from the control set. Column 1 shows that there is no significant relationship between a firm's *position* in the group and the amount of dividends that it pays out to shareholders. The accrual regression (column 2) also shows a lack of correlation between a firm's *position* in the *chaebol* and the magnitude of *accruals*.[36]

<u>TABLE 7 ABOUT HERE</u>

Columns 3 to 8 examine the pre- to post-*chaebol* changes in *dividends*, *accruals*, and profitability for the sample of firms that are added to *chaebol*s during our sample period. If the year of a firm's addition to the *chaebol* is year t, these changes are calculated from year $t-1$ (that is, the year prior to the firm's addition) to year $t+1$ (the year following the firm's addition). In these regressions, the constant term captures the average change in these variables, from year $t-1$ to year $t+1$. We experiment with a specification with no controls, and also with a specification in which we include the same controls used in Tables 5 and 6, plus the firm's initial *position* in the group.[37] Thus, we can also examine whether the changes in *dividends*, *stand-alone profitability*, or *accruals* are related to the firm's *position* in the group in a way that is consistent with the tunneling hypothesis.

The results do not support the tunneling hypothesis. The coefficient on the constant term is significant only in the dividend regressions with no controls, and even in that case, the sign of the coefficient suggests that *dividends* increase, on average, after a firm is added to a *chaebol,* which is opposite to the predictions of the tunneling hypothesis. The coefficients on *position* are also not significant and typically have the opposite sign to the predictions of the tunneling hypothesis. For example, changes in *stand-alone profitability* are positively related to the firm's *position* in the group.

[36] We note that a similar result holds without controls, and after including group dummies.

[37] As in Table 5, the firm's size and *leverage* are measured in the year prior to the firm's inclusion (year $t-1$), while the other variables are measured in year t.

6.6. *Discussion: Selection versus tunneling*

Taken together, the results presented in Tables 4 to 7 are largely consistent with the selection hypothesis, and do not support the tunneling hypothesis. There is strong evidence that the family selects low profitability firms into pyramids. There is some suggestive evidence that low asset pledgeability firms are also selected into pyramids. While the tunneling hypothesis provides an alternative explanation for the profitability results (namely that pyramiding reduces profitability), we present evidence consistent with the direction of causality suggested by the selection hypothesis (low profitability causes pyramiding). In addition, there is no evidence that a new *chaebol* firm's relative performance decreases after it is added to a pyramid. There is also no evidence that dividends and accruals are related to a firm's *position* in the group in a way that would suggest the existence of tunneling.

Next, we provide additional evidence for the selection hypothesis by testing an implication that is unique to that hypothesis (Implication 2).

6.7. *Position and the acquisition premium*

Implication 2 predicts that the family will select low NPV firms into pyramids. We test this implication by examining whether the *position* of a new firm in the *chaebol* is correlated with the *acquisition premium* that the family pays to acquire this new firm. As discussed above, the basic idea is that if the *chaebol* pays more for a new firm, then the acquisition's NPV will decrease. To implement this test, we use the acquisition data described in Section 6.3.2.

In order to relate a new firm's position to the *acquisition premium*, we estimate an empirical model similar to that in Eq. (14), using the *acquisition premium* as an additional explanatory variable:

$$\begin{aligned} Position_{i,t} &= \beta_1 Acquisition\ premium_{i,t} + \mathbf{\Phi Controls}_{it} + \\ &+ \sum_j industry_j + \sum_t year_t + \varepsilon_{i,t}, \end{aligned} \tag{17}$$

The set of controls is similar to those included in Tables 5 and 6. Given the size of the sample, we use different sets of controls and dummy variables in each regression.

<u>Table 8 About Here</u>

Table 8 shows that the family does appear to place high premium (or lower NPV) firms into pyramids. Specifically, a new firm's position in the *chaebol* is positively correlated with the *acquisition premium*. In column 1, we show that this result holds in a specification with no controls.[38] In column 2, we introduce the same controls as in Tables 5 and 6, including pre-*chaebol* profitability and year dummies, but no industry or group dummies. Notice, in particular, that pre-*chaebol* profitability remains negatively related to a firm's *position*, with a very similar coefficient as in Table 5. This result suggests that the negative effect of profitability on *position* reported in Table 5 is not affected by the omission of the *acquisition*

[38] To be consistent with the later regressions, we require the sample firms to have available data on pre-chaebol profitability to include them in this regression. This results in a sample of 108 firms.

premium in Table 5. In column 3, we introduce *capital expenditures* over assets to control for the new firm's growth opportunities, given that the *acquisition premium* can also be related to growth opportunities. The coefficient on *acquisition premium* is largely unaffected. In column 4, we add group dummies to the basic regression, and in column 5, we add both group and industry dummies. In particular, the industry dummies help control for the effect of unobservable growth opportunities on the *position* of the new firm in the group. These results show that the coefficient on the premium variable is largely unaffected by the inclusion of dummies. Not surprisingly, statistical significance decreases as we include both industry and group dummies. Still, the coefficient on the premium variable remains significant at a 10% level in column (5). These results support the selection hypothesis that lower NPV firms are placed in pyramids (Implication 2).

6.8. Valuation and centrality

We now examine whether central firms trade at a discount relative to non-central firms in the group. According to Implication 3, this valuation discount is due to minority shareholders' anticipation of future pyramidal acquisitions by central firms. This explanation for the discount suggests that it should be larger for central firms that do more acquisitions. We first provide evidence on the relative valuation of central firms, and then we confirm that the central firm valuation discount seems to be associated with acquisition activity.

In order to examine the valuation of central firms, we run the following regression:

$$Q_{i,t} = \gamma_1 central_{i,t} + \boldsymbol{\mu}\mathbf{Controls}_{it} + \sum_j industry_j + \sum_t year_t + \varepsilon_{i,t}, \tag{18}$$

where the controls include firm size (measured by the market value of total assets), age and public status, *leverage*, *capital expenditures* (to control for growth opportunities), and *standalone profitability* (to control for current profitability). The previous literature reports some evidence that firms in which the family retains low ownership but high voting rights trade at discounts. Thus, we also control for measures of ownership concentration and separation between ownership and control. To measure *centrality*, we use the benchmark measure (Eq. (8)) and, in (unreported) robustness checks, we also use the firm's aggregate equity *stake* in other firms normalized by its assets (Eq. (9)) . We include a variable that measures whether a firm belongs to a cross-shareholding loop, because, as explained in Section 5.1.1, central firms also tend to be part of such loops. We control for industry and year fixed effects, and also for group fixed effects in some specifications. Standard errors are clustered at the firm level. Implication 3 suggests that the coefficient γ_1 should be negative.

<u>TABLE 9 ABOUT HERE</u>

Table 9 presents the results, which indicate that *centrality* is negatively related to firm valuation. The other variables have the expected signs. Larger and younger firms have higher Q, as do firms with high growth opportunities, proxied by their capital expenditures. There is also some indication that firms in cross-shareholding loops also trade at a discount, although this effect is not significant statistically. These results are robust to controlling for *ultimate ownership* and the different measures of separation between ownership and control (columns 1, 2, and 3). Interestingly, only the measure of separation based on the *critical control threshold* is significant in these regressions, with the standard negative sign that other papers in the literature have shown. In columns 4 to 6, we include group dummies in the regressions. These regressions show that the correlation between *centrality* and valuation also holds within groups, suggesting that, in each group, central firms carry lower valuations than other group firms. The magnitude of central firms' valuation discount also appears to be significant. The distribution of the *centrality* variable is very modal (see Table 1), with 75% of the firms having a zero value for *centrality*, while a few firms (5% of the sample) have *centrality* values greater than 10%. If we look at these extremes, the coefficients in Table 7 (which range approximately from 0.4 to 0.6) imply that a firm with a *centrality* value equal to 10% would have a Q that is 4.5% to 6.5% lower than a firm with zero *centrality*.[39]

As shown in Fig. 2, there are three basic types of firms in a *chaebol*, namely central firms, pyramidal firms, and non-central firms owned directly. Thus, an interesting question is what is the relevant comparison group for central firms in the regressions discussed above. In other words, are central firms valued at a discount relative to directly owned, pyramidal, or both types of firms? The regressions in columns 1 to 6 effectively compare public central firms to all other public group firms, controlling for variation in ownership concentration. In order to provide evidence on this point, we construct dummy variables that capture specific comparison groups more directly. As above (in Table 4), we define a central firm as a firm that has a value of *centrality* greater than the mean value. Among public firms, the average value of *centrality* is 0.05, so we create a dummy variable (called *Central*) that takes the value of one if *centrality* is greater than 0.05, and zero otherwise. We can then use this dummy variable to make specific valuation comparisons by selecting the group of non-central firms for which *Central* takes the value of zero (the comparison group). Specifically, we create a dummy variable *Central vs. Direct* that takes the value of zero only for non-central firms which are owned directly by the family (as in Table 4, those with *position* lower than 1.5). And we create a second dummy variable (*Central vs. Pyramid*) which takes the value of zero only for non-central firms that are owned through pyramids (as in Table 4, those with *position* greater than 2.0). We then replace *centrality* with these dummy variables in our valuation regressions. We drop from the regression in which we use *Central vs. Direct* (*Central vs. Pyramid*) non-central firms that are owned through a pyramid (directly).

The results are shown in columns 7 to 9. In column 7, we use the dummy variable *Central* to compare the valuation of central firms to all other public group firms, as in columns 1 to 6. The purpose of this regression is to verify that the results continue to hold when we use a dummy variable for *centrality* instead of the continuous version, and to provide a better benchmark for the next valuation regressions. The result is shown in column 7, and it is consistent with the previous results. The coefficient on *Central* indicates that a central firm has a Q that is approximately 9% lower than an average non-central group firm. The next columns introduce the specific comparisons to directly owned and pyramidal firms. Column 8 shows that the central firm valuation discount relative to firms owned through pyramids is approximately 16%. And column 9 shows that the discount measured relative to directly owned firms is very similar to the average discount, 9%. Thus, central firms are valued at

[39]This calculation assumes that other variables are evaluated at their unconditional averages, that is, the discount is 4.5% to 6.5% of average Q (which is 0.9 in our data according to Table 2).

a discount relative to all other types of group firms. This result indicates that the defining firm characteristic that generates the discount is the fact that a firm holds significant equity in other firms, and not the firm's position in the group (consistent with Implication 3).

We also conduct some robustness checks on our definition of *centrality* and valuation measures. Given the difficulties in measuring control, which is a crucial component of our *centrality* measure, we also use the *stake* variable to measure centrality (see Eq. 9). Given that the definition of *stake* is independent of our measure of control, these tests help alleviate concerns that the results are driven by the particular control measure we used. The results of our valuation regressions suggest that this is not the case—*stake* is also negatively and significantly related to firm valuation. In addition, we test whether our results are sensitive to our definition of Q. Given the difficulty of adjusting Q for the values of equity stakes (see Section 5.2), we used unadjusted Q in our benchmark regressions. However, our robustness checks suggest that the results remain if we use Q_{sa} (the implied stand-alone market-to-book ratio of *chaebol* firms) to value *chaebol* firms. In particular, *centrality* is negatively and statistically significantly related to Q_{sa}.[40]

6.8.1. Central firm valuation discount and acquisition activity

The fact that central firms trade at a discount is consistent with Implication 3, which suggests that the central firm discount is due to the anticipation of acquisition activity by these firms. In this section, we provide direct evidence that the discount is, in fact, related to acquisition activity by the group's central firms.

While we cannot directly measure shareholders' expectations of future acquisitions by central firms and other group firms, we can examine whether central firms did more acquisitions than other group firms during our sample period. Under the hypothesis that shareholders look at past acquisitions to predict future ones, a positive correlation between *centrality* and past acquisition activity can help validate Implication 3. In addition, under the logic suggested by Implication 3, central firms that have shown greater acquisition activity should trade at a larger discount than other central firms that have not been used as acquisition vehicles. We test both these hypotheses in this section.

To test these hypotheses, we construct a measure of a group firm's *acquisition intensity* during our sample period, by using the sample of acquisitions of new *chaebol* firms. We define a firm's *acquisition intensity* as the sum of the value of equity stakes acquired by each group firm in the event of an acquisition of a new group firm, divided by the book value of the equity of the acquirer. This proxy captures the size of a firm's acquisitions, relative to its total equity. As shown already in Table 2, for the vast majority of firm-years this variable is equal or close to zero. This suggests that only a few group firms are used as acquisition vehicles by the family.

<u>TABLE 10 ABOUT HERE</u>

Columns 1 to 3 of Table 10 provide evidence on which group firms are typically used as acquisition devices, by regressing *acquisition intensity* on ownership variables and other firm

[40] These results are available upon request.

characteristics.[41] The results show that central group firms are, in fact, the ones that are most likely to be used as acquisition devices. Not surprisingly, older and larger firms are also more likely to acquire stakes in newly added group firms. The family's *ultimate ownership* in a group firm is not significantly related to *acquisition intensity*. These results hold both before and after controlling for industry and group dummies, and help support Implication 3.

In columns 4 to 6 we take a further step and ask whether central firms that show large acquisition activity trade at a greater discount than other central firms. Given that the distribution of *acquisition intensity* is significantly bimodal (with many values at zero), we construct a dummy variable to increase the power of the test. The dummy variable *acquirer* takes the value of one if a firm's acquisitions comprise a significant amount of its equity. Specifically, we let *acquirer* take the value of one if *acquisition intensity* is greater than 0.02, which is one-standard-deviation above the median value of zero for this variable (see Table 2), and zero otherwise. We then interact this dummy variable with the dummy variable *central* that characterizes central firms (defined above). We use the same controls as those used in Table 9, including year, industry, and group dummies.

The results provide evidence that central firms that are active acquirers trade at larger discounts than other central firms. The coefficient on the interaction variable *centralXacquirer* is negative and statistically significant after controlling for firm characteristics, industry, and group dummies. To interpret the economic magnitude of the results, notice that we have to take into account the effect of the three dummies together (*central*, *acquirer*, and *centralX-acquirer*). For example, take the coefficients in column 6 which control for industry and group dummies. A central firm that is not a heavy acquirer (*acquirer* = *centralXacquirer* = 0) trades at a discount of approximately 5.6%. After parsing out the correlation between *acquirer* and Q,[42] we obtain that a central firm that is also a heavy acquirer (*acquirer* = *centralXacquirer* = 1) trades at a discount of 9.2%, which is significantly larger than the effect of *centrality* alone. This result supports Implication 3.

6.8.2. Discussion: Central firms' valuation discount

In addition to the systematic evidence presented above, there are many examples of low valuation of central *chaebol* firms. A well-known case is that of SK Corporation, the most central firm in the SK group. In December 2003, the market capitalization of SK Corporation (the largest oil refinery in Korea) was approximately 2.9 billion dollars. Besides several stakes in private group firms, SK Corporation had a stake of 20% in SK Telecom (the largest mobile telecom company in Korea), which was worth 13.6 billion dollars, and a 39% stake in SK Networks, which was worth 4.3 billion dollars. The value of these equity stakes alone (i.e., assuming a zero value for the stakes in private firms) was 4.4 billion dollars. Thus, the implied equity value of SK Corporation's *stand-alone assets* was -1.5 billion dollars. One possible explanation for SK Corporation's negative equity value is that the firm had a large amount

[41] In these regressions, we lag the centrality variable to make sure that the correlation between *acquisition intensity* and *centrality* is not mechanical.

[42] This positive correlation is consistent with the empirical literature on mergers and acquisitions which suggests that high Q firms are more likely to engage in acquisitions (the Q-theory of mergers). See, for example, Jovanovic and Rousseau (2002).

of liabilities (book value of liabilities equal to 8.1 billion dollars). If we add the entire amount of the book liabilities to SK Corporation's stand-alone equity value, we obtain a stand-alone market value of 6.6 billion dollars for SK Corporation. Under these assumptions, the implied stand-alone Q (Q_{sa}) of SK Corporation was 0.68 in December 2003. The true Q_{sa} was likely to be even lower, because the stakes in private firms are not worthless, and because the book value of liabilities probably overestimates the true market value of debt of SK Corporation.

This relatively low valuation for SK Corporation attracted the interest of an activist investment fund that specializes in emerging market stocks (the Sovereign Fund), which amassed 15% of SK Corporation shares in the market during 2003 and started issuing takeover threats. Sovereign's attack subsequently raised SK Corporation's equity value. As a result, by December 2004, SK Corporation's Q_{sa} had increased to 0.92. The initial low valuation of SK Corporation is consistent with the argument that central firms should be discounted due to anticipated pyramiding. In addition, the increase in its market value after the Sovereign Fund amassed a large stake might be due to the market's realization that the large blockholder would prevent some of this pyramiding.

The key characteristic of central firms is that they hold substantial equity stakes in other firms. Thus, the finding that central firms have low valuations bears some resemblance to the closed-end fund puzzle (see, e.g., Shleifer, 2000). Closed-end mutual funds tend to trade at substantial discounts relative to the NAV (net asset value) of the securities in their portfolios.[43] In particular, some of the explanations developed to explain the closed-end fund puzzle bear some resemblance to Implication 3. It is possible, for example, that shareholders of the closed-end fund expect poor portfolio management in the future (similar to Implication 3). Nevertheless, not all arguments regarding the closed-end fund puzzle seem equally relevant. For example, the investor sentiment story explained in Shleifer (2000) applied to the *chaebol* context would require individual investors (who are more subject to fluctuations in sentiment when compared to institutional investors) to be more likely to hold and trade shares of the parent company, relative to the subsidiaries. Although we do not examine this issue directly in this paper, there is no reason to expect that condition to hold in the Korean data.

Cornell and Liu (2001), Mitchell, Pulvino, and Stafford (2002), and Lamont and Thaler (2003) provide evidence on another phenomenon that bears some resemblance to the central firm discount (the "parent company discount"). For example, in the period of 1985–2000, Mitchell, Pulvino, and Stafford (2002) identify 70 firms in which the market value of the equity stake that the parent holds in the subsidiary is higher than the market value of the parent. Lamont and Thaler (2003) show some extreme examples of potential misvaluations (such as the Palm and 3Com example), in which a commitment by the parent to spin-off the shares of the subsidiary at a fixed rate in a future date creates an apparently clear "arbitrage" opportunity.[44] The standard explanation for this phenomenon in the US is that it is due to noise traders bidding up the prices of the subsidiary stocks, and arbitrage costs that make a price correction difficult to sustain (a large fraction of the firms analyzed in

[43] See Rommens, Deloof, and Jegers (2008), for related evidence using data from Belgian holding companies.

[44] The spin-off fixed a ratio of shares of Palm that each 3Com shareholder would receive (1.5) in one year, subject to the Securities and Exchange Commission (SEC) approval. However, 3Com traded at a price that was substantially lower than 1.5 times the price of Palm. Ross (2004) offers a rational explanation for this phenomenon.

these studies is in the internet sector). We believe this market inefficiency story is also not likely to explain the central firm discount in Korea. First, the Korean phenomenon seems to be more general and persistent than the internet bubble-related discounts in the US. In particular, the subsidiaries of central Korean firms are not concentrated in any particular industry. Second, we provide some evidence in Section 6.8.1 that the discount is linked to expectations about acquisition activities of central firms, thus supporting the logic behind Implication 3.

7. Final remarks

The main contribution of this paper is to shed new light on the process by which groups form. In doing this, we depart from the standard approach of assuming that ownership structure is exogenously given. We take advantage of a unique data set that allows us to observe the details of the ownership structure of Korean *chaebols*, and to have a small window on how *chaebol* structure evolves over time. We see this paper as a first step towards the understanding of the evolution of business groups. Naturally, many questions are open for future research.

First of all, it would be interesting to see if our findings about group structure are particular to Korean *chaebol*s or if they extend to groups in other countries as well. For that purpose, we note that the metrics of ownership structure that we derive in the paper (such as the *critical control threshold*, *position*, and *centrality*) can be easily applied to other data. To facilitate the implementation of our measures, we provide algorithms that can be used to calculate these variables for groups of any complexity.

Second, while our short time-series allows us to observe a few major changes in ownership structure (such as the addition of new firms to the group), there are many questions that require a longer time series. For example, besides observing that central firms are the most established firms in the group, we have little to say about how the family chooses central firms among several candidate group firms. Given that *centrality* changes little over time, addressing such a question requires a much longer time-series than the one we currently have. Such data might also allow us to better understand the sources of the low profitability of central firms that we report document in Section 6.1.

Last, but not least, we have focused exclusively on understanding the family's choice of ownership for *chaebol* firms, ignoring the question of why a given firm becomes a *chaebol* member in the first place. Clearly, understanding the selection of firms into a *chaebol* is an essential component of a complete theory of business group structure. In addition, while we have taken the presence of cross-shareholdings into account to compute our ownership measure, we have not attempted to understand the reasons that motivate the family to create cross-shareholding loops among *chaebol* firms. Both of these questions could be analyzed in future research.

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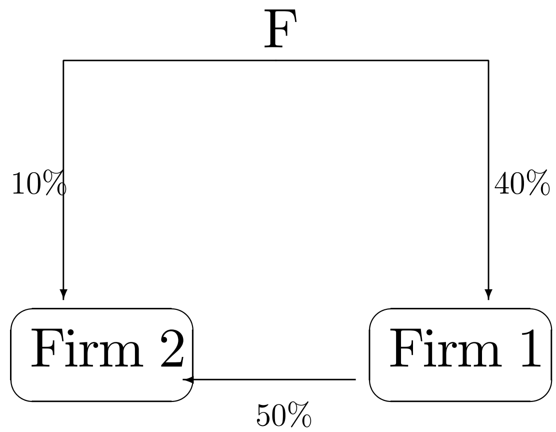

Fig A1. A simple group.

A. Numerical examples of *position*, voting rights and centrality

We illustrate the computation of our main ownership measures using a simple example. The group is represented in Fig. A1. The family owns a 40% direct stake in firm 1 and a 10% direct stake in firm 2. In addition, firm 1 owns a 50% stake in firm 2. While this simple structure is not representative of real world *chaebol* structures, it can help the reader understand the logic behind the new measures.

Ultimate ownership

Ultimate ownership is easy to compute. The family's ultimate ownership in firm 1 is 40% and in firm 2 is 10% + (40%)(50%) = 30%.

Position

Firm 1's *position* is clearly equal to one as there is only one chain leading to that firm. The formula we propose leads to the same answer: $\frac{0.4}{0.4} \cdot 1 = 1$. Regarding firm 2, the family holds the direct stake of 10%, and it also retains a 20% ownership stake through firm 1. Our formula yields:

$$pos_2 = \frac{0.1}{0.3} \cdot 1 + \frac{0.2}{0.3} \cdot 2 = 1.7. \tag{19}$$

This is intuitive, since firm 2's ownership is close to a pure pyramid (the biggest stake is held through firm 1), but it is not a pure pyramid because of the direct stake of 10%.

Voting rights

Take, for example, a control threshold equal to 30% ($T = 30\%$). In that case, the family controls firm 1 (since it holds 40% of its votes). According to our formula, the family has 50% of the votes in firm 2 (10% directly and 50% through firm 1, which it controls). Thus, the family also controls firm 2. Clearly, the family controls both firms for any control threshold lower than or equal to 40%. Thus:

$$C(T) = \{1, 2\} \text{ for any } T \leq 40\%. \tag{20}$$

For T above 40%, the family no longer controls firm 1. Also, the votes it controls in firm 2 are only 10% (we no longer add the 50% since for $T > 40\%$, the family does not control firm 1). Thus, the family does not control firm 2 either:

$$C(T) = \emptyset \text{ for any } T > 40\%. \tag{21}$$

It follows that the *critical control threshold* measures are:

$$CC_1 = CC_2 = 40\%. \tag{22}$$

The VR measures for any $T \leq 40\%$ are:

$$\begin{aligned} VR_1 &= 40\% \\ VR_2 &= 10\% + 50\% = 60\%. \end{aligned}$$

The VR measure adds the entire stake held by firm 1 in firm 2 to the direct stake of 10%, as long as the family retains control of firm 1. If $T > 40\%$, VR_2 drops to 10%.

Centrality

To compute *centrality* measures, we compute the average *critical control threshold* with and without the relevant firm. Let's start with firm 2. We know that $CC_1 = 40\%$. If we eliminate firm 2 from the group and recompute CC_1, we would still have $CC_1 = 40\%$. This implies that eliminating firm 2 from the group does not affect the average voting rights in other group firms. Accordingly, the *centrality* of firm 2 is zero.

In contrast, if we eliminate firm 1, the family will only control firm 2 if $T \leq 10\%$. That is, CC_2 goes to 10%. Thus:

$$central_1 = \frac{40\% - 10\%}{1} = 30\%.$$

B. Computing the set $C(T)$

We first provide a formal definition of the algorithm to compute $C(T)$ and then we explain how it works.

Definition 6. *(Algorithm) Let the sequence of sets* $S(0) \supseteq S(1) \supseteq S(2)...$ *be defined by* $S(0) = N$*, and* $S(n+1) = \{i \in S(n) : f_i + \sum_{j \in S(n),\, j \neq i} s_{ji} \geq T\}$.

The idea behind this algorithm is to start with all the firms, $S(0) = N$. In the first stage, we assume that the family controls all the firms and we drop the firms in which the direct and indirect stake of the family is below T. This procedure generates $S(1)$. Next, we assume that the family controls only the firms in $S(1)$ and again drop from $S(1)$ the firms in which the direct and indirect stake of the family is below T. This generates $S(2)$. We can repeat this algorithm a number $\sharp N$ of times to arrive at $S(\sharp N)$. This last set is important in light of the following proposition.

Proposition 4. *$S(\sharp N)$ satisfies condition (6) which we re-write here:*

$$C(T) = \{i \in N : f_i + \sum_{j \in C(T),\, j \neq i} s_{ji} \geq T\}.$$

A property that simplifies the algorithm is that if $S(n) = S(n+1)$ for $n < \sharp N$, then $S(\sharp N) = S(n)$. This means that we can stop the computation of the algorithm the first time we do not drop a firm.

To prove this proposition, we need to show $S(\sharp N) = \{i \in N : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$. The proof is divided into a number of steps.

Step 1: $S(\sharp N) = S(\sharp N + 1)$.

Consider two cases: 1) $S(\sharp N) = \varnothing$ and 2) $S(\sharp N) \neq \varnothing$. In case 1), the lemma follows directly from the definition of $S(\sharp N + 1)$. In case 2), we have that, after $\sharp N$ stages, there are firms that are not yet eliminated. Because we started with $\sharp N$ firms, this means that there was a stage $n \leq \sharp N$ such that no firm was dropped. In other words, we have that $S(n) = S(n-1)$. We can now compute $S(n+1) = \{i \in S(n) : f_i + \sum_{j \in S(n),\, j \neq i} s_{ji} \geq T\} = \{i \in S(n-1) : f_i + \sum_{j \in S(n-1),\, j \neq i} s_{ji} \geq T\} = S(n)$, where the first equality follows from $S(n) = S(n-1)$ and the second from the definition of $S(n)$. Analogously, we can show that $S(n) = S(n+1) = S(n+2) = \ldots = S(\sharp N) = S(\sharp N + 1)$. The last equality proves Step 1.

Step 2: $S(\sharp N) \subseteq \{i \in N : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$.

Note that $S(\sharp N) = S(\sharp N + 1) = \{i \in S(\sharp N) : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$, where the first equality follows from Step 1 and the second is simply the definition of $S(\sharp N + 1)$. Because $S(\sharp N) \subseteq N$, it is clear that $i \in S(\sharp N) \Rightarrow i \in \{i \in N : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$.

Step 3: $S(\sharp N) \supseteq \{i \in N : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$.

Towards a contradiction, we suppose that $k \in \{ i \in N : f_i + \sum_{j \in S(\sharp N),\, j \neq i} s_{ji} \geq T\}$ and $k \notin S(\sharp N)$. The first condition implies that

$$f_k + \sum_{j \in S(\sharp N),\, j \neq i} s_{jk} \geq T. \tag{23}$$

The last condition implies that firm k was eliminated in some earlier stage in the algorithm, say stage n. Thus, $k \in S(n-1)$ but $k \notin S(n)$. We now have

$$T > f_k + \sum_{j \in S(n-1),\, j \neq k} s_{jk} \geq f_k + \sum_{j \in S(\sharp N),\, j \neq k} s_{jk}, \tag{24}$$

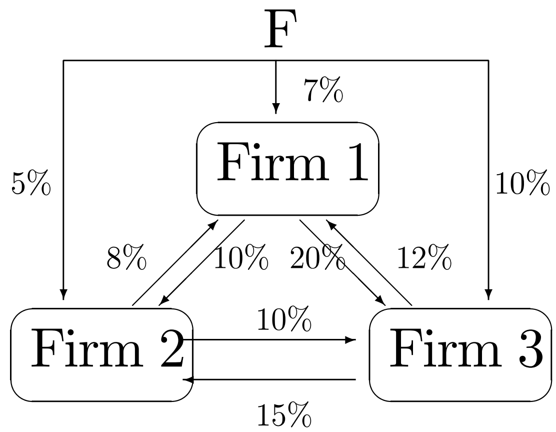

Fig. A2. A complex group with many cross-shareholdings.

where the first inequality follows from the fact that firm k was eliminated in round n and the second inequality follows from $S(n-1) \supseteq S(\sharp N)$ and the fact that $s_{ij} \geq 0$. This is a contradiction because Eqs. 23 and 24 cannot hold at the same time. Putting together Steps 2 and 3 leads to the statement of Proposition.■

One problem that we need to address is the existence of multiple sets that satisfy Proposition 4. Consider the example in Fig. A2, and assume that $T = 25\%$. Clearly, we have that $C(25\%) = \{1, 2, 3\}$ because the set $\{1, 2, 3\}$ satisfies Proposition 4. However, the null set also satisfies Proposition 4 for the same control threshold. To see this, suppose that the family controls no firms, then its voting rights in firms 1, 2, and 3 are 5%, 7%, and 10%, respectively. Note that all of them are below the threshold of 25%, confirming that the family does not control any of these firms.

Because in the case of Korea the firms with which we start (the set N) have already been pre-classified as members of the *chaebol*, we would like to choose the set that satisfies Eq. (6) and at the same time has the maximum number of firms. We can prove the following proposition.

Proposition 5. *Consider all possible sets of firms that satisfy Eq. (6) for a given control threshold* T*:* $C_1, C_2, \ldots, C_M$*. The following holds:* $S(\sharp N) = \bigcup_{i=1}^{M} C_i$*.*

This proposition is important for two reasons. First, it tells us that there is a unique set that has the maximum number of firms over all the sets that satisfy Eq. (6). This is important since it removes the arbitrariness of picking a set among many. Second, the proposition tells us that the outcome of the algorithm is precisely the set we are looking for.

The proof of this result is divided into two steps.

Step 1: $S(\sharp N) \subseteq \bigcup_{i=1}^{M} C_i$.

By Proposition 4, we know that $S(\sharp N)$ satisfies Eq. (6), thus, there is an m such that $S(\sharp N) = C_m$. The result follows.

Step 2: $S(\sharp N) \supseteq \bigcup_{i=1}^{M} C_i$.

We show that $C_m \subseteq S(\sharp N)$ for all $m = 1 \ldots M$. Step 2 follows directly from this. Take a set C_m. Because C_m satisfies Eq. (6), the following is true:

$$\text{For all } k \in C_m,\ f_k + \sum_{j \in C_m,\, j \neq k} s_{jk} \geq T. \tag{25}$$

Towards a contradiction, suppose that some of the firms in C_m are not in $S(\sharp N)$. That is, there must be a stage in the algorithm in which the first firm of C_m is eliminated. Let that stage be n. We then have that $C_m \subseteq S(n-1)$ but there is at least one $k \in C_m$ such that $k \notin S(n)$. We now have that

$$T > f_k + \sum_{j \in S(n-1),\, j \neq k} s_{jk} \geq f_k + \sum_{j \in C_m,\, j \neq k} s_{jk}, \tag{26}$$

where the first inequality follows from the fact that k is eliminated in round n and the second follows from $C_m \subseteq S(n-1)$ and the fact that $s_{jk} \geq 0$. This is a contradiction because Eq. (25) and (26) cannot hold at the same time. This proves Step 2. Finally, putting together Steps 1 and 2 leads to the statement of the proposition.■

C. Accounting measures of stand-alone assets and stand-alone profitability

After January 1, 2003, the item 'stocks accounted in equity method' (code number KLCA 123560) reports the aggregate book value of the shares subject to the equity method. Before 2003, however, 'stocks accounted in equity method' was not separately recorded but pooled into all investment securities. The data are available from the footnotes to financial statements, which we examined to calculate this item for the remaining years. Regarding profitability, the profits coming from affiliate companies (call it "equity method profits") are recorded in two items in the non-operating portion of the income statement of parent companies. If equity method profits are positive, they are called "Gain on valuation of equity method" (KLCA # 242100). If they are negative, they are called "Loss on valuation of equity method" (KLCA # 252600). The total profits coming from affiliate firms can thus be calculated as:

$$\text{Affiliate profits} = \text{Gain on equity method - Loss on equity method.} \tag{27}$$

With this knowledge, it is easy to adjust the financial statements to back out the values of the accounting figures that refer to each individual *chaebol* firm. Specifically, we have:

$$\textit{Stand-alone assets} = \text{Total assets - Equity method stock.} \tag{28}$$

Our profitability measure is:

$$\textit{Stand-alone profitability} = \frac{\text{Ordinary income + Interest payments - Affiliate profits}}{\text{Stand-alone assets}}. \tag{29}$$

Notice that we compute profitability before interest payments and taxes. Our profitability measure thus corresponds to an earnings before interest and taxes (EBIT) measure in US accounting, adjusted for profits coming from affiliate firms.

We also check the data for basic consistency requirements. In particular, if the balance sheet shows a number for the equity method stock (i.e., if item KLCA#123560 is non-missing), then there should also be an item in the income statement for gains and losses from equity method (i.e., KLCA#242100 and KLCA#252600 cannot both be missing). The reverse should also hold. In addition, it should not be the case that both items KLCA#242100 and KLCA#252600 are positive, since affiliates will either generate a profit or a loss. We eliminate all firm-years that do not satisfy this consistency requirement.

Table 1
Summary statistics of ownership variables and firm characteristics

Panel A presents summary statistics of ownership variables of Korean *chaebol* firms for the period 1998–2004. Data are from the Korean Fair Trade Commission (KFTC). The variables are defined in detail in the text (see Section 4). *Ultimate ownership* is a measure of the family's cash flow rights, and *VR (consistent voting rights)* and *CC (critical control threshold)* are two alternative measures of voting rights. *Separation CC* and *Separation VR* are defined, respectively, as *CC* minus *ultimate ownership*, and *VR* minus *ultimate ownership*. *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Centrality* is the average drop in voting rights when a firm's votes are not taken into account to compute *CC* for the other group firms. *Stake* is the book value of equity stakes held by a *chaebol* firm in other firms, normalized by assets. *Cross-shareholdings* takes a value of one if the firm belongs to a cross-shareholding loop. *Public* is a variable that takes the value of one if the firm is publicly traded. Panel B presents the correlation matrix for the variables summarized in Panel A.

Panel A: Basic statistics

Variable	Mean	StDev	Median	25%	75%	Firm-years
Ultimate ownership	0.21	0.22	0.13	0.05	0.28	3545
VR	0.68	0.28	0.68	0.47	1.00	3545
CC	0.33	0.19	0.30	0.19	0.43	3545
Separation VR	0.47	0.29	0.44	0.23	0.73	3545
Separation CC	0.12	0.11	0.12	0.03	0.19	3545
Position	2.11	0.82	2.06	1.40	2.56	3545
Centrality	0.02	0.05	0.00	0.00	0.00	3545
Stake	0.08	0.34	0.00	0.00	0.04	3545
Cross-shareholdings	0.25	0.43	0.00	0.00	1.00	3545
Public	0.26	0.44	0.00	0.00	1.00	3545
Employees	1198	3755	190	43	840	3545
Firm age	17	14	13	4	26	3545
No.firms	1085					
No.groups	47					

Panel B: Correlations

	Ult own	*Separ VR*	*Separ CC*	*Position*	*Centrality*	*Cross-SH*	*Public*	*Employees*
Separation VR	-0.42							
Separation CC	-0.50	0.28						
Position	-0.52	0.60	0.54					
Centrality	0.10	-0.25	0.06	-0.26				
Cross-SH	-0.06	-0.20	-0.04	-0.18	0.21			
Public	-0.16	-0.44	0.06	-0.23	0.37	0.42		
Employees	-0.09	-0.18	0.01	-0.16	0.24	0.30	0.35	
Firm age	0.01	-0.33	-0.04	-0.31	0.39	0.46	0.59	0.32

Table 2
Summary Statistics of Accounting and Financial Variables

This table presents summary statistics for financial and accounting variables for chaebol firms during 1998–2004. Insurance, securities firms, and other financial institutions are excluded from the sample. Data are from KLCA (Korea Listed Companies Association) and KIS (Korea Investors Service). *Stand-alone profitability* and *Stand-alone assets* are computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). See Eqs. (12) and (13) for the definitions of *Q*, *Qsa*, and the stand-alone market value of equity (the numerator of Eq. (13)). *Leverage* is defined as non-current liabilities divided by stand-alone assets. *Accruals* are defined as the absolute value of the difference between net income divided by stand-alone assets, and cash flows divided by stand-alone assets. The *Acquisition premium* is the ratio between the acquisition price and the book value of the equity of firms that were added to a chaebol during the sample period of 1998–2004. *Tangibility* is property, plant, and equipment divided by stand-alone assets. *Intangibles* is the ratio of intangible assets to stand-alone assets. *Collateral* is the ratio of the sum of property, plant, and equipment and inventories to stand-alone assets. *Acquisition intensity* is the sum of the value of equity stakes acquired by each group firm in the event of an acquisition of a new group firm, divided by the book value of the equity of the acquirer. Panel A presents summary statistics, and Panel B presents the correlations among these variables and the ownership measures described in Table 1.

Panel A: Basic statistics

Variables	Mean	StDev	25%	Median	75%	Firm-years
Stand-alone profitability	0.050	0.115	0.007	0.058	0.103	2695
Assets (millions USD)	794	2320	29	110	527	2695
Stand-alone assets (millions USD)	714	2029	27	103	489	2695
Q	0.917	0.324	0.734	0.838	0.994	823
Qsa	0.908	0.363	0.707	0.828	1.011	806
Capital expenditure/Stand-alone assets	0.056	0.148	0.008	0.029	0.073	2601
Leverage	0.213	0.296	0.043	0.146	0.301	2644
Accruals	0.107	0.126	0.030	0.070	0.136	2679
Dividends/Stand-alone assets	0.006	0.013	0.000	0.000	0.007	2695
Tangibility	0.419	0.275	0.170	0.431	0.634	2670
Intangibles	0.037	0.109	0.001	0.006	0.024	2065
Collateral	0.518	0.251	0.325	0.556	0.718	2297
Acquisition intensity	0.004	0.021	0.000	0.000	0.000	2691
Acquisition premium	1.543	1.537	0.693	1.065	1.548	144

Panel B: Correlations

	Stand-alone profitability	*Stand-alone assets*	*Q*	*Capex/ Stand-alone* assets	*Leverage*	*Accruals*	*Dividends/ Stand-alone* profits	*Acquisition Premium*
Stand-alone asset	0.073							
Q	0.146	0.154						
Capital expenditure/Stand-alone assets	0.003	-0.005	0.246					
Leverage	-0.131	0.075	-0.004	0.009				
Accruals	-0.219	-0.013	0.223	-0.103	0.149			
Dividends/Stand-alone assets	0.328	0.051	0.291	0.002	-0.125	-0.076		
Acquisition Premium	-0.094	-0.139	0.701	-0.060	0.056	0.242	-0.024	
Tangibility	-0.061	0.098	-0.128	0.232	0.227	-0.123	-0.063	0.034
Intangibility	-0.110	-0.031	0.173	0.023	0.150	0.051	-0.049	-0.069
Collateral	-0.057	0.085	-0.175	0.151	0.241	-0.143	-0.024	-0.118
Acquisition intensity	0.019	0.031	0.089	0.034	0.031	0.086	0.006	0.282
Separation VR	-0.062	-0.90	-0.027	0.068	0.011	0.033	-0.147	-0.138
Separation VC	-0.016	0.028	-0.101	0.037	0.051	-0.012	0.056	0.087
Average position	-0.000	-0.137	0.082	0.139	-0.021	0.029	-0.021	0.133
Centrality	0.032	0.252	-0.147	-0.057	0.068	-0.020	0.015	NA

	Tangibility	*Intangibles*	*Collateral*	*Acquisition intensity*	*Separation VR*	*Separation VC*	*Average Position*
Intangibility	-0.213						
Collateral	0.912	-0.191					
Acquisition intensity	0.005	-0.025	-0.009				
Separation VR	0.030	0.166	0.044	-0.021			
Separation VC	0.085	0.185	0.114	0.037	0.282		
Average position	0.042	0.196	0.041	0.017	0.598	0.537	
Centrality	0.091	-0.072	0.102	0.116	-0.250	0.079	-0.026

Table 3
Family ownership and profitability

This table contains the tests described in Section 6.1, which relate a firm's profitability to family ownership variables (Eq. (14)). The dependent variable is *Stand-alone profitability*. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ultimate ownership* is a measure of the family's cash flow rights. *Ln assets* is the logarithm of the book value of assets. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. The coefficients on firm age are multiplied by 1000. *Separation CC* and *Separation VR* are defined, respectively, as *CC* (critical control threshold) minus ultimate ownership, and *VR* (consistent voting rights) minus ultimate ownership. *Centrality* is the average drop in voting rights when a firm's votes are not taken into account to compute the critical control threshold for the other group firms. *Cross-shareholdings* takes a value of one if the firm belongs to a cross-shareholding loop, and zero otherwise. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable: *Stand-alone profitability*							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm age	-0.223	0.074	-0.098	0.125	-0.089	0.118	-0.161	0.110
	(-0.866)	(0.259)	(-0.387)	(0.435)	(-0.354)	(0.411)	(-0.586)	(0.368)
Ln assets	0.008***	0.007**	0.006**	0.006**	0.006**	0.006**	0.008***	0.007**
	(2.824)	(2.216)	(2.319)	(2.165)	(2.244)	(2.184)	(2.795)	(2.170)
Public	-0.002	-0.002	-0.011	-0.010	-0.005	-0.005	-0.002	-0.002
	(-0.314)	(-0.215)	(-1.380)	(-1.269)	(-0.670)	(-0.649)	(-0.214)	(-0.218)
Leverage	-0.053***	-0.050***	-0.052***	-0.049***	-0.052***	-0.049***	-0.053***	-0.050***
	(-4.683)	(-4.052)	(-4.669)	(-4.030)	(-4.711)	(-4.065)	(-4.623)	(-4.018)
Ultimate ownership	0.064***	0.058***					0.067***	0.061***
	(4.132)	(3.173)					(4.242)	(3.298)
Separation VR			-0.020	-0.016				
			(-1.579)	(-1.211)				
Separation CC					-0.040	-0.042		
					(-1.586)	(-1.445)		
Centrality							-0.089**	-0.102**
							(-2.140)	(-2.141)
Cross-shareholdings							0.002	0.007
							(0.286)	(1.122)
Constant	-0.105*	-0.046	-0.064	-0.019	-0.063	-0.017	-0.127**	-0.240***
	(-1.826)	(-0.724)	(-1.113)	(-0.304)	(-1.096)	(-0.277)	(-2.118)	(-3.873)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2643	2643	2643	2643	2643	2643	2620	2620
R^2	0.097	0.163	0.086	0.156	0.086	0.157	0.098	0.165

Table 4
Determinants of a firm's position in the Chaebol

This table contains the tests described in Section 6.2, which relate a firm's position in the group to firm characteristics (Eq. (15)). *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ln assets* is the logarithm of the book value of assets. *Centrality* is the average drop in voting rights when a firm's votes are not taken into account to compute the critical control threshold for the other group firms. Central (Non-central) firms are those for which *Centrality* is greater (lower) than its mean value of 0.02. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. *Pyramid* is a dummy that takes the value of one if a (Non-central) firm is owned through a pyramid, and zero if the Non-central firm is owned directly. We classify a firm as being owned through a pyramid if its *Position* is greater than or equal to 2.0. The (Non-central) firm is owned directly if its *Position* is lower than 1.5.The coefficients on *Firm age* are multiplied by 1000. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Regression model Dependent variable: *Position*				Probit model Dependent variable: *Pyramid*	
	All firms		Non-central	Central	Non-central	
	(1)	(2)	(3)	(4)	(5)	(6)
Stand-alone profitability t-1	-0.380**	-0.347**	-0.347**	-0.403	-2.308***	-2.857***
	(-2.567)	(-2.274)	(-2.201)	(-1.293)	(-4.813)	(-5.269)
Firm age	-9.557***	-8.356***	-10.455***	6.674	-32.171***	-36.757***
	(-3.997)	(-3.367)	(-3.379)	(1.399)	(-4.419)	(-4.523)
Ln assets	-0.027	-0.078***	-0.028	-0.070	0.086*	0.019
	(-1.143)	(-3.422)	(-1.118)	(-1.218)	(1.695)	(0.311)
Public	-0.111	-0.072	0.008	-0.387**	-0.039	-0.050
	(-1.309)	(-0.913)	(0.102)	(-2.154)	(-0.188)	(-0.239)
Leverage	-0.123*	-0.147**	-0.169**	-0.112	-0.183	-0.137
	(-1.697)	(-2.010)	(-2.204)	(-0.569)	(-1.300)	(-0.861)
Constant	2.461***	3.021***	1.499*	3.237***	-0.080	0.427
	(3.528)	(3.579)	(1.907)	(2.851)	(-0.0918)	(0.322)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	Yes	Yes	No	Yes
Observations	2160	2160	1745	396	1386	1325
R^2	0.287	0.455	0.454	0.668	NA	NA

Table 5
Does Profitability Predict Pyramidal Ownership?

This table contains the tests described in Section 6.3. The variable *Position increase* takes the value of one if position increased by more than 0.10 from one year to the next, and zero otherwise. The variable *Position decrease* takes the value of one if position decreased by more than -0.10 from one year to the next, and zero otherwise. In columns 1 to 4 we use a probit model. The regressions in columns 5 to 8 use a sample of firms in the years in which they first appear as a member of a chaebol. In column 7 we eliminate all cases in which we can determine that a firm was owned by a chaebol in the year prior to its inclusion in a chaebol as a new firm. In column 8 we use the dummy variable *Pyramid* (which is defined in Table 4) as a dependent variable. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ln assets* is the logarithm of the book value of assets. *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. The coefficients on *Firm age* are multiplied by 1000. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable							
	Position increase		*Position decrease*			*Position*		*Pyramid*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stand-alone profitability t-1	-0.380*	-0.468*	0.317	0.596	-1.709***	-1.591***	-1.717***	-4.279***
	(-1.645)	(-1.915)	(0.989)	(1.565)	(-2.904)	(-2.619)	(-2.722)	(-2.798)
Firm age	-3.967	-3.677	-2.246	1.511	19.044**	22.311**	17.049*	13.673
	(-1.142)	(-0.887)	(-0.615)	(0.386)	(2.105)	(2.358)	(1.739)	(0.770)
Ln assets	0.053*	0.020	0.020	-0.028	-0.002	-0.053	-0.026	0.277**
	(1.814)	(0.611)	(0.719)	(-0.857)	(-0.0234)	(-0.794)	(-0.307)	(2.078)
Public	0.019	0.035	-0.003	-0.074	-0.921***	-0.988***	-0.801***	-1.264*
	(0.158)	(0.280)	(-0.028)	(-0.647)	(-3.795)	(-3.859)	(-3.010)	(-1.898)
Leverage	-0.121	-0.246	0.087	0.107	-0.411	0.137	-0.483	-1.058*
	(-1.030)	(-1.624)	(0.851)	(0.978)	(-1.317)	(0.400)	(-1.563)	(-1.767)
Constant	-1.094**	-0.260	-1.433***	1.045	3.848***	2.857*	5.665***	-3.666
	(-2.133)	(-0.266)	(-2.823)	(0.955)	(2.847)	(1.896)	(4.031)	(-1.556)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	Yes	No	Yes	No	Yes	No	No
Firms in sample	All	All	All	All	Additions	Additions	Additions Not owned by chaebol	Additions
Observations	1849	1641	1820	1786	143	143	127	113
R^2	NA	NA	NA	NA	0.531	0.750	0.567	NA

Table 6
Position and stock measures of pledgeability

This table contains the tests described in Section 6.4. *Tangibility* is property, plant, and equipment divided by stand-alone assets. *Intangibles* is the ratio of intangible assets to stand-alone assets. *Collateral* is the ratio of the sum of property, plant, and equipment and inventories to stand-alone assets. The dummy variable *Pyramid* is defined in Table 4. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ln assets* is the logarithm of the book value of assets. *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. The coefficients on *Firm age* are multiplied by 1000.Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable:					
	Position	*Pyramid*	*Position*	*Pyramid*	*Position*	*Pyramid*
	(1)	(2)	(3)	(4)	(5)	(6)
Stand-alone profitability t-1	-1.727***	-4.188***	-1.904***	-2.436	-1.699***	-4.015**
	(-2.785)	(-2.673)	(-2.626)	(-1.562)	(-2.709)	(-2.439)
Tangibility t-1	-0.186	-0.518				
	(-0.578)	(-0.928)				
Collateral t-1			-0.341	-1.798*		
			(-0.663)	(-1.756)		
Intangibles t-1					0.975	0.931
					(1.500)	(0.670)
Firm age	20.209**	16.218	14.936	9.983	20.199*	38.636*
	(2.192)	(0.881)	(1.645)	(0.517)	(1.860)	(1.653)
Ln assets	0.009	0.312**	-0.024	0.504***	-0.012	0.269*
	(0.119)	(2.483)	(-0.263)	(2.763)	(-0.172)	(1.669)
Public	-0.918***	-1.327**	-0.772***	-1.900**	-0.951***	-2.104**
	(-3.792)	(-2.087)	(-2.751)	(-2.492)	(-3.126)	(-2.518)
Leverage	-0.379	-0.970	-0.370	-1.480**	0.125	0.002
	(-1.216)	(-1.544)	(-0.871)	(-2.063)	(0.298)	(0.00165)
Constant	5.081***	-5.344**	2.319	-7.496**	3.522**	-6.155**
	(4.050)	(-2.411)	(1.316)	(-2.458)	(2.420)	(-2.173)
Industry fixed effects	Yes	No	Yes	No	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	No	No	No
Observations	141	111	110	71	105	84
R^2	0.538	NA	0.558	NA	0.495	NA

Table 7
Testing predictions of the tunneling argument

This table contains the tests described in Section 6.5, which test some predictions of the tunneling hypothesis. *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ln assets* is the logarithm of the book value of assets. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. *Accruals* are defined as the absolute value of the difference between net income divided by stand-alone assets, and cash flows divided by stand-alone assets. The *changes in stand alone profits*, *dividends*, and *accruals* are measured from the year prior to the firm being added to the chaebol, to the year following the firm's addition. The coefficients on *Firm age* are multiplied by 1000. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable							
	Dividends/ Stand-alone assets	*Accruals*	*Change in stand-alone profits*		*Change in dividends*		*Change in accruals*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.001	0.366***	-0.001	0.379	0.003**	-0.037	0.016	0.377
	(-0.099)	(3.560)	(-0.0247)	(1.033)	(2.456)	(-1.446)	(0.380)	(0.987)
Firm age	-0.077**	-0.054		1.131		-0.153		-4.054
	(-2.376)	(-0.222)		(0.357)		(-1.272)		(-1.224)
Ln assets	0.000	-0.011***		-0.002		0.002		-0.001
	(0.176)	(-4.275)		(-0.171)		(1.331)		(-0.102)
Public	0.003**	-0.002		0.035		0.002		0.015
	(2.410)	(-0.270)		(0.717)		(0.728)		(0.265)
Leverage	-0.003**	0.079***		0.065		-0.002		-0.073
	(-2.427)	(4.573)		(0.778)		(-0.560)		(-0.804)
Stand-alone profitability	0.035***							
	(7.725)							
Position	-0.000	0.001		0.038		0.002		0.006
	(-0.621)	(0.251)		(1.572)		(1.058)		(0.251)
Industry fixed effects	Yes	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	No	Yes	No	Yes	No	Yes
Observations	2643	2629	137	118	138	119	137	119
R^2	0.194	0.108	0.000	0.235	0.000	0.397	0.000	0.372

Table 8
Acquisition premium and position in the Chaebol

This table contains the tests described in Section 6.7, which relate a firm's position in the group to the acquisition premium and firm characteristics. *Position* is a measure of the distance of a firm relative to the controlling family in the group structure. *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Capital Expenditure* is capital expenditures / stand-alone assets. *Ln assets* is the logarithm of the book value of assets. *Public* is a variable that takes the value of one if the firm is publicly traded. *Leverage* is defined as non-current liabilities divided by stand-alone assets. The *Acquisition premium* is the ratio between the acquisition price and the book value of the equity of firms that were added to a chaebol during the sample period of 1998–2004. The coefficients on *Firm age* are multiplied by 1000. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable: *Position*				
	(1)	(2)	(3)	(4)	(5)
Acquisition premium	0.142**	0.104**	0.115**	0.108**	0.100*
	(2.560)	(2.091)	(2.317)	(1.998)	(1.680)
Stand-alone profitability t-1		-1.033**	-0.981**	-0.924*	-1.330**
		(-2.180)	(-2.097)	(-1.921)	(-2.509)
Firm age		25.758***	27.320***	33.760***	37.106***
		(2.904)	(3.103)	(3.781)	(3.818)
Ln assets		-0.004	0.030	-0.004	-0.011
		(-0.0706)	(0.560)	(-0.0628)	(-0.156)
Public		-1.085***	-1.142***	-1.223***	-1.233***
		(-3.531)	(-3.753)	(-4.089)	(-3.817)
Leverage		0.170	-0.061	0.188	0.461
		(0.440)	(-0.149)	(0.388)	(0.808)
Capital expenditure/Stand-alone assets			0.683	0.924*	1.427**
			(1.476)	(1.884)	(2.203)
Constant	2.477***	2.529***	1.889*	1.988	2.379
	(20.59)	(2.757)	(1.963)	(1.564)	(1.584)
Industry fixed effects	No	No	No	No	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	Yes	Yes
Observations	108	107	106	106	106
R^2	0.058	0.409	0.432	0.652	0.782

Table 9
Valuation and centrality

This table contains the tests described in Section 6.8, which relate a firm's valuation to firm characteristics (Eq.(18)). The dependent variable is Tobin's Q, as defined in Eq. (12). *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ultimate ownership* is a measure of the family's cash flow rights. *Cross-shareholdings* takes a value of one if the firm belongs to a cross-shareholding loop. *Size* is the log of the market value of equity. *Centrality* is the average drop in voting rights when a firm's votes are not taken into account to compute the critical control threshold for the other group firms. *Separation CC* and *Separation VR* are defined, respectively, as CC (critical control threshold) minus ultimate ownership, and VR (consistent voting rights) minus ultimate ownership. *Leverage* is defined as non-current liabilities divided by stand-alone assets. *Capital Expenditure* is capital expenditures / stand-alone assets. The coefficients on *Firm age* are multiplied by 1000. The dummy variable *Central* takes the value of one if a firm is classified as being a central firm, among the group's public firms, and zero otherwise. A central firm is defined as a firm with a value of centrality greater than the mean value of centrality among public firms, which is 0.05. The dummy variable *Central vs. Pyramid* takes the value of one if a public group firm is classified as being a central firm, and zero if a public group firm is not central, and is owned through a pyramid (position greater than 2.0). The dummy variable *Central vs. Direct* takes the value of one if a public group firm is classified as being a central firm, and zero if a public group firm is not central, and is owned directly (position lower than 1.5). Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable: Tobin's *Q*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Centrality	-0.465***	-0.560***	-0.511***	-0.386**	-0.396**	-0.405**			
	(-3.176)	(-3.774)	(-3.402)	(-2.237)	(-2.435)	(-2.377)			
Central							-0.086***		
							(-2.910)		
Central vs. Pyramid								-0.159***	
								(-3.024)	
Central vs. Direct									-0.086***
									(-2.899)
Cross-shareholdings	-0.052	-0.054	-0.052	-0.046	-0.044	-0.045	-0.046	-0.012	-0.036
	(-1.597)	(-1.630)	(-1.591)	(-1.107)	(-1.068)	(-1.104)	(-1.442)	(-0.300)	(-1.077)
Firm age	-4.265***	-4.258***	-4.265***	-4.596***	-4.521***	-4.558***	-4.299***	-3.375***	-3.896**
	(-3.694)	(-3.623)	(-3.672)	(-3.393)	(-3.246)	(-3.344)	(-3.663)	(-2.760)	(-2.487)
Size	0.083***	0.087***	0.086***	0.089***	0.090***	0.090***	0.083***	0.111***	0.064***
	(5.841)	(6.398)	(6.380)	(5.346)	(5.369)	(5.354)	(5.736)	(5.586)	(3.960)
Stand-alone profitability	0.259	0.253	0.252	0.342	0.340	0.342	0.282	0.548**	-0.176
	(1.149)	(1.136)	(1.138)	(1.644)	(1.648)	(1.649)	(1.242)	(2.220)	(-0.536)
Capital Expenditure	0.418*	0.402*	0.393*	0.330	0.328	0.329	0.426*	0.732**	0.278
	(1.891)	(1.844)	(1.806)	(1.570)	(1.565)	(1.571)	(1.910)	(2.135)	(1.374)
Leverage	0.059	0.068	0.068	0.002	0.001	0.002	0.053	-0.079	0.179
	(0.463)	(0.528)	(0.534)	(0.017)	(0.008)	(0.020)	(0.409)	(-0.648)	(1.224)
Ultimate ownership	-0.114			-0.061			-0.121	-0.051	-0.194**
	(-1.231)			(-0.440)			(-1.283)	(-0.390)	(-1.988)
Separation VR		-0.069			0.030				
		(-0.819)			(0.336)				
Separation CC			-0.215*			0.017			
			(-1.908)			(0.138)			
Constant	-1.429***	-1.103***	-1.101***	-1.573***	-1.597***	-1.581***	-1.436***	-2.126***	-0.907**
	(-3.780)	(-3.002)	(-3.002)	(-3.538)	(-3.545)	(-3.531)	(-3.701)	(-3.927)	(-2.141)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	No	Yes	Yes	Yes	No	No	No
Observations	807	807	807	807	807	807	807	482	422
R^2	0.426	0.425	0.427	0.527	0.527	0.527	0.425	0.577	0.503

Table 10
Central firm valuation discount and acquisition activity

This table contains the tests described in Section 6.8.1. In columns 1 to 3 the dependent variable is *Acquisition intensity*, which is described in Table 2. *Centrality* is the average drop in voting rights when a firm's votes are not taken into account to compute the critical control threshold for the other group firms. The variable *Centrality* is lagged one period in the regressions of columns 1 to 3. In columns 4 to 6 the dependent variable is Tobin's *Q*, as defined in Eq. (12). *Stand-alone profitability* is computed after an adjustment that takes into account the effect of equity stakes held in other chaebol firms (see Appendix C for details). *Ultimate ownership* is a measure of the family's cash flow rights.*Cross-shareholdings* takes a value of one if the firm belongs to a cross-shareholding loop. *Size* is the log of the market value of equity. The dummy variable *Central* takes the value of one if a firm is classified as being a central firm, among the group's public firms, and zero otherwise. A central firm is defined as a firm with a value of centrality greater than the mean value of centrality among public firms, which is 0.05. The dummy variable *Acquirer* takes the value of one if *Acquisition intensity* is greater than 0.2, and zero otherwise. The dummy variable *Central*×*Acquirer* is the product of the dummy variables *Central* and *Acquirer*. *Leverage* is defined as non-current liabilities divided by stand-alone assets. The coefficients on *Firm age* are multiplied by 1000. Robust standard errors are in parentheses, clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Dependent variable:					
		Acquisition intensity			Tobin's *Q*	
	(1)	(2)	(3)	(4)	(5)	(6)
Central				-0.032 (-1.262)	-0.072*** (-2.720)	-0.056* (-1.886)
Acquirer				0.091 (1.607)	0.089* (1.662)	0.106** (2.065)
Central×*Acquirer*				-0.101 (-1.218)	-0.130* (-1.695)	-0.143* (-1.958)
Centrality t-1	0.046*** (3.355)	0.029** (2.205)	0.025* (1.790)			
Firm age		0.079* (1.835)	0.086* (1.719)		-4.327*** (-5.624)	-4.769*** (-5.309)
Ln assets		0.000 (1.406)	0.001 (1.273)			
Public		0.002 (1.147)	0.001 (0.982)			
Leverage		0.001 (0.809)	0.001 (1.085)		0.049 (0.747)	0.000 (0.00375)
Cross-shareholdings					-0.046** (-2.169)	-0.042* (-1.699)
Size					0.080*** (8.925)	0.087*** (8.094)
Stand-alone profitability					0.301** (2.560)	0.358*** (2.972)
Capital Expenditure					0.423*** (2.898)	0.330** (2.301)
Ultimate ownership		-0.000 (-0.151)	0.002 (0.678)		-0.132* (-1.759)	-0.064 (-0.650)
Constant	0.003** (2.128)	-0.008 (-1.311)	-0.016* (-1.860)	0.657** (2.358)	-0.970*** (-2.751)	-1.117*** (-3.004)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Group fixed effects	No	No	Yes	No	No	Yes
Observations	1937	1885	1885	812	803	803
R^2	0.041	0.049	0.068	0.307	0.430	0.532

Fig. 1. Ownership structure of Hyundai Motor in 2004. This figure depicts the ownership structure of the Hyundai Motor *chaebol* in 2004. Mr. Mong Koo Jung is the ultimate owner of Hyundai Motor. The other boxes represent individual group firms. The figures over the arrows show the equity stakes that each firm holds in other firms.

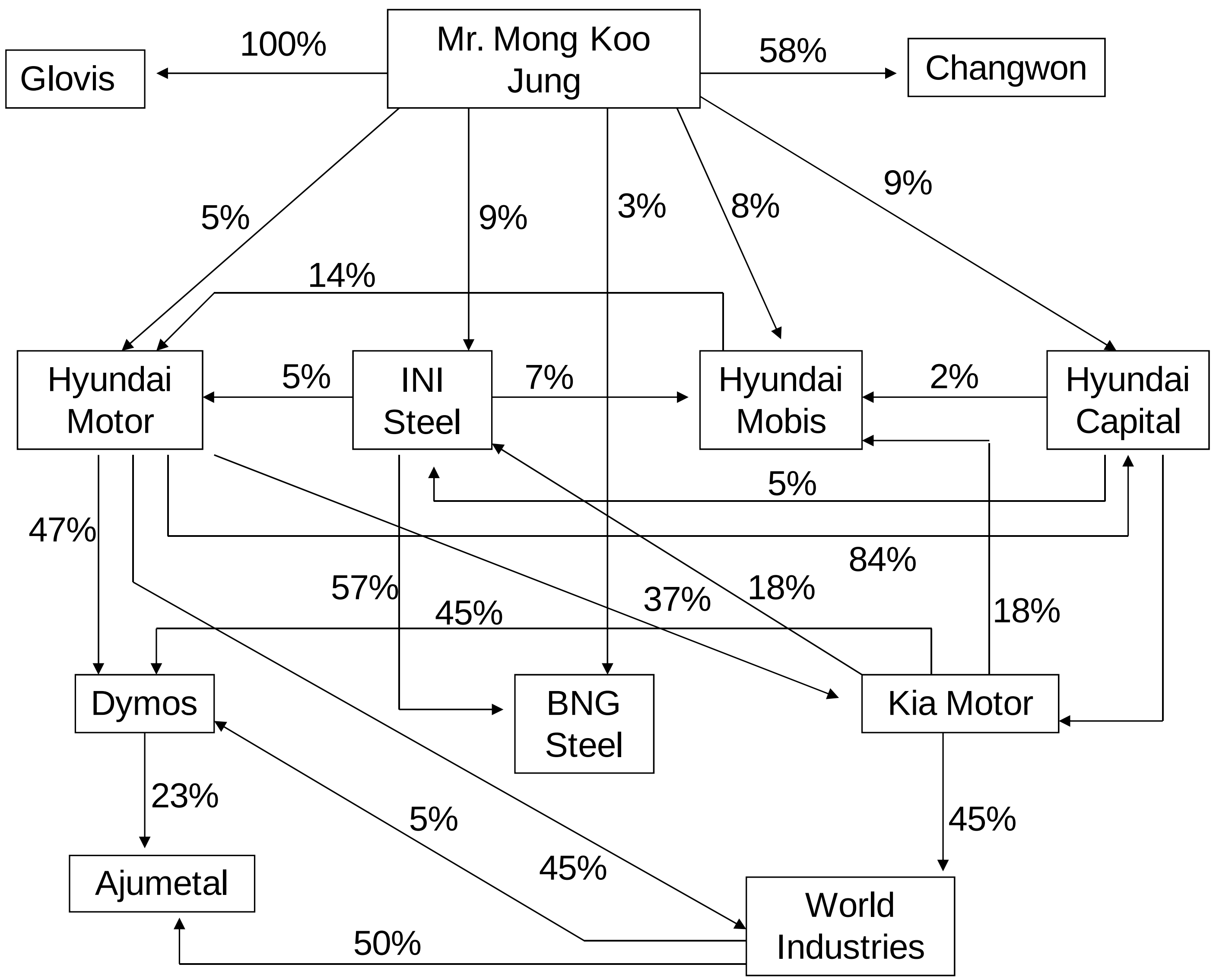

Fig. 2. Typical ownership structure of a Korean *chaebol*, 1998—2004. This figure depicts the typical structure of a Korean *chaebol*. Each box represents and individual firm, with the controlling family in the top box. The arrows represent equity stakes that the family and the firms hold in other firms. In the left, we descibe some of the key characteristics of the firms in each layer of the chaebol. For example, central firms (those in the middle layer) tend to be larger and older than other chaebol firms.